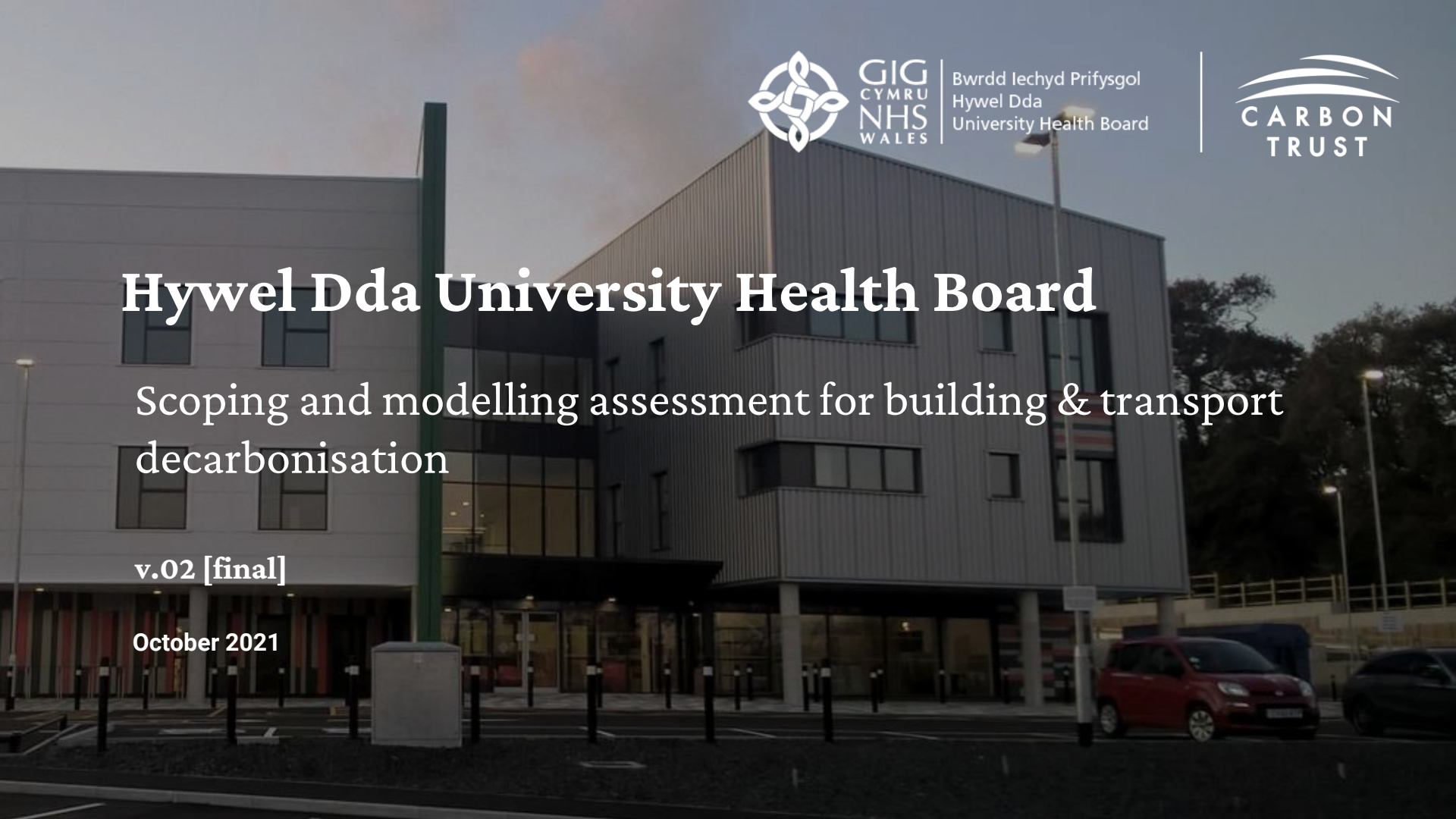


Hywel Dda University Health Board

Scoping and modelling assessment for building & transport decarbonisation

v.02 [final]

October 2021

Contents

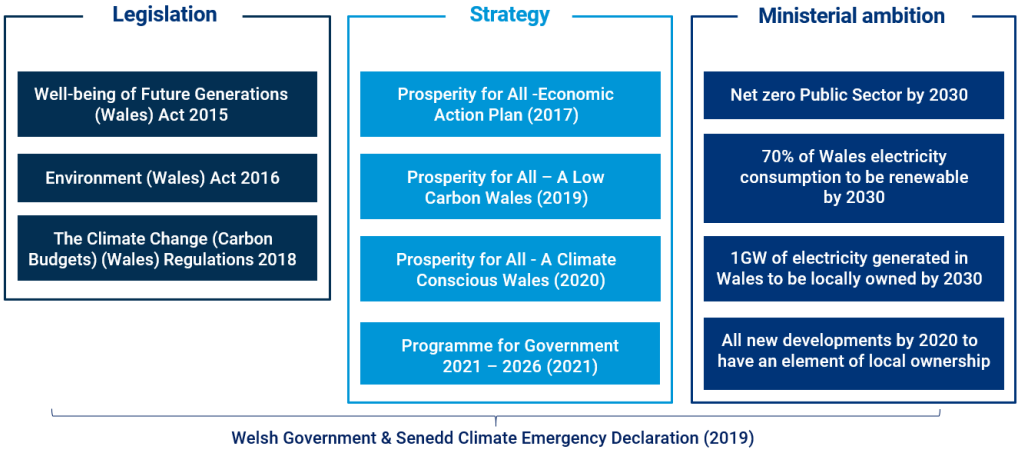
Context

The climate and ecological emergency now has unprecedented political recognition and demand for action across the world. The UK Climate Change Committee has advised Welsh Government on the steps required to tackle the climate crisis, and legislation, strategy, and ministerial ambitions have been set to drive action in Wales.

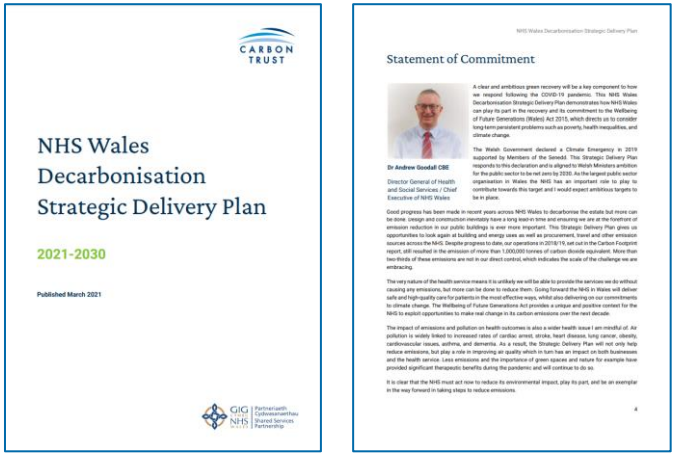
Earlier this year, NWSSP, with support of the Carbon Trust, released the *NHS Wales Decarbonisation Strategic Delivery Plan 2021-2030* to set out the targets, initiatives, and requirements of Health Boards out to 2030. The Plan includes a 'Statement of Commitment' from Dr Andrew Goodall CBE, the Director General of Health and Social Services and Chief Executive of NHS Wales, and was launched by the Minister of Health and Social Services through Welsh Government.

This report provides an initial high-level assessment of Scope 1 & 2 opportunities for Hywel Dda University Health Board (HDUHB) to scope target areas and next step activities for the Health Board to fulfil it's requirements in contributing to a net zero public sector.

The political drivers set by Welsh Government



NHS Wales Strategic Delivery Plan & Statement of Commitment



1. State of play

Footprinting

Introduction to carbon footprinting

The Carbon Trust has conducted the footprinting and baseline validation in accordance with the green house gas (GHG) protocol – the most widely used and accepted methodology for GHG accounting. The GHG protocol categorises emissions into three scopes:

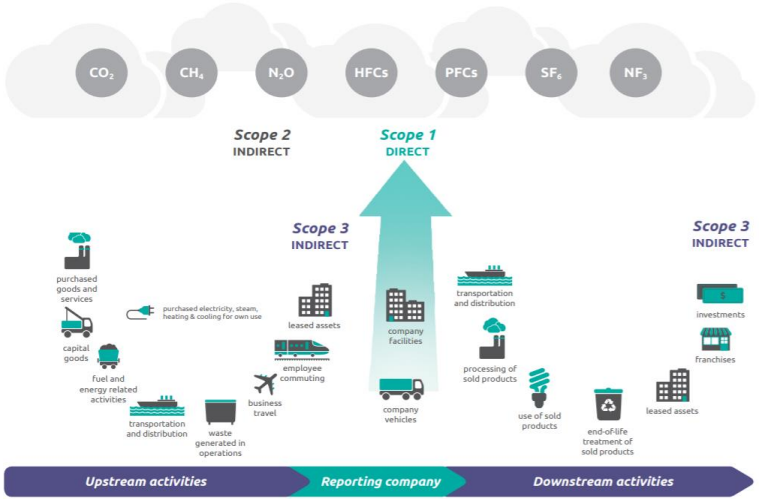
a. **Scope 1:** All direct GHG emissions (i.e. 'on-site' emissions, such as gas from a gas boiler or tailpipe emissions from a vehicle).

b. **Scope 2:** Indirect GHG emissions from consumption of purchased electricity, heat or steam.

c. **Scope 3:** All other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, outsourced activities, waste disposal, etc.

Where direct and indirect emissions are defined according to operational control, such that:

- Direct GHG emissions are emissions from sources that are operationally controlled by the Health Board.
- Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources controlled by another entity (for example, a power plant that generates the electricity consumed by HDUHB, or a waste water treatment site that processes HDUHB's waste water).



Above: Emission scopes, as defined by the GHG Protocol.

HDUHB footprint

Footprint analysis

HDUHB footprint for FY 18/19 was calculated to be **98,854 tCO_2e**. The composition of the footprint aligns to NHS Wales overall footprint[1], with the majority of emissions (~80%) attributed to the Board's value chain. Energy consumption at HDUHB-operated sites is still a substantial emission source, totalling 19,227 tCO_2e.

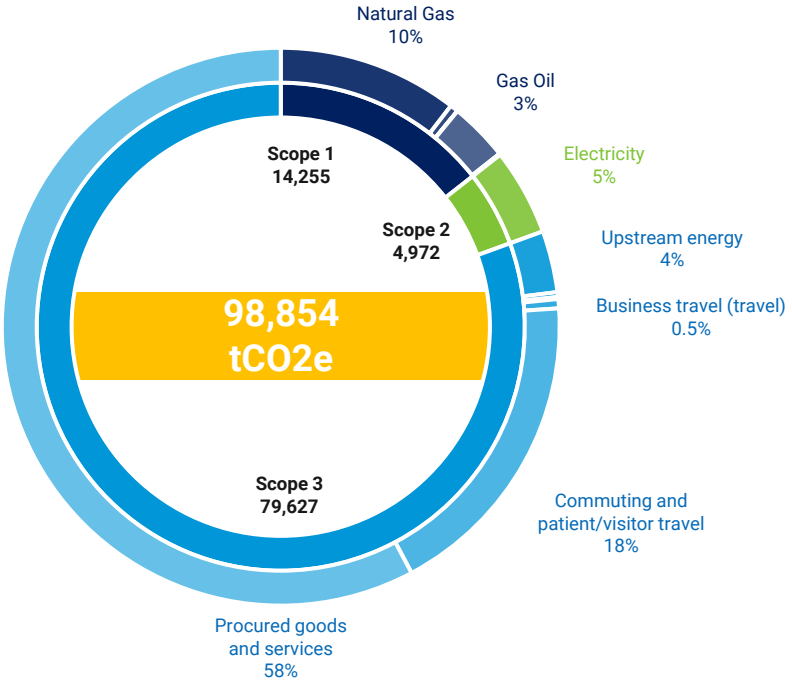
The three largest emission categories make up 86% of the total footprint:

1. **Procured goods and services** (57,109 tCO_2e)
2. **Employee commuting and patient/visitor travel** (18,067 tCO_2e)
3. **Natural gas consumption** in Health Board operated buildings (2,066 tCO_2e)

HDUHB's footprint in numbers:

- Annual procurement spend of ~£177 million
- Estimated 57 million miles of employee commuting and patient/visitor travel
- Over 180,000 m^2 of occupied floor space

Below: Summary of HDUHB's measured footprint

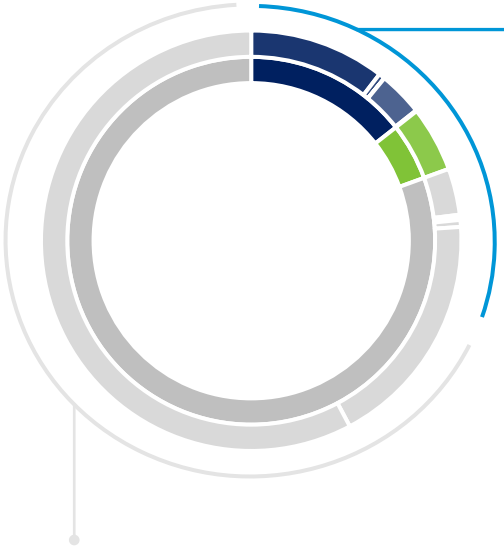


[1] https://gov.wales/nhs-wales-carbon-footprint-2018-2019

HDUHB footprint

Report focus

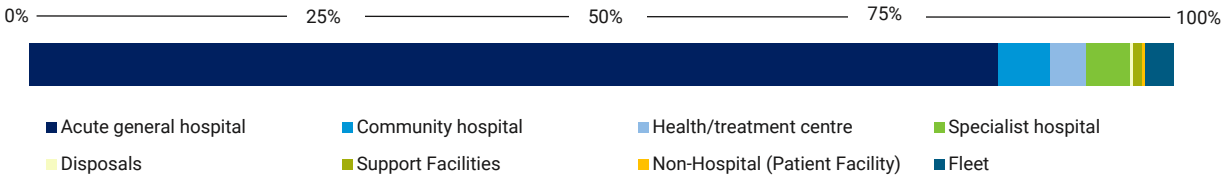
The scope of this study is restricted to buildings and transportation under the operational control of HDUHB (i.e., scope 1 and 2 emissions)



HDUHB's Scope 1 and 2 footprint for the FY 18/19 was 19,227 tCO2e. This comprises of:

Natural gas	10,328 tCO_2e	53.7%	**Diesel**	467 tCO_2e	2.4%
Electricity	4,972 tCO_2e	25.9%	**Biomass**	69 tCO_2e	0.4%
Gas oil	3,382 tCO_2e	17.6%	**Petrol**	8 tCO_2e	<0.1%

% of scope 1 and 2 emissions by asset type:



It should be recognised that this report is only focuses on 19% of the measured footprint and should therefore only be a part of the HDUHB's sustainability planning. **A complementary strategy / action plan addressing scope 3 emissions should be developed**. Scope 3 emissions are harder to monitor and reduce due to their inherent remoteness from the Health Boards own operational control but, due to their magnitude, cannot be left out of any credible decarbonisation strategy. It is recommended that HDUHB:

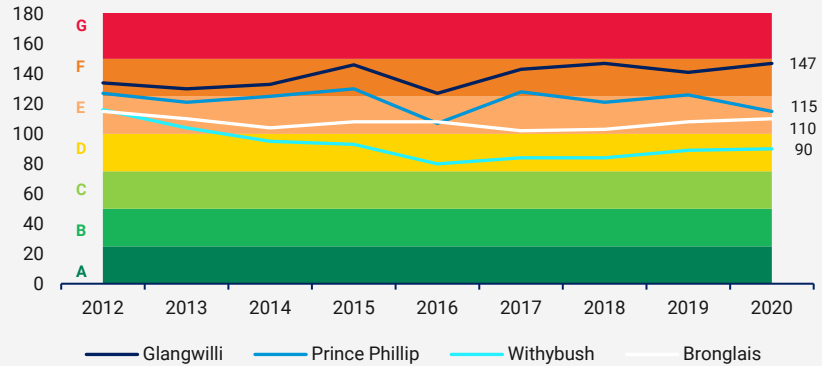
- Engage with and assist NHS Wales Shared Services Partnership (NWSSP) in their efforts to embed sustainability into procurement procedures.
- Dedicate resource in appropriate areas of the HDUHB (waste disposal, travel, procurement) as scope 3 leads and provide the necessary training to allow them to gather data, calculate scope 3 emissions and deliver savings along the value chain.

Estate Profile

The Hywel Dda baseline is made up of seven building categories (below). Due to their contribution to the overall baseline (see page 13), further profiling of the acute general sites has been provided below and on the following pages:

Site type	Number of sites	m^2	Brief description of general function
Acute general hospital	4	144,582	Inpatients and acute care and A&E
Community hospital	4	10,167	Inpatients
Specialist hospital	2	13,264	Outpatients only
Health/treatment centre	17	12,092	Outpatients only
Support Facilities	9	599	-
Non-Hospital (Patient Facility)	3	3,389	-
Disposals	2	684	Assets to be removed from the Hywel Dda estate in the next reporting period

Acute sites: Historical DEC ratings



Display energy certificates (DECs) are designed to show the energy performance of public buildings. The assessment is required annually and provides an operational rating that indicates the annual emissions of a building resulting from energy consumption. A building is then 'banded' by comparing the buildings performance to a value considered typical for the type of building. As DECs are based on metered energy consumption, the resulting certificate offers a good insight into the operational efficiency of the building.

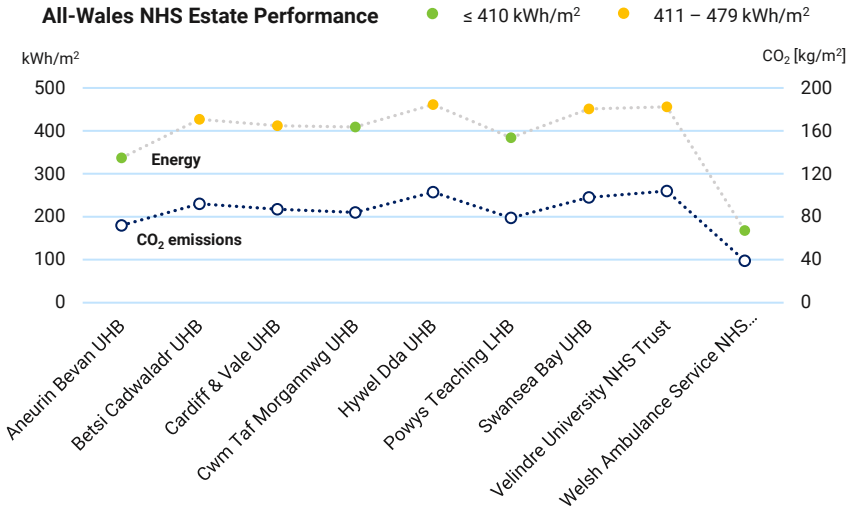
Analysis of acute site shows consistent operational ratings between 90 – 140 (band D – F) in the past 8 yeas , suggesting that substantial energy efficiency and retrofit options to improve operational performance are available.

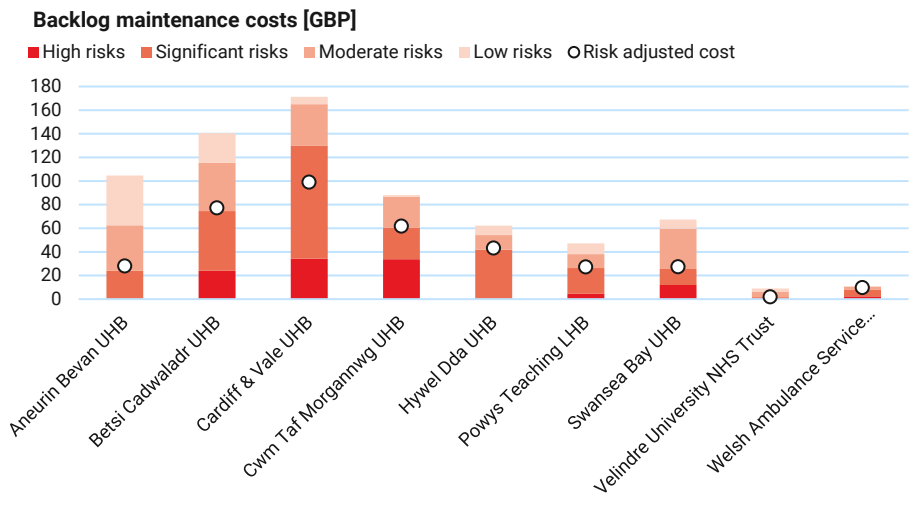
Estate profile

Estates and Facilities Performance Management System (EFPMS)

The Estates and Facilities Performance Management System (EFPMS) provides access to real time data and benchmarking across the NHS Estate, and produces an annual dashboard to show performance of Health Boards across NHS Wales. A summary of the most recent dashboard (2019/20) is provided below. The dashboard shows that Hywel Dda is the worst performing University Health Board (UHB) across NHS Wales in terms of relative energy consumption and carbon emissions. This is consistent with the DEC analysis and is indicative of poor thermal and electrical performance across the estate, particularly the acute sites. Substantial changes to the operational performance of these sites will have to be realised for HDUHB to realise their decarbonisation ambitions.

However, the backlog of maintenance costs is relatively low, and HDUHB has the second lowest risk adjusted costs and no costs that are deemed high risk. However, the backlog is still significant (~£60mil) and indicates that there will be significant challenge in addressing the backlog of maintenance requirements whilst also rolling out the recommendations made in this report.





Estate profile

Acute general hospitals

Glangwili General Hospital

Age:	Predominantly 1955 – 74
Floor area:	50,650 m^2
DEC rating:	F
Energy efficiency:	
	T5 lighting with controls, VSD motors
Main heating fuel(s):	Gas oil (11.37 MW) and biomass (0.99 MW)
Thermal performance:	
	Partial roof insulation, partial double glazing, heat recovery units, optimised BMS
On-site generation:	3.5 kW solar PV

Prince Phillip Hospital

Age:	Predominantly 1985 – 1994
Floor area:	29,099 m^2
DEC rating:	E
Energy efficiency:	
	T5 lighting with controls, VSD motors
Main heating fuel:	Natural gas (1.27 MW)
Thermal performance:	
	Complete roof insulation, single glazing throughout, optimised BMS
On-site generation:	Proposal for 734 kW solar PV

Estate profile

Acute general hospitals

Withybush General Hospital

Age:	Predominantly 1975 – 84
Floor area:	38,501 m^2
DEC rating:	D
Energy efficiency:	
	T5 lighting with controls, VSD motors
Main heating fuel(s):	Natural gas
Thermal performance:	
	Complete roof insulation, partial double glazing, optimised BMS
On-site generation:	14.28 kW solar PV installed. Further 277 kW proposed.

Bronglais General Hospital

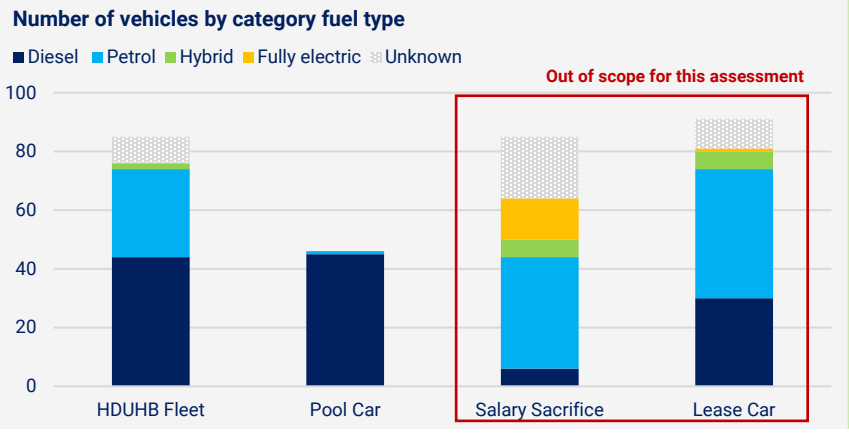
Age:	Predominantly 1965 – 1974
Floor area:	26,331 m^2
DEC rating:	E
Energy efficiency:	
	T8 lighting without controls, VSD motors
Main heating fuel:	Natural gas
Thermal performance:	
	Partial roof insulation, partial double glazing, optimised BMS
On-site generation:	14.28 kW solar PV installed. Further 185 kW proposed.

Estate profile

Fleet

HDUHBs core fleet (business use only and pool cars) is a relatively small contributor – 2.47% of total scope 1 and 2 emissions. Of the 131 vehicles, 96 are classified as cars and 33 are light commercial vehicles (LCVs). The NHS Wales Decarbonisation Strategic Delivery Plan recommends that all non-emergency cars and light good fleets vehicle procured after April 2022 are battery-electric vehicles, and ultra-low emission vehicles (ULEV) should be procured where this is not feasible. Under this recommendation, the Health Boards fleet will undergo a significant change between now and 2030, with an almost entirely electric fleet being operational at the end of the decade. A recent ULEV report delivered under the Welsh Government Energy Service (WGES) identified that this is feasible, stating that all of the fleet under 3.5 tonnes gross weight, including 4x4 pickups and minibuses, could be transitioned to BEV by 2025. However, data improvements have been recommended to ensure that the transition is informed by vehicle fuel data, trip distance etc., which is currently not possible due to lack of data. There are also challenges related to electrical capacity at the main acute sites, which will have to be addressed to allow for the necessary supporting infrastructure.

Whilst HDUHB's own fleet is a relatively small emission source, the impact of HDUHB's own transport strategy (e.g. provision of charging points) has the potential to impact commuting and patient/visitor travel (scope 3), and provide several co-benefits (e.g., air quality, identified as the single biggest risk to human health in Wales).



Fleet make-up: HDUHB operate a core fleet of 131 vehicles, and a further 81 cars are leased via the Health Boards lease car scheme to staff who exceed a minimum business mileage per annum. 64 cars are provided by a salary sacrifice scheme that is available to all staff regardless of business mileage. The majority of vehicles across all categories are either diesel or petrol powered (~90%), with the remaining vehicles split evenly between hybrid or fully-electric models. Interestingly, the category with the highest proportion of hybrid and electric models is salary sacrifice, showing an appetite amongst HDUHB employees to procure electric vehicles.

Only the fuel consumption associated with business use and pool cars is included in scope for this assessment.

2. Footprint analysis

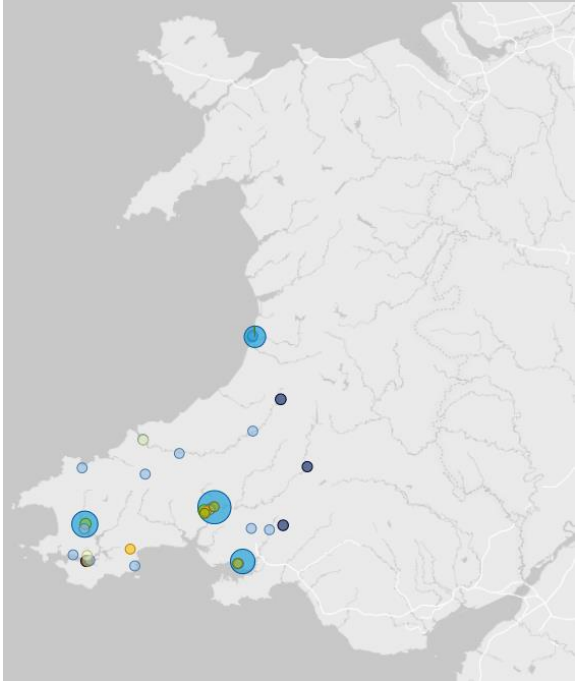
Footprint analysis

Introduction

In the following section, benchmarking has been performed to provide an indication of site level energy performance. The Chartered Institute for Building Service Engineers (CIBSE) benchmarks[1] have been used, which are derived from the DEC database and metered consumption of similar buildings. Benchmarking has primarily focused on hospital sites due to their contribution to the total building footprint (95.8%). From a carbon perspective, particular attention should be paid to non-electric consumption due to it's significance to the baseline (73.4%) and the likely constant emission factors between now and 2030 (unlike electricity, which is expected to decrease by ~60%). Analysis of HDUHB footprint in the context of NHS Wales' Decarbonisation Strategic Delivey Plan has also been undertaken.

	Site type	Electricity [tCO_2e]	Natural Gas [tCO_2e]	Gas oil [tCO_2e]	Biomass [tCO_2e]	Total [tCO_2e]
87.2%	Acute general hospital	4,120	9,089	3,006	69	**16,284**
4.6%	Community hospital	288	392	178	0	**858**
4.0%	Specialist hospital	312	437	0	0	**748**
2.9%	Health/treatment centre	170	268	181	0	**620**
0.8%	Support Facilities	55	77	16	0	**149**
0.3%	Non-Hospital (Patient Facility)	16	40	0	0	**56**
0.2%	Disposals	11	26	0	0	**37**
		4,972	**10,328**	**3,382**	**69**	**18,751**

Geographic spread of HDUHB buildings:
Size of bubbles are proportional to tCO_2e

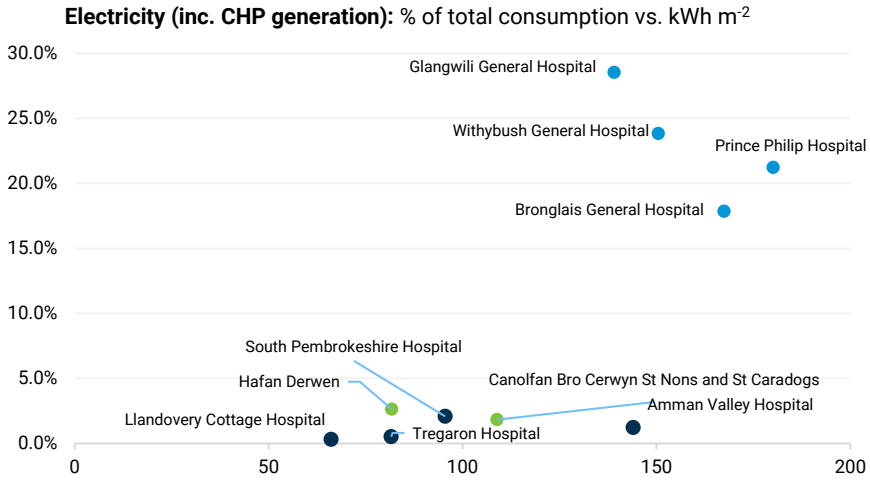


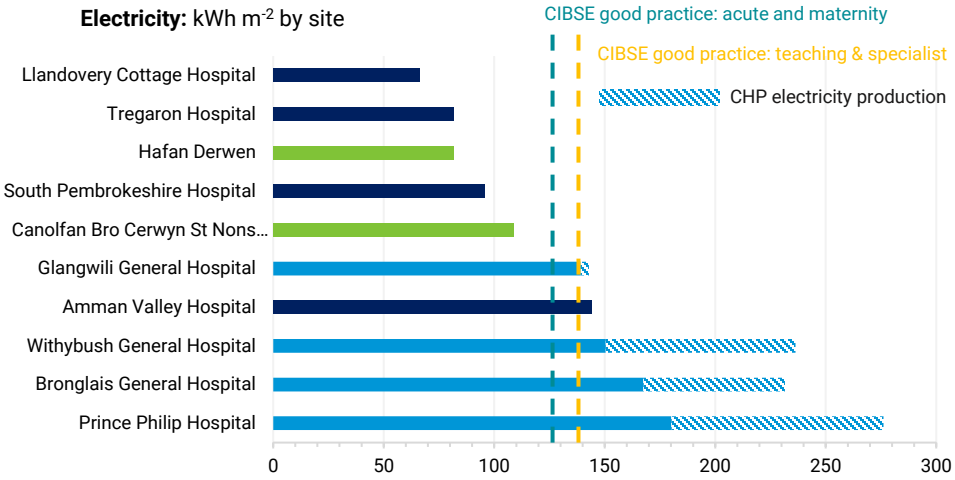
[1] https://www.cibse.org/knowledge/digital-tools/the-energy-benchmarking-tool-(beta-version)

Estate profile

Electricity consumption: hospitals

Hospitals sites are inherently energy intensive due to the requirements of healthcare (particularly acute sites), and they account for 95% of all electrical energy consumed by the Health Board and 96% of all non-electrical consumption. Decarbonisation opportunities cannot compromise the delivery of care, and to continue effective operation whilst achieving the scale of reductions required to align to a 2030 net zero target make hospitals HDUHBs largest decarbonisation challenge. The large proportion of electricity consumption is associated with the four acute sites, at 91.4% of total (including CHP generated power used on-site). For decarbonisation targets to be realised, performance beyond CIBSE current 'good practice' benchmarks must be achieved. However, benchmarking shows that currently only five non-acute sites meet 'good practice' operational standards, indicating that are significant opportunities for energy efficiency across the hospital sites. Due to their contribution to the overall footprint, savings across the acute sites in particular have to be targeted as a priority.



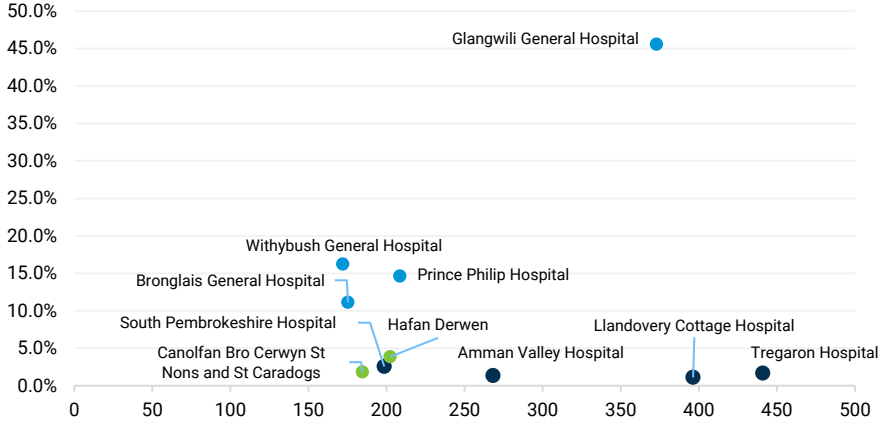


Estate profile

Non-electrical consumption: hospitals

Acute sites account for 87.6% of all non-electric energy consumption (gas oil, natural gas, biomass). Glangwili General Hospital is the largest acute site and accounts for 45.6% consumption, and is the only acute site that does not exceed CIBSE's good practice benchmark for fossil fuel consumption. The presence of some end-uses unique to Glangwili (e.g. laundry) will contribute to the sites high consumption, and their absence in the other sites will increase the apparent performance gap between Glangwili and the other acute sites. Emission factors associated with non-electric consumption will remain relatively constant, meaning any reductions will come from proactive measures to reduce consumption. As these emissions account for ~72% of scope 1 and 2 emissions, reducing non-electric consumption will be central to decarbonisation ambitions. Previous condition surveys indicate that the thermal performance of buildings can be improved (e.g. roof insulation, double glazing) and that the several sites are being heated by old natural gas and/or oil boilers. A co-ordinated plan to bring these up to best-practice whilst satisfying other operations (sterilisation, catering etc.) with lower carbon solutions should be an absolute priority for the Health Board.

Non-electrical consumption: % of total consumption vs. kWh m^{-2}



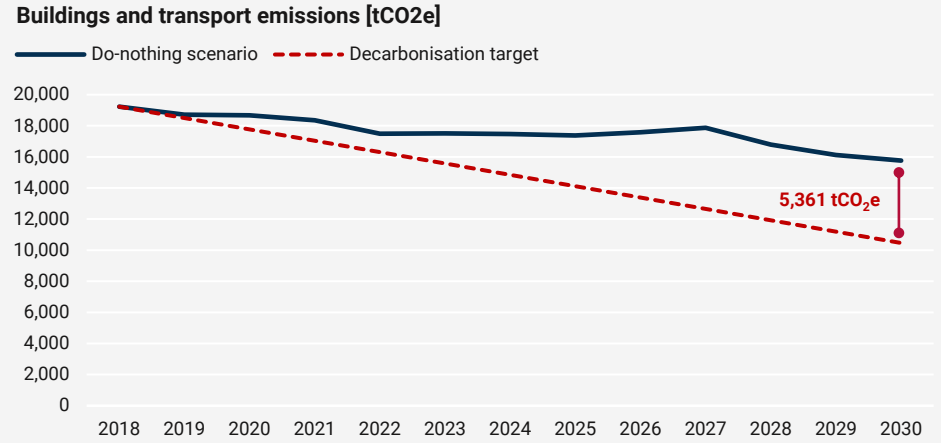
Non-electric consumption: kWh m^{-2}

Acute site Community hospital Specialist hospital

NHS Wales decarbonisation targets

The NHS Wales Decarbonisation Strategic Delivery Plan[1] sets a target of 34% emissions reduction by 2030, relative to a 2018/19 baseline. This overall target is inclusive of procurement and staff, patient and visitor travel, and a supporting strategy has been recommended to achieve emission reductions across these categories. However, the contribution of buildings and transport to this overall target is significant, and a scope 1 and 2 reduction of 45.6% is set out in the Delivery Plan (*below*).

The national grid is decarbonising as renewables increase their share of power generation, and by 2030 the emission factor associated with electricity consumption is expected to decrease by >50% relative to the baseline year. This effect will be a key driver behind the Health Boards decarbonisation and the impact of it alone has been presented as a 'do-nothing' scenario. In the scenario a gap-to-target of 5,361 tCO2e is forecast, which are emissions that HDUHB will have to proactively reduce to achieve their decarbonisation ambitions. The 'pathway projection' section of this report layers decarbonisation initiatives on top of the do-nothing scenario to determine the type and magnitude of projects required to close this gap and achieve the decarbonisation target.



Do-nothing scenario. The carbon intensity of the UK's electricity supply is reducing as traditional power generation from fossil fuels (e.g. coal, natural gas) is being displaced by renewable generation. Therefore, even in a do-nothing scenario HDUHB's emissions will reduce as a result of consuming 'greener' electricity.

Various scenarios on the extent of electric decarbonisation exist. For the purposes of this project an indexed version of the National Grid's 'Steady Progression' in the Future Energy Scenarios 2021 has been used as a baseline scenario. Relative to other projections this represents a conservative scenario for grid decarbonisation. Regardless of the scenario, the decarbonisation of the national grid makes fuel switching (e.g. electrification of heat) a necessity for HDUHB to achieve their decarbonisation targets.

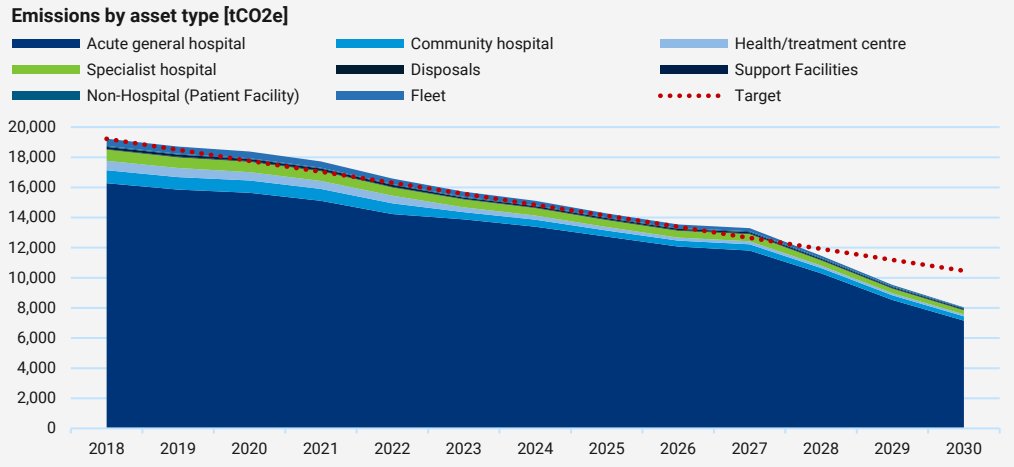
[1] https://gov.wales/nhs-wales-decarbonisation-strategic-delivery-plan

3. Pathway projection

Pathway projection

Analysis has been performed to project HDUHB's emissions out to 2030 and determine the Health Boards expected progress against decarbonisation targets. The analysis has identified decarbonisation projects to be implemented between now and 2030 – either planned (e.g. disposal of existing sites, on-site renewable generation) or theoretical – and estimated the changes in fuel consumption associated with their implementation. Further details of the modelled projects and the assumptions used are included on page 22 and in the appendix.

The scenario presented is ambitious and far-reaching. If implemented, it is expected that HDUHB will achieve a reduction in scope 1 and 2 emissions of 58.2% by 2030 relative to the baseline year. This would exceed the scope 1 and 2 emissions target set out in the NHS Wales strategy (the 'target') by 2,426 tCO_2e. However, **transformational change will be required to realise this projection**. Extensive energy efficiency upgrades will be prerequisite across the estate and significant fuel switching (inc. the decommissioning of all CHP plants at acute sites) will be a necessity. Large-scale and multi-mullion pound projects form the backbone of the scenario, and only pursuing 'like-for-like' upgrades of current technologies established within the Health Board, and requiring financial returns will not be sufficient. Whilst this projection shows that the target is achievable, the scale of change required to achieve it should not be underestimated.



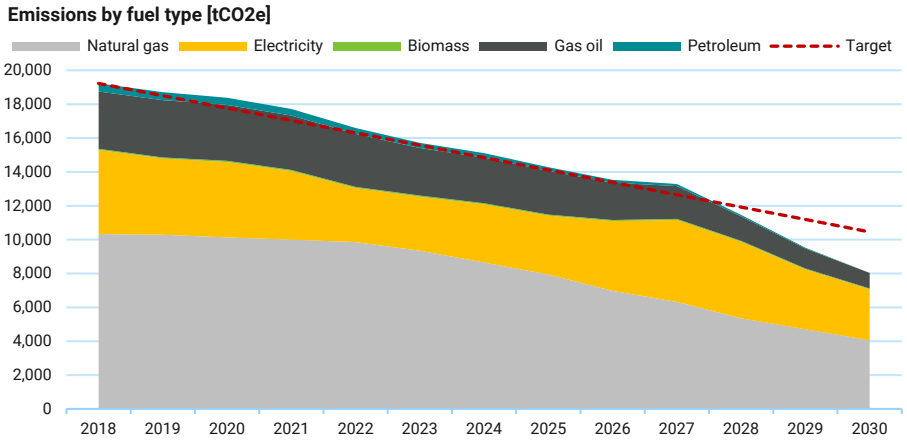
Acute sites are modelled to still dominate HDUHB's footprint, accounting for 87% of total emissions by 2030 in the modelled scenario. However, reductions in acute sites will be the core driving force behind reaching HDUHB's decarbonisation targets and decrease by over half (58%) in the scenario. Measures across the acute sites alone were sufficient to meet the decarbonisation target.

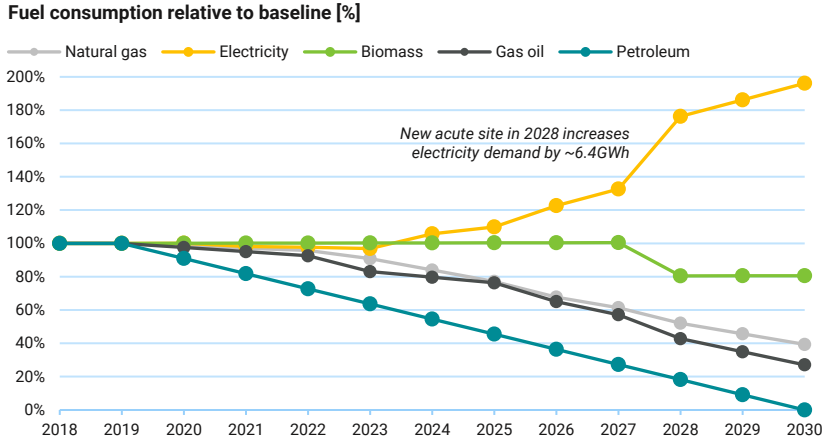
The majority of emission savings come from space heating load being supplied by high efficiency heat pumps in acute sites and all CHP plants being decommissioned. The modelling also assumes that significant fabric improvements have been made to shift thermal performance towards 'good practice', as well as heat pumps and energy efficiency measures.

Pathway projection

The modelling provides an outlook of how consumption across the estate will alter in the next decade. Reductions in grid electricity demand from energy efficiency measures (LED lighting, enhanced controls, EC plug fans etc.) and on-site renewable generation are entirely negated by an increase in demand from the electrification of fleet vehicles and heating, as well as the decommissioning of CHPs increasing grid electricity demand. The addition of an acute site in 2028 also leads to a substantial increase (~6.4 GWh) in electricity demand. Despite an almost 2-fold increase in grid electricity, the associated emissions are forecast to reduce by 40% in the scenario due to the decarbonisation of the national grid, reemphasising the importance of electrification across the estate. Natural gas and gas oil consumption are still present in the scenario due to catering, sterilisation and hot water heating requirements, primarily at acute hospital sites. 25% of baseline space heating demand is also still met by fossil fuels in the scenario.

Whilst beneficial from an emissions perspective the changing of fuel types has a social and economic impact, and the improper installation and/or operation of electrified technologies (e.g. heat pumps) can result in increased costs. HDUHB should therefore develop feasibility studies with accompanying business cases to ascertain the wider impacts of any change; consideration of government incentives, funding streams, smart tariffs and ancillary services (e.g. demand side response) should be considered in the business case for electrification. HDUHB should also look to engage with end-users and BMS operators to ensure best-practice operation is followed to facilitate the user's transition to new technologies, and ultimate acceptance/comfort in doing so.

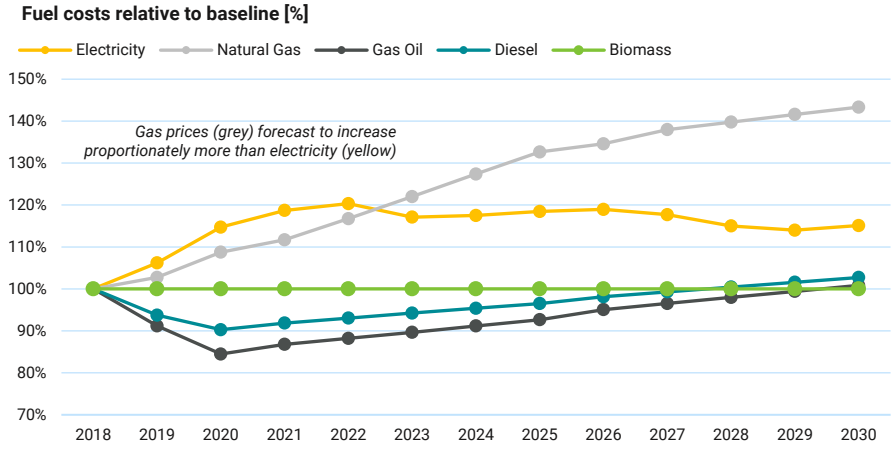


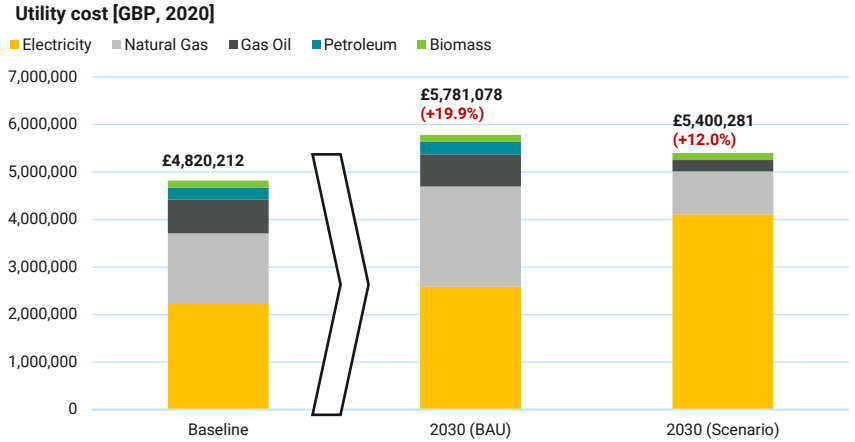


Pathway projection

Adjusting the composition of fuel consumed will have an emissions *and* economic impact. Though economically beneficial in some circumstances (e.g. displacement of petroleum with electricity for vehicles), electricity is currently 3-4x more expensive per kWh than natural gas and the displacement of natural gas with electricity should be managed carefully. For example, a heat pump with a low COP of < 3 is likely to result in increased fuel costs relative to a gas boiler.

The financial impact of the presented scenario has been modelled using Government cost projections[1], alongside a business-as-usual scenario[2] for comparative purposes. The modelling shows that an 19.9% increase in utility bills can be expected in a BAU scenario due to the rising cost of natural gas and electricity per kWh consumed. Whilst the modelled projects increase the Health Board's consumption of higher-cost electricity, a 30% overall reduction in energy consumption is forecast to reduce utility costs, and the implementation of modelled projects on top of the BAU scenario results in an **annual saving of £380,797 relative to BAU**. The increased share of electricity will make the overall utility bill more sensitive to operational performance (i.e. overheating) and optimised performance of assets will therefore become integral as the HDUHB estate transitions to electricity. For example, reducing the COP of heat pumps from the conservative estimate of 2.7 to 2 in the scenario increases utility bills by almost £290,000. The reverse is also true however, and HDUHB will stand to benefit more from optimised operation.





[1] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal. Biomass assumed constant as no projection was available.

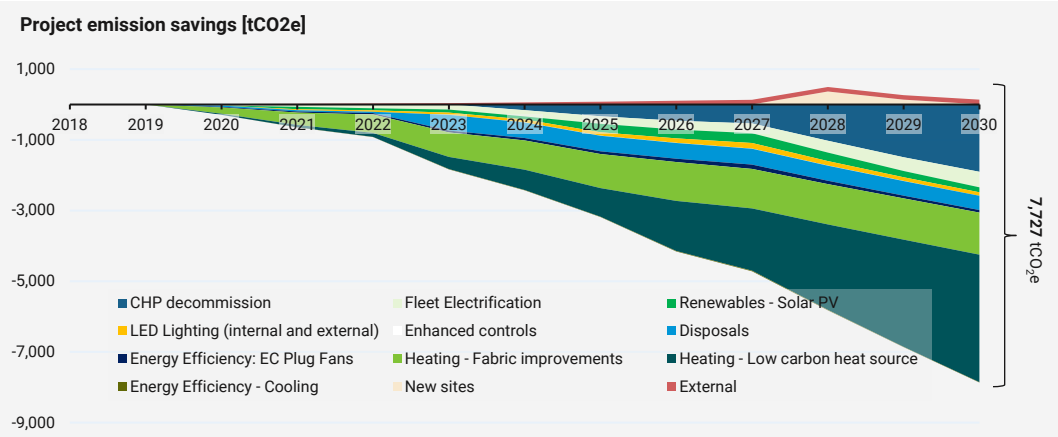
[2] BAU pathway includes the projects defined as 'external': population growth, increased power demand, disposals (pg. 28 for more detail). The new acute site has been removed from both BAU and the modelled scenario to allow for an appropriate comparison to the baseline.

Pathway projection

The modelled reduction in scope 1 and 2 emissions (11,193 tCO_2e) is the sum of the implementation of projects and the effect of grid decarbonisation on baseline consumption unchanged by projects. The contribution of each initiative to the overall project reductions (7,727 tCO_2e) is shown below. Modelled projects can be grouped into the following categories:

- **Energy efficiency -** LED lighting upgrades, lighting controls, EC plug fans, cooling upgrades, building fabric enhancements;
- **Fuel switching -** CHP decommissioning, electrification of fleet, electrification of heating systems;
- **Asset ownership -** Either the disposal or addition of assets out of/into HDUHB's emissions inventory;
- **Renewables -** Increase in on-site renewable generation that reduces HDUHB's consumption of grid-supplied electricity;
- **External -** Population growth, increased power demand of medical equipment, grid decarbonisation.

The modelling demonstrates that the vast majority of project emission reductions (87%) are expected to come from three main areas: CHP decommissioning, fabric improvements to reduce heat demand, and the electrification of heat demand. The remaining projects primarily involve the reduction in electricity demand that, because of the low emissions factor by 2030, has a relatively low impact on emissions. However, these projects will have a stronger financial case than the core emission-reducing projects and will be key to reducing costs and making an overall decarbonisation strategy viable.



The projects that achieve the largest emission savings are also those for which the least work has currently be performed. A strategy / action plan should be devised with commitments for CHP decommissioning, fabric improvements, and low carbon heat as a critical next step.

It is expected that the financial case for the three core projects will be poor in current market conditions. However, the counterfactual (i.e. continuing with BAU) is not net zero aligned and will risk meeting emission targets. A holistic view to decarbonisation across the estate should be taken and projects with a strong financial case (e.g. solar PV) should be seen as complementary, both from an economic and technical perspective, in an overall decarbonisation strategy.

4. Next steps

Pathway projection

A summary of the projects modelled is outlined below, with their anticipated financial performance and modelled carbon savings provided. This analysis should be used as a high-level indication only, and is designed to provide HDUHB with a sense of scale and type of projects that will are required to reach their decarbonisation targets for buildings and fleet. In doing so, this work sets out the level of ambition required for Hywel Dda to reach the decarbonisation target and should inform more detailed assessments that outline how the modelled projects can be realised.

Initiative	Scope of measure modelled	Expected investment	Expected financial return	Carbon impact (2030 tCO_2e)
CHP decommissioning	Displacement of CHPs at all acute sites	££	- ££	H (- 1,907 tCO_2e)
Fleet electrification	Complete electrification of the fleet by 2030	£££	+ ££	M (- 436 tCO_2e)
Solar PV	1.9 MW of solar capacity installed across 6 sites	££	+ £££	M (- 142 tCO_2e)
LED lighting	LED lighting installed across the estate (buildings and car parks)	£	+ ££££	L (-96 tCO_2e)
Enhanced controls (lighting)	Lighting controls put in place across the estate	£	+ ££	L (-4 tCO_2e)
Disposals	Disposal of 10 sites (see Appendix for detail of sites)	£	+ £££	M (-403 tCO_2e)
EC plug fans	All AHUs upgraded to EC plug fans	££	+ ££	L (-69 tCO_2e)
Fabric improvements	Reduction in kWh m^2 modelled, assumed to come from several different measures (e.g., roof insulation, draught proofing, wall insulation)	£££	+ £	H (-1,189 tCO_2e)
Low carbon heating	Displacement of 75% of residual space heating load with air source heat pumps operating at 2.7 COP (indicative low carbon heat source only)	££££	- ££	H (-3,608 tCO_2e)
Energy efficiency: cooling	10% reduction in cooling load across the estate from energy efficiency measures	£	+ ££	L (-10 tCO_2e)
External	Population growth and increased power demand at acute site (*see assumptions*)	£	- ££	M (+ 132 tCO_2e)
New sites	New all-electric 60,000 m^2 acute facility with 2.3 MW of on-site renewable generation. Displacement of demand at other acute sites assumed (*see assumptions*)	££££	- ££	L (+ 6 tCO_2e)

Addressing the NHS Wales Decarbonisation Strategic Delivery Plan

The NHS Wales Decarbonisation Strategic Delivery Plan sets out 46 initiatives with corresponding key actions, including responsible bodies and dates, to be address for progression towards net zero.

Mobilisation of the Delivery Plan and the overarching governance structure (*HSS National Climate Change & Decarbonisation Programme Board*) is currently underway. The overarching headline commitments of the Delivery Plan are consistent with the WG Roadmap for public sector decarbonisation (presented as follows), HDUHB should support and embrace the Delivery Plan as a key driver and resource to progress decarbonisation.

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

Developing the Action Plan

The NHS Wales Decarbonisation Strategic Delivery Plan sets a key requirement of Health Boards for developing the strategic approach for decarbonisation:

> ***'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.***

Development of a HDUHB Action Plan to report to the NHS Wales Decarbonisation Programme Board is seen as the most important next step. The Action Plan should seek to address some of the following initiatives for buildings and fleet (as per scope of this assessment) as well as developing the wider approach for Scope 3 emissions. The following numbered *Initiatives* from the Delivery Plan are highlighted as key for buildings and transport decarbonisation.

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.
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.
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	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.
10	Determine the overall viable potential for on-site renewable energy generation at each NHS Wales organisation by 2023. Install half of this potential by 2026, and the remainder by 2030.
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.
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..
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.

Next Steps Summary

Modelling has demonstrated that, whilst achievable, Hywel Dda UHBs will need to undertake transformational changes to shift away from BAU in order to achieve a target aligned with the NHS Wales Delivery Plan.

The following key next step recommendations are put forward:

I. **Governance -** Determine the Health Boards responsible Director for climate action, and the define a clear governance structure for how activity will be managed. Ensure coverage across multiple departments, in particular with the need for procurement and health care to engage.

II. **Resource -** Ensure appropriate resource and capacity is given to drive activity. This does not need to be a single person, but can be responsibility of many departmental leads to drive activity.

III. **Holistic approach to decarbonisation -** Significant stakeholder engagement, feasibility studies, and options appraisal activity will be required to bring together a phased Action Plan for the Health Board, this will require top-down sign off and support. The high-level modelling undertaken within this reports scope should be built upon to develop the site specific feasibility studies.

IV. **Taking action -** HDUHB is already progressing several low carbon projects, with the scale of the challenge ahead it is important that this momentum is kept and built upon. This includes progressing projects whilst a holistic Action Plan is developed.

V. **Integrating low carbon into financial decisions -** Whilst this report has focussed on Hywel Dda's scope 1 and 2 emissions, procurement is the largest contributor to HDUHB's footprint. It is vital that low carbon is considered in decision making outside of the normal decarbonisation project space. Influencing supply chains will be critical for all of Wales in the move to net zero. Additionally, other capital budgets and maintenance spending must align with the agenda – for example, maintenance replacement of boilers must appraise low carbon options as kit installed now will still be there in 2030.

Appendix

Pathway projection

Assumptions

External

I. **Population growth:** 0.6% 10 year population growth forecast leads to proportional increase in consumption across building energy https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections

II. **Power demand:** 10% increase in power demand from medical equipment at acute general hospitals. Medial equipment assumed to account for 18% of total electrical consumption (CIBSE)

III. **Disposals.** Several sites will be removed from HDUHB's operational control and therefore emissions inventory between now and 2030. The consumption for these sites has been set to zero. This applies to the following sites present in the baseline year:

Site	Gas oil [kWh]	Electricity [kWh]	Natural gas [kWh]
Cardigan Health Centre	0	-31,057	-89,498
Neyland Health Centre	0	-7,593	-50,781
Pond Street Clinic	0	-13,322	-114,403
Penlan (MHLD)	0	-41,248	-186,397
Cross Hands Health Centre	-88,544	-62,275	0
North Road Clinic	0	-20,621	-93,200
Gorwelion (MHLD)	0	-41,971	-149,108
Llys Steffan (MHLD)	0	-12,496	-54,487
Tregaron Hospital	-644,752	-128,353	-48,779
Fishguard Health Centre	0	-23,041	-122,370

Pathway projection

Assumptions

New acute site

- A new acute site c. 60,000 m^2 is planned for 2028. It is assumed that the site is entirely electrically powered with a total electricity consumption of 11,220,000 kWh. The site is assumed to reduce energy consumption at Glangwilli and Withybush acute sites (after all other measures have been applied) by 20% due to reduced services at those sites.
- A 2.3 MW solar PV farm generating 18% of total electricity demand at the new site has been assumed. The solar farm has been sized in a separate piece of work and optimised to minimise exports.

CHP phase out

- Phase out of all natural gas CHPs at acute sites between 2024 and 2030. Natural gas savings modelled from CHP electrical generation and waste gas usage, space heating considered separately in 'Heating – low carbon heat source'. Grid electricity assumed to displace electrical generation from CHP.
- Efficiencies of CHP used:

Site	CHP consumption [kWh]	Heat efficiency	Electrical efficiency	Losses
Glangwili General Hospital	558,744	38%	34%	28%
Bronglais General Hospital	4,964,688	38%	34%	28%
Prince Philip Hospital	7,164,714	26%	39%	35%
Withybush General Hospital	7,861,012	30%	43%	27%

Pathway projection

Assumptions

New Renewables [Solar PV]

- Modelled capacities were provided by HDUHB. The associated kWh:kWp ratio is derived from feasibility studies or HelioScope simulations at the proposed site:

Site	Modelled capacity [kWp]	kWh / kWp	Generation [kWh]
Bronglais General Hospital	185	821	151,811
Prince Philip Hospital	734	911	668,529
Withybush General Hospital	277	1,060	293,620
South Pembrokeshire Hospital	174.4	968	168,830
Hafan Derwen	500	629	314,490
Canolfan Bro Cerwyn St Nons and St Caradogs	29.8	1,000	29,800

Lighting

- Internal lighting assumed to account for 32.8% and 17.8% of all electricity consumption in health centres and hospitals, respectively (BEES, Sector Tables: Health, Table C.3). Most prevalent lighting type at each site provided by HDUHB. Assumed that all lighting is upgraded to energy efficient LED. Savings applied according to:

Lighting type:	LED	T5	T8	T12	PLL	Metal Halide
W m^2	5.5	7.5	11	13.3	14	18

- Additional 10% saving assumed if lighting controls are not present.

Fleet

- Complete electrification of fleet by 2030 modelled. Assumes fleet currently operate at 45 mpg and an equivalent electric vehicle will run at 0.25 kWh/mile.

Pathway projection

Assumptions

EC Plug Fans

- Fans assumed to account for 4.9% and 17.1% of all electricity consumption in health centres and hospitals, respectively (BEES, Sector Tables: Health, Table C.3). Sites with forced ventilation assumed to be upgraded to EC plug fans, with an associated electrical saving of 30%.

Cooling

- Space cooling assumed to account for 4.9% and 7.6% of all electricity consumption in health centres and hospitals, respectively (BEES, Sector Tables: Health, Table C.3). 10% savings assumed at acute sites due to efficiency improvements in cooling systems.

Space heating (fabric and low carbon heat source)

- Proportion of non-electrical consumption used for space heating at each site estimated using BEES sector tables and knowledge of sites/other end-uses. Floor areas of each site used to produce kWh/m^2 figures for space heating
- Fabric upgrades assumed to bring each site in line with benchmarks provided by BEES: 90 kWh/m^2 and 148 kWh/m^2 for health centres and hospitals respectively. Energy savings associated with closing the 'gap' between current space heating kWh/m^2 and BEES benchmark were calculated and attributed to fabric upgrades (glazing, enhanced insulation, draught proofing etc.). A correction factor of 50% was applied, assuming that some sites will inherently fall short of this target due to technical and/or financial limitations.
- The new baseline was taken forward into fuel switching calculations. Heating load of sites estimated using typical efficiencies of 80% and 70% for natural gas and gas oil boilers, respectively. Heat pumps operating at a COP of 2.7 used as an indicative low carbon solution. Entire space heating load assumed to be displaced by electric-powered heat pump.

Pathway projection

Assumptions

Space heating (fabric and low carbon heat source cont.)

- Fabric and low carbon heat installation were phased according to the site's current thermal performance. Sites with a low 'gap-to-target' were prioritised for early fabric upgrades before installation of a heat pump. This analysis provides an indicative phasing only and should not be considered as a firm recommendation. Further work should be done to develop a phased heat strategy:

	Phase i	Phase 1	Phase 2	Phase 3	Phase 4
Gap' to kWh/m^2 target:	0	< 55	55 - 77	77 - 115	> 115
Fabric upgrades:	-	2020 - 2023	2020 - 2026	2020 - 2030	2020 - 2030
Heat pump installation	2020 - 2026	2023 - 2026	2026 - 2030	> 2030	> 2030
	South Pembrokeshire Hospital	Cardigan Integrated Care Centre	Withybush General Hospital	Llandovery Cottage Hospital	Swn-y-Gwynt Day Hospital (MHLD)
	Hafan Derwen	Amman Valley Hospital	Brynmair Clinic (MHLD)	Ty Gwili (MHLD)	2 Greville Court (MHLD)
	Canolfan Bro Cerwyn...	Minaeron	22 Wellfield Road (MHLD)	Prince Philip Hospital	Bro Preseli Community Resource Centre
	Neyland Health Centre	Milford Haven Health Centre	Glangwili General Hospital	Haverfordwest Health Centre	Begelly Learning Disability (MHLD)
	Pembroke Dock Health Centre	Hafan Hedd (MHLD)	New Tenby Hospital	Elizabeth Williams Clinic	79 Bro Myrddin (MHLD)
	Pant-y-Fedwen Offices - Family Child Health	Bronglais General Hospital			

Freehold

Leasehold