Tackling the Climate Emergency

Wessex Water's routemap to **net zero carbon** emissions

Wessex Water
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Introduction by Colin Skellett, Chief Executive

There is no doubt we are in the midst of a climate crisis.

Due to human activity, carbon dioxide and other greenhouse gases in the atmosphere are at unprecedented levels during the last million years.

Unless substantially reduced or removed, these gases will result in a level of global warming that will be catastrophic for humanity and most of the world's remaining ecosystems. The climate is changing rapidly and the effects will become more severe unless we act now.

This is of fundamental importance to Wessex Water in two ways.

Firstly, our day-to-day work is greatly influenced by the weather. We now expect to experience drier summers, wetter winters, and more frequent extreme weather events, which will have a direct bearing on the services we provide. Secondly, our greenhouse gas emissions are a major part of our overall environmental footprint. We use a lot of energy to treat and pump water and sewage, we have a large vehicle fleet, and our wastewater activities emit two powerful greenhouse gases - methane and nitrous oxide - as well as carbon dioxide.

In addition to operational emissions, there is the carbon footprint from construction work and other materials and products in our supply chain.

It is critical that we focus our efforts on ways to neutralise our carbon footprint and are committed to achieving net zero operational carbon emissions by 2030. However, we believe we must decarbonise all aspects of our work, and will work to achieve net zero total emissions by 2040 at the latest.

This document explains what decarbonisation means for Wessex Water and sets out our routemap and commitments during the next ten years and beyond. We will build on a long track record of action, which has included pioneering work to generate energy from sewage sludge and food waste, and to avoid emissions through catchment management, nature-based solutions and innovative repair. Their importance will grow as we further develop the links between carbon reduction and sustainable land management.

It will require substantial investment, collaboration and innovation. We are keen to work with our communities, our customers, and other stakeholders to meet this challenge, often with new ways of working or emerging technologies. As such, this plan will evolve in discussion with our partners and as our learning grows. We look forward to working together to help halt the environmental and societal damage being caused by climate change.

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1. Executive summary

The need for action

The world faces a climate emergency that we must address in two ways. Firstly, we must decarbonise all aspects of human activity, to reduce the risk of dangerous climate change. Secondly, we need to adapt to the effects of climate change: in our case, drier summers, wetter winters, and more frequent extreme weather events.

This routemap explains our plans for tackling the first of these over the next ten years.

Our ambition

By 2030, we aim to achieve net zero operational carbon emissions. These are our annual emissions linked to our energy use and transport, plus other greenhouse gases that are emitted from sewage and sludge treatment processes.

However, our goal does not end there. We also aim to achieve net zero total carbon emissions by 2040 at the latest. This includes our operational emissions outlined above, plus emissions linked to construction materials, and consumables such as treatment chemicals.

Our current position

In 2019-20 our net emissions were 117 kilotonnes carbon dioxide equivalent. Around 65% of this is related to energy use, 25% from sewage and sludge process emissions and 10% from transport. We have a long track record of carbon management work through a wide range of activities.

Our plan

Background reductions in the UK's carbon footprint will mean that our energy and transport emissions will fall by around one third from our current position. We therefore need to take concerted action between now and 2030 to reduce our operational carbon emissions to net zero.

We will do this by:

- Emissions avoidance measures, such as reducing water use and leakage; increasing the use of lower carbon transport; and promoting nature-based solutions that avoid energy use.
- Optimisation measures, such as energy efficiency work and systems for monitoring and controlling nitrous oxide from sewage treatment.
- Renewable energy – increasing the amount of biogas that we generate from anaerobic digestion and pursuing opportunities for wind and solar power, either as generators or as the end-user.

Innovative options

Reductions in background emissions and the most readily-available options will not be sufficient to achieve our goal of net zero carbon. We will need to pursue more innovative options involving emerging science and technology, such as turning sewage sludge into biochar, as well as promoting nature-based solutions. While these methods are not yet well-established, we are assessing their maturity and availability and will take part in trials where appropriate.

Offsetting

This would be a last resort if we were unable to secure net zero carbon emissions from background reductions, our own operations and from emerging science and technologies.

Beyond operational carbon emissions

We plan to develop a whole-life 'total carbon' approach, rather than treat operational emissions and embodied carbon in the materials and products we use as separate issues. This will include building whole-life carbon into our decision-making processes, to enable our transition into a truly low carbon business.

Looking ahead, this will necessarily mean challenging assumptions about the best ways to carry out investment for customers, communities, and the water environment.

2. Background

Climate change, caused by greenhouse gas emissions from human activity, is our biggest long-term challenge. The world's climate has already warmed by 1°C above pre-industrial levels and could warm by a further 2-3°C by the end of the 21st century. The level of warming leaves us facing a climate emergency and we must take urgent action if we are to avoid serious consequences.

In the UK, we expect to see warmer, drier summers, milder, wetter winters and more frequent extreme weather events becoming the norm. We must collectively adapt to these future impacts and reduce our greenhouse gas emissions (commonly called carbon emissions).

The Paris Climate Agreement aims to a) hold the increase in the global average temperature to well below 2°C above pre-industrial levels; and b) pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels. The UK Government aims to achieve net zero carbon emissions by 2050 and as part of the 2008 Climate Change Act, has legally-binding carbon budgets, placing a restriction on the amount of greenhouse gases the UK can emit over five-year periods.

Net zero carbon emissions are achieved when greenhouse gas emissions from operational activities have been eliminated or neutralised through the draw-down and storage of carbon from the atmosphere. These emissions are commonly expressed as carbon dioxide equivalent (CO_2e) or simply carbon emissions.

Given the critical need to reduce greenhouse gas emissions, external stakeholders – including investors, NGOs and the public – are increasingly expecting businesses to reduce their carbon footprint. The English water companies have committed to achieving net zero operational carbon emissions by 2030. UK Water published a sector-level routemap in November 2020 setting out options for achieving this and our commitments are broadly in alignment.

We aim to be a genuinely sustainable water company, and reducing our carbon footprint is one of the many environmental, social and economics issues that this entails. Decarbonising our activities must connect with other environmental work, linking with our efforts to promote sustainable land use, protect biodiversity and the water environment, improve resource efficiency and reduce air pollution. This in turn will benefit our customers and the communities we serve.

Additionally, the economic and financial rationale for reducing our carbon footprint is becoming more compelling. Renewable energy generation offers financial benefits in terms of sold energy or avoided energy purchase, as well as the subsidies that are offered. Reducing the use of imported electricity and gas, and generating our own energy, can create financial savings. Further, through a performance commitment agreed with Ofwat, we pay customers £19,500 for every kilotonne of carbon dioxide equivalent emissions that exceeds our annual target.

Carbon footprint reporting is required for our Annual Report to Ofwat; for Streamlined Energy and Carbon Reporting to Companies House and will be part of the UK Emissions Trading Scheme.

Our approach to addressing climate change is underpinned by the two main themes of mitigation and adaptation.

Mitigation: the need to drastically reduce greenhouse gas emissions from human activity, to reduce the risk of dangerous climate change.

Adaptation: the need to be resilient to the effects of climate change; in our case, drier summers, wetter winters, and more frequent extreme weather events.

In terms of our mitigation efforts, we are committed to:

- reducing our own operational carbon emissions to net zero by 2030
- reducing our total emissions to net zero, including those related to our supply chain emissions, by 2040 at the latest.

We are fully focused on reducing our own emissions and will build on aspects where we have taken a lead such as waste to energy; nature-based solutions and sustainable land use. We will need an optimal blend of engineered and 'softer' non-asset based solutions and will explore new methods, such as environmental markets for scaling-up the most promising methods. Offsetting any remaining, unavoidable emissions would be a last resort and we intend to consult customers and other stakeholders to understand their views.

3. The scope of our 2030 net zero carbon routemap

Our net zero commitment includes our regulated activities for water treatment and distribution, sewage treatment and sludge treatment.

The emissions we report are divided into three 'scopes', as per greenhouse gas reporting standards:

Scope 1	Emissions from our own sites and assets e.g. fuels burnt on site, our vehicle fleet
Scope 2	Emissions from the generation of grid electricity that we use
Scope 3	Other indirect emissions that occur in the company's value chain, including core activity that is outsourced

Our 2030 net zero operational carbon target will include:

- Scope 1 and 2 emissions as outlined above.
- Selected scope 3 emissions, i.e. those associated with grid electricity transmission and distribution; contractors' work on our behalf; public transport and private vehicles used on company business. Emissions from the export and use of treated sewage sludge ('bioresources') are not included, in line with the regulatory reporting boundary used by all the water companies in England and Wales.

Our future 'total carbon' target will include the above, plus:

- Emissions related to our capital programme (e.g. materials, transport, construction).
- Emissions related to the manufacture and delivery of goods and consumables that we use including chemicals, IT equipment and stationery.

4. Our greenhouse gas emissions

Historical emissions

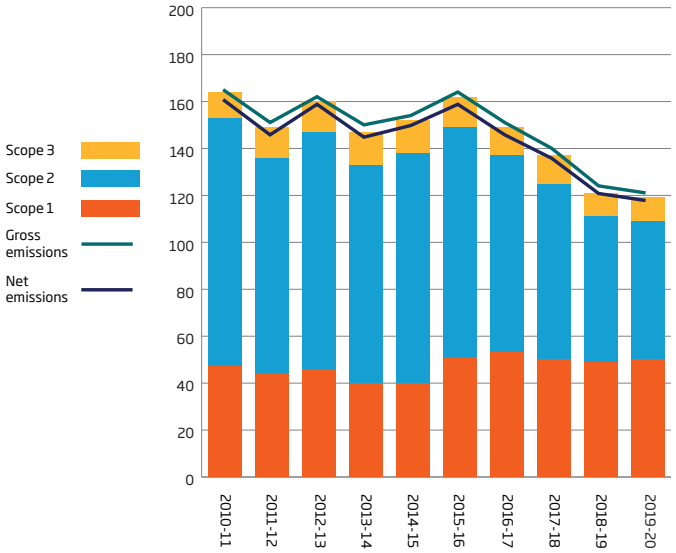
We have monitored operational carbon emissions for more than 20 years, using the water industry's standardised Carbon Accounting Workbook since 2007.

Net emissions are gross emissions minus the CO_2e displaced by renewable energy that we generate and export, except where green energy certificates have also been sold to an end-user.

Our annual emissions have fallen consistently since 2015 due to reduced carbon intensity of UK-wide electricity generation (as renewable sources have replaced coal) and our own work to improve energy efficiency and renewable energy generation. This is shown below in the contraction of scope 2 emissions. Since the mid-1990s our electricity use has increased significantly due to higher quality standards which often requires energy intensive treatment such as mechanical aeration and ultraviolet disinfection.

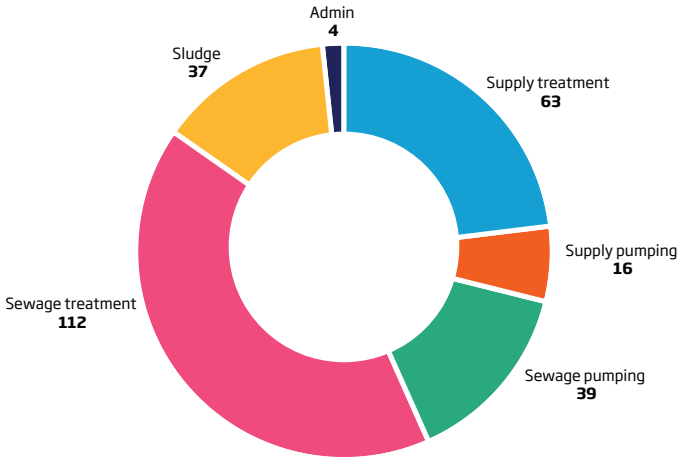
Concerted energy efficiency work has been necessary to prevent even higher energy use. Our electricity consumption is also extremely sensitive to the weather. High rainfall increases the volume of sewage moving through our sewerage network, and heatwaves increase public water demand and the energy required for treating and pumping water. Electricity use for different activities in 2019-20 and total electricity use over the last ten years are shown below (figures in gigawatt hours (GWh)).

Wessex Water's recent greenhouse gas emissions, kilotonnes carbon dioxide equivalent ($ktCO_2e$):

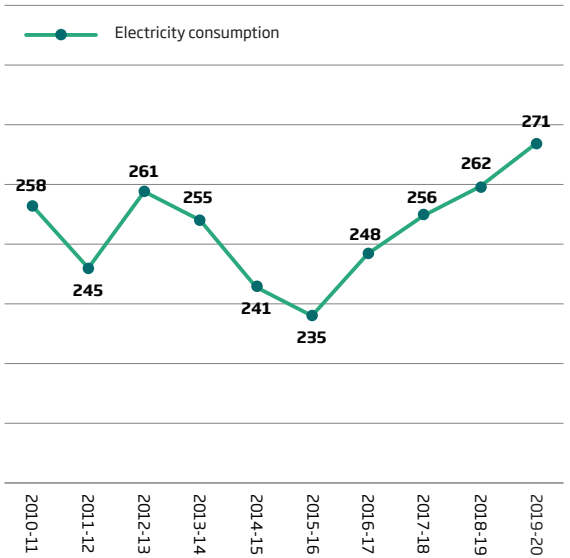


Net emissions are gross emissions minus the CO_2e displaced by renewable energy that we generate and export, except where green energy certificates have also been sold to an end-user.

Electricity use



Total electricity use



Baseline emissions

For this routemap, we are treating 2019-20 as the baseline year, representing our current position. Emissions in 2019-20 were as follows:

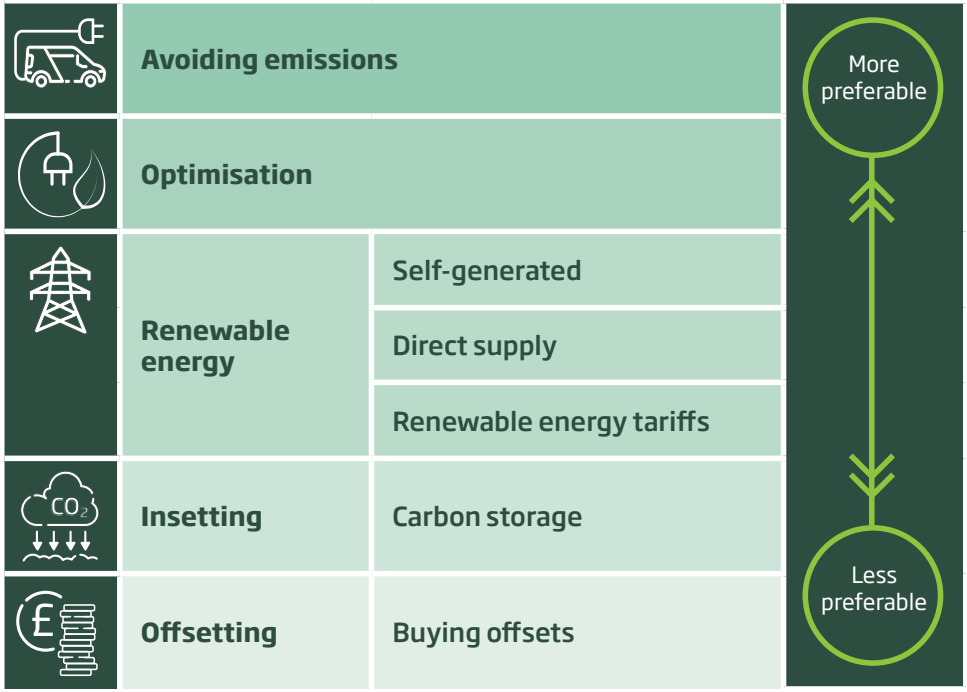
Baseline emissions	$ktCO_2e$	% of net emissions
Scope 1 Direct emissions		
Burning fossil fuels on-site	9.7	9%
Methane and nitrous oxide from sewage & sludge treatment	28.5	25%
Transport - company vehicles	11.6	10%
Scope 2 Grid electricity generation emissions		
Grid electricity generation emissions	59.4	50%
Scope 3 Other indirect emissions		
Grid electricity transmission and distribution	5.0	4%
Outsourced activities	3.6	3%
Public transport and private vehicles	1.3	1%
Gross emissions	119	
Netted-off emissions *	-2	-2%
Net emissions	117	

*Netted-off emissions relates to our export of renewable energy.

We are confident in the level of emissions related to energy and transport. However, emissions of methane and nitrous oxide (within scope 1) are much less certain, as they are estimated by water companies in the absence of direct measurement methods. Work is underway nationally to better quantify methane and nitrous oxide, and initial findings suggest that historically they have been under-estimated. Please see 'Uncertainties' within section 8 of this report for more information.

5. Our carbon management work

We have a strong track record of carbon management work. Our Carbon Management Strategy was originally developed in 2001 and has evolved into this routemap to net zero emissions. Our overall approach includes the carbon management hierarchy shown below:



Avoidance

Reducing volumes of water and sewage
Our ongoing programme of leakage reduction and customer demand management is focused on protecting water supplies. This has also reduced energy consumed and our carbon footprint. Leakage reductions achieved during the last 20 years mean that our annual carbon footprint is two kilotonnes less than it would have been.

Catchment management/nature-based solutions
We have an extensive catchment management programme that promotes farming practices that reduce fertiliser and pesticide use. This in turn has helped us to avoid additional energy and resource-intensive water treatment at specific sites.

Avoiding transport emissions
In recent years, we have adopted technologies that enable video-conferencing and remote working as an alternative to travelling to other locations. The 2020-21 pandemic has accelerated this, and it is certain that more flexible work patterns and improved connectivity will further reduce business mileage and commuting. In terms of avoiding fossil fuels, our sister company GENeco has been a pioneer in the introduction of vehicles of different sizes running on biomethane. We have started installation of electric charging points and are trialling the use of compressed natural gas for large vehicles, instead of diesel. This may be switched to biomethane at a later date.

Optimisation

Energy efficiency
We are a major energy user, consuming around 260 gigawatt hours of electricity every year. The electricity we buy from the grid accounts for around 50% of our carbon footprint at present. Maintaining the efficiency of equipment at treatment sites and in pumping networks is an important way of controlling energy use. We do this using advanced monitoring and targeting systems, which help us identify sites using more electricity than they should and carrying out focused remedial work as a result.

Process emissions from sewage and sludge
Nitrous oxide and methane from sewage and sludge treatment are our second largest category of emissions, currently accounting for around a quarter of our operational emissions. We are exploring potential methods for monitoring and control of nitrous oxide from sewage treatment. This will be informed by trials in the UK and overseas of systems that combine sensors and data analysis software.

Transport efficiency
We use route optimisation software to improve the efficiency of journeys and are trialling systems to improve driver behaviour with benefits for safety as well as fuel efficiency.

Renewable energy

Energy from waste
Using anaerobic digestion of sewage sludge and food waste, we create biogas that is either used to generate electricity (at five of our sludge treatment centres) or is refined into biomethane (at Bristol and Trowbridge) that can be injected into the gas grid or used as a renewable fuel for transport. We have upgraded digesters at Bristol and Trowbridge sludge treatment centres to a more advanced form that reduces process emissions and increases biogas production. We have conventional digesters at Bournemouth, Poole and Taunton sludge treatment centres.

In 2019-20, we generated 33 GWh of renewable electricity from sewage sludge and hydro, consumed 8 GWh from on-site food waste digestion and exported 11 million cubic metres of biomethane derived from sewage sludge.

Other renewable generation
We operate medium and small-scale hydro turbines at three sites and we have solar photovoltaic panels on the roofs of our Operations Centre and Sutton Bingham water treatment centre. We are assessing our operational sites and landholding for further solar generation potential as well as suitable candidate sites to take renewable generation from beyond our landholdings.

Partnerships with third-party renewable energy generators
We host four wind turbines at our water recycling centre in Bristol; these are owned and operated by Thrive Renewables and generate around 20 GWh of electricity each year.

Carbon insetting and offsetting

Carbon insetting involves other emissions-reducing activity within the 'sphere of influence' of a company – often through nature-based solutions, such as tree planting and retention of soil carbon. We are at the early stages of quantifying the carbon storage potential with these types of methods on our own landholding.

Carbon offsetting refers to the purchase of carbon credits created by other organisations reducing emissions. We have not undertaken any carbon offsetting to date and we regard it as a last resort. It may, however, be necessary to meet our new zero carbon commitment in 2030.

We are also looking at opportunities to play a part in the creation of markets for carbon reductions through the promotion of nature-based solutions through our subsidiary company, EnTrade, which is an online platform for collaboration with farmers and landowners.

6. Future work to get to net zero carbon emissions

This section provides an overview of what we plan to do over the next ten years and beyond to get to net zero carbon. There are three main parts:

Background emissions reductions, happening across the UK especially in energy and transport.

Readily available options which require action on our part but involve technologies that are already proven at scale.

More innovative options, involving technologies that are in development or have been implemented in only a few locations.

Background emissions reductions

If we were to just continue with current carbon management work, with no additional efforts, we would expect to see our carbon footprint fall during the 2020s. This will be due to two main factors.

Firstly, the continuing decarbonisation of grid electricity across the UK, with the closure of coal-fired power stations and the growth of renewable generation from wind, solar and biomass. The Government forecasts that an average kilowatt hour of electricity will have a carbon intensity of around 100g carbon CO_2 equivalent (CO_2e) in 2030, compared with 231g today.

Secondly, the decarbonisation of road vehicles with the sale of new petrol and diesel cars and vans to be banned from 2030.

As a large user of electricity and road vehicles we will see these changes happening through the supply chain without our direct intervention.

All other things being equal, we expect that these changes will reduce our carbon footprint by around 40 ktCO_2e by 2030. While this is welcome, it is a long way short of our goal to achieve net zero carbon emissions.

For this reason, we will need to pursue a wide range of opportunities for cutting carbon that will require additional effort and investment. These will include some readily-available options, using established methods and known technologies, which have a favourable balance of costs and carbon reduction benefits. Beyond these are more innovative options involving emerging science and technology; it is likely that these will need to play a part if we are to achieve a net zero carbon position.

Readily available options

The following is an overview of what we consider to be readily available options, most of which are familiar to us already.

During 2020-25, we will focus on extending work that we have carried out to date and assessing options for investment and implementation during 2025-30. Then, during the second half of the decade. we will need to invest across all available routes for carbon reductions, while also continuing prior work.

Avoiding emissions

Reducing volumes of water and sewage	**From 2020** • Reducing the amount of water that has to be pumped and treated by reducing leakage by 15% and reducing our customers' water consumption through demand management measures. **2025-30** • Promoting sustainable drainage, primarily to reduce flooding risk but also to reduce pumped volumes.
Avoiding transport emissions	**From 2020** • Investing in infrastructure to enable the transition to electric and other non-fossil fuel vehicles. • Starting to use electric cars and vehicles on a regular basis. • Trialling HGVs powered by compressed natural gas and biogas. • Wide use of homeworking and teleconferencing technologies. **2025-30** • Programmed roll-out of appropriate electric cars and vans and associated infrastructure. • Integration of lower carbon HGVs.
Avoiding fossil fuel use	**From 2020** • Investigating alternatives to diesel for backup electricity generation, and avoiding like-for-like replacement. • Looking at lower carbon methods for keeping anaerobic sludge digesters at a warm temperature. **2025-30** • Investment in non-diesel backup generation, including renewable energy with battery storage. • Investment in alternative, low carbon heating of anaerobic digesters.
Nature and land-based solutions	**From 2020** • Ongoing catchment delivery work focused on water quality, with side-benefits of avoiding more energy-intensive treatment methods, and delivering multiple environmental benefits. • Investigation of the carbon footprint of more novel treatment methods eg, constructed wetlands. **2025-30** • Extending the scope and sophistication of catchment management in rural areas to prevent diffuse pollution and help retain soil carbon. • Targets and systems within our capital programme for minimising the whole-life carbon footprint of water and wastewater investment.
Asset maintenance	**From 2020** • Ongoing use of lower carbon methods eg, trenchless pipe repairs and rehabilitation. • Appraising methane leakage at sewage sludge treatment centres. **2025-30** • Ongoing methane monitoring at sludge treatment centres, with corrective maintenance work.

Optimisation

Energy efficiency	**2020-30** • Continuation and expansion of energy efficiency initiatives. • Ongoing development of advanced monitoring and targeting. • Aiming for a 25 GWh cumulative saving over the period.
Process emissions from sewage and sludge	**From 2020** • Initial testing of nitrous oxide monitoring and control systems. • Improving quantification of methane emissions from sewage treatment, of both existing assets and those in design. **2025-30** • Roll-out of nitrous oxide monitoring and control measures, starting at the largest water recycling centres with aeration processes.
Transport efficiency	**2020-30** • Further use of technology to optimise vehicle movements and reduce mileage. • Increasing focus on vehicle fuel / electrical efficiency.
Lower-carbon construction materials and methods	**From 2020** • Investigation and delivery of lower carbon construction materials and methods eg, low carbon cement / concrete, offsite and modular build . • Developing systems for comparing the whole-life carbon footprint of competing options. **2025-30** • Putting whole-life carbon benchmarks and targets into place for capital schemes. • Working with our supply chain to understand their carbon footprint and putting in place plans to reduce this.

Renewables

Energy from waste	**From 2020** • Optimising existing digesters, in part to maximise gas production. • Ongoing export of biomethane at Bristol and Trowbridge. • Trials of heat recovery from sewage pumping stations. **2025-30** • Ongoing work to increase biogas production. • Retaining green gas certificates, relating to exported biomethane. • Increased digestion of other organic waste streams. • Implementing sewer heat recovery at sites with the greatest potential.
Other renewable generation	**From 2020** • Investigating suitable sites for further renewable generation. • Exploring partnership opportunities with commercial and community energy developers. • Reviewing the potential for energy crops and other types of biomass for heat generation. **2025-30** • Implementing new installations (eg, wind, solar) on or adjacent to our own land. • By 2030, increasing renewable electricity generation to double the current quantity.
Renewable grid electricity purchase	**From 2020** • Exploring potential power purchase agreements with off-site renewable generators. • Monitoring green energy tariff markets. • Ensuring future energy contracts offer transparent and verifiable green energy **2025-30** • Any agreed power purchase agreements to commence. • 100% of residual electricity and gas requirement from verified renewable sources.

Insetting

Land-based measures	**From 2020** • Quantifying carbon capture on our landholding, beyond current high level estimates. • Ensuring that our mitigation and landscaping measure maximise carbon capture as part of scheme designs and planning. • Developing guidance for improving carbon uptake and soil carbon levels on our land. **2025-30** • Working with farmers on retention of soil carbon, eg, restoration of grassland.

We estimate the items set out in this section to deliver the following reductions:
- Background reductions: approximately 40 $ktCO_2e$.
- Additional readily available options: approximately 70 $ktCO_2e$.

A break down of these estimates is shown on the next page. The remaining reductions to achieve our goal of net zero carbon would need to come from more innovative options, or as an absolute last resort, from carbon offsetting. These are discussed on page 13.

Tackling the climate emergency – our routemap to net zero carbon

The figues in this diagram represent the emissions reductions that we believe can be achieved via the actions set out in section 6. Items under 'business as usual' and 'readily available options' will occur in the 2020s, whereas the 'innovative technologies' are more likely to be implemented at scale in the 2030s once they are established in the supply chain. All figures are reductions in kilotonnes carbon dioxide equivalent.

More innovative options

There is a growing list of options that are not yet sufficiently established to be considered as 'readily available'. Over the next few years, we will, at the very least, maintain a watching brief over these, although in some cases we will carry out closer investigations or take part in trials. If we go ahead with implementation, it is likely to happen in the later 2020s to early 2030s. They include the following:

Avoiding emissions

- Integration of hydrogen generation and use with our activities, e.g. electricity needs, transport – to avoid fossil fuels.
- Alternative sewage treatment e.g. anaerobic treatment processes, algae.
- Roll-out of further measures to minimise use of potable water, e.g. water reuse, rainwater harvesting.
- Close engagement with suppliers to limit emissions associated with products and services that we use.

Insetting

- Technological carbon capture, e.g. biochar from sewage sludge via pyrolysis, gasification or hydrothermal carbonisation.

Biochar

The final option is potentially the most significant. Biochar, a charcoal-like material, is widely recognised for its potential for greenhouse gas removal. By turning organic material such as sewage sludge into biochar, the carbon it contains would remain inert over several decades at least, rather than breaking down into carbon dioxide or methane.

This means that biochar could be for us a crucial method for carbon capture. There are also potential benefits related to soil management and our wider bioresources activities. However, biochar-creating technologies are not straightforward and have only been used to process sewage sludge in a few locations worldwide.

Initial estimates suggest that a full-scale biochar unit at our Bristol sludge treatment centre could capture around 20 ktCO_2e per annum. However, it would likely cost tens of millions of pounds to build and would involve a major change in our sludge management practices.

For now, we are assessing the maturity and availability of biochar-creating technologies, with a view to potential implementation in the late 2020s to early 2030s.

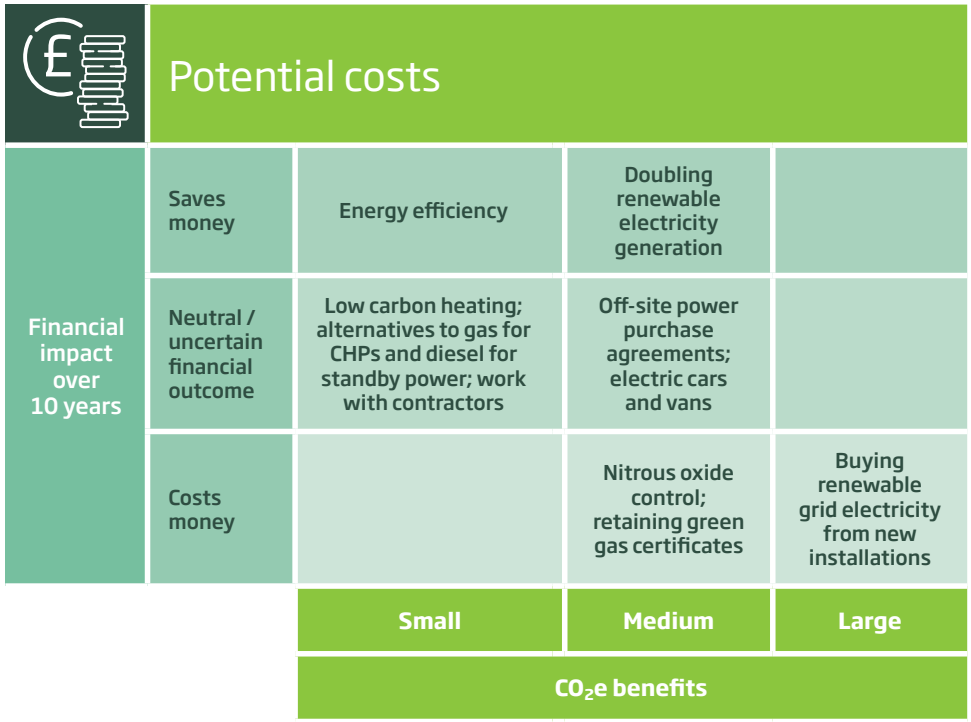
Offsetting

Buying carbon offsets would be a last resort, although we cannot entirely discount this approach. If this were the case, we would favour schemes that offered benefits for biodiversity and local communities as well as carbon reduction, such as nature-based projects in our region, or more innovative approaches such as coastal wetland creation or restoration, or storage in marine vegetation such as sea grass.

We will engage with our customers and other stakeholders on the topic of carbon offsetting to understand their viewpoints.

Potential costs

We have carried out initial costings of carbon-saving initiatives to understand the total cost per tonne of carbon dioxide equivalent saved over ten years. In this way, initiatives with the best net-present value, and the largest potential for carbon emissions reductions, can be identified and prioritised for action. The grid below shows our current broad understanding of how readily-available options compare.



7. Going beyond operational carbon emissions

As well as operational carbon emissions, we know that we must address embodied carbon – the emissions associated with the materials, products and services that we use. This is a topic that is rising rapidly up the environmental agenda.

There are two broad categories. Firstly, emissions linked to building materials (eg, concrete, cement, steel, aggregates) and other aspects of our construction programme – sometimes referred to as capital carbon. Secondly, emissions associated with consumables such as treatment chemicals, IT equipment and clothing.

Currently, the full extent of our embodied carbon footprint is not known. A few water companies have been routinely assessing emissions associated with construction and found that capital carbon tends to be equivalent to 33% - 50% of annual operational carbon emissions. The absolute figure should decrease as heavy industry and manufacturing decarbonises, although this could be a relatively slow process as cement, steel, chemicals and manufacturing are recognised as sectors that will have difficulty reducing their carbon footprint.

In the next two years we will start to publish our own estimates of our embodied emissions as part of our annual reporting.

Subsequently, we aim to develop a whole-life 'total carbon' viewpoint – rather than treating operational emissions and capital carbon as separate issues. This will include building whole-life carbon into our decision-making processes, to enable our transition to a truly low carbon business. This will necessarily mean challenging assumptions about the best ways to carry out investment for customers, our communities, and the water environment.

Taking all this into account, we are committed to reducing our total emissions to net zero, including those related to our supply chain emissions, by 2040 at the latest. This will be ten years ahead of the UK's commitment to achieve net zero carbon emissions by 2050.

8. Other aspects of this work

Alongside the options set out above for achieving net zero carbon are a number of other issues that will come into play – some of which could add complexity while others could speed-up progress. Either way, decarbonising our work is unlikely to be a predictable, linear process.

Working with others

We will not be able to achieve everything set out in this routemap on our own. Collaboration and positive relationships with other businesses and organisations will be crucial for our decarbonisation work, and we will need to draw on the expertise and assistance of many others if we are to succeed.

Partnership working has always been a feature of all aspects of our work, and we already have strong links with many other sectors of the economy. This includes energy, transport, communications, construction, engineering, advanced technology and data, agriculture and environmental services. We are also firmly embedded within the region that we serve and have close links with local authorities, community groups and other local interests. Partnerships are also critical for issues such as carbon reduction where rapid change and new approaches are needed. To this end we will be working closely with innovators, developers of new technologies and researchers, as well as other water companies and companies in the supply chain and other organisations with which we are already linked.

Regulation

We are required to bring about a large range of improvements for customer service, drinking water quality and the wider water environment. Meeting tighter standards has often resulted in additional energy consumption or the use of carbon-intensive materials for creating new infrastructure. As regulation is often focused on specific objectives, any additional greenhouse gas emissions caused by this work has often seemed to be a peripheral consideration. Looking ahead, there will need to be a more joined-up view and open dialogue with regulators to promote the lowest carbon options.

Uncertainties

There are two areas of uncertainty surrounding the scale of emissions that we will need to reduce. Firstly, as noted in section 4 there is considerable uncertainty about the true level of methane and nitrous oxide emitted from sewage and sludge treatment processes. These are not measured directly because of how they arise, e.g. diffusing into the air from tanks and filters in which sewage is treated, or from anaerobic digesters that are not fully-sealed. Instead, UK water companies estimate these emissions via a standard method, using a few emissions factors that have remained largely the same for around fifteen years.

The water companies recognise the shortcomings of this estimation method, and are reviewing it in the light of evolving science and the availability of new technology that enables some degree of measurement. As things stand, we know that our reported nitrous oxide emissions (currently around 9 kt CO_2e) will certainly double due to a recommended change of an accounting procedure. Thereafter, it is probable that the emission factor for nitrous oxide emitted from every kilogramme of nitrogen in the sewage that we receive, will be revised upwards. A literature review carried out in 2020 for UK Water Industry Research, and the base assumptions used by the Intergovernmental Panel on Climate Change, suggest that a more accurate estimate of nitrous oxide emissions overall could be four to eight times higher than reported historically. For now, monitoring work is starting that will confirm typical nitrous oxide emissions at UK water recycling centre and we expect a revised set of emissions factors in two to three years' time, at which point we will need to revise our overall carbon footprint calculation.

The second uncertainty involves emissions associated with construction materials and products and services that we consume via our supply chain - as set out in section 7. While we are working to gain a better high-level understanding of these emissions, we understand the calculations involved often carry many assumptions and estimates. For example, the carbon footprint of one tonne of steel or cement can vary substantially depending on the types of energy used, the place where it was manufactured, the distance it has travelled to reach us and the mode of transport used.

Enabling technology

We are broadly optimistic about the role technology and innovation will play in the years ahead. Through technological improvements we have already seen sharp reductions in the cost of renewable energy generation and energy storage. We expect to see this trend continue; and more activity around topics such as hydrogen for energy storage and replacing gas and diesel. We are also increasingly seeing the potential for digitalisation and data-led innovations, which offer a lot of promise for operating water mains, sewers and water and sewage treatment in the most efficient way possible. We look forward to working with other businesses and the research community for putting new low carbon technologies into practice.

Climate change adaptation

As noted in section 2, addressing climate change will mean adapting to the effects of climate change as well as eliminating our own contribution as much as we can.

Climate change will affect us through 'stresses' - changes that gradually apply more pressure over time - and 'shocks' in the form of extreme weather events such as heatwaves, droughts, intense storms and prolonged rainfall. While shock events such as these have happened in the past, climate change is a 'threat multiplier' that increases risks. So, extreme weather events that are considered possible but unusual by today's standards will occur more frequently and to a greater intensity in future.

In response we have developed a climate change adaptation plan because some effects of climate change are already happening and we must be prepared for the impacts on our activities. Our plan outlines the main climate-related risks that we face and the work that we are carrying out in response. This plan is being updated during 2021 and will include a blend of measures (as per the recent independent assessment of UK climate risk by the Climate Change Committee), including both engineered and nature-based solutions; behavioural measures; data analysis and new research. More widely, we expect to see an evolution in the roles and responsibilities of different organisations and ways in which they work together to adapt to climate risk, as well as the financing of adaptation work.

Wessex Water's routemap to **net zero carbon** emissions

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