NHS Wales Decarbonisation Strategic Delivery Plan

2021-2030

(including Technical Appendices)

Published March 2021

Who we are

Established in 2001, the Carbon Trust works with businesses, governments and institutions around the world, helping them contribute to, and benefit from, a more sustainable future through carbon reduction, resource efficiency strategies, and commercialising low carbon businesses, systems and technologies.

The Carbon Trust:

- works with corporates and governments, helping them to align their strategies with climate science and meet the goals of the Paris Agreement;
- provides expert advice and assurance, giving investors and financial institutions the confidence that green finance will have genuinely green outcomes; and
- supports the development of low carbon technologies and solutions, building the foundations for the energy system of the future.

Headquartered in London, the Carbon Trust has a global team of over 200 staff, representing over 30 nationalities, based across five continents.

The Carbon Trust's mission is to accelerate the move to a sustainable, low carbon economy. It is a world leading expert on carbon reduction and clean technology. As a not-for-dividend group, it advises governments and leading companies around the world, reinvesting profits into its low carbon mission.

The NHS Wales Shared Services Partnership (NWSSP) is an independent organisation, owned and directed by NHS Wales. NWSSP supports NHS Wales through the provision of a comprehensive range of high quality, customer focused support functions and services.

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Numerous stakeholders have engaged with the development of this Delivery Plan. We would like to extend our thanks to all those who gave their time to contribute and review. This has helped to give this Delivery Plan the foundation it needs to be successful.

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Statement of Commitment

Dr Andrew Goodall CBE

Director General of Health and Social Services / Chief Executive of NHS Wales

A clear and ambitious green recovery will be a key component to how we respond following the COVID-19 pandemic. This NHS Wales Decarbonisation Strategic Delivery Plan demonstrates how NHS Wales can play its part in the recovery and its commitment to the Wellbeing of Future Generations (Wales) Act 2015, which directs us to consider long-term persistent problems such as poverty, health inequalities, and climate change.

The Welsh Government declared a Climate Emergency in 2019 supported by Members of the Senedd. This Strategic Delivery Plan responds to this declaration and is aligned to Welsh Ministers ambition for the public sector to be net zero by 2030. As the largest public sector organisation in Wales the NHS has an important role to play to contribute towards this target and I would expect ambitious targets to be in place.

Good progress has been made in recent years across NHS Wales to decarbonise the estate but more can be done. Design and construction inevitably have a long lead-in time and ensuring we are at the forefront of emission reduction in our public buildings is ever more important. This Strategic Delivery Plan gives us opportunities to look again at building and energy uses as well as procurement, travel and other emission sources across the NHS. Despite progress to date, our operations in 2018/19, set out in the Carbon Footprint report, still resulted in the emission of more than 1,000,000 tonnes of carbon dioxide equivalent. More than two-thirds of these emissions are not in our direct control, which indicates the scale of the challenge we are embracing.

The very nature of the health service means it is unlikely we will be able to provide the services we do without causing any emissions, but more can be done to reduce them. Going forward the NHS in Wales will deliver safe and high-quality care for patients in the most effective ways, whilst also delivering on our commitments to climate change. The Wellbeing of Future Generations Act provides a unique and positive context for the NHS to exploit opportunities to make real change in its carbon emissions over the next decade.

The impact of emissions and pollution on health outcomes is also a wider health issue I am mindful of. Air pollution is widely linked to increased rates of cardiac arrest, stroke, heart disease, lung cancer, obesity, cardiovascular issues, asthma, and dementia. As a result, the Strategic Delivery Plan will not only help reduce emissions, but play a role in improving air quality which in turn has an impact on both businesses and the health service. Less emissions and the importance of green spaces and nature for example have provided significant therapeutic benefits during the pandemic and will continue to do so.

It is clear that the NHS must act now to reduce its environmental impact, play its part, and be an exemplar in the way forward in taking steps to reduce emissions.

This Decarbonisation Strategic Delivery Plan sets out our plan for addressing the Climate Emergency. The targets are ambitious, and in some areas will require a fundamental shift to our approach to healthcare, but will contribute to reducing our impact on the Global Health Emergency. The Strategic Delivery Plan sets out 46 initiatives and targets for the decarbonisation of NHS Wales that will be assessed and reviewed in 2025 and 2030.

Taking swift action over the next five years is critical to ensuring the targets within this strategy are adhered to. This relies on minimising our waste, increasing our efficiencies, and investing heavily in decarbonisation of our buildings and vehicles. Low carbon must be core to the decisions, and embedded into our everyday processes so that it becomes integral to the decisions that we make. The NHS in Wales, together with our public sector partners, must lead by example. This is particularly important with regard to our supply chain where our decisions and influence needs to be used to take our suppliers on the low carbon journey with us.

The Decarbonisation Strategic Delivery Plan has been developed through a partnership approach. Whilst recognising that some planned engagement activities were unable to take place due to the pandemic there has been significant interest in the development of the Plan both amongst NHS colleagues and wider stakeholders. I am encouraged to note that more than 100 industry experts and healthcare professionals have contributed to ensuring this plan is informed, targeted, credible, and will have a significant impact on the future operation of the Health Service in Wales.

I would conclude by saying that every single person in Wales has a role to play in the decarbonisation of our health service in line with prudent healthcare. The choices you make as an individual, as a patient, as a member of staff, as a supply chain partner, will undoubtedly play a role in helping to reduce our combined contribution to greenhouse gas emissions. We all need to contribute to this which will significantly improve wider health and well-being across the population of Wales.

Dr Andrew Goodall CBE

Director General of Health and Social Services / Chief Executive of NHS Wales

The Climate Emergency Challenge

A Climate Emergency for Wales

Immediate and bold action to tackle climate change is more crucial now than ever before.

There is now unprecedented political recognition of a global Climate Emergency. The Intergovernmental Panel on Climate Change has made it clear that limiting global warming to 1.5°C above pre-industrial levels is necessary to prevent a sustained public health catastrophe. This has culminated in the Paris Climate Change Agreement, in which 189 countries united to ratify a legally-bound commitment to act to limit global temperature rise this century .[1]

The five warmest years on record have occurred in the five years succeeding the Paris Agreement.[2]

Climate change is recognised as the most significant threat to the health of humanity on a global scale. The World Economic Forum states climate change as the greatest risk to the stability of the global economy, in terms of scale and likelihood;[3] which will increase pressure on health systems across the world. The World Health Organization estimates that climate change will lead to around 250,000 extra deaths per year globally from 2030, and that the direct cost impact will be $2-4 billion per year over the next decade.

With climate change and detrimental health impacts inextricably linked, the Climate Emergency must also be recognised as a health emergency.

Increased societal awareness has led to calls for greater action to tackle climate change. Activism has enhanced the media spotlight on the climate agenda. Increased public awareness has led to growing pressure on governments and businesses to act rapidly to mitigate climate change, calling for the UK and devolved governments to formally declare a Climate Emergency. This was also supported in 2019 by an open letter signed by over 1,200 UK doctors calling for direct action against the climate crisis, citing the significant threat that climate change poses to public health.

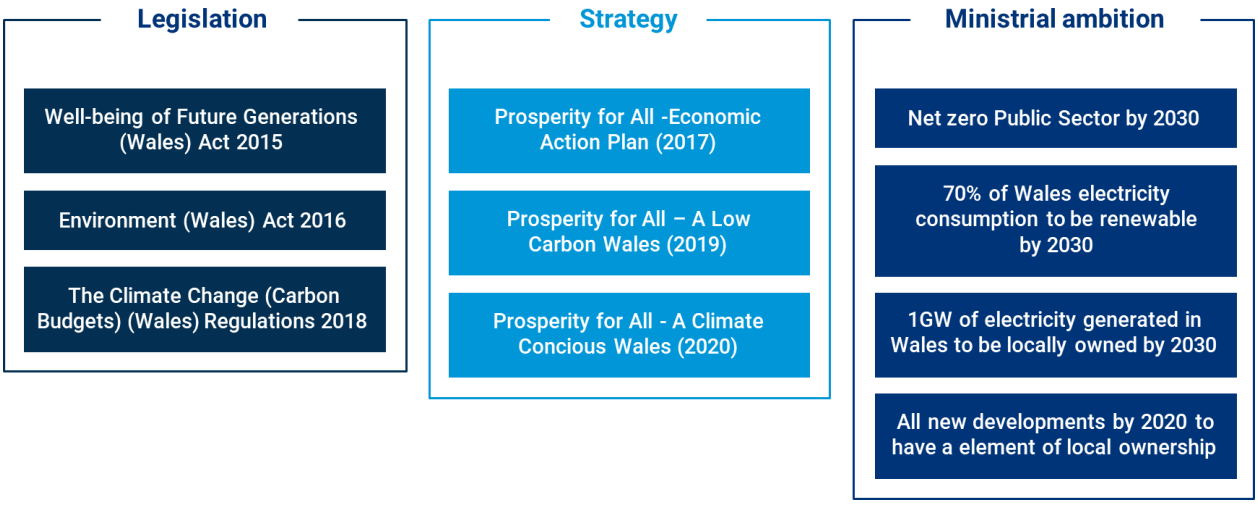
In April 2019, with cross-party support, the Senedd was the first Parliament in the world to declare a Climate Emergency.

Since the Climate Emergency declaration, Welsh Government has accepted the Climate Change Committee's recommendation to increase Wales's 2050 emissions target to a 95% reduction with a further ambition to achieve net zero. However further advice published in December 2020 has recommended that action needs to be taken sooner, and this must chart a steeper trajectory towards net zero.[4] If accepted, the advice would lead to a net zero target for all sectors in Wales by 2050 and a stretching target of a 63% reduction in greenhouse gas emissions by 2030 (compared with the current target of 45%).

To lead the way on climate action in Wales, Welsh Government set the ambition for the public sector in Wales to be net zero by 2030.

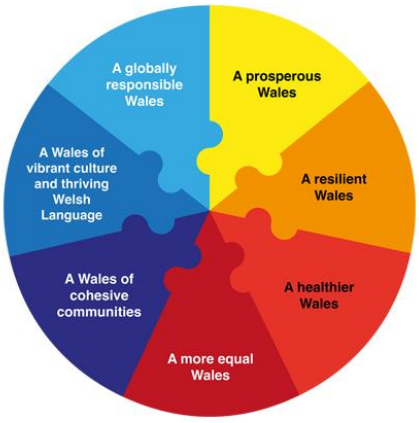
NHS Wales Climate Emergency

To implement decarbonisation, Welsh Government has put in place binding legislation, strategies, and ambitions to drive carbon reduction activity in Wales. In March 2019 the First Minister for Wales launched Prosperity for All: A Low Carbon Wales[5], this sets out Welsh Governments plan for decarbonisation in Wales. This further states the ambition for the public sector to be net zero by 2030, and the specific policy to reduce emissions in the health sector.



NHS Wales recognises it has a significant contribution to make towards the 'team Wales' target of a net zero public sector. To stimulate engagement and action across all parts of NHS Wales, the first initiative within this Delivery Plan provides the commitment to address the Climate Emergency.

NHS Wales will show leadership and commitment to deliver this Decarbonisation Delivery Plan in order to address the Climate Emergency for Wales as declared by Welsh Government and the Senedd.



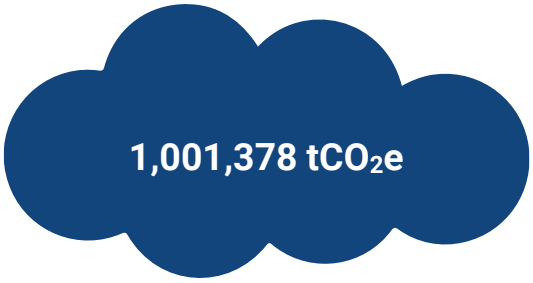
The NHS Wales requirements under the *Well-being of Future Generations* (Wales) Act 2015 will ensure that the climate is considered at an everyday decision-making level. This world-leading legislation places NHS Wales with a duty to support the seven Well-being Goals put in place by the act. Decarbonisation has a critical role to play in meeting this duty, in particular to achieve a resilient, healthier, and globally responsible Wales. 6

With climate change, pollution, and detrimental health linked, it is the responsibility of NHS Wales to act on the climate and health emergency to support a healthier Wales now and in the future.

NHS Wales Carbon Footprint

Prior to developing this Delivery Plan, NHS Wales Shared Services Partnership (NWSSP) commissioned a Carbon Footprint assessment for the whole of NHS Wales. The *NHS Wales Carbon Footprint 2018/19*[7] has influenced the approach set out in this Delivery Plan and provides initial baseline emissions data for target setting.

Total NHS Wales Carbon Emissions 2018/19



The NHS Wales 2018/19 Carbon Footprint has been calculated as approximately 1 million tonnes of CO_2e, which represents around 2.6% of Wales's total greenhouse gas emissions.[8] This has been set as the baseline for emissions reduction targets going forward.

Emissions have been attributed to the three scopes as defined by the Green House Gas Protocol:

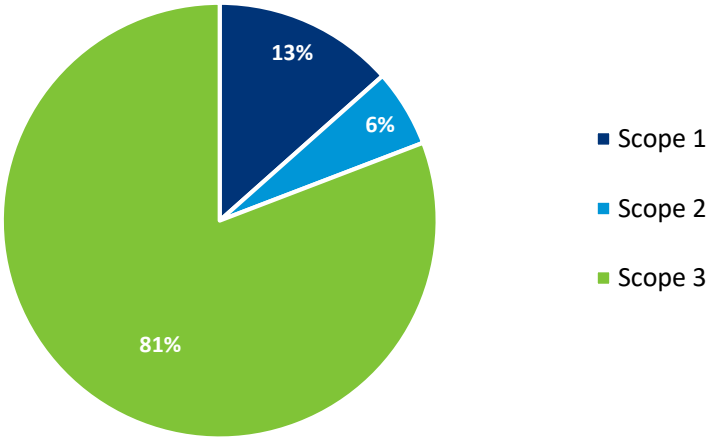
Scope 1	Scope 2	Scope 3
Direct emissions of an organisation, including combustion of fuels and fugitive emissions	*Indirect emissions of an organisation, including purchased electricity and heat*	*Other indirect emissions associated with an organisation, including the supply chain, transport and distribution, business travel and commuting, use of products, waste, investments and other leased assets or franchises.*

To aid understanding, emissions have been further broken down and analysed into **four** categories:

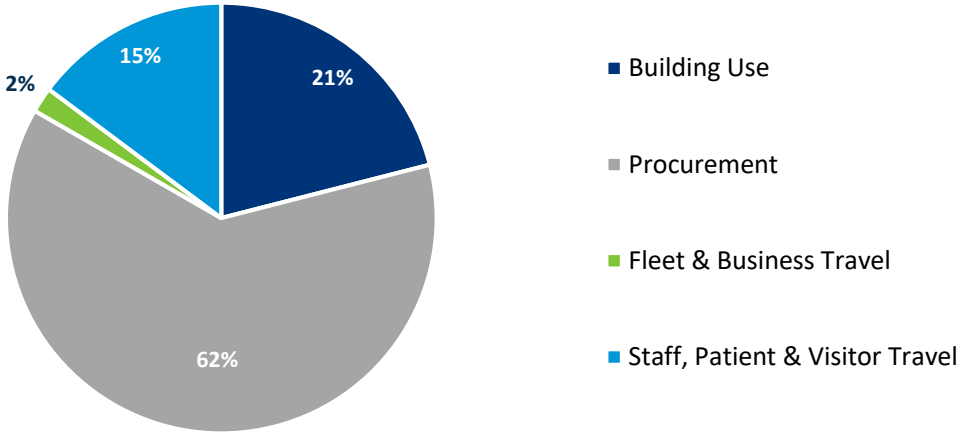
1. **Business use**
2. **Fleet and Business Travel**
3. **Staff, Patient and Visitor Travel**
4. **Procurement**

The following charts provide the split of NHS Wales Carbon Footprint by scope and by category.

NHS Wales Carbon Footprint by Scope 2018/19



NHS Wales Carbon Footprint by Category 2018/19

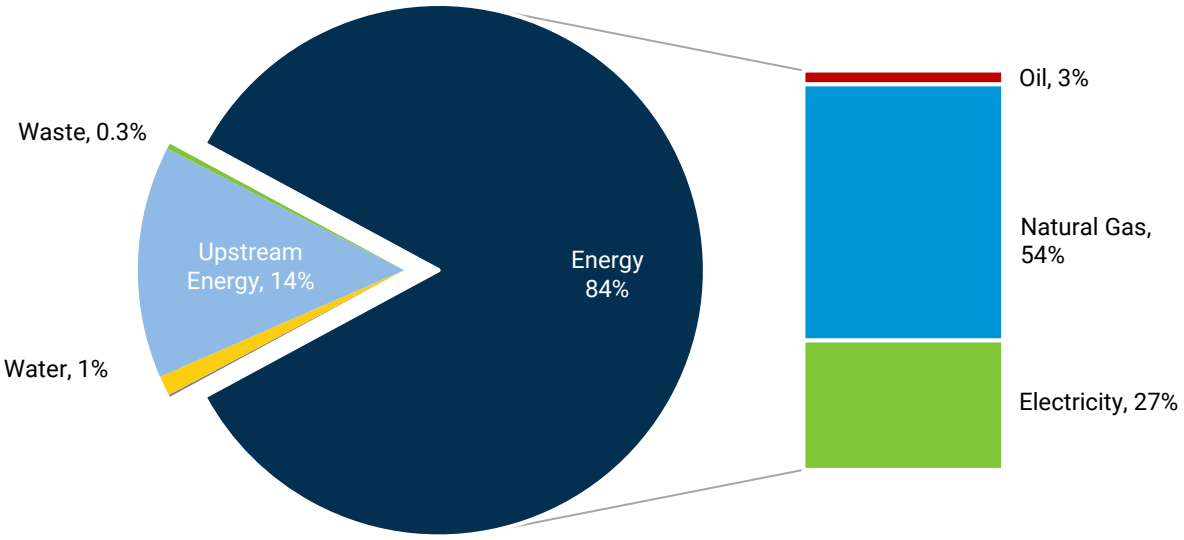


This Delivery Plan sets out a target for NHS Wales as a whole, and for the four categories of emissions assessed. However, no target has been set by scope of emissions.

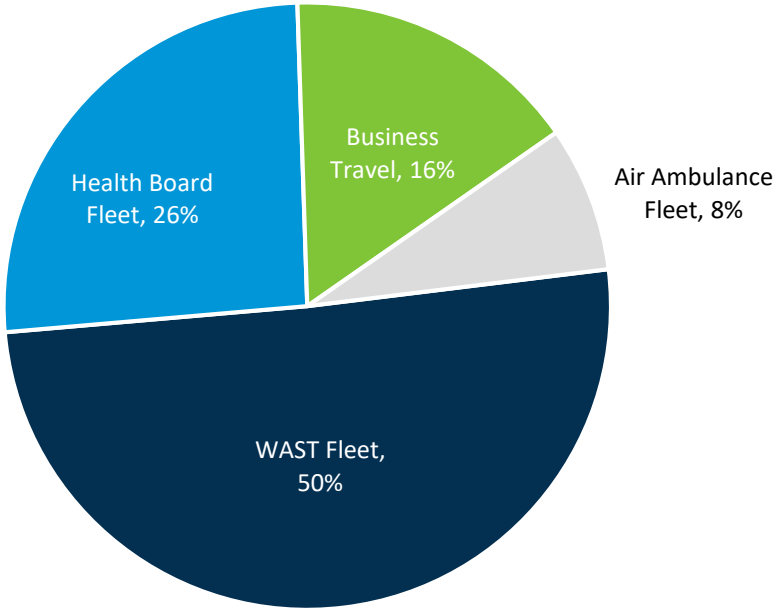
The need to improve emissions data accuracy and coverage is recognised within the NHS Wales Carbon Footprint assessment. The requirement for ongoing data improvement, in particular for transport- and procurement-related emissions, is set-out within the Delivery Plan.

The following charts provide key summary information regarding the **four** categories assessed within the Carbon Footprint. Further detail and analysis of the *NHS Wales Carbon Footprint 2018/19* can be found on the Welsh Government website.

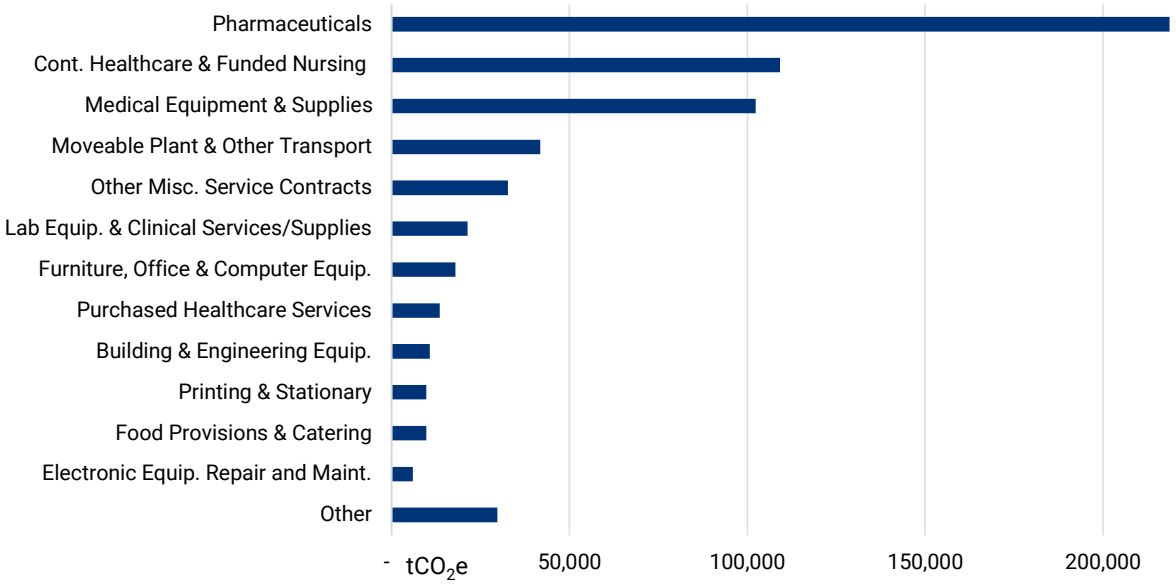
Buildings: 210,436 tCO_2e



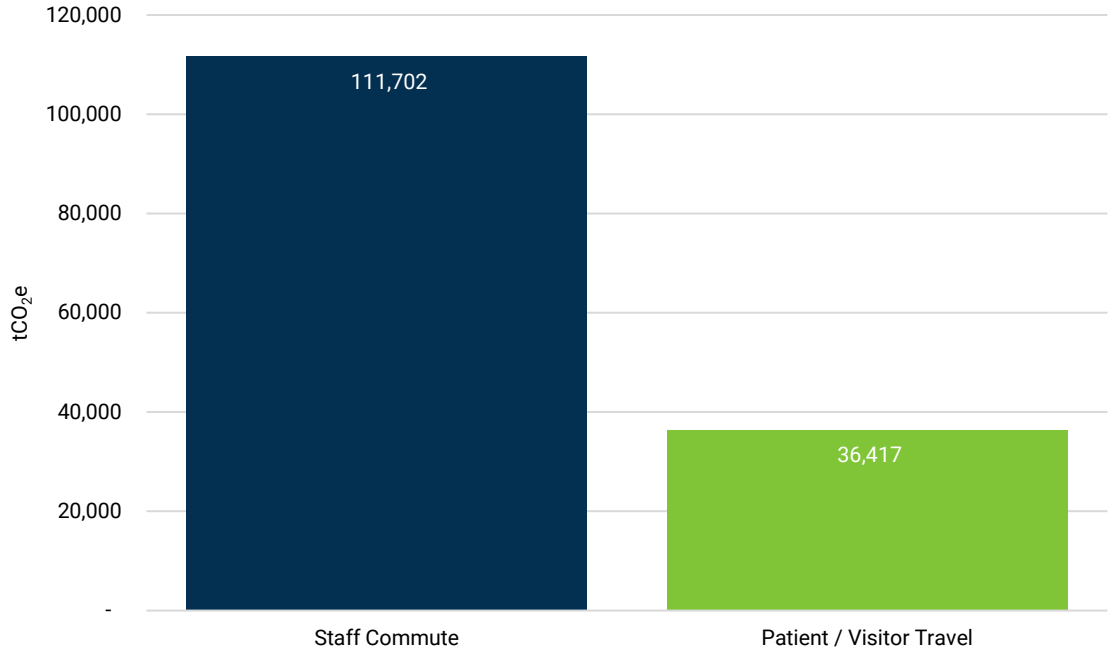
Fleet & Business Travel: 19,073 tCO_2e



Procurement: 623,750 tCO_2e



Staff, Patient & Visitor Travel: 148,119 tCO_2e



Sustainable Recovery to the Pandemic

Alongside the tragic impact of the Covid-19 pandemic, a devastating economic impact has also been recognised.

Hundreds of health professionals in Wales have called on Welsh Government to support a *'healthy recovery'* to the pandemic. In June 2020, the UK Health Alliance on Climate Change wrote to the Prime Minister setting out 'Climate Change Principles for a Healthy Recovery.'[9] In July 2020, a letter signed on behalf of hundreds of Welsh doctors and healthcare workers highlighted evidence linking air pollution to the susceptibility of Covid-19 in patients, demonstrating their support for the climate agenda and recognition of the potential health benefits a green recovery can provide.

Photo credit: Laing O'Rourke

In response to the economic impact of the Covid-19 pandemic, the Welsh Government has set up a *Green Recovery Taskforce*. The aims of the task force are closely aligned with the aims of NHS Wales in this Delivery Plan. The opportunity for investment against the initiatives set-out will support a green economic recovery in Wales.

The response to the pandemic has demonstrated how significant and impactful change can be enforced into the day-to-day life of the public and the approach to work; this includes how healthcare is delivered. An NHS Trust in England demonstrated that remote working during the first Coronavirus lockdown reduced business mileage by 67% and reduced electricity consumption by 12-18% across their sites.[10]

With the pandemic demonstrating that rapid and significant societal change is achievable, the goal now must be to stir similar urgency and commitment to tackle the Climate Emergency.

NHS Wales Commitments

This NHS Wales Decarbonisation Strategic Delivery Plan has been developed to drive an ambitious but realistic reduction in carbon emissions from NHS Wales's operations.

This Delivery Plan sets out 46 initiatives for decarbonising NHS Wales. The commitments cover emissions from Scopes 1, 2, and 3.

The following table provides specific headline commitments up to 2030 which will be reviewed in 2025 and 2030 alongside the overall carbon reduction targets for these periods.

Access to resource and finance is critical to ensure the success of this Delivery Plan, and this will be supported by Welsh Government and NWSSP as part of the Action Plan review process. For the first year of delivery (2021-22), Welsh Government has made available £16m in capital finance.

Moving up a gear (2020-2022)

- → NHS Wales will fully support the Climate Emergency for Wales as declared by the Welsh Government
- → Carbon reduction will be a high priority in business case decision making – this will mean that increased revenue costs will not be a barrier to the optimal low carbon option
- → An 'NHS Wales Climate Change Group: Decarbonisation Board' and a 'Decarbonisation Programme Manager' will be put in place to lead Delivery Plan implementation
- → Welsh Government will enable access to finance to support the successful implementation of the Delivery Plan
- → 'Decarbonisation Action Plans' will be developed by Health Boards, Trusts, and NWSSP Procurement – these will be regularly updated and committed to within Integrated Medium-Term Plans on a 2-yearly basis
- → All new-build developments and major refurbishments will be designed and accredited to a net zero framework

Well on our way (2022-2026)

- → NHS Wales will have reduced carbon emissions by 16% in line with the 2025 interim target
- → Low carbon heat evolution plans for acute hospitals will be in place
- → By 2025, all lighting across the estate will be LED
- → The total renewable energy potential for the NHS Wales estate will be known, with an implementation plan progressing
- → Reducing emissions will be mandated within new procurement contracts for major suppliers
- → Procurement emissions accounting will shift to a 'market-based' approach
- → Medical gases with low global warming potentials will be used as standard with improved emissions accounting data available to assess the impact
- → All cars and light goods vehicles procured will be battery-electric where practically possible. Sufficient charging infrastructure will have been installed to support an increased uptake in fleet, staff, and public electric vehicles
- → Digital technology and telemedicine will be increasingly used to increase efficiency and reduce travel

Achieving our goal (2026-2030)

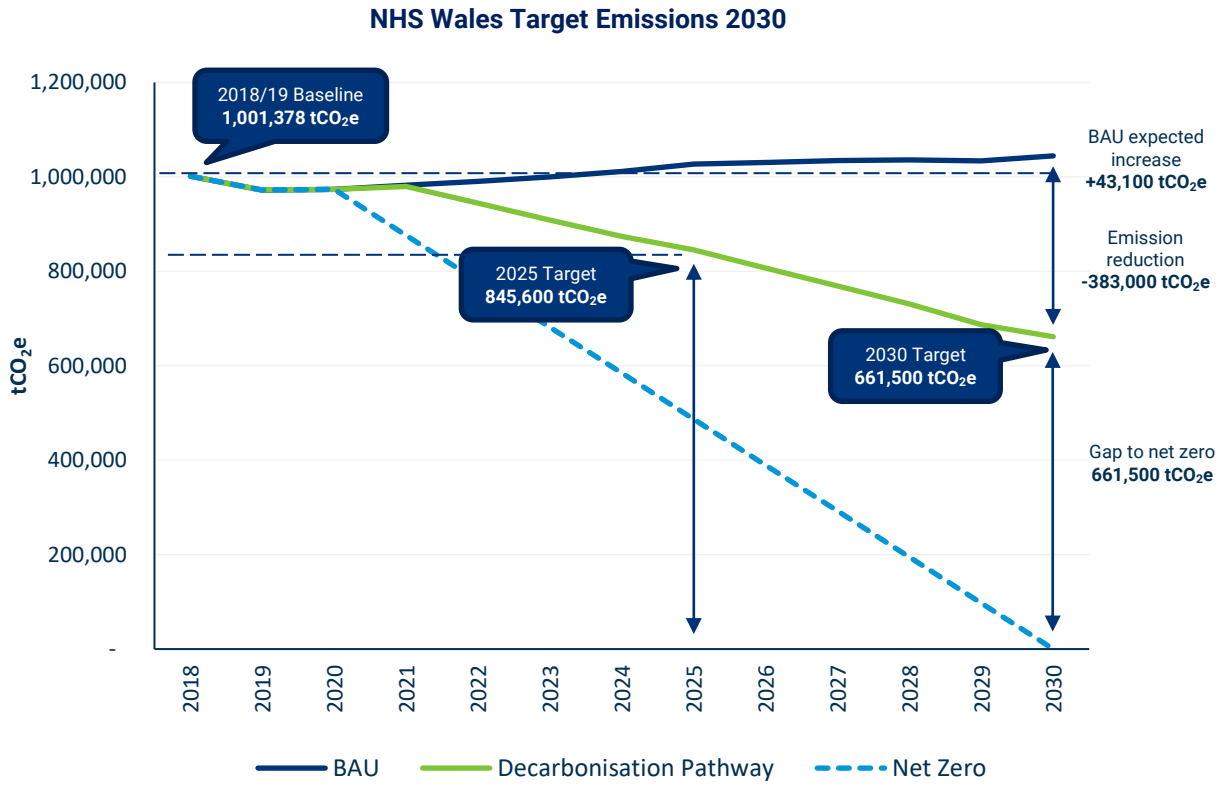
- → NHS Wales will have reduced carbon emissions by 34% equivalent to 383,000 tCO_2e as a minimum contribution to a net zero Welsh Public Sector
- → Every building will have undergone an energy-efficient upgrade – low carbon heating will be utilised and renewable energy will be generated on site
- → Aim for all natural-gas combined heat and power plant to be decommissioned
- → WAST will aim for new ambulances procured to be plug-in electric, or alternative low carbon fuelled
- → Large-scale renewable energy generation will be implemented by collaborating with public sector partners, landowners, developers, and local communities
- → Carbon sequestration land will have been developed and included within carbon accounting
- → A climate smart approach to modern healthcare will be incorporated into new developments

2025 and 2030 Emissions Targets

NHS Wales' Target

NHS Wales's emissions pathway has been mapped out between 2018 and 2030 for three scenarios:

- **Business-as-usual (BAU)** – presents the expected emissions if NHS Wales took no additional action to decarbonise; despite the ongoing decarbonisation of UK electricity grid, an increase is forecast due to the continual growth of the Health Service.
- **Decarbonisation Pathway** – presents a targeted decarbonisation scenario based upon the initiatives set within this Delivery Plan; this pathway sets the overall 2025 and 2030 emissions reductions targets.
- **Net zero** – a theoretical linear decarbonisation approach that achieves zero carbon to demonstrate the gap to net zero for NHS Wales.

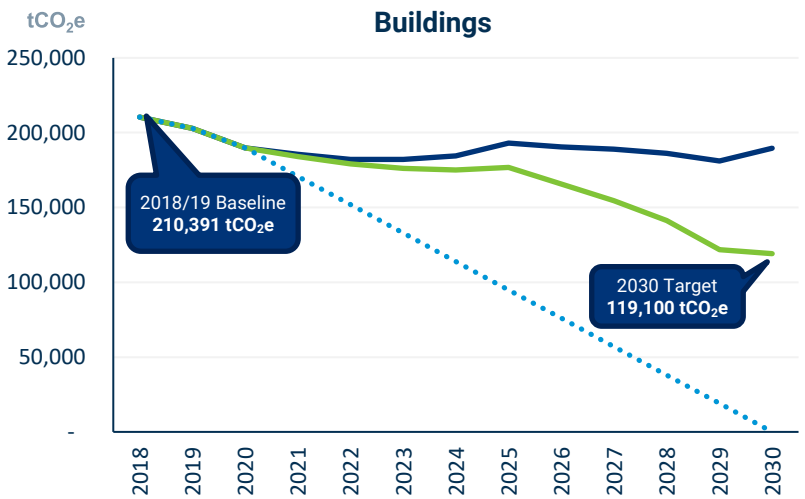


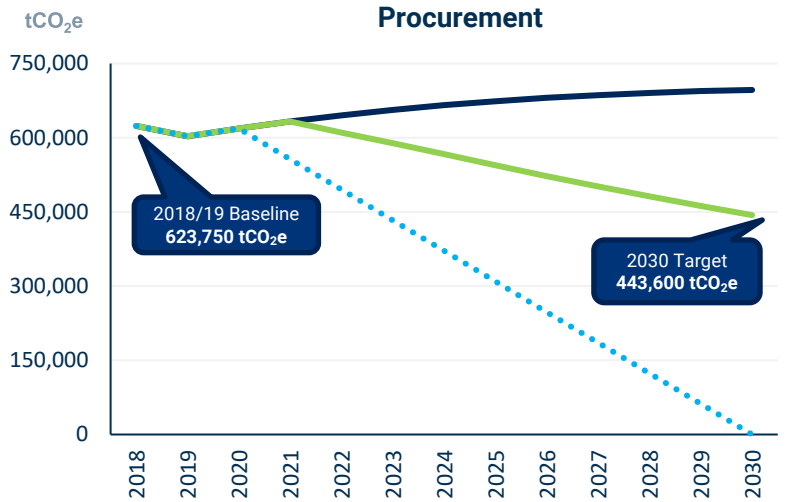
The NHS Wales 2025 and 2030 decarbonisation targets are set as follows:

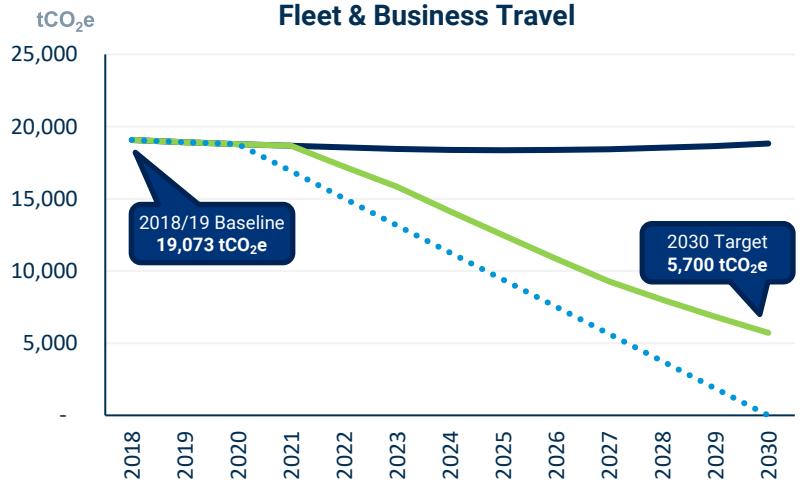
NHS Wales Decarbonisation Target	Emissions (tCO_2e)	Percentage reduction from 2018/19	Cumulative savings from initiatives will total (tCO_2e)
2025	845,600	-16%	459,000
2030	661,500	-34%	1,982,500

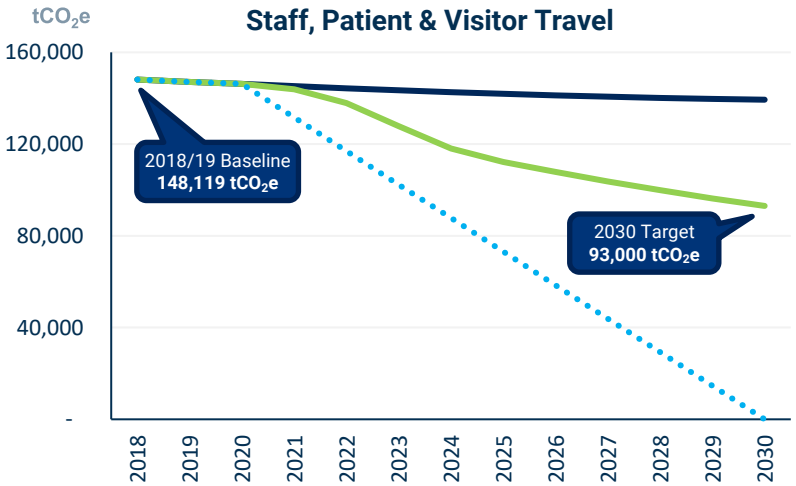
Category Targets

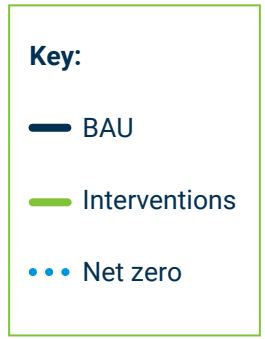
Alongside the overall NHS Wales emissions targets, assessments of performance will be made against the following category targets:











Delivery Plan Implementation

The success of this Delivery Plan will be highly dependent on the governance structure put in place, the management approach to ensure sustained momentum, and the financial investment put forward to support implementation. The following activities set out the implementation approach for the Delivery Plan; these are split between mobilisation and an improvement approach. Further detail regarding the specific actions, responsibilities, and target dates can be found within the Technical Appendices.

Mobilisation

1. NHS Wales will show leadership and commitment to deliver this Decarbonisation Delivery Plan in order to address the Climate Emergency for Wales as declared by Welsh Government and the Senedd.
2. A 'Decarbonisation Board' will be put in place to oversee implementation of the Delivery Plan; this will be a sub-group of the Welsh Government NHS Wales Climate Change Group.
3. A 'Decarbonisation Programme Manager' will be put in place as a dedicated role to drive the focussed implementation of the Delivery Plan.
4. 'Action Plans' will be developed, which will form the basis of how NHS Wales organisations will implement Delivery Plan initiatives – these will be developed two-yearly and committed to within Integrated Medium-Term Plans.
5. Welsh Government will enable the successful implementation of the Delivery Plan by supporting access to additional resource and finance for delivery of initiatives.

Improvement and Revision Approach

6. NWSSP Specialist Estate Services will oversee the evolution of the Estates and Facilities Performance Management System (EFPMS) returns to capture improved data coverage and communicate carbon performance – this will evolve to align with the 'Carbon reporting guide for the public sector in Wales' data requirements when published.
7. Welsh Government and NWSSP will issue a revision of the Delivery Plan with updated and refined targets by 2023.
8. Welsh Government and NWSSP will review the success of Delivery Plan implementation in 2024, and issue an update of the Plan in 2025.

Decarbonisation Initiatives

Decarbonisation of NHS Wales has been structured into six main activity streams:

- Carbon Management
- Buildings
- Transport
- Procurement
- Estate Planning and Land Use
- Approach to Healthcare

The activity streams do not specifically match the Carbon Footprint categories or the specific targets; they are structured to aid understanding of implementation. The initiatives included within the activity streams will often provide carbon reduction across several of the footprint categories.

Initiatives are the decarbonisation activities, or projects, that NHS Wales will undertake.

The identification of initiatives involved multiple parties, including the Carbon Trust, NWSSP, Welsh Government, NHS organisations, voluntary commissions, healthcare staff, and industry experts.

The Technical Appendices provides a full summary of the initiatives and sets out the specific actions, responsibilities, target dates for implementation, and appropriate exclusions.

	Content
Carbon Management	• Approach to carbon management
Buildings	• Decarbonising the existing estate • Requirements for new build developments and major refurbishments
Transport	• Improvements to non-emergency response fleet • Improvements to fleet, staff, patient and visitor travel • Improvements to the Welsh Ambulance Service NHS Trust emergency response fleet
Procurement	• Improvements to supply chain carbon accounting and engagement • Approach to decarbonisation of the supply chain
Estate Planning and Land Use	• Approach to strategic estate planning and building use • Approach to using land for offsetting and renewable energy generation
Approach to Healthcare	• Approach to smart working • Approach to climate and decarbonisation education • Approach to management of healthcare and medicines • Approach to reducing carbon emissions from waste

Carbon Management

No.	Initiative
1	Implement best practice carbon management with dedicated roles in place to undertake Delivery Plan initiatives.
2	Proactively communicate the Climate Emergency to staff and the public with the aim of stimulating low carbon behaviours and growing engagement in the decarbonisation agenda.
3	Drive the engagement required for decarbonisation across each organisation's leadership team – Finance, Procurement, Estates, and Capital Project teams will engage to develop a focussed and active approach to project implementation.

Existing Buildings

No.	Initiative
4	Progress a transformational energy and water efficiency retrofit programme across the estate – every building with a long-term future will have undergone a multi-technology energy-efficient upgrade by 2030.
5	Fully replace all existing lighting with LED lighting by 2025.
6	Complete expert heat studies by the end of 2023 for all acute hospitals to set the plan to transition away from fossil fuel heat sources.
7	Progress low carbon heat generation for all non-acute sites larger than 1,000m^2 by 2030.
8	We will not plan to install any further natural gas CHP plant - renewable CHP will be championed instead. For existing CHP plant, we will prioritise decommissioning over investment in major refurbishment of failed CHP from 2025, with the ambition for all CHP to be decommissioned by 2030.
9	Take an active approach to efficient control of energy in our buildings. All buildings will have up-to-date, standardised, and effective building management systems (BMS). Dedicated resource to optimise the use of energy by BMS control will be put in place by 2023.
10	Determine the overall viable potential for onsite renewable energy generation at each NHS Wales organisation by 2023. Install half of this potential by 2026, and the remainder by 2030.

New Builds and Major Refurbishments

No.	Initiative
11	Develop and build low carbon buildings to net zero standard – engage and collaborate with NHS partners across the UK on the emerging net zero building standard for hospitals, and adopt a net zero building accreditation approach which will be defined by 2022.
12	All project teams to have an independent client-side sustainability representative to provide due diligence support for the optimal low carbon design across all development stages – and be responsible for ensuring the Net Zero Framework process is followed.
13	Integrate Modern Methods of Construction (MMC) into the design and construction of new buildings – this will consider modular design, offsite fabrication, and just-in-time delivery to minimise construction-related carbon emissions.
14	Install electric vehicle charging points in new developments beyond minimum requirements, and future-proof new car parks by installing infrastructure to enable straightforward installation of future charging points.
15	Prioritise low carbon heating solutions as a key design principle. No fossil fuel combustion systems are to be installed as the primary heat source for new developments.
16	Incorporate the principles of sustainable transportation into the design of new sites (in addition to electric vehicle infrastructure) in line with the Welsh Government's Active Travel Action Plan for Wales.[11]

Photo credit: Laing O'Rourke

Transportation

No.	Initiative
17	NWSSP will work with Health Boards and Trusts to develop the best practice approach for electric vehicle (EV) charging technology, procurement, and car park space planning – this will include consideration of NHS Wales' own fleet, staff vehicles, and visitor EV charging.
18	A standardised system of vehicle management for owned and leased vehicles will be developed to plan, manage, and assess vehicle performance - this will entail central fleet management oversight within each organisation.
19	All new cars and light goods fleet vehicles procured across NHS Wales after April 2022 will be battery-electric wherever practically possible. In justifiable instances where this not suitable, ultra-low emission vehicles should be procured.
20	All new medium and large freight vehicles procured across NHS Wales after April 2025 will meet the future modern standard of ultra-low emission vehicles in their class.
21	All Health Boards and Trusts will appraise the use of staff vehicles for business travel alongside existing pool cars. Health Boards and Trusts will update their business travel policies to prioritise the use of electric pool cars, electric private vehicles, and public transport.
22	The Welsh Ambulance Service NHS Trust will continue to develop their electric vehicle charging infrastructure network plan for the existing NHS Wales estate to facilitate the roll-out of electric vehicles.

No.	Initiative
23	The Welsh Ambulance Service NHS Trust will aim for all rapid response vehicles procured after 2022 to be at least plug-in hybrid EV, or fully battery-electric in appropriate locations.
24	The Welsh Ambulance Service NHS Trust will actively engage with vehicle manufacturers for research and development of low carbon emergency response vehicles and report annually, with the ambition to operate plug-in electric, or alternative low carbon fuelled, emergency ambulances by 2028.

Procurement

No.	Initiative
25	NWSSP will transition to a market-based approach for supply chain emissions accounting.
26	NWSSP will expand its current Sustainable Procurement Code of Practice to include a framework for assessing the sustainability credentials of suppliers.
27	Value to the local supply chain will be maximised, whilst maintaining high standards for goods and services.
28	100% REGO-backed electricity will be procured by 2025, and 100% offset gas by 2030.
29	NWSSP Procurement Services will embed NHS Wales' decarbonisation ambitions in procurement procedures by mandating suppliers to decarbonise.
30	Sustainability will be embedded within strategic governance – NWSSP Procurement Services will work across Wales to champion decarbonisation in the supply chain, and influence decarbonisation ambitions for buildings and transport.
31	NWSSP Procurement Services will improve supply chain logistics and distribution to reduce the carbon emissions from associated transport.
32	NWSSP Procurement Services will actively develop and support procurement requirements to support implementation of this Delivery Plan.

Estate Planning and Land Use

No.	Initiative
33	All-Wales strategic estate planning will have carbon efficiency as a core principle – *quantified carbon* will be a key decision metric for planning new developments, rationalisation of the estate, and championing smart ways of working.
34	NWSSP and Welsh Government will advise Health Boards and Trusts on an appraisal approach for allocating land for uses such as renewable energy generation, greenhouse gas removal and afforestation – NHS Wales organisations will maintain green space and utilise land for decarbonisation, including collaborating with neighbouring land owners.
35	Large-scale renewable energy generation opportunities with private wire connections to NHS Wales sites will be progressed where viable.

Approach to Healthcare – Smart Working

No.	Initiative
36	Our approach to 21st-century healthcare will be central to the design of new hospital developments – redesigning the whole journey with care closer to home in a carbon-friendly primary care estate with a reduced need to visit hospitals.
37	Support the Welsh Government's target for 30% of the Welsh workforce to work remotely[12], by continuing to facilitate flexible and smart working, developing the existing approach to remote working technology, and rationalising existing office space.
38	Continue to utilise technology to increase the efficiency of engagements between staff and the public where suitable.

Approach to Healthcare – Education

No.	Initiative
39	Health education will be used to champion decarbonisation across our service – we will encourage sustainable healthcare practice, waste efficiency, and low carbon staff and patient behaviour.

Approach to Healthcare – Healthcare and Medicines

No.	Initiative
40	Support the work of existing working groups such as the Welsh Environmental Anaesthetic Network to raise awareness of the carbon impact of medical gases and transition to a culture where gases with low global warming potentials are prioritised.
41	Explore methods of minimising gas wastage and technologies to capture expelled medical gases.
42	Take a patient-centric approach to optimise inhaler use, focusing on a reduction in the over-reliance of reliever inhalers where possible and emphasising the importance of inhaler-specific disposal and recycling.
43	Transition the existing use and distribution of carbon-intensive and high global warming potential (GWP) inhalers to alternative lower GWP inhaler types where deemed suitable.

Approach to Healthcare – Waste

No.	Initiative
44	Support the development of guidance by 2022 for best practice reduction of pharmaceutical waste.
45	Develop a 'plastics in healthcare' initiative to address waste in the delivery of health care – this will aim to tackle PPE, single use plastics, and packaging waste.
46	Engage with pharmacists and prescribers to build upon and support existing efforts to encourage responsible disposal of inhalers through discussions with patients, information leaflets, posters and media.

Roadmap

The roadmap timeline sets out the NHS Wales summarised initiative activity out to 2030. To influence the roadmap, and the initiatives included within this Delivery Plan, a high-level scoring exercise has been undertaken. The scoring reflected should be used to reflect and visualise initiatives only, this does not provide the detail required to justify that one initiative should be prioritised over another, and is not a precise representation of impact.

Appraisals of initiatives were undertaken using the following metrics:

- *Carbon impact*
- *Technology and market readiness*
- *Effort and resource demands*
- *Strategic importance for enablement*

A quantitative scoring was allocated to each metric, with the combined total providing the overall score for each initiative. To maintain a decarbonisation focus, the carbon impact metric has a double weighting than that of other metrics. The Technical Appendices provides a full summary of initiative scoring and additionally includes a high-level financial impact assessment.

	Selected Example Initiatives	Score (/25)
5	Fully replace all existing lighting with LED lighting by 2025.	**14**
6	Complete expert heat studies by the end of 2023 for all acute hospitals to set the plan to transition away from fossil fuel heat sources.	**17**
11	Develop and build low carbon buildings to net zero standard – engage and collaborate with NHS partners across the UK on the emerging net zero building standard for hospitals, and adopt a net zero building accreditation approach which will be defined by 2022.	**15**
19	All new cars and light goods fleet vehicles procured across NHS Wales after April 2022 will be battery-electric wherever practically possible. In justifiable instances where this not suitable, ultra-low emission vehicles should be procured.	**12**
29	NWSSP Procurement Services will embed NHS Wales' decarbonisation ambitions in procurement procedures by mandating suppliers to decarbonise.	**22**

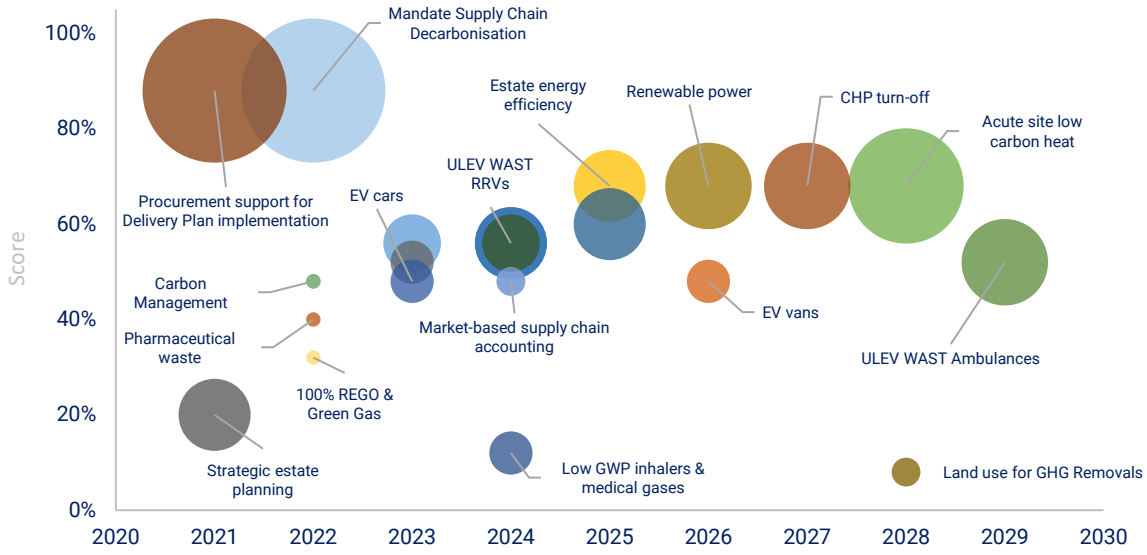
Initiative Roadmap Scoring

The following charts provide a visualisation of the initiative appraisal. The chart presents:

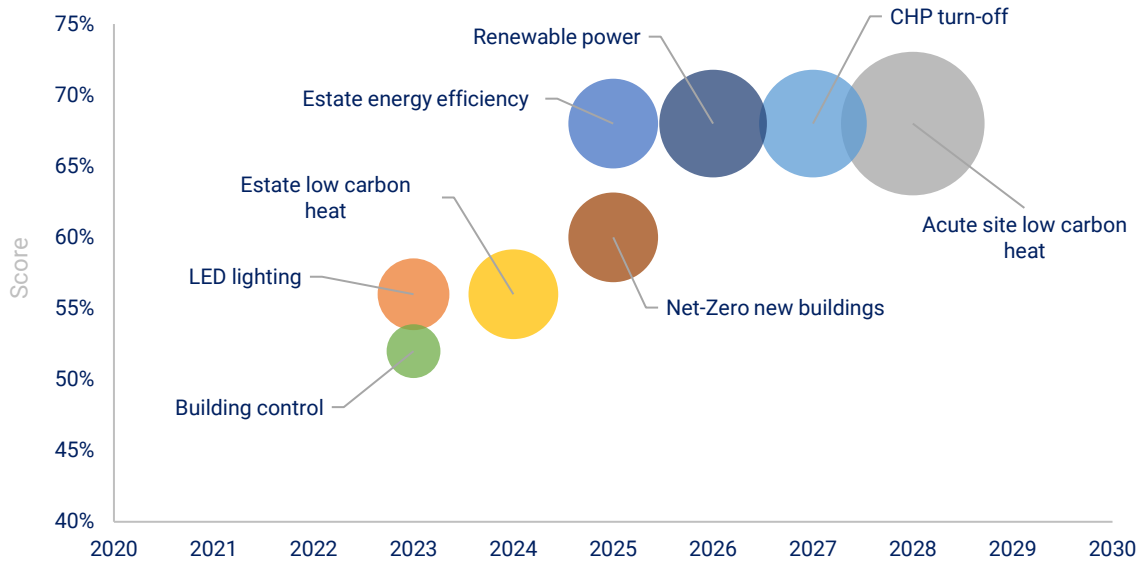
- *Indicative year in which implemented (in reality each will be across several years)*
- *Initiative score, shown as a percentage, based on the assessment against the four metrics*
- *Initiative carbon impact, represented by the size of the bubble.*

Selected initiatives are presented in the first chart covering buildings, transport, procurement, and the approach to healthcare. Highest scoring and largest impact initiatives relate to procurement, these are shown early on the timeline. The second chart presents building only initiatives for comparison.

Selected Initiative Roadmap Scoring



Building Initiatives Roadmap Scoring



Roadmap Timeline for Implementation

The following timeline summarises key initiatives across buildings, transport, procurement, and the approach to healthcare.

	Buildings	Transport	Procurement	Approach to Healthcare
2021	Action Plan requirements and expectations to be developed	A best practice approach for EV infrastructure and management will be developed	NWSSP will start the transition to a market-based approach for supply chain emissions accounting	The Welsh Government's 30% work from home target will be facilitated with appropriate technology and an updated approach to office use
2022	Effective building management systems and dedicated resource to optimise the use of energy by better control will be put in place	All new cars and light goods fleet vehicles procured across NHS Wales after April 2022 will be battery-electric where possible	The Sustainable Procurement Code of Practice will include a framework for assessing the sustainability credentials of suppliers	Anaesthetists will be prioritising medical gases with low global warming potentials as standard
2023	By 2023 low carbon heat evolution plans will be completed for all acute hospitals, and renewable energy implementation plans will be developed	WAST will aim for all rapid response vehicles procured after 2022 to be at least plug-in hybrid-electric or fully battery-electric for appropriate locations	NWSSP Procurement will actively be working with targeted suppliers and sectors, and will have contractually mandated decarbonisation into major procurements	Best practice pharmaceutical waste practice will be in place championing better prescribing, reviewing, just in time delivery, and a shift away from procuring bundles of pharmaceuticals
2024	New buildings will be constructed and accredited to a net zero standard.		NWSSP Procurement Services will improve supply chain logistics and distribution to reduce the carbon emissions from associated transport	Technologies to capture expelled medical gases will have been assessed and put into trial

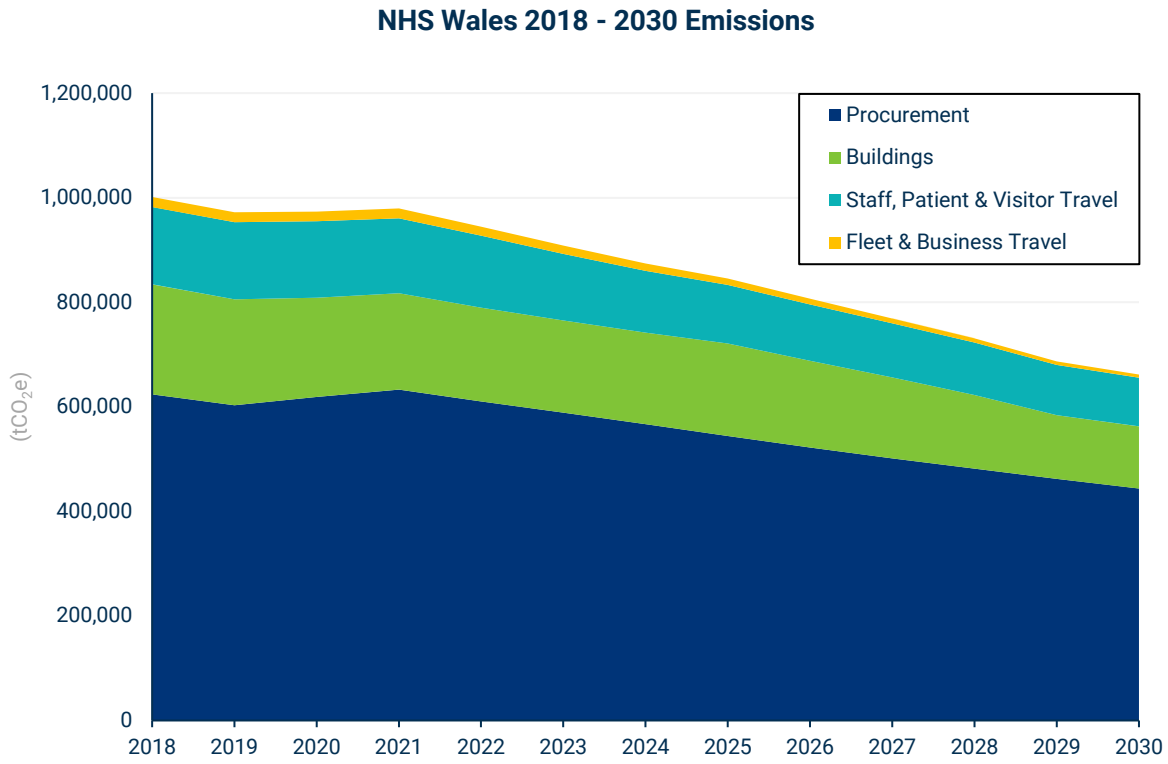
	Buildings	Transport	Procurement	Approach to Healthcare
2025	Decommissioning of natural gas CHP plants will be prioritised over refurbishment. All lighting will be fully replaced by LED	All new medium / large freight vehicles procured across NHS Wales after April 2025 will be to the future modern standard of ultra-low emission vehicles	NWSSP will have updated to market-based emissions accounting, and continues to engage with supply chains to support decarbonisation	Digital technology will be developed to support a smart communication approach between our sites and with the public at home
2026 / 27	50% of overall renewable energy generation potential will have been installed			
2028 / 29		WAST will aim for new ambulances procured to be plug-in electric, or alternative low carbon fuelled		
2030	Every building will have undergone an energy-efficient upgrade – low carbon heating will be utilised, renewable energy will be generated on site, and all gas CHPs will be decommissioned		Significant parts of the supply chain will have progressed to net zero emissions	

Emissions Modelling

The decarbonisation initiatives set out in the roadmap were modelled across the next decade based upon when and how the measures could be implemented.

The figure below shows an indication of how NHS Wales' emissions could look if the decarbonisation roadmap is followed. It shows decarbonisation speeding up after 2021, with the most significant decreases in emissions occurring from 2026 onwards with increasing scale of implementation of the Delivery Plan initiatives.

All emissions categories assessed demonstrate a reduction in emissions, this is also with respect to business-as-usual increases due to estate and healthcare service expansion. The largest source of emissions shown up to 2030 remains emissions associated with the procurement of goods and services.



In 2030, the estimated residual emissions are 661,500 tCO2e, with a 34% reduction achieved against the BAU. This presents the anticipated contribution to a net zero Welsh public sector.

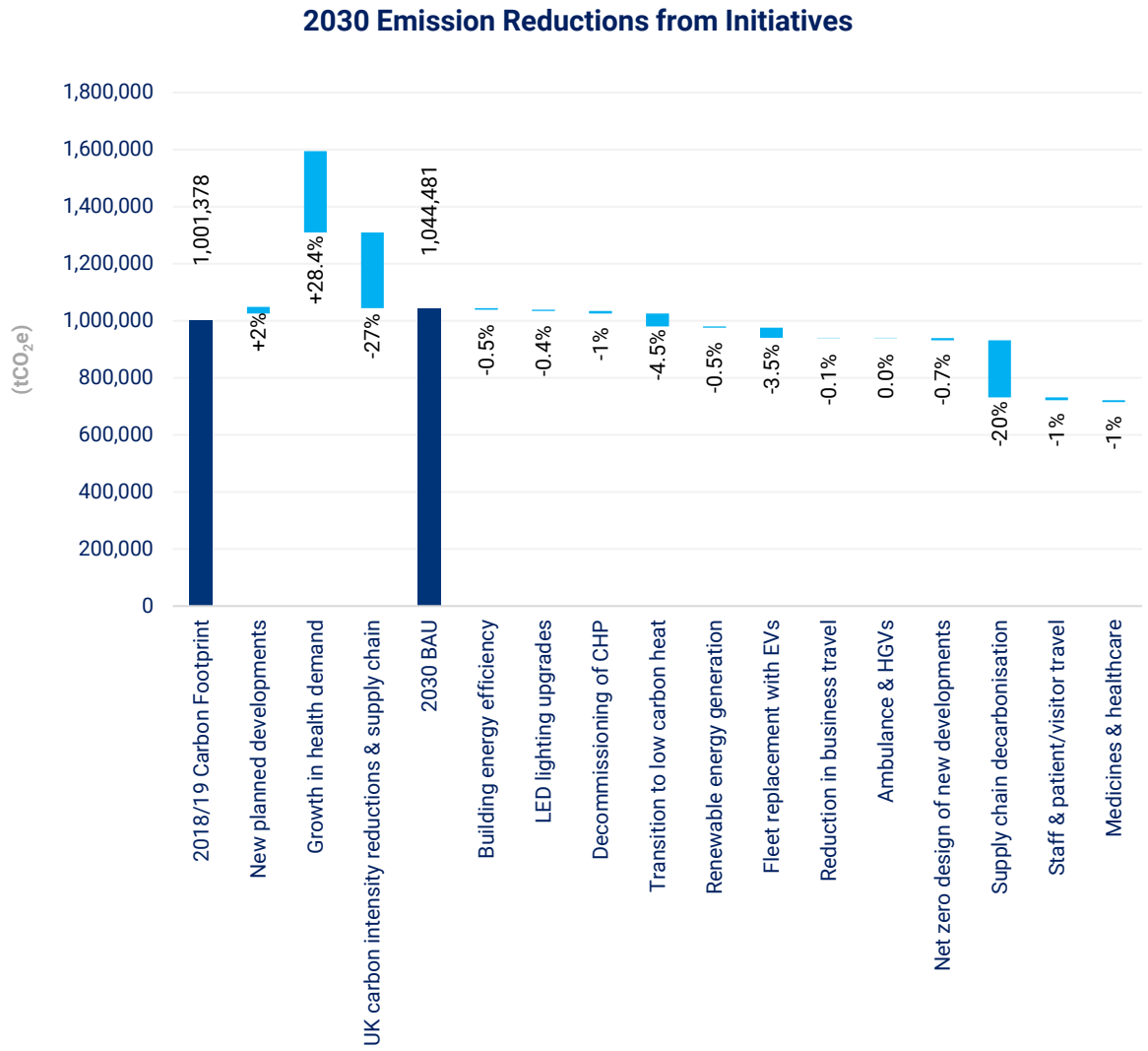
The net zero target for the public sector will be on a 'team Wales' basis[13]; this means that carbon-positive organisations (such as Natural Resources Wales) will balance with residual emissions of other Public Bodies such as NHS Wales. To support consistent carbon accounting, a Carbon reporting guide for the public sector in Wales developed by Welsh Government is expected to be published in 2021.

NHS Wales 2030 Emission Reduction Breakdown

The carbon reduction contribution of initiatives set out in the Delivery Plan has been mapped against the 2018/19 carbon footprint as a baseline (1,001,378 tCO_2e).

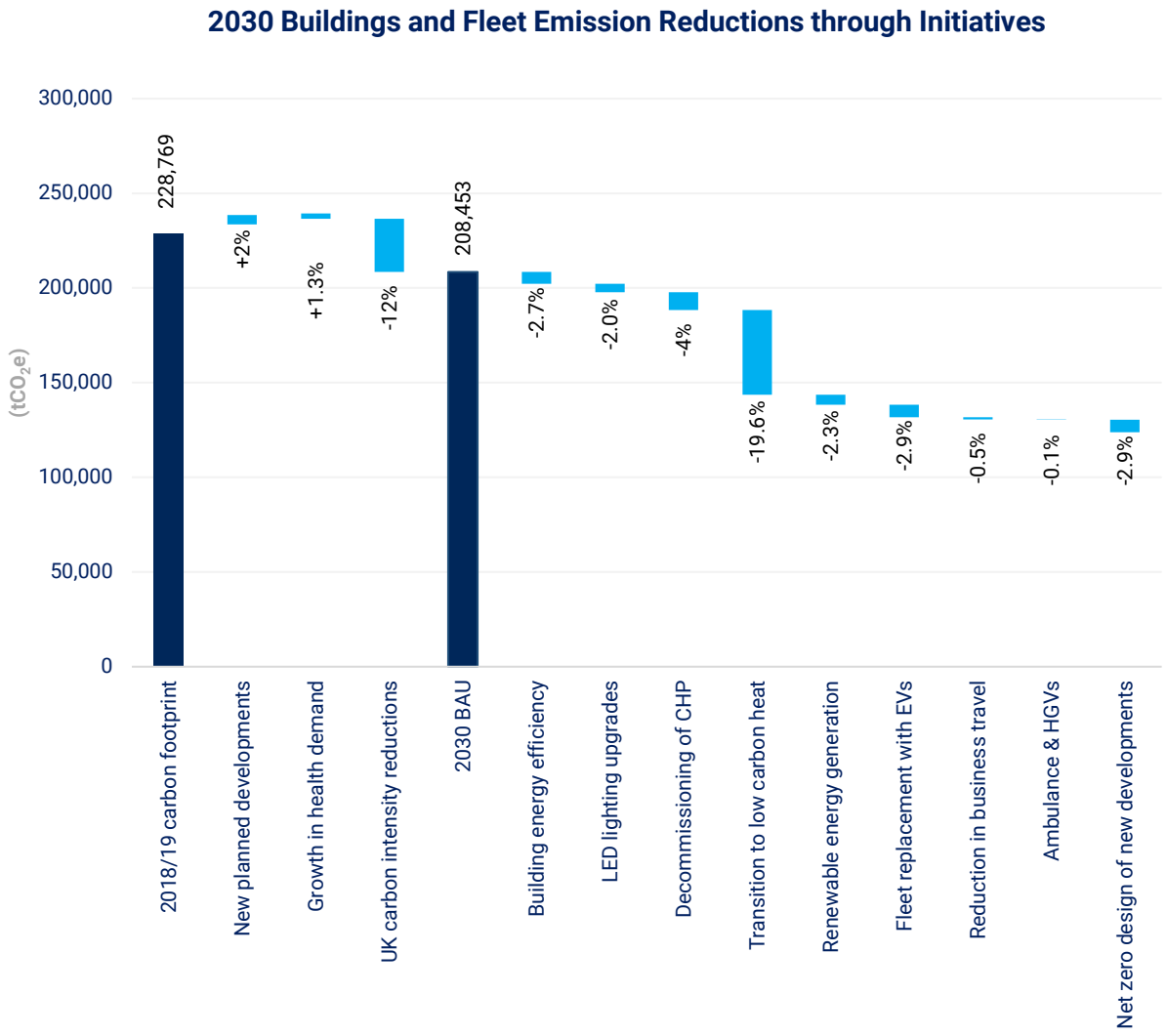
Business-as-usual (BAU) up to 2030 includes the estimated increases in emissions from the expansion of the NHS Wales estate (2% increase in emissions), and increased demand for health care (28% increase in emissions linked to population growth and higher energy intensity of healthcare technology, etc.). The decarbonisation forecasts for UK grid electricity, the average UK vehicle emissions, and for the supply chain are reflected within 'UK carbon intensity and supply chain'; this presents a 27% reduction to show a BAU 2030 down to a similar level of emissions as 2018/19.

Initiatives have been simplified and modelled to present the contribution to the 34% carbon reduction target against a 2030 BAU.



Buildings and Fleet 2030 Emission Reduction Breakdown

The following chart shows the potential emission reductions against the two categories of buildings, and fleet & business travel. These categories have been selected for presentation due to NHS Wales' direct control and influence over emissions.



Next Steps

The key next steps for putting this Delivery Plan into motion are focused around the five mobilisation activities.

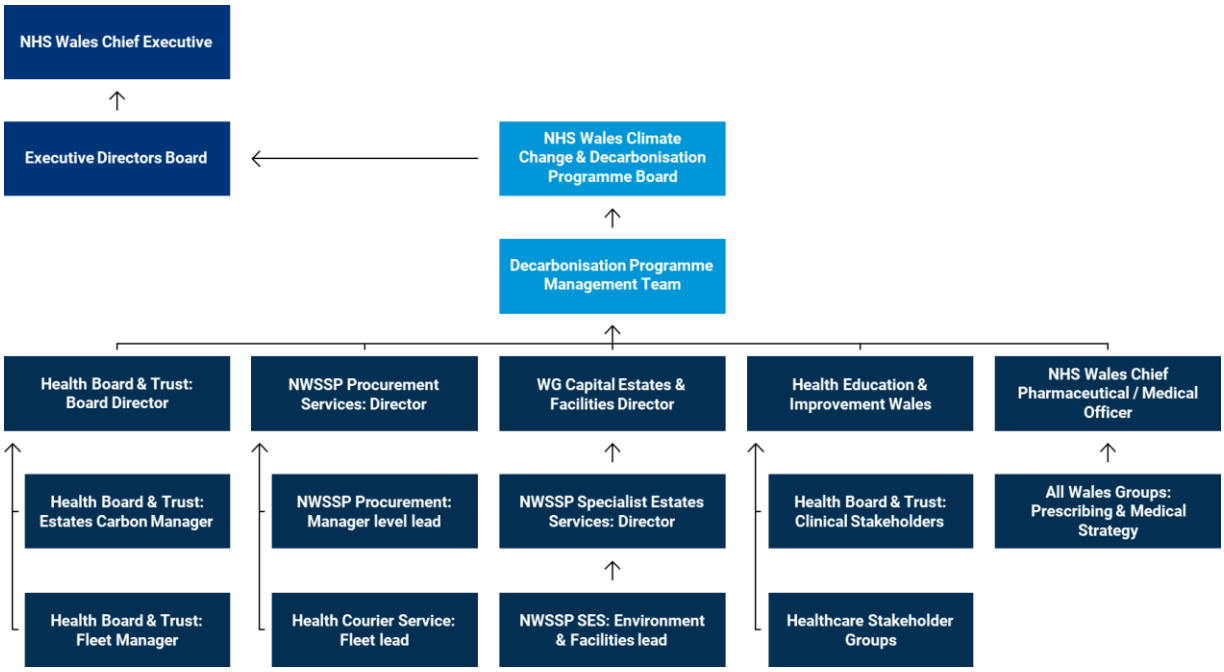
2 A 'Decarbonisation Board' will be put in place to oversee implementation of the Delivery Plan; this will be a sub-group of the Welsh Government NHS Wales Climate Change Group.

3 A 'Decarbonisation Programme Manager' will be put in place as a dedicated role to drive the focussed implementation of the Delivery Plan.

To sustain momentum and action over the longer term, an effective governance structure must be put in place.

To oversee the implementation of this Delivery Plan, a new *Climate Change & Decarbonisation Programme Board* will be put in place. This Board will report to the existing Executive Directors Board and the NHS Wales Chief Executive; this demonstrates the significance and importance given to implementing this Delivery Plan. This importance must be recognised by NHS Wales organisations also, therefore responsibility for responding to the Climate Emergency must sit at Board Director level.

A *Decarbonisation Programme Manager* and a wider management team will be put in place to be the focal point of implementing the Delivery Plan. This team will undertake a breadth of engagement spanning estates and facilities, planning, fleet management, procurement, clinical, and wider stakeholder groups to drive activity forward. The organigram below provides the governance structure put forward; it is however recognised that this will evolve as the Delivery Plan is mobilised.



4 'Action Plans' will be developed, which will form the basis of how NHS Wales organisations will implement Delivery Plan initiatives – these will be developed two-yearly and committed to within Integrated Medium-Term Plans.

5 Welsh Government will enable the successful implementation of the Delivery Plan by supporting access to additional resource and finance for delivery of initiatives.

For this Delivery Plan to be considered successful, a step-change in decarbonisation activity must be recognised.

The basis for the response to this Delivery Plan will be for NHS Wales organisations to develop Action Plans setting out how progress will be made against the initiatives set. It is important this is aligned with the strategic direction of each organisation also; therefore, the implementation of decarbonisation Action Plans are required to be committed to within Integrated Medium-Term Plans.

Key actions for each initiative are highlighted in the Technical Appendices, many of which will support Action Plan development. Important early actions for 2021/22 include putting in place data collection requirements to support market-based emissions accounting, supporting the approach for electric vehicles, planning specialist heat assessments, and engaging on the development of a new net zero building standard.

It is recognised that access to additional resource and finance is critical to ensure the success of this Delivery Plan. However, much progress can be made by championing decarbonisation within the decision-making process, and by integrating this into behaviour across NHS Wales.

Nevertheless, significant investment will be needed to meet the 16% reduction target by 2025 and 34% reduction target by 2030.

As part of the Action Plan development and review process, the *Climate Change & Decarbonisation Programme Board* and Welsh Government will understand the capital and revenue impacts for NHS Wales organisations. This will allow a strategic approach to be taken for investment decisions. The journey must start right away, to support this Welsh Government have ringfenced an initial £16m of decarbonisation capital to support initiative implementation in 2021/22.

The ultimate focus of Action Plans and investment decisions must be to recognise a step change in emissions across NHS Wales. Targets have been set for 2025 and 2030 for the overall emissions and a percentage reduction, these however will both be impacted by other business as usual changes in the health service. To appraise the success of action taken, a cumulative savings from initiatives target will be set; this will provide a focus to tracking interventions made through Action Plans across NHS Wales.

NHS Wales Decarbonisation Target	Emissions (tCO_2e)	Percentage reduction from 2018/19	Cumulative savings from initiatives will total (tCO_2e)
2025	845,600	-16%	459,000
2030	661,500	-34%	1,982,500

1 NHS Wales will show leadership and commitment to deliver this Decarbonisation Delivery Plan in order to address the Climate Emergency for Wales as declared by Welsh Government and the Senedd.

The most critical next step is to ensure that all parts of NHS Wales fully engage with and support the Climate Emergency.

This Delivery Plan provides a clear statement of commitment from Dr Andrew Goodall CBE, Chief Executive of NHS Wales, that NHS Wales will show leadership to tackle the Climate Emergency. This simple message must be the catalyst for all NHS Wales to engage and act.

Urgency, collaboration, and ongoing action are required to address climate change as a common cause, and to support the well-being of our future generations for a healthier Wales.

1. Technical Appendices

1.1 List of Abbreviations

BAU	Business as Usual
BEIS	UK Department for Business, Energy and Industrial Strategy
BEV	Battery-electric vehicle
BMS	Building Management System
CHP	Combined Heat and Power
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Coronavirus (or severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2))
DPI	Dry Powder Inhaler
EFPMS	Estates and Facilities Performance Management System
EV	Electric vehicle
GHG	Greenhouse Gas
GWP	Global Warming Potential
HEIW	Health Education Improvement Wales
HFC	Hydrofluorocarbon
HGV	Heavy goods vehicle
HTM	Health Technical Memorandum
IMTP	Integrated Medium-Term Plan
LGV	Light goods vehicle
MDI	Metered Dose Inhaler
NHS	National Health Service
NHSI	NHS Improvement (England)
NICE	National Institute for Health and Care Excellence
NWSSP	NHS Wales Shared Service Partnership
OJEU	Official Journal of the European Union
PHW	Public Health Wales
$PM_{2.5}$	Particulate matter with an aerodynamic diameter <2.5 µm
RHIG	Respiratory Health Implementation Group
ULEV	Ultra-low emission vehicle
WAST	Welsh Ambulance Service NHS Trust
WEAN	Welsh Environmental Anaesthetic Network
WG	Welsh Government
WHO	World Health Organisation
WHTM	Welsh Health Technical Memorandum

1.2 Glossary of Key Terms

Carbon footprint	A carbon footprint is the total greenhouse gas (GHG) emissions caused by an individual, event, organisation, service, or product, expressed as carbon dioxide equivalent (CO_2e). Greenhouse gases, including the carbon-containing gases carbon dioxide and methane, can be emitted through the burning of fossil fuels, land clearance and the production and consumption of food, manufactured goods, materials, wood, roads, buildings, transportation and other services.
Carbon negative (and carbon positive)	When the balance of carbon emissions exceeds zero, indicating the process of absorbing more CO_2 than is emitted. There is no official definition, and the term "carbon positive" is confusingly sometimes used to mean "carbon negative" where corporate communications attempt to avoid the use of the word "negative".
Carbon offsetting	A carbon offset allows organisations to compensate for emissions they cannot reduce. By funding an equivalent saving in carbon emissions elsewhere, residual emissions can be balanced.
Decarbonisation	Reducing and ultimately eliminating related carbon emissions from upstream, operational, and downstream activities.
GHG Protocol Standard	This Greenhouse Gas (GHG) Protocol Corporate Standard provides standards and guidance for companies and other types of organizations preparing a GHG emissions inventory. It covers the accounting and reporting of the six greenhouse gases covered by the Kyoto Protocol — carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6).
Low carbon	Technology, energy, sources and services that yield minimal output of greenhouse gases.
Low carbon heat	Heat that originates from sources that do not require direct combustion of scope 1 fossil fuels. This includes heat pumps, solar thermal heating, and biomass.
Market-based approach	Emissions calculated with consideration of the specific supply chain or product carbon footprint. Engagement with the market to understand supplier specific emissions for incorporation within a carbon footprint. Commonly provides improved accuracy of emissions for procured goods and services, waste streams and

	electricity supply. Defined as 'supplier-specific' emissions, as stated in GHG Protocol Scope 3 guidance.
Net zero	Net zero in the context of the Welsh public sector will be on a 'team Wales' basis whereby overall emissions across the whole public sector will balance to zero.[13]
Scope 1 Emissions	Direct emissions of an organisation, including combustion of fuels and fugitive emissions.
Scope 2 Emissions	Indirect emissions of an organisation, including purchased electricity and heat.
Scope 3 Emissions	Other indirect emissions associated with an organisation, including the supply chain, transport and distribution, business travel and commuting, use of products, waste, investments and other leased assets or franchises.
Supply chain	Covers all suppliers procured by an organisation to produce, transport, manufacture and/or process purchased raw materials and goods.

2. Delivery Plan Implementation Detail

2.1 Mobilisation

Leadership

1 **NHS Wales will show leadership and commitment to deliver this Decarbonisation Delivery Plan in order to address the Climate Emergency for Wales as declared by Welsh Government and the Senedd.**

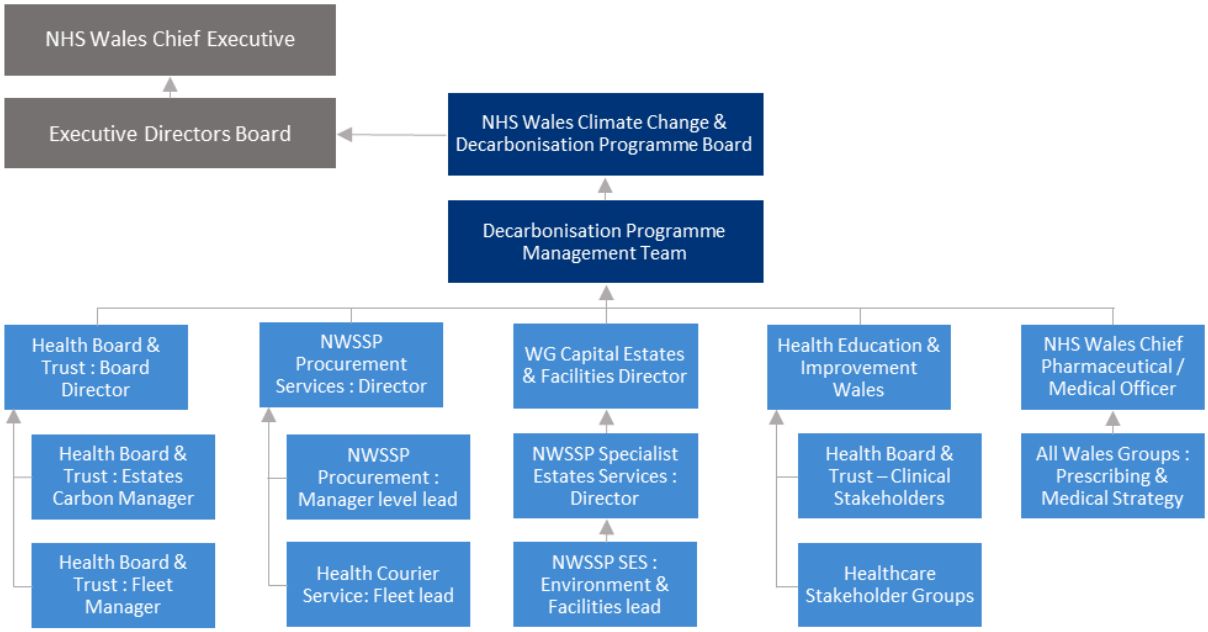
On 29th April 2019, the Welsh Government and the Senedd declared a Climate Emergency. The government committed to not let other political issues, such as the UK's departure from the European Union, detract from the need to act to combat climate change, which impacts "our health, economy, infrastructure and our natural environment".[14]

Management Structure

2 **A 'Decarbonisation Board' will be put in place to oversee implementation of the Delivery Plan; this will be a sub-group of the Welsh Government NHS Wales Climate Change Group.**

A Decarbonisation Board will be set up to oversee implementation. The Board will include technical specialists and operational leads who have the remit to oversee and appraise the delivery of the Plan. This is anticipated to mainly include key Welsh Government and NHS staff with the expertise to oversee and appraise buildings, transport, and procurement related decarbonisation activity.

The governance structure for Delivery Plan implementation is detailed as follows, with dark blue boxes demonstrating the operational aspects to be put in place.



A core responsibility of the Decarbonisation Board will be to receive, appraise, and approve 'Action Plans', and assess and accept progress reports. The Decarbonisation Board will engage at Board Director level within organisations to ensure that the Action Plan development, progress reporting, and overall delivery of initiatives are enacted across NHS Wales.

Although the Decarbonisation Board will be the focal point for delivery of the Plan, upward reporting will be channelled via the Executive Directors Board, and up to the NHS Chief Executive as the highest role in leadership for decarbonisation delivery. Also, the 'Healthier Wales Board' is anticipated to have an important role to play concerning decarbonisation, and will be included in the final working governance structure as appropriate.

3 **A 'Decarbonisation Programme Manager' will be put in place as a dedicated role to drive the focussed implementation of the Delivery Plan.**

The requirement to oversee and action implementation of this Plan requires a dedicated role(s) to be put in place. This position will be the pivotal point to drive engagement with the Delivery Plan across NHS Wales organisations, and ensure compliance with the requirements.

This role will be able to engage at Director level within organisations. This is where responsibility will lie within each organisation, and the Decarbonisation Programme Manager will have the remit to engage, influence, and raise issue at a senior level. This role will be supported as required by a wider Programme Management Team.

4 **'Action Plans' will be developed, which will form the basis of how organisations will implement Delivery Plan initiatives – these will be developed two-yearly and committed to within Integrated Medium-Term Plans.**

Each Health Board, Trust, special body, and NWSSP Procurement will develop an Action Plan every two years as stipulated, with the first to be published by March 2022. Each plan will detail how the respective organisation will implement the initiatives set out in this Delivery Plan.

Date	NHS Wales Organisation Requirements
Mar 2021	
Mar 2022	Action Plan
Mar 2023	Progress Review
Mar 2024	Action Plan
Mar 2025	Progress Review
Mar 2026	
Mar 2027	Action Plan
Mar 2028	Progress Review
Mar 2029	Action Plan
Mar 2030	Progress Review
Mar 2031	

The two-year timescale has been put forward to allow for strategic development of larger scale decarbonisation schemes whilst also driving regular engagement with the requirements of Delivery Plan initiatives. Although Action Plans are required two-yearly, it is important that a progress review is undertaken on a yearly basis. This will allow for assessment of sufficient progress being made and detail further actions to take to ensure the plan will be adhered to. Individual Action Plans will need to highlight how departments within Health Boards and Trusts will take individual responsibility for implementation.

To ensure consistency across NHS Wales organisations, and to set the expected standard, an 'Action Plan' template will be developed. Commitment to implementing the Action Plans will be reflected within each Integrated Medium-Term Plan, with the expectation that the Actions Plans will be published as an annex.

5 **Welsh Government will enable the successful implementation of the Delivery Plan by supporting access to additional resource and finance for delivery of initiatives.**

Access to resource and finance is critical to ensure the success of this Delivery Plan. Welsh Government and NWSSP recognise the important role they play in facilitating these aspects. Welsh Government and NWSSP will work closely with the Decarbonisation Board to review and understand the Action Plans put forward by Health Boards and Trust to support financial planning.

Resource to develop Action Plans and implement the interventions will ultimately sit with Health Boards and Trusts, however, any resource constraints to successfully deliver decarbonisation will be monitored by Welsh Government and NWSSP and actioned as appropriate.

Welsh Government will provide technical and commercial expertise to support NHS Wales's implementation of the Delivery Plan through services such as the *Welsh Government Energy Service*. In addition, appropriate internal costs such as project management can be included within requests for finance.

For the first financial year of delivery, 2021-22, Welsh Government have made available £16m in capital funding for decarbonisation. NWSSP will communicate to NHS organisations how this money can be accessed.

Health Boards and Trusts will also be able to apply for additional funding or finance streams through other initiatives, such as:

- The Wales Funding Programme – Invest to Save [15]
- The Welsh Government's proposed £30m investment over 5 years to boost electric vehicle charging points (under consultation at the time of writing)[16]

Summary Activities for Strategic Delivery Plan Mobilisation

		Key Actions	Responsibility	Implemented
1	NHS Wales will show leadership and commitment to deliver this Decarbonisation Delivery Plan in order to address the Climate Emergency for Wales as declared by Welsh Government and the Senedd.	Signed 'Statement of Commitment' and publication of this Delivery Plan	NHS Wales Chief Executive	Early 2021
2	A 'Decarbonisation Board' will be put in place to oversee implementation of the Delivery Plan; this will be a sub-group of the Welsh Government NHS Wales Climate Change Group	Creation of an 'NHS Wales Climate Change Decarbonisation Board' with allocated responsibility, reportable to 'Executive Board'	NWSSP & WG	Mid 2021
3	A 'Decarbonisation Programme Manager' will be put in place as a dedicated role to drive the focussed implementation of the Delivery Plan	Assign a 'Decarbonisation Programme Manager' with dedicated responsibility and authority to oversee Delivery Plan implementation.	NWSSP & WG	Mid 2021
4	'Action Plans' will be developed, which will form the basis of how organisations will implement Delivery Plan initiatives – these will be developed two-yearly and committed to within Integrated Medium-Term Plans.	Agree and circulate an 'Action Plan' proforma to set the standard required	NWSSP	Mid 2021
		Develop 'Action Plans' specifically setting out how the initiatives will be implemented	NHS Organisations	Mar 2022 (two-yearly)
		Commit to 'Action Plan' implementation within Integrated Medium-Term Plans	NHS Organisations	Mar 2022 (two-yearly)
		Implement 'Action Plans' and assess progression	NHS Organisations	Mar 2023 (two-yearly)

		Key Actions	Responsibility	Implemented
5	Welsh Government will enable the successful implementation of the Delivery Plan by supporting access to additional resource and finance for delivery of initiatives.	Engage with the 'Decarbonisation Board' to assess and feedback on 'Action Plans', for acceptance	WG NHS Capital Estates & Facilities	Mar 2022
		Assess business cases put forward, prioritising the low carbon options within 'Action Plans' – approve and progress	WG NHS Capital Estates & Facilities	Ongoing
		Put in place a ring-fenced capital fund to support multi-year decarbonisation schemes – this should be scaled to meet the needs of 'Action Plans' and the overall aims of the Delivery Plan	WG NHS Capital Estates & Facilities	2021
		Provide technical and commercial expertise to support implementation of the Delivery Plan (such as the Welsh Government Energy Service)	Welsh Government	Ongoing

2.2 Improvement and Revision Approach

6 **NWSSP Specialist Estate Services will oversee the evolution of the Estates and Facilities Performance Management System (EFPMS) returns to capture improved data coverage and communicate carbon performance – this will evolve to align with the 'Carbon reporting guide for the public sector in Wales' data requirements when published.**

Collecting high-quality operational data is a key priority if we are to understand and mitigate carbon emissions. Our existing data quality and management system, the EFPMS, is used to collect and track data associated with our environmental performance.

The EFPMS has provided the basis of building and transport-related emissions data for the Carbon Footprint. However, improvements can be made to improve the consistency of data across Health Boards and Trusts and plug gaps in the data reported. In addition, an evolution of EFPMS reporting (including dashboards) will be undertaken to communicate performance in carbon dioxide emissions (tCO_2e) – this will support understanding of carbon impact across all NHS organisations.

A review of the lessons learned from the Carbon Footprint exercise will be undertaken. This will provide direction on where data fields should be extended and how data definitions should be clarified. Engagement with Health Board and Trust carbon management contacts will be undertaken to support understanding of EFPMS developments and requirements going forward.

7 **Welsh Government and NWSSP will issue a revision of the Delivery Plan with updated and refined targets by 2023.**

There are two fundamental reasons for doing this: firstly, to reflect upon progression to date, and secondly to update targets to reflect improved data collection.

Issues with the existing data include:

- Business travel emission data collection is medium quality, with a proportion of data estimated. A system will be implemented to collect more detailed business travel data.
- Procurement data has been collected using financial proxies. This means that wide variations in the carbon intensity of services have not been captured (for example, inhalers have a proportionally high carbon impact per pound (£) spent). A market-based data collection approach will be implemented.

The Delivery Plan will be updated with revised baseline and targets to reflect an improved understanding and increased accuracy of carbon emission accounting. It is envisaged that the 2023 update will be solely for the purpose of updating targets as appropriate to reflect improved data collection techniques. In 2025 a formal review and update of the Delivery Plan as a whole is proposed.

8 **Welsh Government and NWSSP will review the success of Delivery Plan implementation in 2024, and issue an update of the Plan in 2025.**

In 2024 there will be a formal appraisal of progress against the stipulated emissions targets and commitments, this will be for issue by March 2025. A consultation will be undertaken across NHS Wales to reflect upon lessons learned and how to improve the Delivery Plan to ensure maximum impact. Subsequently, a fully updated Delivery Plan will be published setting out decarbonisation measures up to 2030.

A summary of the Welsh Government / NWSSP / Programme Board requirements for the agreement of Action Plans, progress review, and revision of the Delivery Plan is set out as follows:

Welsh Government / NWSSP / Programme Board Requirements:

Date	Action Plan Reviews	Progress & Target Reviews	Issue and Update
Mar 2021			Delivery Plan Issued
Mar 2022	Action Plan Review		
Mar 2023		Delivery Plan Progress Review	Re-issue with Refined Targets
Mar 2024	Action Plan Review		
Mar 2025		2025 Target Assessment	
Mar 2026			Delivery Plan Update
Mar 2027	Action Plan Review		
Mar 2028		Delivery Plan Progress Review	
Mar 2029	Action Plan Review		
Mar 2030			
Mar 2031		2030 Target Assessment	

Summary Activities for Strategic Delivery Plan Updates

		Key Actions	Responsibility	Implemented
6	NWSSP Specialist Estate Services will oversee the evolution of the Estates and Facilities Performance Management System (EFPMS) returns to capture improved data coverage and communicate carbon performance – this will evolve to align with the 'Carbon reporting guide for the public sector in Wales' data requirements when published.	NWSSP Specialist Estates Services will review and adapt the EFPMS system to improve data capture and analysis capabilities to improve the quality of carbon footprinting	NWSSP SES	Late 2021
7	Welsh Government and NWSSP will issue a revision of the Delivery Plan with updated and refined targets by 2023.	NWSSP Procurement Services will implement a market-based approach for supply chain emissions data to improve the quality of emissions data collection for purchased goods and services.	NWSSP Procurement Services	2023
		Develop improved and reliable data collection processes for Travel (fuel card data, expense claims, staff/patient/visitor travel surveys)	NWSSP SES	2023
		Incorporate improved and revised data into the footprinting process, and reissue Delivery Plan targets as appropriate	Welsh Government, NWSSP	2023
8	Welsh Government and NWSSP will review the success of Delivery Plan implementation in 2024, and issue an update of the Plan in 2025	Assess Delivery Plan progress against the commitments and specific targets, and critically review the success of the management arrangement and implementation.	Welsh Government, NWSSP	2024
		Develop and publish a revised Delivery Plan for 2025 – 2030 incorporating learnings, and advances in low carbon best practice.	Welsh Government, NWSSP	2025

3. Decarbonisation Initiatives Detail

3.1 Decarbonisation Initiatives

Decarbonisation of NHS Wales has been structured into six main activity streams:

- Carbon management
- Buildings
- Transport
- Procurement
- Estate Planning and Land Use
- Approach to Healthcare

The activity streams do not specifically match the Carbon Footprint categories or the specific targets; they are structured to aid understanding of implementation. The initiatives included within the activity streams will often provide carbon reduction across several of the footprint categories.

Initiatives are the decarbonisation activities, or projects, that NHS Wales will undertake.

The identification of initiatives involved multiple parties, including the Carbon Trust, NWSSP, Welsh Government, NHS organisations, voluntary commissions, healthcare staff, and industry experts.

	Content
Carbon Management	• Approach to carbon management
Buildings	• Decarbonising the existing estate • Requirements for new build developments and major refurbishments
Transport	• Improvements to non-emergency response fleet • Improvements to fleet, staff, patient and visitor travel • Improvements to the Welsh Ambulance Service NHS Trust emergency response fleet
Procurement	• Improvements to supply chain carbon accounting and engagement • Approach to decarbonisation of the supply chain
Estate Planning and Land Use	• Approach to strategic estate planning and building use • Approach to using land for offsetting and renewable energy generation
Approach to Healthcare	• Approach to smart working • Approach to climate and decarbonisation education • Approach to management of healthcare and medicines • Approach to reducing carbon emissions from waste

3.2 Carbon Management

The application of best practice carbon management is key to decarbonisation. Consequently, carbon management will the foundation of delivering this Delivery Plan across NHS organisations.

Carbon Management Roles

Dedicated resource for carbon management within Health Boards and Trusts will be required to deliver best practice and to progress the decarbonisation initiatives included in this Delivery Plan. Energy management roles are currently in place across Health Boards and Trusts. However, there is variation in the coverage of the role, in particular with regard to developing decarbonisation projects.

The 2019 Welsh Public Sector Decarbonisation Survey (due for publication in the near future) noted that less than 0.1% of the public sector workforce in Wales had carbon management responsibilities within their job description. To address the importance of carbon reduction across the public sector, a shift in emphasis of is needed for existing energy management roles to provide a greater focus on carbon management. To support decarbonisation, carbon management will require a project development emphasis, with the role expanding beyond solely utility management.

As implementation of this Delivery Plan progresses, NHS organisations will need to review their carbon management to ensure decarbonisation is progressing. As required, carbon management responsibility should broaden within organisations, for instance carbon management to closely align with capital project teams who may be better placed to deliver largescale transformative decarbonisation projects.

Welsh Health Environment Forum

The Welsh Health Environment Forum (WHEF) is a consultative body for organisations across NHS Wales. They meet regularly to discuss initiatives, experiences and good practice on all environmental matters. WHEF will continue to meet on a regular basis and use the opportunity as a mechanism to support delivery and implementation of this Delivery Plan. WHEF is split into three sub-groups, one of which is the Energy Manager Sub-group. WHEF could consider converting the Energy sub-group into an Energy and Decarbonisation sub-group and use this as an opportunity to share knowledge in decarbonisation opportunities to support the delivery of this plan.

Best Practice Guidance

'Health Technical Memorandum 07-02: EnCO_2de 2015 - making energy work in healthcare' provides the current best practice framework for energy management, energy efficiency progression, and procurement of new developments.[17,18] With the changing political landscape, and progression in technology, NWSSP will support the review of *EnCO_2de HTM 07-02* alongside other NHS partner organisations in the UK.

Bi-Annual Action Plans

Carbon management within NHS organisations will also provide a foundation role in the Delivery Plan as a whole. Bi-annual 'Action Plans' and progress reports will be developed by each Health Board; the carbon management function is a sensible focal point to lead this within each organisation. Also, carbon management representation and communication through key groups (such as the WHEF) will play a key role in supporting alignment and longevity if engagement with the Delivery Plan across Wales.

Decarbonisation Communication

To achieve the scale of impact required for decarbonisation, NHS Wales staff will need to fully engage on the agenda and adjust behaviours.

Proactive and structured communication with staff will be used by Health Boards and Trusts to raise the profile of the decarbonisation agenda, encourage low carbon behaviour, and encourage staff to take individual responsibility for energy, waste, and transport emissions both at work and at home. Regular engagement will be key to maintain momentum in the agenda. Case studies of Initiative implementation can be used to showcase progress by Health Boards and Trusts, and provide collateral to engage with staff. An element of decarbonisation education can be provided through Health Education Improvement Wales.

Carbon Management – Initiatives and Key Actions

The following table of initiatives sets out the actions that will be taken to ensure best practice carbon management is implemented across NHS Wales:

		Key Actions	Responsibility	Implemented
1	Implement best practice carbon management with dedicated roles in place to undertake Delivery Plan initiatives.	Support the review of *EnCO_2de HTM 07-02* to develop best practice guidance to support carbon management in Welsh Health Boards and Trusts. Distribute this guide to Health Boards and Trusts upon publication.	NWSSP	2022
		Put in place dedicated and appropriately skilled resource to deliver best practice carbon management – a key focus of the role will be to implement initiatives.	Health Boards & Trusts	2022
		Use the Welsh Health Environment Forum as a mechanism to support delivery plan implementation, share lessons learned, emphasise the importance of decarbonisation and share best practice.	NWSSP, Health Boards & Trusts	Ongoing
2	Proactively communicate the Climate Emergency to staff and the public with the aim of stimulating low carbon behaviours and growing engagement in the decarbonisation agenda.	Develop a staff engagement approach to communicate: • NHS Wales commitments to decarbonisation • Case studies of progress Undertake consultations to support and engage in projects and encourage best practice behaviour.	Health Boards & Trusts	Ongoing / Annually
		Provide building and energy managers with additional training in best practice use of BMS for carbon reduction (more details included in Existing Buildings section).	Health Boards & Trusts	2022
		Develop a targeted approach to encourage and facilitate low carbon staff travel. This will include keeping staff up to speed with available travel options and exploring opportunities to support and encourage the purchase of battery-electric vehicles (BEVs), ultra-low emission vehicles (ULEVs), bicycles, electric bicycles and public transport loan schemes and discounts.	Health Boards & Trusts	Ongoing

		Key Actions	Responsibility	Implemented
		Closely follow the guidance set out in the *Active Travel Action Plan for Wales*[Error! Bookmark not defined.] to ensure suitable considerations for active t ravel are factored into decision making. Install secure compartmentalised bicycle storage at each site greater than 1,000m^2 allowing adequate provision for electric bicycle charging. Continue to explore localised opportunities to improve cycling infrastructure to and from hospital sites.	Health Boards & Trusts	Ongoing
		Brief senior management staff of the key themes of decarbonisation to ensure low carbon principles are integrated into decision making at all levels.	Health Boards & Trusts	Mar 2022
3	Drive the engagement required for decarbonisation across each organisation's leadership team – Finance, Procurement, Estates, and Capital Project teams will engage to develop a focussed and active approach to project implementation.	Consider implementation models such as Energy Performance Contracts	Health Boards & Trusts	Ongoing
		Engage with technical and commercial support available such as the Welsh Government Energy Service	Health Boards & Trusts	Ongoing
		Build engagement and responsibility for decarbonisation across the organisations from the top down – actively engage across finance, procurement and estates teams	Health Boards & Trusts	Ongoing

3.3 Existing Building Retrofit

Current Situation

Emissions associated with building use accounted for more than 195,000 tCO_2e in 2018/19, which equated to 20% of NHS Wales's total emissions in 2018/19. Almost all of these buildings are expected to still be in operation in 2030.

NHS Wales has a portfolio of 950 built assets including hospitals, health centres, warehouses, offices, industrial laundries, mass food production facilities and training academies; of these, 350 buildings are on hospital sites. The volume and variation in buildings provide the need for a targeted approach for decarbonisation.

Carbon reduction will be a high priority in business case decision making.

The optimal carbon solution may, in some cases, lead to an increase in energy costs.

In recent years, progress has been made to reduce energy use across the NHS Wales estate. This has primarily been driven by the demonstration of energy cost savings with attractive financial paybacks to justify the business cases for investment. However, to progress towards a net zero ambition, a shift in emphasis is required. Within business cases, carbon will now be a high priority in business case decision making beyond that of energy cost savings. This will open up the opportunity for strategic low carbon heat projects which have a high impact in terms of carbon reductions but often provide little or no energy cost-benefit. In some cases, the optimal carbon solution will lead to an increase in energy costs.

The interaction between the approach to carbon management and the operation of buildings is recognised as having a significant influence on the emission performance of buildings. The previous *Carbon Management* section includes initiatives to tackle the operational use of buildings (e.g. staff behaviours in the operation of a building). This section focuses on ensuring the existing building stock operates in a carbon-efficient way.

Decarbonisation of Heat

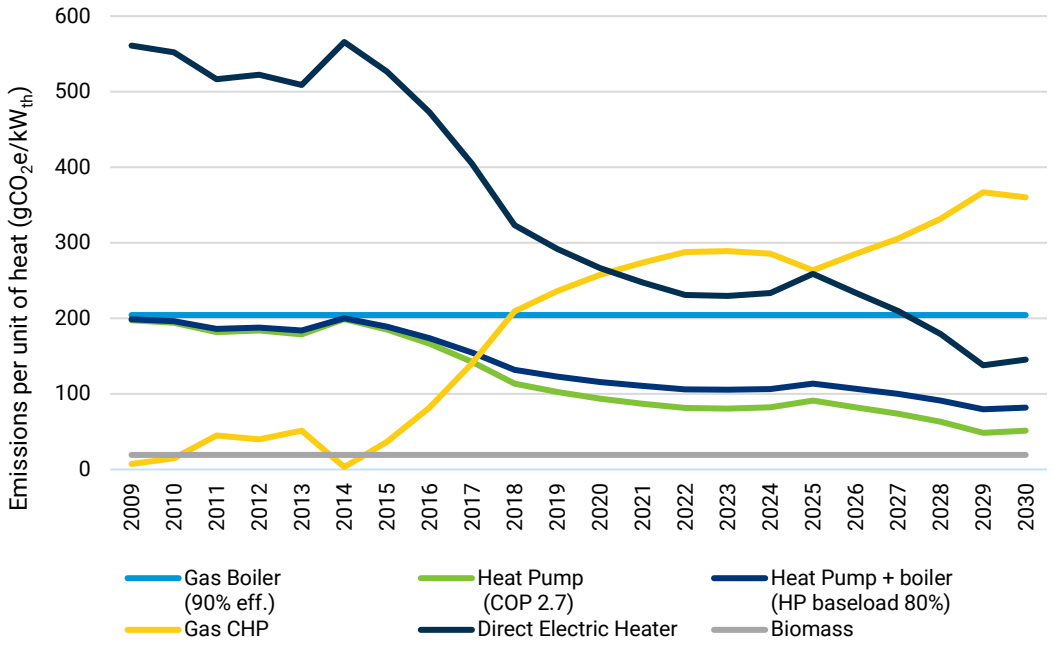
Climate Change Committee's *The Path to a Net Zero Wales* report made clear that the installation of low carbon heating should be a "high priority for the Welsh Government".[19]

However, decarbonisation of heat is also one of the largest obstacles for progression to net zero. Almost all of the heat currently used in the NHS Wales estate relies on the burning of fossil fuels, mainly natural gas. Fossil fuel use for heat accounts for 64% of NHS Wales's building-related emissions, and the majority of this is attributed to 16 sites considered as 'acute' hospitals.

NHS acute hospitals often use various types of heating systems across each site; there is a mixture of steam, high-temperature hot water, low-temperature hot water, multi-building heat networks, single building solutions, wet radiator systems, direct expansion units and air handling unit heat emitters. There is a need to assess each acute site individually and develop a tailored plan to transition away from fossil fuel heat sources.

The figure overleaf presents the carbon intensity of for the generation of heat over time. This uses actual historical carbon factors and the forecasted factors up to 2030 using the National Grid Future Energy 'steady progression' scenario.[20]

Rapid decarbonisation of the electricity grid is shown by the 'direct electric' (dark blue line) – this demonstrates how the carbon intensity of grid electricity has dropped by more than 50% since 2014. Since 2009 the carbon intensity of the natural gas grid has not varied. The forecast shows the trend of electricity gird decarbonisation to continue out to 2030. This results in a significant increase in the carbon intensity of gas-fired CHP, whilst heat pump technology improves over time.



Carbon intensity of heat by generation technology from 2009 to 2030 (using BEIS 'Steady Progression' scenario)

Heat Pumps

Heat pumps are a highly efficient form of electric heating. For the majority of healthcare sites, heat pumps (including air source, ground source, water source, chiller heat recovery) will be explored as the favoured low carbon heating technology.

Heat pumps are not necessarily a simple like-for-like replacement for gas boilers, and will not be able to raise steam. With gas prices currently relatively cheap, significant carbon saving can come at a negative revenue impact. However, heat pump operational cost impacts can be negligible or even provide a saving. Heat pump efficiency is highly driven by the operating temperature to support efficient operation enabling measures such as heat emitter resizing or building fabric improvements are sometimes undertaken to support higher efficiency and lower running costs.

It is important to note that heat pump technology is advancing and higher temperature solutions at higher efficiencies are now available – these provide an easier retrofit alternative to boiler plant.[21] In addition, the policy position is championing electrification of heat, an example of this is the UK Government's commitment to align natural gas and electricity climate change levy costs. The BEIS energy price projections also forecast a proportionally greater increase in gas costs than electricity out to 2030,[22] which further supports the financial case for heat pumps moving forward.

Biofuels

On a localised basis, opportunities for low carbon heating fuel such as biomethane and biomass will be considered. Although significant challenges are recognised regarding the sustainability of supply and long-term operation of equipment, these are not insurmountable and in some cases options for local biofuel supply may provide a decarbonisation opportunity.

Hydrogen

It is acknowledged that decarbonisation of the national gas grid is not expected to be realised in the near term (before 2030). National Grid provide the Future Energy Scenarios[20] that map out the potential UK energy mix. Hydrogen as an energy source is recognised as an important contributor to a net-zero 2050; however, significant development is still needed and therefore this will not contribute towards a net zero 2030. Hydrogen does not feature significantly in any Future Energy Scenarios for heat until 2035, and at that point, this is anticipated to be on a local hydrogen grid basis targeting industrial areas. This is also reflected in the latest Committee on Climate Change advice for Wales.[4] With the ambition to be net zero by 2030, NHS Wales cannot rely on, or wait for, the transformation of the natural gas distribution network to decarbonise heat.

Conventional Combined Heat and Power

The generation of heat using combined heat and power (CHP) plants are much less efficient than the operation of standard boilers, but has the added benefit of producing electricity cheaply. Where sites have a constant year-round heat load (such as large hospitals), CHP often represents a viable investment as electricity generation is significantly cheaper than the market value.

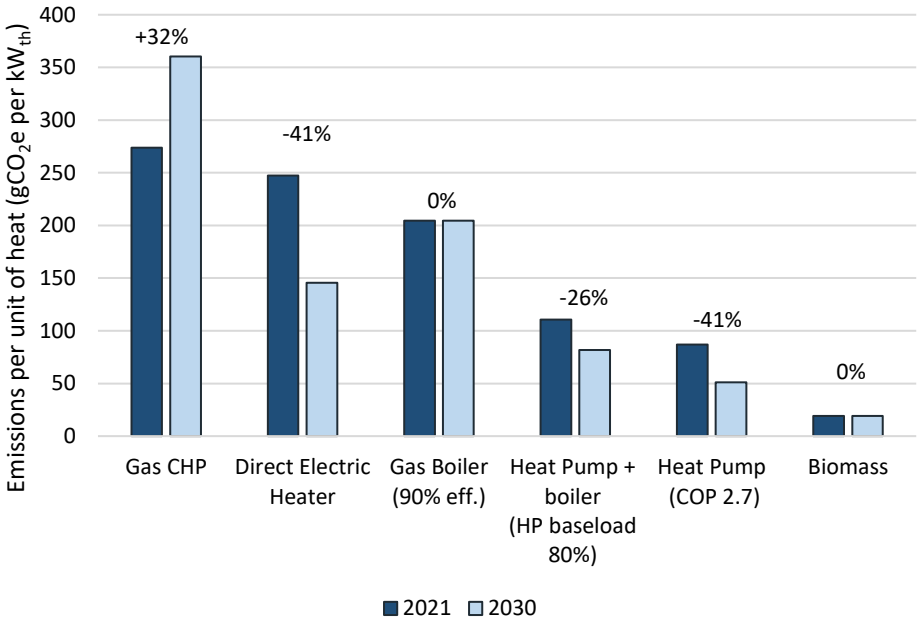
In the past, conventional natural gas CHP plants were heralded as an effective technology to reduce energy costs and save carbon. However, as the electricity grid is transitioning to a low carbon future, the carbon emission savings associated with CHP have diminished to the point where the operation of CHP in Wales is now increasing carbon emissions. Each year as the carbon intensity of grid electricity reduces, the emissions associated with CHP will increase further.

This increase in emissions up to 2030, alongside a comparison with alternative heat generation technology, is shown on page 55. The variation in the carbon intensity of heat generation between 2021 and expected 2030 is shown below. Modest and conservative heat pump efficiencies have been applied.

The UK Department for Business, Energy and Industrial Strategy (BEIS) conducted a call for evidence on CHP during 2020. Industry stakeholders' responses to the consultation noted that whilst steps can be taken to amend the operation of CHP to improve carbon efficiency, or install hydrogen ready units, there are no options in the short term for existing or new natural gas CHP stock such that carbon will be saved in the face of grid decarbonisation.[23]

NHS Wales is known to have thirteen sites with CHP units, two of which are known to not be currently operational. CHPQA data, where available, show that some of the units are optimised for electrical efficiency and therefore dumping a large proportion of heat, whereas other units are more optimised for heat.

As the combustion of fossil fuels will always emit carbon, NHS Wales will need to transition away from this technology to achieve its zero-carbon ambitions. The UK policy position for CHP has now shifted to be



Carbon intensity of heat by generation technology: 2021 vs 2030

discouraging of natural gas CHP. For example, England's Public Sector Decarbonisation Scheme grant will not fund natural gas CHP, and instead targets low carbon heat projects. In addition, natural gas CHP for large-scale heat networks now struggles to satisfy carbon criteria for Heat Networks Investment Project finance.

The main driver to retain natural gas CHP is to provide revenue cost savings. With the priority for NHS Wales now shifting to carbon savings, the case to retain CHP units for the long term weakens. Financial savings from CHP total 0.6% of the overall estates budget, but by 2030 will account for 4.5% of total building emissions if not decommissioned.

The most significant impact on revenue costs by shifting away from natural gas CHP will be at Cardiff and Vale University Health Board. However, with potential plans to replace the University Hospital of Wales, it is envisaged that a new heat strategy will be put in place for the new development.

By 2030, the aim is that all CHP will be decommissioned in NHS Wales. During this period, increased reporting will be undertaken through EFPMS returns, to demonstrate efficient operation (certified to CHPQA) and manage maintenance spend. After 2025, no major refurbishment or replacement works will be undertaken on CHP plant, and decommissioning will be prioritised over refurbishment. The overall decommissioning plan (except for CHP unit failure) will be included with acute hospital heat studies which will set the plans on how to transition towards low carbon heat.

Financial savings from CHP account to 0.6% of the total Estates budget

By 2030, CHP will account for 5% of total building emissions

Existing Building Retrofit – Initiatives and Key Actions

The interaction between the approach to carbon management and the operation of buildings is recognised as having a significant influence on the emission performance of buildings. The previous Carbon Management section includes Initiatives to tackle the operational use of buildings (e.g. staff behaviours in the operation of a building, active BMS use). This section focuses on low carbon retrofit upgrades to the existing building stock.

It is recognised that some sites will be planned for decommissioning prior to 2030, in these cases investment to action initiatives may not be justifiable. However, uncertainty should not be a barrier to decarbonisation and estate plans should be determined such that decarbonisation progress can be prioritised.

		Key Actions	Responsibility	Implemented
4	Progress a transformational energy and water efficiency retrofit programme across the estate – every building with a long-term future will have undergone a multi-technology energy-efficient upgrade by 2030.	Commission specialist energy and carbon audits every two years to evaluate the opportunities for carbon reduction and water savings at each site to inform decarbonisation 'Action Plans' as appropriate.	Health Boards and Trusts	2022
		Buildings should be operated as efficiently as possible. Consideration should be given to: • Operational controls of buildings via BMS (included improved automated control), and local heating controls (e.g. TRVs). • Installation of high-efficiency equipment such as chillers, high-efficiency-motors / pumps, EC fans, pipework insulation and lighting. • Ensuring cooling systems (e.g. space cooling, food storage, mortuaries, etc.) are well maintained and operated at maximum efficiency (e.g. variable speed compression). • Ensuring only low-global warming potential (GWP) refrigerants will be used in refrigeration and heat pump systems (e.g. Ammonia, CO2, R1234zd, R1234ze). • Ensuring existing HVAC equipment is operated at maximum efficiency (e.g. EC fans, auto fan speed regulation, heat recovery). • Low carbon heat technologies installed as replacement for fossil fuel-burning plant. • Improving thermal efficiency of buildings with fabric upgrades and draught proofing.	Health Boards and Trusts	2022

		Key Actions	Responsibility	Implemented
		• Utilising electric alternatives to gas tumble driers when replacement is due. • Ensuring gas-fired catering equipment is replaced with induction equipment during refurbishments/replacements. • Ensuring all ICT equipment procured is low-power equipment and that server rooms utilise free cooling and efficient cooling systems which are maintained at a sensible temperature.[24] • Ensuring localised domestic hot water heaters are used where appropriate to reduce long pipe runs. • Ensuring that water saving equipment is used (e.g. water-saving urinals, automatic taps, dual flush toilets).		
		Ensure 'Action Plans' demonstrate estate-wide impact such that every building with an expected future towards 2030 will have undergone a multi-technology energy-efficient upgrade by 2030.	Health Boards & Trusts	2030
5	Fully replace all existing lighting with LED lighting by 2025.	Develop a lighting upgrade approach for each site, considering whether like-for-like replacement will be sufficient or if a new design is required. Seek expert advice in areas where LED lighting could have a detrimental impact on specialist technologies (e.g. LED flicker). Utilise natural lighting solutions where available.	Health Boards & Trusts	2022
		Procure and implement LED upgrades across the estate by 2025. Exceptions may be made where buildings are known not to have a future beyond 5 years (March 2027 with regard to this initiative)	Health Boards & Trusts	2025
6	Complete expert heat studies by the end of 2023 for all acute hospitals to set the plan to transition away from fossil fuel heat sources.	Commission low carbon heat specialists to develop a low carbon heat evolution plan at each acute site to set out a transition plan away from fossil fuelled heat toward low carbon heat. This will include heat generation, heat distribution, heat emitters, and building fabric upgrades.	Health Boards & Trusts	2023

		Key Actions	Responsibility	Implemented
		The evolution plans should consider technologies such as heat pumps, biomass, chiller heat recovery, wider heat networks (where realistic) and other innovative heat solutions such as sewage heat recovery and emerging heat pump technology.		
		Implement upgrades to ensure that 60% of generated heat at acute sites is low carbon by 2030.	Health Boards & Trusts	2030
7	Progress low carbon heat generation for all non-acute sites larger than 1,000m^2 by 2030.	Commission low carbon heat specialists to evaluate the potential to convert non-acute sites to low carbon heat by 2030, including heat generation, heat distribution, heat emitters, and building fabric upgrades.	Health Boards & Trusts	2022
		Implement changes to target a shift to full low carbon heating by 2030. Aim to have converted 50% of heat to low carbon heat by 2026.	Health Boards & Trusts	2026 / 2030
8	No further natural gas CHP plant will be installed – renewable CHP will be championed instead. For existing CHP plant, decommissioning will be prioritised over investment in major refurbishment of failed CHP from 2025, with the ambition for all CHP to be decommissioned by 2030	Continue to certify all CHP plant to the CHPQA programme to ensure efficient operation. Health Board will also report CHPQA compliance information and CHP maintenance spend through EFPMS when inputs developed.	Health Boards & Trusts	Ongoing
		Increase CHP metric reporting on EFPMS to track CHPQA compliance and maintenance spend – this will be developed to understand compliance with this initiative.	NWSSP	2021
		No new natural gas CHP units will be considered going forward. For the existing known schemes, these will be subject to an options appraisal.	Health Boards & Trusts	2021
		Decommissioning will be prioritised over refurbishment from 2025. Normal standard maintenance will continue; however, in the event of a CHP unit failing (for instance, engine replacement) decommissioning should be prioritised.	Health Boards & Trusts	2022

		Key Actions	Responsibility	Implemented
		The ambition will be to decommission all CHPs by 2030 to support the transition away from fossil fuelled heating. For some installations, it is recognised that this 2030 ambition may need to tie in with timescales for new build hospital developments.	Health Boards & Trusts	2030
9	Take an active approach to efficient control of energy in our buildings. All buildings will have up-to-date, standardised, and effective building management systems (BMS). Dedicated resource to optimise the use of energy by BMS control will be put in place by 2023.	Install effective building management systems (BMS) across the building portfolio, allowing members of estates staff to optimise energy consumption in heating, cooling and ventilation (HVAC) systems. At smaller sites, a simple programmable intelligent heating control with remote access will suffice.	Health Boards & Trusts	2024
		Develop standard operating procedures to optimise the efficient operation of buildings, this will include set schedules for time-clocks / operating setpoint / alarms.	Health Boards & Trusts	2022
		Ensure trained resource is in place to optimise energy use by BMS control. Ensure a process is put in place to regularly manage and optimise BMS controls.	Health Boards & Trusts	2023
10	Determine the overall viable potential for onsite renewable energy generation at each NHS organisation by 2023. Install half of this potential by 2026, and the remainder by 2030.	Conduct feasibility studies to establish the viability of onsite generation such as solar PV and solar thermal collectors (either roof-mounted or car port mounted) at each site.	Health Boards & Trusts	2023
		Proceed with renewable energy installation in all viable instances. 50% of identified viable potential to be installed by 2026. 100% of identified viable potential to be installed by 2030.	Health Boards & Trusts	2026 / 2030
		Develop a strategy to ensure existing renewable energy systems remain well maintained (e.g. periodic cleaning schedule, schedule of consumable part replacement (e.g. inverters) in line with expected lifespans).	Health Boards & Trusts	2023

3.4 New Builds and Major Refurbishments

Undertaking new-build development and major refurbishment works are carbon intensive activities. The decision-making process at the design stage is critical when considering the whole operational life of a built asset, as new buildings are expected to have a lifespan exceeding 50 years. The decisions made at the design stage not only impact the emissions associated with construction, operational energy, and end of life decommissioning, but also the readiness of a building to incorporate future low carbon technologies.

NHS Wales have adopted the BREEAM definition for major refurbishment as follows: *"Major refurbishment is defined as construction that results in the fundamental remodelling or adaptation of existing elements of the building envelope, structure and renewal of key building services. And where, on completion of the works, such remodelling/renewal will materially impact on the performance of the building."*

Between 2021-2030 several new build development projects are anticipated, including:

- New Velindre Cancer Centre
- 10+ Community Health Hubs
- A new University Hospital Wales (UHW2)

There are several new developments in planning for NHS Wales, these vary from community health hubs to major new developments. NHS Wales has the ambition for these new developments, alongside major refurbishments, to be the exemplar in their low carbon credentials and considered net zero. To achieve this is it recognised that building designs will need to go beyond the minimum requirement of building regulations, and not necessarily be bound to BREEAM as the main mechanism to define a net zero design.

The definition of a net zero building is still emerging. As part of the understanding and position of NHS Wales to progress exemplar low carbon design, it is recognised that NHS Wales must collaborate with partners across the UK. NHS England has engaged with the UK Green Building Council[25] and is developing a net zero building standard for hospitals. Alongside that, it is understood that HTMs are currently being updated to greater support low carbon design. NHS Wales will engage with both these activities to support joint learnings.

It is important that whichever definition is decided to be supported by NHS Wales, that there is a robust approval and accreditation approach. It is understood that the BRE are developing a net zero standard that will provide accreditation, which may be suitable for NHS Wales to adhere to going forward.

Green Building Council – Net Zero Carbon Building Framework Steps

New Builds and Major Refurbishments – Initiatives and Key Actions

NHS Wales is adopting an approach that supports exemplar low carbon design for all new build developments and major refurbishments. The following initiatives and key actions set out how this will be implemented.

		Key Actions	Responsibility	Implemented
11	Develop and build low carbon buildings to net zero standard – engage and collaborate with NHS partners across the UK on the emerging net zero building standard for hospitals, and adopt a net zero building accreditation approach which will be defined by 2022.	Continue in the short-term to ensure that all new buildings achieve a BREEAM 'Excellent' score and all refurbishments achieve a BREEAM 'Very Good' score.	Health Boards & Trusts	Ongoing
		All NHS organisations will adopt the agreed net zero approach for all new building designs and ensure new builds are certified to net zero. This will ensure: • Carbon in construction is identified and reduced as much as possible (e.g. low carbon building materials, replacement of onsite diesel generators with solar generators, etc.) • Carbon throughout the life of the building and resource use is reduced as much as possible (e.g. only the highest efficiency equipment can be utilised) • Renewable energy will be utilised on-site (e.g. solar PV and/or solar thermal on roofs)	Health Boards & Trusts	2022
		A net zero building standard framework for hospitals is being developed, and NWSSP should continue to engage with NHS partners and other organisations to support its development. Through these engagements NWSSP should stay sighted on updates to Health Building Notes / Health Technical Memorandum.	NWSSP	Ongoing

		Key Actions	Responsibility	Implemented
12	All project teams to have an independent client-side sustainability representative to provide due diligence support for the optimal low carbon design across all development stages – and be responsible for ensuring the Net Zero Framework process is followed.	Ensure that each new build project has in place a suitably qualified client-side sustainability representative. They will be responsible for: • Providing due diligence support for the optimal low carbon design across all development stages • Ensuring the agreed net zero approach and accreditation process is followed The sustainability representative will be responsible for championing flexibility in the design to ensure that new and emerging low carbon technologies can be added at later stages of the design process.	Health Boards & Trusts	2024
		In support of larger capitals projects, consideration should be given to whether a client-side sustainability representative job role is included as a specific lot in the 2024 capital construction framework.	NWSSP	Jan 2024
13	Integrate Modern Methods of Construction (MMC) into the design and construction of new buildings – this will consider modular design, offsite fabrication, and just-in-time delivery to minimise construction-related carbon emissions.	Consider the use of modular designs to standardise the construction approach and therefore minimise construction waste and transportation of construction machinery. This will be championed alongside designs incorporating efficient low carbon heat and a modern healthcare approach.	Health Boards & Trusts	2022
14	Install electric vehicle charging points in new developments beyond minimum requirements, and future-proof new car parks by installing infrastructure to enable straightforward installation of future charging points.	Health Boards and Trusts will undertake an activity to establish the Authorised Service Capacity (kVA) required at each new build and major refurbishment site to service additional capacity requirements for electric vehicle (EV) charging infrastructure (including staff, public and fleet vehicles). Once capacity is assigned to EV charging, it must not be removed at a later date (e.g. for site expansion).	Health Boards & Trusts	2021
		In new car parks, install underground cabling infrastructure (e.g. trunking) to enable straightforward installation of cabling for future charging points.	Health Boards & Trusts	2022

		Key Actions	Responsibility	Implemented
		Install a sufficient electric vehicle charging infrastructure as set out in the Transportation section of this report. Enough infrastructure must be in place to ensure charging is not a barrier to the procurement of electric fleet vehicles.	Health Boards & Trusts	2022
		Ensure sufficient rapid charging infrastructure is in place to ensure charging infrastructure is not a barrier to the procurement of electric emergency ambulances when they become commercially available (expected in 2028). It's acknowledged that in some rural areas this technology may not be feasible and in this instance, Health Boards and Trusts may exclude this action.	Health Boards & Trusts	2027/28
15	Prioritise low carbon heating solutions as a key design principle. No fossil fuel combustion systems are to be installed as the primary heat source.	Ensure all new or refurbished sites utilise low temperature heating systems with variable flow temperatures and a low carbon heat source. No new natural gas, oil or LPG boilers will be installed as a primary heat source going forward beyond those which are currently planned - fossil fuels may only be used as backup energy sources.	Health Boards & Trusts	2021
16	Incorporate the principles of sustainable transportation into the design of new sites (in addition to electric vehicle infrastructure) in line with the Welsh Government's Active Travel Action Plan for Wales.	Ensure that newly constructed sites sufficiently consider and incorporate sustainable transport, such as good public transport links, secure cycle storage, and changing facilities.	Health Boards & Trusts	2022
		Provide and promote secure cycle storage for staff and visitors, accommodating for emerging technologies such as larger e-bikes and electric scooters. Provide and promote public showers and changing facilities to encourage active travel.	Health Boards & Trusts	2022
		Strategically plan the location of new sites to reduce private vehicle commuting requirements where possible.	Health Boards & Trusts	2021
		Engage with local authorities to ensure that adequate zero-carbon transport facilities are installed to allow easy access to healthcare facilities (e.g. segregated bicycle lanes, park and ride facilities).	Health Boards & Trusts	2023

3.5 Transportation

Importance

Transportation was highlighted by the Welsh Government as a key sector for decarbonisation in their strategy document *Prosperity for All: A Low Carbon Wales*, with the plan committing to ensuring all cars and light goods vehicles in the public sector fleet will be ultra-low emission by 2025.[5] The importance of decarbonising transport was further emphasised in the Climate Change Committee's *The Path to a Net Zero Wales* report, which identified electrifying transportation as a key mechanism to achieving a net zero future.[4]

A Vision for Charging in Wales

By 2025, all users of electric cars and vans in Wales are confident that they can access electric vehicle charging infrastructure when and where they need it.

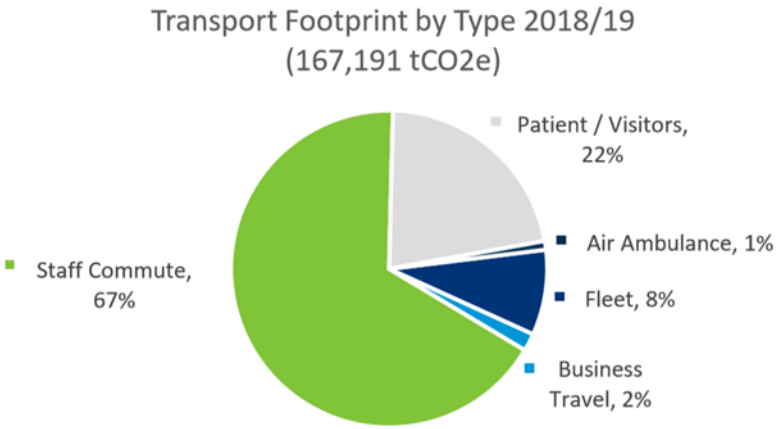
In November 2020, the UK Government announced a ban on the sale of internal combustion engine cars by 2030. In December 2020, Welsh Government launched a consultation for its 'Electric Vehicle Charging Strategy' for Wales,[26] setting the vision for sufficient and confident access to EV charging infrastructure by 2025. In support of this, the Welsh Government recently committed £30m to aid charging point delivery.[27]

NHS Wales recognise the need and challenge to rapidly upscale charging capacity across its sites to serve all site users including staff, visitors, fleet vehicles, and emergency response vehicles.[28]

Current Situation

Emissions from transportation across the healthcare network and operations contributed to around 167,000 tCO_2e in 2018/19, which accounts for 17% of the total NHS Wales footprint. Two-thirds of transport emissions are a direct result of staff commuting, which includes more than 3 million miles of private vehicle use.

It should be noted that there are high levels of estimation in the calculation of emissions associated with staff commuting and patient visits.



NHS Wales' carbon footprint from transport

Impact of Poor Air Quality

Internal combustion engine vehicles emit pollutants including nitrogen oxides, particles, carbon monoxide and hydrocarbons, all of which have a negative impact on peoples' health and the health of the surrounding environment. Exposure to such pollutants can increase health risks from heart disease, lung diseases, lung cancer[29] as well as possible effects of dementia, diabetes, low birth weights,[30] eye irritation, throat irritation and nose irritation.[31]

Public Health Wales estimates the burden of long-term air pollution exposure in Wales to be the equivalent of 1,000 to 1,400 deaths (at typical ages) each year

Public Health Wales estimates the burden of long-term air pollution exposure in Wales to be the equivalent of 1,000 to 1,400 deaths (at typical ages) each year, and note that this typically impacts the most vulnerable in society.[32] Research in early 2021 highlighted that the atmospheric particulate matter $PM_{2.5}$ (which is emitted by internal combustion engines) is thought to be a major contributor to COVID-19 cases in England, concluding that a small increase in air pollution leads to a large increase in the COVID-19 infectivity and mortality.[33]

In 2020, Welsh Government produced the *Clean Air Plan for Wales*, designed to reduce the impact of air pollution. The plan includes measures such as implementing the Welsh Government electric vehicle charging strategy and promoting ULEVs.[34]

Low emission vehicles in Wales

Ultra-low emission vehicle (ULEV) uptake (which includes battery-electric vehicles (BEVs)) in Wales lags significantly behind the rest of the UK. In 2019, there were only 1,241 new registrations of ULEVs in Wales, which accounts for:

- 1.5% of the 80,500 newly registered ULEVs across the UK in 2019[35]
- 0.05% of the 2.29 million newly registered vehicles across the UK in 2019[36]

One of the fundamental barriers to the shift to low carbon transportation, in particular for battery-electric vehicles, is the lack of existing charging infrastructure.[26] A significant improvement to the existing charging infrastructure is needed to catalyse a rapid uptake in low carbon vehicles in Wales, both for NHS' own fleet and for staff, patients and visitors.

Active Travel

Note that active travel-related initiatives (e.g. encouraging uptake in cycling) is covered in the *Carbon Management* and *New Buildings* sections and will be guided by the Welsh Government's *Active Travel Action Plan for Wales*.

Transport Infrastructure – Initiatives and Key Actions

The following list of initiatives and key actions outlines how NHS Wales will address transportation emissions. There is a cross-over between this section and certain parts of the Approach to Healthcare section, which targets a reduction in travel through a long-term shift to community-focused care, tele-medicine, and work from home initiatives.

		Key Actions	Responsibility	Implemented
17	NWSSP will work with Health Boards and Trusts to develop the best practice approach for EV charging technology, procurement, and car park space planning – this will include consideration of NHS Wales' own fleet, staff vehicles, and visitor EV charging	NWSSP will facilitate the development of the best practice approach for electric vehicle (EV) uptake across NHS Wales sites – this will include working closely with Health Boards and Trust to understand the current approach taken, any shared learnings, collaboration requirement, and overall best practice. Developing the best practice and supporting charge point installation, is important in the near term to ensure charging infrastructure is not a barrier to the procurement of EVs for both NHS Wales' own fleet and wider staff / public vehicles. Closely follow the outcomes of the Welsh Government Electric Vehicle (EV) charging strategy[26] which is under consultation at the time of publication and align with the strategy where necessary. As part of this NWSSP will engage with the Welsh Government Energy Service who have undertaken fleet reviews across Health Boards and Trusts in Wales.	NWSSP	2021
		Health Boards and Trusts will engage with NWSSP to develop the best proactive approach for EV charging infrastructure. Develop the approach for EV charging infrastructure implementation across each estate – this will include action on increasing electrical capacity, understanding the other development plans (e.g. renewable energy), and collaborating across other NHS organisations such as WAST. Implement the EV charging rollout at the scale and pace to match demand, which will be specified in the best practice approach.	Health Boards and Trusts	2022
		Explore localised opportunities for low carbon transport infrastructure as they arise (e.g. hydrogen) and implement if deemed feasible.	Health Boards & Trusts	Ongoing

Non-Emergency Response Fleet – Initiatives and Key Actions

Health Board and Trust fleet mileage was responsible for an estimated 19,500 tCO_2e emissions in 2018/19 (2% of total emissions). The owned and leased fleet represents an area where significant emission reductions can be achieved by providing access to a fleet of low-and-zero emission vehicles.

		Key Actions	Responsibility	Implemented
18	A standardised system of vehicle management for owned and leased vehicles will be developed to plan, manage, and assess vehicle performance – this will entail central fleet management oversight within each organisation	Develop an NHS-wide procurement, operation, financial management and maintenance system to standardise fleet practices across the service.	NWSSP	2023
		Ensure each Health Board and Trust has a single Fleet Manager in place with oversight of all Health Board / Trust fleet vehicles. They should put in place a central fleet management approach.	Health Boards & Trusts	2023
		Implement / continue to implement telematics solutions to analyse and improve driver behaviour.	Health Boards & Trusts	2023
19	All new cars and light goods fleet vehicles procured across NHS Wales after April 2022 will be battery-electric wherever practically possible. In justifiable instances where this not suitable, ultra-low emission vehicles should be procured.	Continue with existing vehicle procurement schedule, prioritising battery-electric vehicle fleet where practically possible from March 2022. In justifiable instances where this is not suitable (e.g. range issues), ultra-low emission vehicles can be procured. Exceptions will be made where technology is not market-ready (e.g. there are currently no market-ready ULEVs suitable to replace existing Non Emergency Patient Transport (NEPTS) vehicles).	Health Boards & Trusts	2022
		Evaluate the advantages of obtaining corporate membership to local car clubs that utilise battery-electric and hybrid vehicles. Implement if deemed valuable.	Health Boards & Trusts	2022

		Key Actions	Responsibility	Implemented
20	All new medium and large freight vehicles procured across NHS Wales after April 2025 will meet the future modern standard of ultra-low emission vehicles in their class.	Develop an approach to decarbonise fleet emissions, including: • Vehicle management systems to consolidate journeys • Technologies such as low energy tyres and aerodynamic improvements • Exploring localised opportunities for alternative fuels (e.g. biodiesel / hydrogen)	Health Boards & Trusts	2023
		Conduct an annual review to assess how emerging medium / large freight technologies can be incorporated into the fleet	NWSSP	2022
		Procure ultra-low emissions freight vehicles across NHS Wales from 2025.	Health Boards & Trusts	2025

Grey Fleet (staff-owned vehicles used for business travel) – Initiatives and Key Actions

In 2018/19, private vehicles were estimated to have a significant contribution to NHS Wales transport emissions. NHS Wales has little control over the procurement of private vehicles used for these activities, but can incentivise the use of fleet vehicles as an alternative, and can incentivise ULEV purchases through salary sacrifice schemes.

		Key Actions	Responsibility	Implemented
21	All Health Boards and Trusts will appraise the use of staff vehicles for business travel alongside existing pool cars. Health Boards and Trusts will update their business travel policies to prioritise the use of electric pool cars, electric private vehicles and public transport.	Consult staff to establish appropriate actions that can be taken to encourage wider uptake of BEVs/ULEVs and disincentivise high emission travel. Examples might include: • Introducing financial incentives to encourage/enable staff to purchase BEVs and ULEVs (e.g. salary sacrifice schemes) • Reducing the existing financial payment per mile to disincentivise private vehicle use, unless the vehicle is an ULEV vehicle. • Creating a financial incentive for using ULEV fleet vehicles (alongside increased access to ULEVs outlined in previous initiatives)	Health Boards & Trusts	2023
		Update business travel policies to implement a travel hierarchy that encourages/incentivises sustainable travel and reduces the use of high emission vehicles.	Health Boards & Trusts	2022
		Evolve existing accounting systems to improve records of grey fleet journeys, including: • Fuel type • Mileage • Type of vehicle	Health Boards & Trusts	2022

Welsh Ambulance Service NHS Trust Emergency Response Fleet – Initiatives and Key Actions

The Welsh Ambulance Service NHS Trust (WAST) provides emergency response services across the entire country, attending around a quarter of a million emergency calls per year, spread across a diverse urban, coastal, and rural landscape. They work across 90 ambulance stations, employing around 3,400 people. WAST fleet consumed more than 3.6 million litres of petrol/diesel in 2018/19, resulting in the emission of more than 11,900 tCO_2e (1.2% of the total footprint).

WAST's work is undoubtedly critical to NHS Wales's services, and decarbonising the ambulance service carries significant challenges with ambitious timescales set out below.

Note that where ambitions for WAST differ from the ambitions in the sections above, the WAST-specific initiatives in this section should be prioritised.

		Key Actions	Responsibility	Implemented
22	The Welsh Ambulance Service NHS Trust will continue to develop their electric vehicle charging infrastructure network plan for the existing NHS Wales estate to facilitate the roll-out of electric vehicles.	Determine the spare Authorised Service Capacity (kVA) available at each site, accounting for predicted future changes to the site (e.g. additional planned buildings, CHP decommissioning, onsite energy generation potential, energy efficiency measures, conversion to low carbon heat). Work with Health Boards and Trusts, who are separately responsible for installing EV chargers for staff and public parking, to ensure capacity is shared. Once capacity is assigned to EV charging, it must not be removed at a later date (e.g. for site expansion).	WAST	2021
		Continue to develop the existing WAST EV charging implementation plan in anticipation of plug-in hybrid and electric rapid response vehicle procurement from 2022 and electric emergency ambulances by 2028. It's acknowledged that in some rural areas this technology may not be feasible yet.	WAST	2022
		Apply for funding and install as appropriate to ensure the infrastructure is in place to accommodate electric rapid response vehicles by 2022 and electric emergency ambulances by 2028.	WAST	2022 / 2028

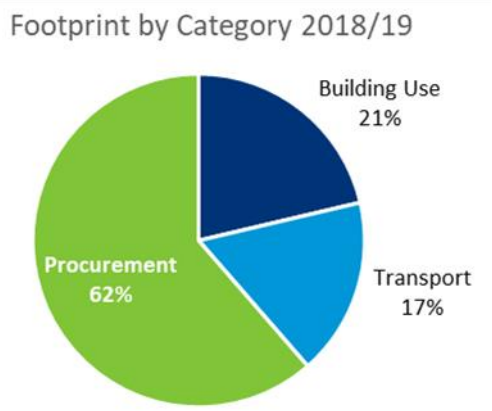
		Key Actions	Responsibility	Implemented
23	The Welsh Ambulance Service NHS Trust will aim for all rapid response vehicles procured after 2022 to be at least plug-in hybrid EV, or fully battery-electric in appropriate locations.	Continue to engage with vehicle manufacturers to participate in trials and assess the suitability of battery-electric technology for rapid response vehicles (focusing on vehicle range, charge times, and battery longevity).	WAST	Ongoing
		Transition procurement to battery-electric rapid response vehicles by 2022 as planned where possible. Where this is considered non-feasible, plug-in hybrid vehicles should be procured until fully electric vehicles can be reliably utilised.	WAST	2022
24	The Welsh Ambulance Service NHS Trust will actively engage with vehicle manufacturers for research and development of low carbon emergency response vehicles and report annually, with the ambition to operate plug-in electric, or alternative low carbon fuelled, emergency ambulances by 2028.	Continue to engage closely with vehicle manufacturers and the wider NHS to participate in trials and assess the suitability of low carbon technology (e.g. battery-electric) emergency ambulances.	WAST	Ongoing
		Report annually on the readiness of emerging technologies in WAST's Sustainability Report.	WAST	Annually from Mar 2023
		Implement fully-electric emergency ambulances as soon as reasonably practicable and by 2028 if possible. It's acknowledged that in some rural areas this technology may not be feasible by this date.	WAST	2028

3.6 Procurement

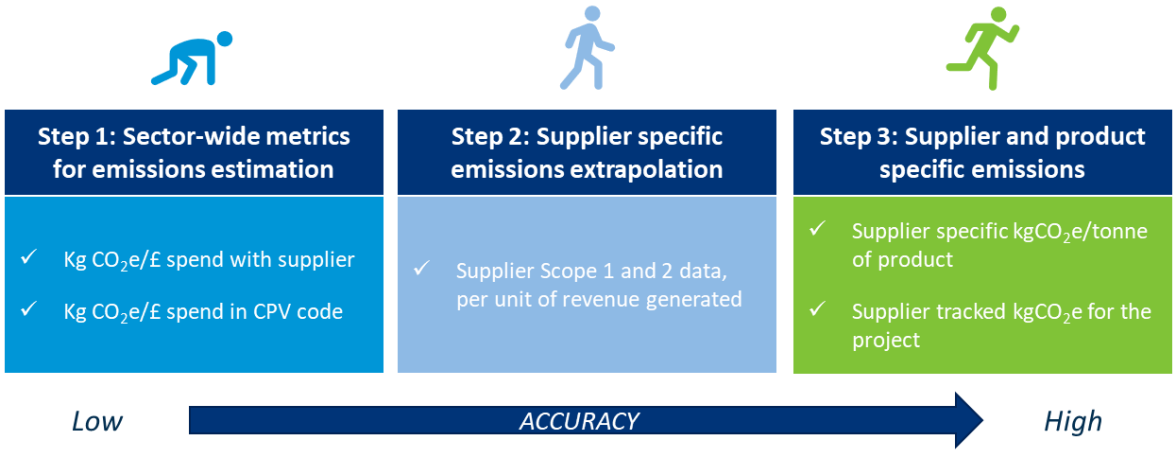
Current Situation

The supply chain for goods is the most significant contributor to carbon emissions for NHS Wales. In 2018/19, procurement-related emissions were estimated at 624,000 tCO_2e, which makes up 62% of total emissions. This, therefore, presents the largest opportunity to decarbonise but is also the hardest area to decarbonise as NHS Wales has no direct control over supplier emissions. However, NHS Wales is able to use its sizable purchasing power to positively influence change.

Accurately calculating procurement-related emissions is a complex task often based on estimation. The Carbon Footprint currently estimates emissions related to goods and services based on financial spend related proxies for carbon emissions. This is a common approach and will be adopted by Welsh Government within the *Carbon reporting guide for the public sector in Wales*.



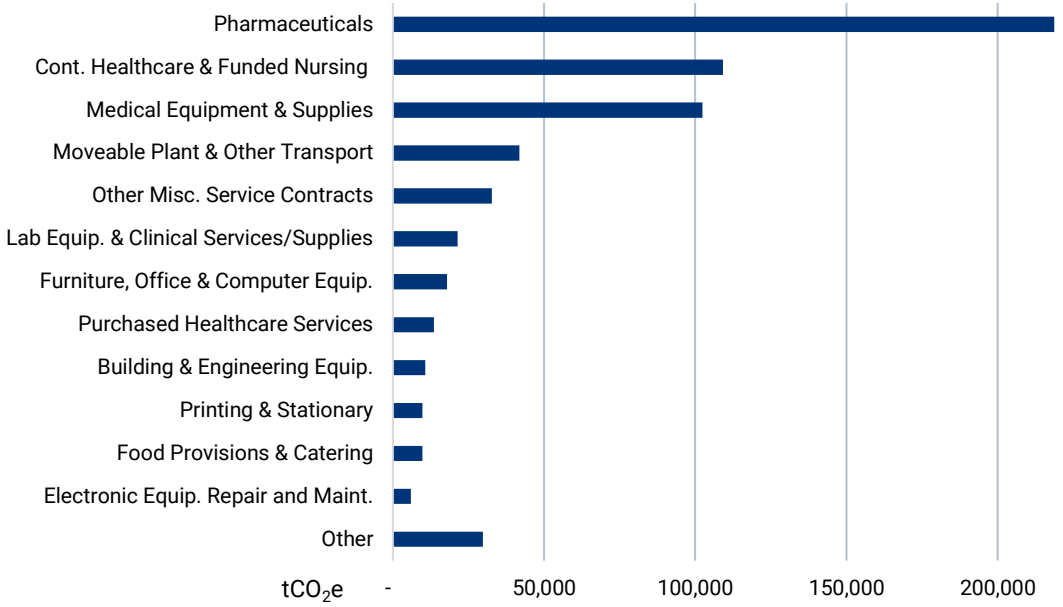
Carbon Footprint Breakdown by Category (2018/19)



Accuracy of procured goods and services carbon accounting approaches

The financial proxy basis, however, has limitations, and does not provide an accurate baseline or sound methodology to assess the impact of supply chain decarbonisation. As a result, the first procurement initiative commits NWSSP Procurement Services to transition to a market-based accounting approach to improve emissions accounting. This will require NHS Wales to engage with suppliers and incorporate their specific emission data within the NHS Wales footprint.

The scale and variation of the NHS Wales supply chain provides a significant challenge in the implementation of blanket policy change across procurement practice. Alongside this, the competing priorities to drive value for money and quality into the delivery of the health service mean that environmental requirements driven through procurement must be targeted and well-thought-out. To ensure the most impactful approach, NWSSP Procurement Services will adapt their *Sustainable Procurement Code of Practice* to include a requirement for suppliers in multi-year contracts to assess the carbon intensity of their goods and services and report this in a standardised format. NHS Wales will mandate certain suppliers to decarbonise as a contractual requirement as the most influential method of progressing decarbonisation in the supply chain.



Procurement emissions breakdown by category (2018/19)

Procurement – Initiatives and Key Actions

The initiatives and actions in the following table outline how a reduction in our procurement emissions will be achieved.

		Key Actions	Responsibility	Implemented
25	NWSSP will transition to a market-based approach for supply chain emissions accounting.	Undertake an analysis activity to understand the supplier emissions breakdown for pharmacy, which is >30% of total emissions.	NWSSP Procurement	2022
		Develop a template for approaching suppliers that provide services/products over a set value to establish product-specific carbon emission information. Approach suppliers annually from March 2022 to collect emissions data.	NWSSP Procurement	2022
		Establish a system for engaging with major suppliers periodically (e.g. two-yearly) to undertake due diligence on supplier carbon emissions calculations.	NWSSP Procurement	2022
		Introduce a standard procurement template for all procurements and tenders above Official Journal of the European Union (OJEU) requirements which emphasises NHS Wales's commitment to emission reduction and scores sellers appropriately.	NWSSP Procurement	2022
		Update the carbon footprint methodology to recognise the market-based carbon emission data collection.	NWSSP Procurement	2023
26	NWSSP will expand its current Sustainable Procurement Code of Practice to include a framework for assessing the sustainability credentials of suppliers.	NWSSP Procurement Services will work with the All Wales Medicines Strategy Group to develop a strategy to effectively ensure carbon emission reductions are accurately reflected in tender and other procurement documents. Together, the organisations will develop a framework for assessing the sustainability credentials of suppliers which emphasises NHS Wales's commitment to emission reduction and scores sellers appropriately.	All Wales Medicines Strategy Group & NWSSP Procurement	2022

		Key Actions	Responsibility	Implemented
		Develop guidance and provide additional training for procurement staff outlining best practice assessments of sustainability credentials specific to their procurement categories. This will include identifying the critical aspects impacting sustainability for specific sectors, for example: • A focus on the locality of food distribution and dietary offering (such as an increased emphasis on plant-based meals - which are low carbon, use land and water efficiently and reduce the risk of cardiovascular diseases), drawing upon the outcomes of the Independent Review of NHS Hospital Food.[37] • The prioritisation of reusable products as default over single-use products where this is deemed clinically acceptable. It's acknowledged that this is complex and will be applied on a case-by-case basis as logistics allow.	NWSSP Procurement	2022
27	Value to the local supply chain will be maximised, whilst maintaining high standards for goods and services.	Undertake an activity to determine air / shipping / land transport miles for services / products over a set value.	NWSSP Procurement	2023
		Target specific activities that are deemed suitable to champion the local supply chain. Challenge the local supply chain to produce sustainable products to encourage and develop the local circular economy. Score a reduction in transport mileage as a way of reducing carbon.	NWSSP Procurement	Mar 2023
28	100% REGO-backed electricity will be procured by 2025, and 100% offset gas by 2030.	Purchase 100% REGO-procured electricity by 2025, and continue to procure renewable electricity thereafter. (In 2018/19, 93% of all electricity purchased by NHS Wales was REGO certified).	NWSSP Procurement	2025
		In instances where it has not been possible to electrify heat by 2030, NWSSP Procurement and/or Health Boards and Trusts must purchase 100% offset gas from December 2030.	NWSSP Procurement	2030

		Key Actions	Responsibility	Implemented
29	NWSSP Procurement Services will embed NHS Wales' decarbonisation ambitions in procurement procedures by mandating suppliers to decarbonise.	Set threshold values to contractually mandate suppliers to proactively decarbonise. Embed this in procurement requirements for suppliers as deemed appropriate. Consider using companies' annual Streamlined Energy and Carbon Reporting requirements as a mechanism for independently monitoring progress (for example, using intensity ratios to show year on year carbon intensity changes).	NWSSP Procurement	2024
		Include in the Supplier Relationship Management (SRM) template a specific reference to NHS Wales's decarbonisation ambition and the role suppliers will have to take.	NWSSP Procurement	2022
		Develop and regularly update an area of the website which expresses NHS Wales's goals and requirements, and signpost suppliers to use materials and resources.	NWSSP Procurement	2021
		Undertake an outreach programme to engage with suppliers to create case studies of decarbonisation improvements to champion the message.	NWSSP Procurement	2022
30	Sustainability will be embedded within strategic governance – NWSSP Procurement Services will work across Wales to champion decarbonisation in the supply chain, and influence decarbonisation ambitions for buildings and transport.	Reflect progress made on the Delivery Plan within annual service reviews. This will be a key focus point for the governance of delivery.	NWSSP Procurement	2022
		Integrate progress against the Delivery Plan within annual reporting against the Well-being Objectives.	NWSSP Procurement	2022
		Assign overall responsibility for Sustainable Procurement to a dedicated Senior Manager (with a support group as required). They will drive project activity within the category teams and will have the responsibility to report to Director level. The Sustainable Procurement lead will sit as part of the overall governance structure for implementation of the whole Delivery Plan.	NWSSP Procurement	2022

		Key Actions	Responsibility	Implemented
		Ensure the Procurement Services Management Team (PSMT) collaboratively work to support the ambition to decarbonise – for the key individual, this will be included within the formal responsibility within their job roles. Targeted areas may include: • Capital and commissioning • Non-Medical (Transport, Energy, Food)	NWSSP Procurement	2022
31	NWSSP Procurement Services will improve supply chain logistics and distribution to reduce the carbon emissions from associated transport.	Evolve stock management approach to utilise IP5 storage. Put in place a smart delivery system to minimise carbon emissions from transport.	NWSSP Procurement	2023
		Optimise deliveries to minimise supply chain transport emissions. Focus on maximising bulk deliveries to IP5 and improve onward distribution via Health Courier Service. Ensure effective engagement with suppliers is undertaken to support this.	NWSSP Procurement	2023
32	NWSSP Procurement Services will actively develop and support procurement requirements to support implementation of this Strategic Delivery Plan.	Engage Health Boards to assess the need for specific frameworks, for example: • Electric vehicles and infrastructure • Renewable power • Low carbon heat • Local supply chain • Low carbon ICT procurement (e.g. low-carbon cloud computing/data centre requirements, increasing focus on circular economy and recycling/re-manufacturing)	NWSSP Procurement	2022
		Collaborate with the Welsh public sector to put in place procurement mechanisms (such as frameworks) for the benefit of Health Boards and Trusts (and as appropriate the wider Welsh public sector)	NWSSP Procurement	2022

3.7 Estate Planning and Land Use

Strategic planning of the NHS Wales built estate to meet service needs is a key priority. Optimal location planning of new developments not only provides services where they are needed but aims to reduce emissions from transportation to and from sites. Alongside this, the approach to upgrade and rationalise sites provides the opportunity for a step-change in emissions.

How NHS Wales chooses to use land in the future will significantly impact its Carbon Footprint. Land can be used for the generation of renewable energy, carbon sequestration and as a space to encourage biodiversity and ecosystem recovery – which has been shown to have a positive impact on public health and wellbeing.[38] Examples exist where community involvement / ownership and an emphasis on sustainable land use have had positive results for all involved (e.g. allowing sheep to graze amongst solar farms, using solar farmland to encourage the growth of wildflower ecosystems) and NHS Wales should manage its own land and engage closely with neighbours to recognise potential opportunities.

Carbon emissions from NHS Wales' activities will never reach zero, and therefore maximising the use of NHS land will play a significant role in reducing the carbon and wider environmental impact of the health service.

Estate Planning and Land Use – Initiatives and Key Actions

The following table of initiatives sets out the actions that will be taken to ensure best practice carbon management is implemented across NHS Wales:

		Key Actions	Responsibility	Implemented
33	All-Wales strategic estate planning will have carbon efficiency as a core principle – quantified carbon will be a key decision metric for planning new developments, rationalisation of the estate, and championing smart ways of working.	Lean upon the net zero framework as part of wider estate planning. Build this into the business case process when considering estate expansion and rationalisation.	WG Capital, Estates, & Facilities	Upon adoption of framework
		Ensure rationalisation of the estate (as planned in business cases) is fully seen through to ensure emissions are reduced as appropriate.	Health Boards & Trusts	Ongoing

		Key Actions	Responsibility	Implemented
34	NWSSP and Welsh Government will develop an approach to land use to advise Health Boards and Trusts on land identification, collaboration with Local Authorities and the community, and the appraisal approach for renewable energy and greenhouse gas removal.	NWSSP and Welsh Government will provide guidance for carbon accounting of existing land, and identifying suitable land for renewable energy generation and greenhouse gas removal. This will be informed in part by the GHG Protocol Guidance on carbon removals and land use, which is due for publication by the end of 2021.	NWSSP & Welsh Govt.	2022
		Each Health Board and Trust will undertake a land evaluation to establish areas of the existing estate for potential renewable energy generation or greenhouse gas removal. Assessments will factor in location, existing land use, planned future land use, proximity to NHS sites and private wire opportunities.	Health Boards & Trusts	2024
		Health Boards and Trusts should support localised initiatives to maintain green spaces on hospital sites for use by staff, the public and patients. Research widely notes the positive effect this can have on the mental and physical health of populations. Should land be required for development (which is sometimes unavoidable), equivalent mitigation (such as replacement planting, green space or a carbon sink) should be provided, ideally locally. Health Boards and Trusts may wish to work with organisations such as NHS Forest[39] to develop green spaces, encourage biodiversity, develop localised carbon sinks and provide a space where the health and wellbeing of patients, staff and communities can be enhanced. These areas can also be used to aid recovery and social prescribing. Organisations should consider land use change and biodiversity enhancement projects as these will contribute to the overall carbon reduction targets. This should be done in line with their public sector biodiversity duty.	Health Boards & Trusts	2024

		Key Actions	Responsibility	Implemented
35	NHS Wales will explore and progress large scale renewable generation with private wire connection to our sites	Conduct feasibility assessments for large-scale renewables including solar PV and wind generation. Actively and collaboratively engage with Local Authorities and neighbouring landowners to scope opportunities and partnerships to share space and promote sustainable land use.	Health Boards & Trusts	2023
		Proceed with renewable energy installation in all viable instances. 50% of identified viable potential must be installed by 2026. 100% of identified viable potential must be installed by 2030.	Health Boards & Trusts	2026 / 2030
		Develop a strategy to ensure existing renewable energy systems remain well maintained (e.g. periodic cleaning schedule, schedule of consumable part replacement (e.g. inverters) in line with expected lifespans).	Health Boards & Trusts	2023

3.8 Approach to Healthcare

The following initiatives have been developed drawing upon advice from medical professionals in Wales, national strategies, health strategies, recommendations from specialist groups (including the Bevan Commission[40] and the UK Health Alliance on Climate Change's Health Recovery principles[9]) and Welsh Government policymakers, to reflect a balance of current and future best practice.

Climate Change and Healthcare

The links between climate change and public health are well documented, with research linking climate change to trends in worsening public health. Several of the main impacts of climate change on health are shown in the table below.

	Impact of climate change on health
Air pollution	• 40,000 deaths/year linked to air pollution in the UK,[41] with fossil fuel combustion shown as the primary contributor to deaths in the UK caused by air pollution. [41, 42] • Air pollution is linked to increased rates of cardiac arrest, stroke, heart disease, lung cancer, obesity, cardiovascular issues, asthma and dementia. Research suggests a significant proportion of childhood asthma cases can be attributed to outdoor air pollution,[43,44] and around one-third of asthma cases could be prevented with improved air quality.[42] • Research highlights that "a small increase in air pollution leads to a large increase in the COVID-19 infectivity and mortality rate" (in England). It was noted that the atmospheric particulate matter $PM_{2.5}$ was a major contributor to COVID-19 cases in England. [33]
Extreme weather	• Disruption to healthcare services (e.g. excessive rainfall resulted in flooding closed Welsh hospitals in 2017 & 2018). • Increased risk of deaths associated with extreme weather (e.g. heatwave, droughts, storms). • Increases in exposure to ultraviolet radiation levels will increase the incidence of skin cancer and cataracts.[45] • Vulnerable populations were exposed to an additional 475 million heatwave events globally in 2019, which was, in turn, reflected in excess morbidity and mortality. 296,000 people died worldwide in 2018 from heat-related mortality.[2]

	Impact of climate change on health
Disease risks	• Warmer temperatures increase the risk of communicable diseases (e.g. salmonella, campylobacter and legionnaires)[45] and the prevalence of vector-borne diseases.[46] • The risk of pandemics is increased as climate change drives the movement of people and wildlife, which increases cross-species contact. With over one million undiscovered viruses in mammal and avian hosts, new diseases emerge every year, some of which have the potential to spread.
Financial implications	• Increased pressure on services (e.g. cardiovascular services), higher hospital admission rates, demand on ambulance service, increased waste and PPE, increased prescription requirements (e.g. inhalers). • The summer 2003 heatwave reportedly cost the UK economy £400 million, including £41 million to the NHS.[47] • The monetised cost of heat-related mortality in Europe in 2018 was equivalent to 1.2% of regional gross national income.[2]

A Smart Approach to Working

To effectively reduce emissions for the delivery of healthcare, the model in which the service is delivered must evolve. NHS Wales has a increasing emphasis on moving the point of care away from the hospital setting and closer to home. This shift is envisaged by increasing the provision of care at local community hubs, the use of digital monitoring of patients, and by encouraging people to take greater responsibility for their health.

A key contributor to future emission reduction and air quality improvements is the avoidance of unnecessary travel through increased home working and telemedicine. Before 2020, this was seen by some as not feasible, however the Covid-19 pandemic forced a rapid uptake of efforts to accommodate smart working and has proved successful overall. Exactly how beneficial these shifts in working condition will be over the long term is not yet known, and should be actively monitored.

Smart working creates unique opportunities in certain circumstances. Some Health Boards in certain parts of Wales have difficulty retaining highly qualified staff owing to their location. Smart working (e.g. remote consultations) offers a potential solution to reducing the impact of these challenges on Health Boards.

Using digital technology such as virtual appointments also allows the streamlining of certain services. In these cases, this aids faster diagnosis and identification of the requirement for treatment – and this, in turn, enables earlier treatment to be given, ideally reducing the severity of impact on patients and also reducing the pressure and intensity of NHS services.

Smart Working – Initiatives and Key Actions

Smart working will never be able to replace the majority of NHS Wales's frontline services. Nonetheless, the following initiatives and key actions are set out to ensure that the advantages of smart working can be incorporated into the day-to-day running of NHS Wales where feasible.

		Key Actions	Responsibility	Implemented
36	Our approach to 21st-century healthcare will be central to the design of new hospital developments – redesigning the whole journey with care closer to home in a carbon-friendly primary care estate with a reduced need to visit hospitals	To effectively reduce emissions to a minimum, a new service model must consider a shift in the way that care is delivered. At the design stage, we will ensure that new acute sites will cater to the modern healthcare journey – this will be achieved by engagement between the project/design team and health professionals. Designers will ensure provisions are made to accommodate the incorporation of additional healthcare technology as it becomes available. Designers will ensure building interiors and services will be suitably flexible to accommodate the future changing demands of the health service. For example, the internal layout should be readily changeable to accommodate the expansion of services as demand requires.	WG Capital, Estates, & Facilities	2021
		Strategic planning of non-acute healthcare will consider initiatives set out to modernise and improve health and social care in Wales. This includes: • Greater use of technology to enable home monitoring of health conditions • Increasing the community outreach by providing health and social care from hub locations closer to home	WG Capital, Estates, & Facilities	Ongoing
37	Support the Welsh Government's target for 30% of the Welsh workforce to work remotely, by continuing to facilitate flexible and smart working, developing the existing approach to	Establish the proportion of the workforce that could feasibly work remotely (expected to predominantly be office-based staff). Actively encourage staff to work remotely where this can be feasibly achieved (it's recognised that in some parts of rural Wales this will not be possible without infrastructure upgrades).	Health Boards & Trusts	2022

		Key Actions	Responsibility	Implemented
	remote working technology, and rationalising existing office space.	Where suitable, create hot desk environments to provide smaller office space and facilitate meeting spaces when required.	Health Boards & Trusts	2023
		Consider the future transformation of office space into additional healthcare facilities as required.	Health Boards & Trusts	Ongoing
		Consider opportunities to work with external partners to share and utilise office space to reduce travel requirements.	Health Boards & Trusts	Ongoing
38	Continue to utilise technology to increase the efficiency of engagements between staff and the public where suitable.	Build upon the progress made during the Covid-19 pandemic and maintain the use of digital consultations and patient monitoring where possible to reduce the requirement for avoidable staff and patient travel. It is acknowledged that this is not the case universally and traditional methods of care will be encouraged in scenarios where senior medical staff consider this more effective.	Health Boards & Trusts	Ongoing
		Continue to use technology alongside the 111 service to support patient triage, information gathering, and to signpost patients to appropriate health services. Also consider the opportunity for developing an NHS Wales app (similar to the NHS England app).	Health Boards & Trusts	Ongoing
		Ensure healthcare professionals are provided with the appropriate technology to carry out these tasks effectively.	Health Boards & Trusts	Ongoing
		Develop a best practice approach for the use of digital technology and further explore digital consultation technology. In particular, align this with the Welsh future healthcare journey visions and the concept of providing care closer to home.	NWSSP / Health Boards & Trusts	2023
		Continue to digitalise clinical records and communications to increase resource efficiency and reduce printing resource requirements.	Health Boards & Trusts	Ongoing

Education

The latest knowledge and research on decarbonisation needs to be effectively communicated to our staff, students, and patients across the country. If people are not informed of the most environmentally friendly options, they are unlikely to act.

To address this, it is the ambition to embed decarbonisation into the day-to-day decision-making process of healthcare professionals and members of the public.

This function has been in place for many years through bodies such as Health Education and Improvement Wales (HEIW) and Public Health Wales (PHW). Their work as champions of education will be key to embedding sustainability and decarbonisation knowledge into the health service, educational institutions and public communication.

It should be noted that the most sustainable form of healthcare is preventing illness in the first place. NHS Wales will continue to support the work of Public Health Wales in championing public health (e.g. being proactive on tackling obesity, smoking, unhealthy lifestyle choices, etc.), which will contribute by reducing the requirement for avoidable healthcare.

Education – Initiatives and Key Actions

		Key Actions	Responsibility	Implemented
39	Health education will be used to champion decarbonisation across our service – we will encourage sustainable healthcare practice, waste efficiency, and low carbon staff and patient behaviour	Health Education and Improvement Wales (HEIW) will support the implementation of this Delivery Plan by helping to embed the latest decarbonisation knowledge and research into healthcare practice and the educational curriculum. This may include, for example: • Embedding new ways of delivering education and training that have been implemented in response to the Covid-19 pandemic (e.g. digitally-enabled learning) • Developing a wider range of E-learning materials/content and using existing readily available resources such as Getting it Right First Time (GRIFT)[48], The Green Impact for Health Toolkit[49], and The UK Health Alliance on Climate Change's Carbon Literacy Guide[50] • Investigating how NHS Wales might embed simulation-based education and use of virtual reality capabilities.	HEIW	Ongoing
		Health Boards and Trusts will support sustainability working groups and wider collaboration with healthcare professionals across Wales and beyond (e.g. Doctors for Greener Health Care Networks).	Health Boards & Trusts	Ongoing
		Public Health Wales will continue to positively influence public behaviours, champion low carbon healthcare options, and prevent ill health. This may include, for example: • Communicate the actions NHS Wales is taking to reduce emissions • Highlight opportunities for the public to reduce emissions (e.g. electronic consultations, public transport, recycling of inhalers)	PHW	Ongoing
		Engage with NHS England to provide input and expertise into the development of the best practice blueprint for low carbon digital care.	HEIW	Ongoing

Healthcare and Medicines

Emissions from medical gases and inhalers were not directly accounted for within the 2018/19 NHS Wales Carbon Footprint as no consumption data was available. However, the extent of emissions and volume of use is understood to be significant enough to target these two areas specifically for decarbonisation. It's envisaged this data will be collected through improved recording and incorporated into future Carbon Footprints.

Groups such as the Welsh Environmental Anaesthesia Network and Welsh Respiratory Health Implementation Group have actively been progressing emissions reductions for anaesthesia and inhaler use respectively.

Medical Gases[51]

Medical gases are used widely across the healthcare setting for processes such as emergency pain relief and anaesthesia. Anaesthetic gases are widely used in surgical procedures to produce surgical levels of anaesthesia. Gases used typically include nitrous oxide, isoflurane, sevoflurane, and desflurane, all of which are classed as high global warming potential (GWP) gases. Nitrous oxide (N_2O) and isoflurane are ozone-depleting gases, but desflurane is the agent with the greatest GWP.[52,53]

100-year global warming potential (GWP) of commonly-used anaesthetic gases:

Desflurane: 1790
Isoflurane: 491
Sevoflurane: 216
Nitrous oxide: 265

The anaesthetic effects of desflurane and sevoflurane are similar, but desflurane can be 30-50 times more damaging in terms of emissions, owing to a greater GWP and greater relative concentrations required to achieve the desired effect.[51] Most anaesthetists agree that similar anaesthetic results are achieved by replacing the use of desflurane with sevoflurane.

Consumption of nitrous oxide is known to be increasing in some Health Boards, and it's estimated that N_2O gas canisters are often disposed of when still around 30% full (recycling or reuse is technically difficult). Older hospital sites receive N_2O via a system of pipework, and research is currently being undertaken at Cardiff and Vale UHB to establish leakage rates and make recommendations for any changes as appropriate. It's thought that in practice far more N_2O is consumed than is needed – with the difference put down to leaking, waste, or venting.[54]

At present, no specific NHS Wales guidance is in place to prioritise the use of one anaesthetic gas above the other, and the choice typically falls to the preference of the anaesthetist. Since 2018, the Welsh Environmental Anaesthetic Network (WEAN) have done excellent work engaging with anaesthetists across Wales and encouraging the use of low GWP gases, which they believe has resulted in a 90% reduction in the carbon footprint of anaesthesia to date.

Where considered safe to do so by senior clinicians, NHS Wales will continue to support the existing work of WEAN to transition medical gases away from desflurane to lower GWP alternatives such as sevoflurane or Total Intravenous Anaesthesia (TIVA). This will be achieved by engaging with and supporting the existing work of WEAN and guidance from the Royal College of Anaesthetists to develop a *Low GWP Gas Policy*, which will set the standard for delivering anaesthesia in a sustainable way. The policy will be used to distribute information to inform medical gas prescribers of the environmental implications of their choice of gases and encourage a reduction in unnecessarily high fresh gas flow rates. Higher GWP gases will, however, remain available for use when clinically indicated by senior clinicians.

Medical Gases – Initiatives and Key Actions

		Key Actions	Responsibility	Implemented
40	Support the work of existing working groups such as the Welsh Environmental Anaesthetic Network to raise awareness of the carbon impact of medical gases and transition to a culture where gases with low global warming potentials are prioritised.	Consult with Welsh Environmental Anaesthesia Network (WEAN) and senior medical staff to evaluate their existing trials to reduce emissions associated with anaesthesia, and develop an approach to expand best practice across all of Wales.	All Wales Medicine Strategy Group / WEAN	2021
		Develop and implement an Environmentally Friendly Medical Gas Policy by March 2022, which will ensure staff prioritise low GWP gases and gases with low ozone-depleting features where possible in decision-making processes and ensure that staff can only use high GWP gases in certain circumstances when justified against alternatives.	All Wales Medicine Strategy Group / WEAN	2022
		Extend the existing WEAN engagement on the decarbonisation of medical gases to all acute Health Boards and Trusts.	All Wales Medicine Strategy Group	2022
		Closely monitor the outcomes of WEAN's research in N_2O use and leakage rates. Appraise the use of piped medical gas infrastructure against bottled gas use and monitor consumption of medical gases closely.	All Wales Medicine Strategy Group	2023

		Key Actions	Responsibility	Implemented
41	Explore methods of minimising gas wastage and technologies to capture expelled medical gases.	Conduct an activity to establish commercially available technologies for capturing medical gases and disposing of them responsibly – and implement at a trial site to establish feasibility.	All Wales Medicine Strategy Group	2024
		Ensure medical gas capture technology is integral to all new builds and major refurbishments.	Health Boards and Trusts	Ongoing
		Actively engage with suppliers and disposal facilities to utilise suitable methods to capture left-over bottled nitrous oxide that is not used (estimated to typically be >30%) and ensure sensible disposal. It's not believed that technology is currently commercially available to enable re-use of this left-over gas.	All Wales Medicine Strategy Group	Ongoing

Inhalers

Inhalers are key treatments for patients with airway diseases such as chronic obstructive pulmonary disease (COPD) and asthma as they deliver drugs directly to the lungs. In Wales, there are approximately 300,000 patients with asthma and 80,000 with COPD.

Reviewing inhaler use was identified as an action in the Committee on Climate Change's 2020 'The path to a Net Zero Wales' report.[4] Many inhalers contain hydrofluorocarbons (HFC), which are powerful greenhouse gases, with a global warming effect several thousand times that of carbon dioxide. These gases are used as the propellant in Metered Dose Inhalers (MDIs), which accounted for 70% of all inhalers in the UK in 2017. In contrast, MDIs accounted for 14% of inhalers in Sweden.

Less polluting alternatives to MDIs are available[55] (such as dry-powdered inhalers (DPIs) and soft mist inhalers) and can be prescribed in certain circumstances – but the patient's requirements must be prioritised in any situation.

NHS Wales aims to reduce the carbon impact of inhaler use through the development of careful and considerate guidance for pharmacists and prescribers, to allow them to identify high global warming potential (GWP) inhalers and consider less polluting alternatives where medically suitable. Studies in England have shown that a shift away from MDIs also represents an opportunity to reduce drug costs.[56]

The Respiratory Health Implementation Group (RHIG) have created national guidelines for COPD and asthma, together with patient apps for the same conditions and a raft of educational resources (National Welsh Standards) which will help align patients and healthcare professionals with any change in policy such as this. Resources such as the National Institute for Health and Care Excellence's (NICE) Inhalers for Asthma Patient Decision Aid can support shared decision making between patients and prescribers.

Greener disposal of all inhalers will be facilitated by actively promoting recycling schemes, working together with pharmaceutical companies and pharmacies.

Finally, NHS Wales will closely monitor technical improvements to the technologies available, as several pharmaceutical suppliers have committed to adapt the propellant design to reduce the carbon impact of their inhalers. The use of MDIs with low GWP propellants (which are expected to be widely available from 2025) will be supported to help drive industry towards awareness of and adaptation to low carbon solutions for patient care.

Emissions from Ventolin Evohaler: **28 kgCO_2e**

Emissions from Ventolin Accuhaler: **<1 kg CO_2e**

Inhalers – Initiatives and Key Actions

The following initiatives and key actions have been developed to support the work of working groups like these, as well as wider decarbonisation input from industry groups such as the International Pharmaceutical Aerosol Consortium (IPAC).

		Key Actions	Responsibility	Implemented
42	Take a patient-centric approach to optimise inhaler use, focusing on a reduction in the over-reliance of reliever inhalers where possible and emphasising the importance of inhaler-specific disposal and recycling.	Work with senior medical staff, the Welsh Respiratory Health Implementation Group, pharmacists, doctors and asthma nurses to create alignment and develop guidance for prescribers to encourage reviews of patients' requirements and ensure inhalers are suitably prescribed. Utilise current existing mechanisms such as national guidelines for COPD and asthma management, national apps and the national Welsh Standard educational packages to achieve this change through co-production. The aim of this is to reduce over-reliance on reliever/SABA inhalers and focus on improved patient understanding, non-pharmacological interventions such as smoking cessation, exercise and the correct use of preventative therapies. Avoiding the destabilisation of patients will be paramount.	All Wales Medicine Strategy Group / RHIG	2022
		Brief prescribers, hospital/community pharmacists and dispensers of the key messages from the guidance. Encourage staff to emphasise and champion the importance of inhaler recycling, noting that an 'empty' MDI inhaler contains a high concentration of high-GWP gases and therefore needs to be disposed of properly at the inhaler disposal facilities provided at pharmacies.	All Wales Medicine Strategy Group, Health Boards & Trusts, RHIG	2022

		Key Actions	Responsibility	Implemented
43	Transition the existing use and distribution of carbon-intensive and high global warming potential (GWP) inhalers to alternative lower GWP inhaler types where deemed suitable.	Work with senior medical staff and the Welsh Respiratory Health Implementation Group to develop guidance (or update existing All Wales Asthma Guidance) and education material surrounding the carbon footprint of inhalers for pharmacists and prescribers to: • Help identify high and low GWP inhalers available on the market (to be reviewed and updated annually). Good data is available at the Green Inhaler website. • Assist with decision making to prioritise the distribution of low GWP inhalers or inhalers with low carbon propellants wherever viable. Communicate the carbon impacts of inhaler choices with key medical staff. • Update the existing one-page guidance sheet on inhaler prescribing to reflect the carbon emission impact. • Work with community pharmacists and ICT departments to adapt GP prescribing system to include a feature where high-GWP inhalers are flagged and suitable alternatives are suggested. • Consider making modifications to the repeat prescription ordering systems to reduce prescriptions for unnecessary reliever inhalers.	All Wales Medicine Strategy Group	2021 (annually)
		Where appropriate, proceed with transitioning patients to low GWP inhalers (e.g. dry powdered inhalers (DPIs)), but only where patient care will not be impacted. Where a transition to a low GWP inhaler is not possible (e.g. patients' individual requirements), patients' treatments should not be changed. Low-GWP metered dose inhalers (MDIs) are expected by 2025 and a shift to a different type of inhaler should be revisited when these inhalers become available. Deliver through the Welsh Respiratory Health Implementation Group. Target a shift to 80% of inhalers being low GWP alternatives, to put Wales in line with the current European leaders in the field, but only where it is clear patients' stabilisation will not be affected.	All Wales Medicines Strategy Group / RHIG	2025

		Key Actions	Responsibility	Implemented
		Develop and provide education material to patients surrounding the carbon footprint of inhalers via patient apps to promote patient-driven change. Utilise Welsh Government, the national press and social media to drive the agenda. Communicate with patients and engage with 3rd party organisations (such as Asthma UK) to share ambitions and benefits. Engage with industry through organisations such as IPAC to encourage the incorporation of carbon emission information on inhaler packaging.	All Wales Medicine Strategy Group / RHIG	2021
		Measure the change in inhaler prescribing through national data collection and report in the carbon footprinting report.	NWSSP	2022 (annually)

Waste

Modern, healthcare produces significant quantities of waste, and this is very visible to healthcare staff and patients and therefore an excellent mechanism to catalyse engagement and reduce carbon emissions through improved end-of-life practices.

Types of Waste

Healthcare waste can be broadly split into clinical and non-clinical streams, and the clinical streams are highly regulated with strict treatment and disposal requirements put on them. Clinical waste includes wastes that can only be treated by high-temperature incineration (such as anatomical waste or sharps) as well as waste treated through a heat sterilisation process known as “Alternative Treatment” (this accounts for most regular clinical waste deemed as potentially infectious). There are also non-infectious healthcare wastes classed as “offensive” which do not require these treatment paths.

Non-clinical wastes include general municipal or domestic type wastes, which will be familiar to most people and are made up of readily recyclable or recoverable materials.

Waste within NHS Wales

In 2018/19, EFPMS data reported that NHS Wales generated over 23,000 tonnes of waste of all categories: 53% of this was recovered or recycled, 33% was clinical waste treated by either alternative treatment or incineration, 8% was offensive waste and 6% was sent to landfill, generating an estimated 692 tonnes CO_2e in total.

The fact that more than half of all waste is recycled or recovered shows that good progress has been made to ensure NHS Wales is moving in the right direction, but further improvements can be made to reduce the quantity of landfill and incinerated waste as a result of healthcare practices. Some of this will be addressed through the procurement measures outlined in this plan (e.g. specifying reusable products over single-use, where clinically acceptable), but the handling of waste also has to be addressed.

Emissions Associated with Waste

A recent study of three NHS Hospitals in England noted that recycling has significant carbon advantages over other forms of waste management. It estimated the carbon footprint of hospital waste when recycled is 21-65 $kgCO_2e$ per tonne of waste. In comparison, the emissions of hospital waste when incinerated for Energy from Waste at a low temperature are 172-249 $kgCO_2e$ per tonne of waste, and 1,074 $kgCO_2e$ per tonne of waste for high-temperature incineration.[57]

Reducing waste and prioritising recycling therefore not only reduces waste to landfill and increases the reuse of finite materials, but also contributes significantly to reducing carbon emissions.

Waste – Initiatives and Key Actions

		Key Actions	Responsibility	Implemented
44	We will support the development of pan-Wales guidance by 2022 for best practice reduction of pharmaceutical waste.	We will work with pharmaceutical organisations, clinicians and recycling experts to identify how best practice guidance for the reduction of pharmaceutical waste can be developed and to support them in producing guidance. It is recognised that the key actions relate to direct delivery of healthcare (e.g. Prescribing medication to patients) and so are outside of the remit of NWSSP to impose.	NWSSP	2022
		Upon publication, implement best practice guidance across all Health Boards and Trusts.	Health Boards & Trusts	2023
45	We will develop 'plastics in healthcare' initiatives to address waste in the delivery of health care - this will aim to tackle PPE, single use plastics, and packaging waste.	Consult industry partners, clinicians, recycling experts and literature to develop initiatives to reduce the use of single-use plastics in healthcare where possible and increase the potential for recycling and reuse. Ideally, this will be partially addressed through a shift in procurement practices where feasible, as outlined in initiatives 26-30.	NWSSP	2022
		Upon completion, implement best practice initiatives across all Health Boards and Trusts.	Health Boards & Trusts	2023

		Key Actions	Responsibility	Implemented
		Health Boards and Trusts are encouraged to reduce waste of non-medical equipment that is no longer required (e.g. furniture, consumables, etc.) by reusing it elsewhere or donating it, where permitted and safe to do so.	Health Boards & Trusts	2022
46	We will work with pharmacists and prescribers to build upon and support existing efforts to encourage responsible disposal of inhalers	Introduce additional inhaler-specific disposal facilities in hospitals in partnership with industry stakeholders.	Health Boards & Trusts, industry third parties	2022
		Support the work of groups such as the Welsh Respiratory Health Implementation Group and the International Pharmaceutical Aerosol Consortium to emphasise the importance of responsible disposal with regard to carbon emissions.	Health Boards & Trusts	2021
		Encourage pharmacists and prescribers to stress the importance of responsible disposal to their patients, and the fact that even low carbon inhalers need to be disposed of properly. Also make use of the existing RHIG digital app to effectively communicate with patients.	Health Boards & Trusts, Welsh Respiratory Health Information Group	2022

4. Initiative Impact Assessment

Appraisal Approach

Appraisals of all opportunities were undertaken by scoring the identified opportunities against the following four metrics:

- *Carbon impact*
- *Technology and market readiness*
- *Effort and resource demands*
- *Strategic importance for enablement*

A quantitative scoring was allocated to each metric, using the scoring matrix set out in the table below. The sum of the scores for each measure forms the total score, which was integrated into the development of the decarbonisation roadmap and carbon emission reduction predictions.

The outputs of this table should not be used solely for prioritisation of one initiative over another. Rather, this impact assessment has been used for identifying key initiatives for the roadmap for this delivery plan.

Scoring Available	Carbon Impact
9-10	Significant impact (>3% reduction in footprint)
7-8	High impact (0.5 - 3.0% footprint reduction)
4-6	Medium impact (up to 0.5% footprint reduction)
2-3	Low impact
1	Negligible impact

Scoring Available	Technology and/or Readiness	Effort and Resource Demands	Strategic Importance for Enablement	Total score
5	Ready	Little or no additional effort	Significant	**= Sum of all scores**
4	Expected to be ready imminently	Low – manageable with existing resources	Important	
3	Approaching readiness	Medium – manageable with existing resources	Medium	
2	Medium maturity	High – difficult but manageable	Low-medium	
1	Low maturity	Significant – more resource required	Low	

Additionally, a qualitative scoring was assigned to the following two metrics to recognise the financial implications of each measure:

- Investment cost
- Financial return

The appraisal matrix is set out overleaf.

Initiative Appraisal Matrix

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
Carbon Management Initiatives	1	Implement best practice carbon management with dedicated roles in place to undertake Delivery Plan initiatives.	1	5	1	5	**12**	Low	Short ROI (<10 years)
	2	Proactively communicate the Climate Emergency to staff and the public with the aim of stimulating low carbon behaviours and growing engagement in the decarbonisation agenda.	1	5	2	4	**12**	Low	Short ROI (<10 years)
	3	Drive the engagement required for decarbonisation across each organisation's leadership team – Finance, Procurement, Estates, and Capital Project teams will engage to develop a focussed and active approach to project implementation.	2	5	3	4	**14**	Low	Short ROI (<10 years)
Existing Buildings Initiatives	4	Progress a transformational energy and water efficiency retrofit programme across the estate – every building with a long-term future will have undergone a multi-technology energy-efficient upgrade by 2030.	5	5	3	4	**17**	High	Short ROI (<10 years)
	5	Fully replace all existing lighting with LED lighting by 2025.	4	5	2	3	**14**	High	Short ROI (<10 years)
	6	Complete expert heat studies by the end of 2023 for all acute hospitals to set the plan to transition away from fossil fuel heat sources.	8	3	1	5	**17**	Significant	Increased revenue costs

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
	7	Progress low carbon heat generation for all non-acute sites larger than 1,000m2 by 2030.	5	3	1	5	**14**	Significant	Increased revenue costs
	8	No further natural gas CHP plant will be installed - renewable CHP will be championed instead. For existing CHP plant, decommissioning will be prioritised over investment in major refurbishment of failed CHP from 2025, with the ambition for all CHP to be decommissioned by 2030	6	5	2	4	**17**	Medium	Increased revenue costs
	9	Take an active approach to efficient control of energy in our buildings. All buildings will have up-to-date, standardised, and effective building management systems (BMS). Dedicated resource to optimise the use of energy by BMS control will be put in place by 2023.	3	5	2	3	**13**	Medium	Short ROI (<10 years)
	10	Determine the overall viable potential for onsite renewable energy generation at each NHS organisation by 2023. Install half of this potential by 2026, and the remainder by 2030.	6	5	2	4	**17**	High	Short ROI (<10 years)
New Builds and Major Refurbishment Initiatives	11	Develop and build low carbon buildings to net zero standard – engage and collaborate with NHS partners across the UK on the emerging net zero building standard for hospitals, and adopt a net zero building accreditation approach which will be defined by 2022.	5	3	2	5	**15**	High	Short ROI (<10 years)

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
	12	All project teams to have an independent client-side sustainability representative to provide due diligence support for the optimal low carbon design across all development stages – and be responsible for ensuring the Net Zero Framework process is followed.	2	3	2	3	**10**	Low	Short ROI (<10 years)
	13	Integrate Modern Methods of Construction (MMC) into the design and construction of new buildings – this will consider modular design, offsite fabrication, and just-in-time delivery to minimise construction-related carbon emissions.	2	5	3	3	**13**	Low	N/A
	14	Install electric vehicle charging points in new developments beyond minimum requirements, and future-proof new car parks by installing infrastructure to enable straightforward installation of future charging points.	4	5	3	4	**16**	Medium	N/A
	15	Prioritise low carbon heating solutions as a key design principle. No fossil fuel combustion systems are to be installed as the primary heat source for new developments.	3	5	3	5	**16**	High	Long ROI (10 years+)
	16	Incorporate the principles of sustainable transportation into the design of new sites (in addition to electric vehicle infrastructure) in line with the Welsh Government's Active Travel Action Plan for Wales.	4	5	3	4	**16**	Low	N/A

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
Transportation Initiatives	17	Health Boards and Trusts will ensure suitable sustainable transport infrastructure is installed at their sites.	2	5	2	4	**13**	High	N/A
	18	NWSSP will implement a standardised system of vehicle management in owned and leased vehicles. This will entail central fleet management oversight within each Health Board or Trust.	1	5	3	3	**12**	Low	Short ROI (<10 years)
	19	All new cars and light goods fleet vehicles procured across NHS Wales after April 2022 will be battery-electric wherever practically possible. In justifiable instances where this not suitable, ultra-low emission vehicles should be procured.	3	3	2	4	**12**	Low	Short ROI (<10 years)
	20	All new medium and large freight vehicles procured across NHS Wales after April 2025 will meet the future modern standard of ultra-low emission vehicles in their class.	3	3	2	4	**12**	Medium	Short ROI (<10 years)
	21	All Health Boards and Trusts will appraise the use of staff vehicles for business travel alongside existing pool cars. Health Boards and Trusts will update their business travel policies to prioritise the use of electric pool cars, electric private vehicles and public transport.	3	5	3	4	**15**	No cost	N/A
	22	The Welsh Ambulance Service NHS Trust will continue to develop their electric vehicle charging	3	5	3	4	**15**	Low	N/A

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
		infrastructure network plan for the existing NHS Wales estate to facilitate the roll-out of electric vehicles.							
	23	The Welsh Ambulance Service NHS Trust will aim for all rapid response vehicles procured after 2022 to be at least plug-in hybrid EV, or fully battery-electric in appropriate locations.	5	3	2	4	**14**	Low	Short ROI (<10 years)
	24	The Welsh Ambulance Service NHS Trust will actively engage with vehicle manufacturers for research and development of low carbon emergency response vehicles and report annually, with the ambition to operate plug-in electric, or alternative low carbon fuelled, emergency ambulances by 2028.	6	1	3	3	**13**	Medium	Short ROI (<10 years)
Procurement Initiatives	25	NWSSP will transition to a market-based approach for supply chain emissions accounting.	2	5	2	3	**12**	Low	N/A
	26	NWSSP will expand its current Sustainable Procurement Code of Practice to include a framework for assessing the sustainability credentials of suppliers.	6	5	2	3	**16**	Low	N/A
	27	Value to the local supply chain will be maximised, whilst maintaining high standards for goods and services.	4	5	3	4	**16**	Low	Potentially increased revenue costs
	28	100% REGO-backed electricity will be procured by 2025, and 100% green gas by 2030.	1	5	2	0	**8**	Low	N/A

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
	29	NWSSP Procurement Services will embed NHS Wales' decarbonisation ambitions in procurement procedures by mandating suppliers to decarbonise.	10	5	2	5	**22**	Low	Potentially increased revenue costs
	30	Sustainability will be embedded within strategic governance – NWSSP Procurement Services will work across Wales to champion decarbonisation in the supply chain, and influence decarbonisation ambitions for buildings and transport.	10	5	2	5	**22**	Medium	N/A
	31	NWSSP Procurement Services will improve supply chain logistics and distribution to reduce the carbon emissions from associated transport.	3	5	3	3	**14**	Medium	Short ROI (<10 years)
	32	NWSSP Procurement Services will actively develop and support procurement requirements to support implementation of this Strategic Delivery Plan.	10	5	3	4	**22**	Low	N/A
Estate Planning and Land Use Initiatives	33	All-Wales strategic estate planning will have carbon efficiency as a core principle – quantified carbon will be a key decision metric for planning new developments, rationalisation of the estate, and championing smart ways of working.	5	4	4	4	**17**	Low	N/A
	34	NWSSP and Welsh Government will advise Health Boards and Trusts on an appraisal approach for allocating land for uses such as renewable energy generation, greenhouse gas removal and afforestation – NHS Wales organisations will maintain green space	2	4	4	3	**13**	Low	N/A

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
		and utilise land for decarbonisation, including collaborating with neighbouring land owners.							
	35	Large-scale renewable energy generation opportunities with private wire connections to NHS Wales sites will be progressed where viable.	4	5	4	4	**17**	High	ROI from 5-15 years
Approach to Healthcare – Smart Working Initiatives	36	Our approach to 21st-century healthcare will be central to the design of new hospital developments – redesigning the whole journey with care closer to home in a carbon-friendly primary care estate with a reduced need to visit hospitals.	4	4	3	3	**14**	Low	N/A
	37	Support the Welsh Government's target for 30% of the Welsh workforce to work remotely, by continuing to facilitate flexible and smart working, developing the existing approach to remote working technology, and rationalising existing office space.	2	5	2	3	**12**	Low	Short ROI (<10 years)
	38	Continue to utilise technology to increase the efficiency of engagements between staff and the public where suitable.	2	2	4	4	**12**	Medium	Short ROI (<10 years)
Approach to Healthcare – Education Initiatives	39	Health education will be used to champion decarbonisation across our service – we will encourage sustainable healthcare practice, waste efficiency, and low carbon staff and patient behaviour.	3	3	4	4	**14**	Medium	Short ROI (<10 years)
Approach to Healthcare –	40	Support the work of existing working groups such as the Welsh Environmental Anaesthetic Network to	2	5	4	3	**14**	Low	Short ROI (<10 years)

		Initiative	Carbon Impact (/10)	Technology and/or Readiness (/5)	Effort and Resource Demands (/5)	Strategic Importance for Enablement (/5)	Total score (/25)	Investment Cost	Financial Return
Healthcare and Medicines		raise awareness of the carbon impact of medical gases and transition to a culture where gases with low global warming potentials are prioritised.							
	41	Explore methods of minimising gas wastage and technologies to capture expelled medical gases.	2	3	4	2	**11**	Medium	Short ROI (<10 years)
	42	Take a patient-centric approach to optimise inhaler use, focusing on a reduction in the over-reliance of reliever inhalers where possible and emphasising the importance of inhaler-specific disposal and recycling.	3	5	4	4	**16**	Low	Short ROI (<10 years)
	43	Transition the existing use and distribution of carbon-intensive and high global warming potential (GWP) inhalers to alternative lower GWP inhaler types where deemed suitable.	3	3	4	4	**14**	High	Revenue costs could increase or decrease
Approach to Healthcare – Waste Initiatives	44	Support the development of guidance by 2022 for best practice reduction of pharmaceutical waste.	1	3	3	3	**10**	Low	N/A
	45	Develop a 'plastics in healthcare' initiative to address waste in the delivery of health care – this will aim to tackle PPE, single use plastics, and packaging waste.	1	4	3	3	**11**	Low	N/A
	46	Engage with pharmacists and prescribers to build upon and support existing efforts to encourage responsible disposal of inhalers through discussions with patients, information leaflets, posters and media.	2	5	2	3	**12**	Low	N/A

Pathway Modelling for Target Development

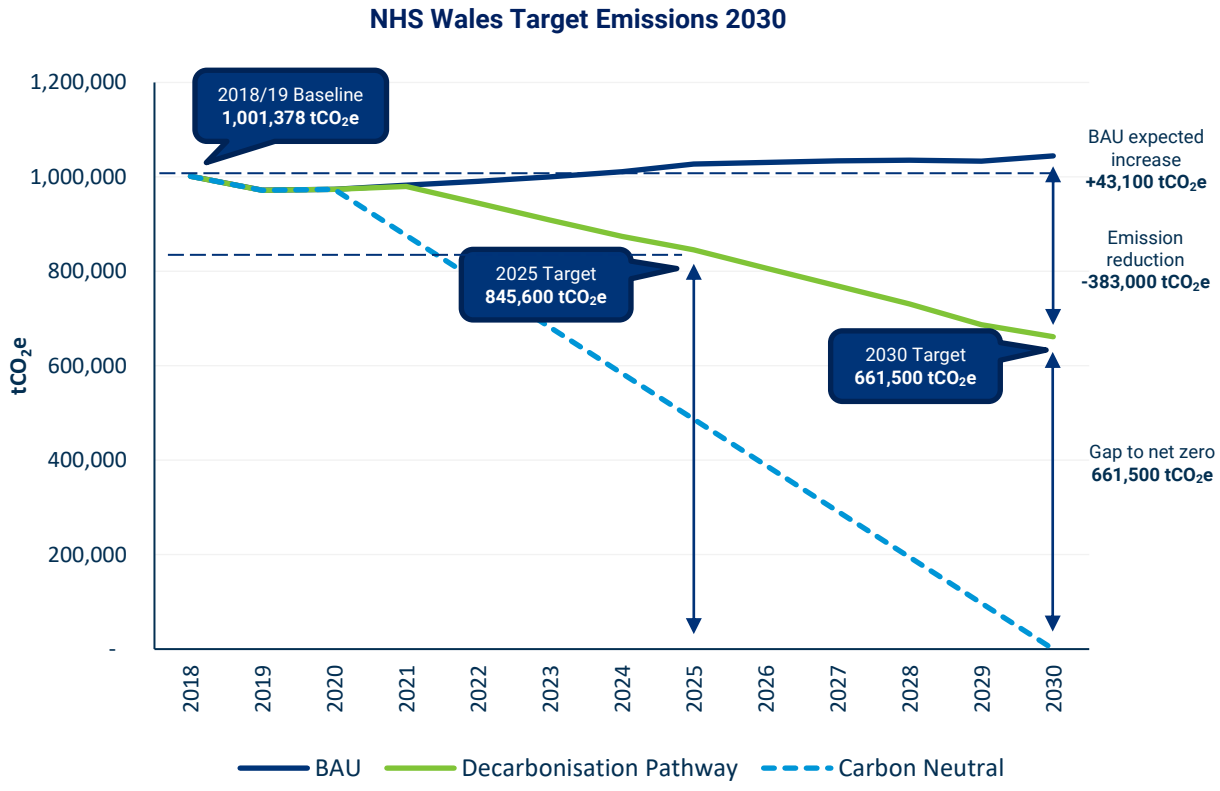
Pathway modelling was undertaken to understand the potential decarbonisation pathway NHS Wales will undertake when the initiatives set out in this Delivery Plan will be implemented.

To develop the pathway model, the potential emission reduction from each initiative was established through calculated savings, estimations based on a metric (e.g. floor area, type of vehicle), and, where data were insufficient, industry benchmarks. These savings were extrapolated against the recommended implementation dates of each measure to develop an estimated carbon reduction for each initiative for each year between the baseline footprint (2018/19) and 2030. Carbon emission factors were projected to 2030 to reflect the expected decarbonisation of the electricity grid, suppliers and transportation technology.

The projected decarbonisation pathway is shown below. It appears to show a slow initial start to decarbonisation, and this reflects a realistic timeline for the implementation of the more impactful - and often more complex - measures. However, from 2024 the speed of decarbonisation of the Health Service will begin to increase to a projected reduction of around 40-45,000 tCO_2e per year.

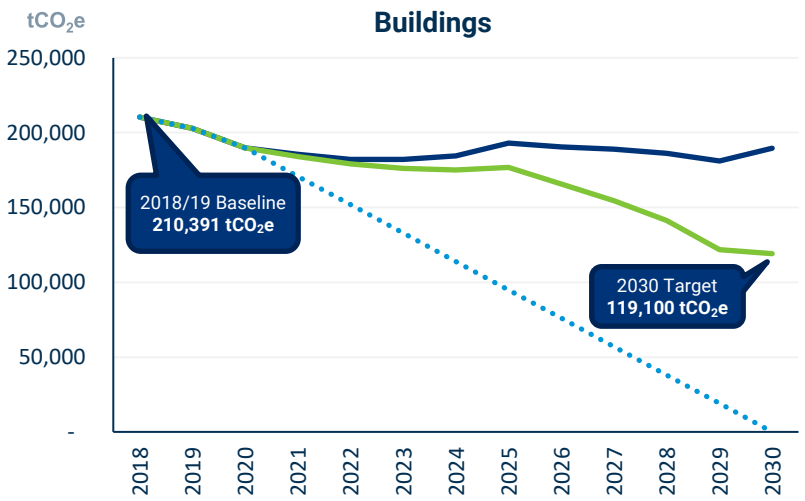
A large proportion of decarbonisation is reflected in the replacement of fossil fuel-burning appliances with electric low carbon equivalents. Electricity use is predicted to increase significantly as a result, but decarbonisation of the electricity grid plus a substantial increase in onsite and solar farm generation will ensure that emissions continue to reduce.

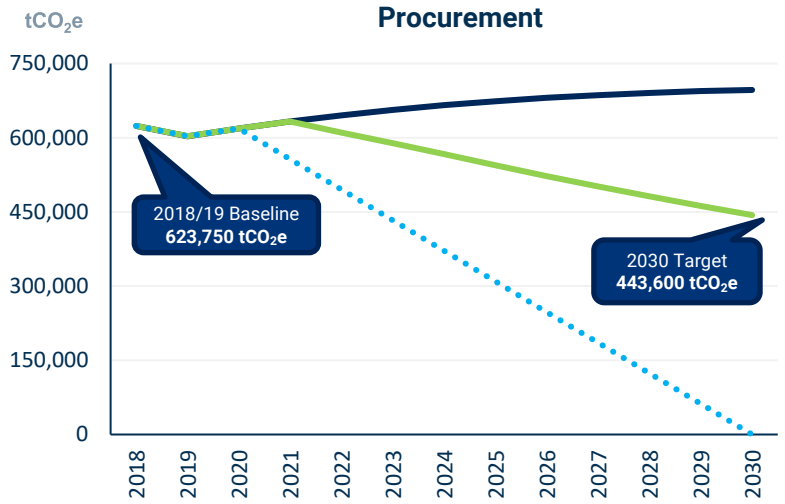
The overall NHS Wales and category targets are shown in the following charts:

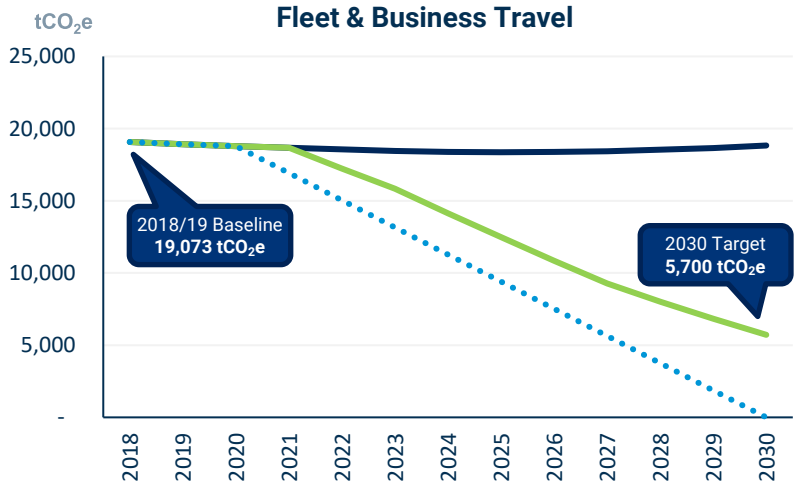


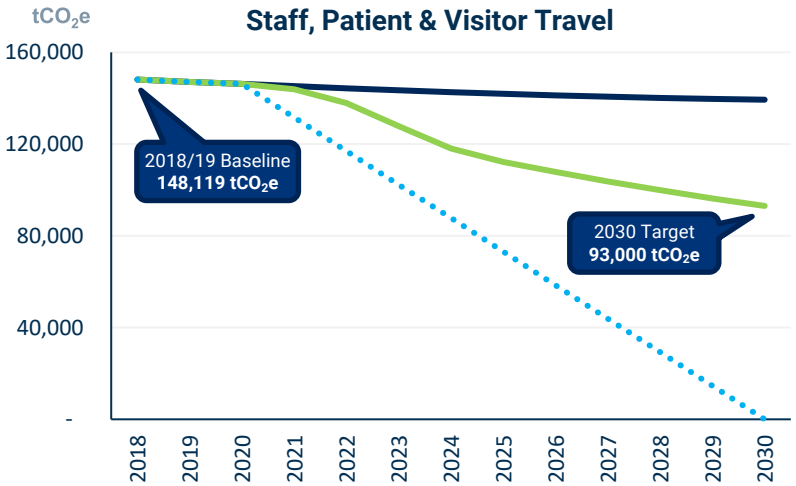
Category Targets

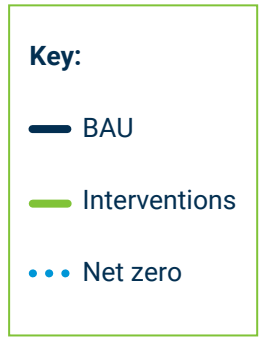
Alongside the overall NHS Wales emissions targets, assessments of performance will be made against the following category targets:











5. References

[1] United Nations (2015), *The Paris Agreement*. Available at: https://www.un.org/en/climatechange/paris-agreement [Accessed 01 Feb. 2021]

[2] The Lancet (2020), *The 2020 report of The Lancet Countdown on health and climate change: responding to converging crises*. Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)32290-X/fulltext [Accessed 01 Feb. 2021]

[3] World Economic Forum (2020), *The Global Risks Report, World Economic Forum (2020)*. Available at: http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf [Accessed 01 Feb. 2021]

[4] Climate Change Committee (2020), *Advice Report: The path to a net zero Wales*. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/Advice-Report-The-path-to-a-Net-Zero-Wales.pdf [Accessed 3 Feb. 2021]

[5] Welsh Government (2019), *Prosperity for All: A Low Carbon Wales*. Available at: https://gov.wales/low-carbon-delivery-plan [Accessed 01 Feb. 2021]

[6] Welsh Government (2015), *Well Being of Future Generations (Wales) Act. (2015)*. Available at: http://www.legislation.gov.uk/anaw/2015/2/contents/enacted [Accessed 01 Feb. 2021]

[7] Carbon Trust (2020), *NHS Wales carbon footprint 2018 to 2019.* Available at: https://gov.wales/nhs-wales-carbon-footprint-2018-2019 [Accessed 01 Feb. 2021]

[8] Welsh Government (2020), *StatsWales Emissions of Greenhouse Gases by Year.* Available at: https://statswales.gov.wales/Catalogue/Environment-and-Countryside/Greenhouse-Gas/emissionsofgreenhousegases-by-year [Accessed 01 Feb. 2021]

[9] UK Health Alliance on Climate Change (2020), *UKHACC Letter to the Prime Minister on our Principles for a Healthy Recovery, UK Health Alliance on Climate Change*. Available at: http://www.ukhealthalliance.org/healthy-recovery-letter/ [Accessed 01 Feb. 2021]

[10] Nottingham Healthcare NHS Foundation Trust (2020), *Environmental Impact Report – COVID-19*. Available at: https://www.nottinghamshirehealthcare.nhs.uk/download.cfm?doc=docm93jijm4n8222.pdf&ver=14458 [Accessed 01 Feb. 2021]

[11] Welsh Government (2016), *Active travel action plan.* Available at: https://gov.wales/active-travel-action-plan [Accessed 01 Feb. 2021]

[12] Welsh Government (2020), *Remote working*. Available at: https://gov.wales/remote-working [Accessed 01 Feb. 2021]

[13] Welsh Government (2020), *Team Wales approach to tackle climate change.* Available at: https://gov.wales/team-wales-approach-tackle-climate-change [Accessed 01 Feb. 2021]

[14] Welsh Government (2019), *Welsh Government makes Climate Emergency declaration.* Available at: https://gov.wales/welsh-government-makes-climate-emergency-declaration [Accessed 01 Feb. 2021]

[15] Salix, The Wales Funding Programme. Available at: https://www.salixfinance.co.uk/loans/welsh-loans [Accessed 01 Feb. 2021]

[16] Welsh Government (2020), *Plans to boost electric charging points in Wales.* Available at: https://gov.wales/plans-boost-electric-charging-points-wales [Accessed 01 Feb. 2021]

[17] Department of Health (2015), *Health Technical Memorandum 07-02: EnCO_2de 2015 – making energy work in healthcare. Part A: policy and management.* Available at: https://nwssp.nhs.wales/ourservices/specialist-estates-services/specialist-estates-services-documents/whtms-library/htm-07-02-encode-making-energy-work-in-healthcare-environment-and-sustainability-part-a-policy-and-management-pdf/ [Accessed 01 Feb. 2021]

[18] Department of Health (2015), *Health Technical Memorandum 07-02: EnCO2de 2015 – making energy work in healthcare. Part B: procurement and energy considerations for new and existing building facilities*. Available at: https://nwssp.nhs.wales/ourservices/specialist-estates-services/specialist-estates-services-documents/whtms-library/htm-07-02-encode-making-energy-work-in-healthcare-environment-and-sustainability-part-b-procurement-and-energy-considerations-for-new-and-existing-building-facili/ [Accessed 01 Feb. 2021]

[19] Climate Change Committee (2020), *Advice Report: The path to a net zero Wales*. Available at: https://www.theccc.org.uk/wp-content/uploads/2020/12/Advice-Report-The-path-to-a-Net-Zero-Wales.pdf [Accessed 01 Feb. 2021]

[20] National Grid ESO (2020), *Future Energy Scenarios | National Grid ESO*. [online] Available at: https://www.nationalgrideso.com/future-energy/future-energy-scenarios. [Accessed 01 Feb. 2021]

[21] Carbon Trust (2018), *Heat Pumps Guide. Opportunities for lower carbon heating*. Available at: https://www.carbontrust.com/resources/heat-pumps-guide [Accessed 01 Feb. 2021]

[22] UK Department for Business, Energy and Industrial Strategy (2019,) *Updated energy and emissions projections 2019.* [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794590/updated-energy-and-emissions-projections-2019.pdf [Accessed 01 Feb. 2021]

[23] UK Department for Business, Energy and Industrial Strategy (2020), *Combined Heat and Power: the route to 2050. Summary of call for evidence responses*. [online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/943523/chp-route-to-2050-summary-of-cfe-responses.pdf. [Accessed 03 Dec. 2020].

[24] ASHRAE (2016), *Data Centre Power Equipment Thermal Guidelines and Best Practices* . Available at: http://tc0909.ashraetcs.org/documents/ASHRAE_TC0909_Power_White_Paper_22_June_2016_REVISED.pdf [Accessed 01 Feb. 2021]

[25] UK Green Building Council (2019), *Net Zero Carbon Buildings: A Framework Definition*. Available at: https://www.ukgbc.org/wp-content/uploads/2019/04/Net-Zero-Carbon-Buildings-A-framework-definition.pdf [Accessed 1 Feb. 2021]

[26] Welsh Government (2020), *Electric Vehicle (EV) charging strategy for Wales Consultation*. Available at: https://gov.wales/sites/default/files/consultations/2020-12/electric-vehicle-charging-strategy-consultation-document.pdf [Accessed 01 Feb. 2021]

[27] Welsh Government (2020), *Plans to boost electric charging points in Wales*. Available at: https://gov.wales/plans-boost-electric-charging-points-wales [Accessed 03 Feb. 2021]

[28] Call-out box reference: Public Health Wales (2020), *Air pollution and health in Wales*. Available from: https://phw.nhs.wales/services-and-teams/environmental-public-health/air-quality/air-pollution-and-health-fact-sheet/ [Accessed 03 Feb. 2021].

[29] World Health Organisation (2016), *Ambient air pollution: A global assessment of exposure and burden of disease.* Available at: https://www.who.int/phe/publications/air-pollution-global-assessment/en/. [Accessed 01 Feb. 2021]

[30] Public Health England (2020), *Review of interventions to improve outdoor air quality and public health: Principal interventions for local authorities*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/937341/Principal_interventions_for_local_authorities-air_quality_public_health.pdf [Accessed 01 Feb. 2021]

[31] World Health Organisation (2013), *Review of evidence on health aspects of air pollution – REVIHAAP project: final technical report*. Available at: https://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2013/review-of-evidence-on-health-aspects-of-air-pollution-revihaap-project-final-technical-report. [Accessed 01 Feb. 2021]

[32] Public Health Wales (2020), *Air Pollution and Health in Wales*. Available at: https://phw.nhs.wales/services-and-teams/environmental-public-health/air-quality/air-pollution-and-health-fact-sheet/ [Accessed 01 Feb. 2021]

[33] Travaglio, M., Yu, Y., Popovic, R., Selley, L., Leal, N.S. and Martins, L.M. (2020). *Links between air pollution and COVID-19 in England.* Environmental Pollution, p.115859.

[34] Welsh Government (2020), *The Clean Air Plan for Wales*. Available at: https://gov.wales/sites/default/files/publications/2020-08/clean-air-plan-for-wales-healthy-air-healthy-wales.pdf [Accessed 01 Feb. 2021]

[35] DVLA/DfT (2020), *Table VEH0172 Ultra low emission vehicles (ULEVs) 1 registered for the first time by region, United Kingdom from 2010 Q1*. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01 [Accessed 01 Feb. 2021]

[36] DVLA/DfT (2020), *Table VEH0150 Vehicles registered for the first time by body type, including breakdown by ULEVs and plug-in grant eligibility, Great Britain from January 2001; also United Kingdom from July 2014*. Available at: https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01 [Accessed 03 Feb. 2021].

[37] Department of Health and Social Care (2020) Report of the Independent Review of NHS Hospital Food. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/929234/independent-review-of-nhs-hospital-food-report.pdf [Accessed 01 Feb. 2021]

[38] A. Callaghan, G. McCombe, A. Harrold, C. McMeel, G. Mills, N. Moore-Cherry & W. Cullen (2020), *The impact of green spaces on mental health in urban settings: a scoping review, Journal of Mental Health*, DOI: 10.1080/09638237.2020.1755027

[39] NHS Forest, https://nhsforest.org/ [Accessed 01 Feb. 2021]

[40] The Bevan Commission, https://www.bevancommission.org/ [Accessed 01 Feb. 2021]

[41] Royal College of Physicians (2016), *Every breath we take: The lifelong impact of air pollution. London: RCP, 2016*. Available at: www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution. [Accessed 21 Jan 2021]

[42] Khreis, H., Cirach, M., Mueller, N., de Hoogh, K., Hoek, G., Nieuwenhuijsen, M.J. and Rojas-Rueda, D. (2019), *Outdoor air pollution and the burden of childhood asthma across Europe. European Respiratory Journal, 54(4), p.1802194*. Available at: https://erj.ersjournals.com/content/54/4/1802194.long [Accessed 4 Feb. 2021]

[43] NHS England (2020). *Greener NHS campaign to tackle climate 'health emergency'*. Available at: https://www.england.nhs.uk/2020/01/greener-nhs-campaign-to-tackle-climate-health-emergency/ [Accessed 5 Jan 2021]

[44] King's College London (2019) *Higher air pollution days trigger cardiac arrests and hospitalisations*. Available at: https://www.kcl.ac.uk/news/higher-air-pollution-days-trigger-cardiac-arrests-and-hospitalisations [Accessed 21 Jan 2021]

[45] Vardoulakis S, Heaviside C (eds). *Health effects of climate change in the UK 2012. London: Health Protection Agency, 2012*. www.climatenorthernireland.org.uk/cmsfiles/resources/files/HealthEffects-of-Climate-Change-in-the-UK-2012_Department-of-Health.pdf [Accessed 23 Jan 2021]

[46] Button D, Coote A (2016). *Public health in a changing climate. York: Joseph Rowntree Foundation*. Available at.www.jrf.org.uk/report/public-health-changing-climate [Accessed 4 Feb. 2021]

[47] Hunt A, Boyd R, Taylor T et al. *Report on the costs of the hot summer of 2003. Bath: Metroeconomica Ltd, 2006.*

[48] Getting it Right First Time. https://www.gettingitrightfirsttime.co.uk/ [Accessed 01 Feb. 2021]

[49] Greener Practice (2020), *Green Impact for Health Toolkit*. Available at: https://www.greenerpractice.co.uk/gifh-audit. [Accessed 21 Jan. 2021]

[50] UK Health Alliance for Climate Change (2021), *Carbon Literacy Guide*. Available at: http://www.ukhealthalliance.org/carbon-literacy-guide/ [Accessed 9 Feb. 2021]

[51] Myhre, G., D. Shindell, F.-M. Bréon, W. Collins, J. Fuglestvedt, J. Huang, D. Koch, J.-F. Lamarque, D. Lee, B. Mendoza, T. Nakajima, A. Robock, G. Stephens, T. Takemura and H. Zhang, 2013: *Anthropogenic and Natural Radiative Forcing. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter08_FINAL.pdf [Accessed 01 Feb. 2021]

[52] Ryan, S. M., & Nielsen, C. J. (2010). Global warming potential of inhaled anesthetics: application to clinical use. Anesthesia and analgesia, 111(1), 92–98. Available at: https://doi.org/10.1213/ANE.0b013e3181e058d7 [Accessed 01 Feb. 2021]

[53] Greenhouse Gas Protocol (2014). *Fifth Assessment Global Warming Potential Values*. Available at: https://ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf [Accessed 8 Feb. 2021].

[54] Fennel-Wells, A. (2021) – *Information from Welsh Anaesthesia Environmental Network investigating N_2O leakage at Cardiff and Vale University Health Board*.

[55] Call-out box reference: Green Inhaler (2021) *Inhaler Comparison*. Available from: https://greeninhaler.org/inhaler-comparison/. [Accessed 01 Feb. 2021]

[56] Wilkinson, et al. (2019). *Costs of switching to low global warming potential inhalers. An economic and carbon footprint analysis of NHS prescription data in England.* BMJ Open, 9(10), p.e028763. https://bmjopen.bmj.com/content/9/10/e028763 [Accessed 01 Feb. 2021]

[57] Rizan, C., Bhutta, M.F., Reed, M. and Lillywhite, R. (2021). *The carbon footprint of waste streams in a UK hospital. Journal of Cleaner Production, 286.* p.125446.

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Published in the UK: 2021