Neath Port Talbot Local Area Energy Plan

Technical Annex

CYNGOR CASTELL-NEDD PORT TALBOT · NEATH PORT TALBOT COUNCIL

CITY SCIENCE
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Contents

1 Introduction

1.1 Report Purpose

This Technical Annex serves to enrich the main Local Area Energy Plan (LAEP) report, offering a deeper understanding of the intricacies and specifics surrounding the local energy landscape and the strategic approach outlined in the LAEP. It provides more detailed information on Neath Port Talbot's current energy system, LAEP methodologies, pathway assumptions, interventions, and the corresponding action plan.

1.2 Process Overview & Report Contents

This report documents the approach and results for each of the key seven LAEP methodology steps shown in Figure 1-1. This process integrates and builds on Energy Systems Catapult's (ESC) LAEP Methodology Guidance, ensuring our outputs were informed by robust technical analysis, and aligned to best practice.

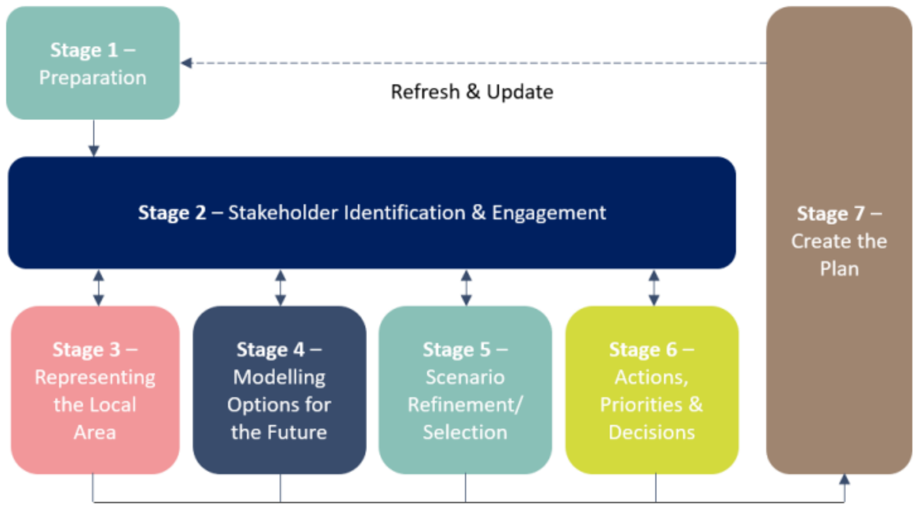


Figure 1-1: LAEP Process Overview

A comprehensive stakeholder engagement programme (see Appendix A – Overview of Stakeholder Engagement Activities) was embedded throughout each stage of the LAEP development. Local and regional sessions were held including interviews, technical validation meetings, workshops and focus groups to ensure the final outputs reflect the needs and ambition of local stakeholders.

The Technical Annex mirrors both the approach and the structure of the main LAEP document, as outlined below:

- **Stage 3 – Representing the Local Area:** This section develops a comprehensive baseline of the local energy system to thoroughly understand key challenges, opportunities, local net zero ambition and previous programmes of work for the LAEP to build on. This included exploring the geographic context, socio-economic characteristics, policy landscape, and conducting analysis into historical and current emission trends and energy infrastructure (see Chapter 3).
- **Stage 4 & 5 – Modelling Options for the Future and Scenario Refinement/Selection:** The future energy system was modelled to 2050 under different policy and technological scenarios. A preferred scenario was selected by stakeholders, which informed a series of interim targets and milestones to reach net zero (see Chapter 4). Interventions were developed across key sectors; Building Energy Efficiency, Building Heating, Transport, Generation and Networks, and Industry, based on the local energy system baseline and the pace and scale of decarbonisation necessary (e.g. the interim targets). This supported the identification of Focus Zones, where interventions are prevalent or should be prioritised in a specific area (see Chapter 5).

- **Stage 6 – Actions, Priorities and Decisions:** The technical analysis and extensive stakeholder engagement fed into a detailed Action Plan. These actions were visualised in a temporal Action Roadmap and provide clear next steps for Neath Port Talbot Council (see Chapter 6).

2 Glossary

Acronym	Definition
ACEA	European Automobile Manufacturers Association
ASHP	Air source heat pump
BEIS	Department for Business, Energy and Industrial Strategy
BRE	Building Research Establishment
BSP	Bulk supply point
BUA	Built-up area
BUS	Boiler Upgrade Scheme
CAPEX	Capital expenditure
CCS	Carbon capture and storage
CIBSE	Chartered Institution of Building Services Engineers
CLAW	Consortium of Local Authorities in Wales
CO_2	Carbon dioxide
DFES	Distribution Future Energy Scenarios
DNO	Distribution network operator
DSR	Demand side response
EPC	Energy performance certificate
ESC	Energy Systems Catapult
ESO	Electricity System Operator
EU	European Union
EV	Electric vehicle
FES	Future energy scenarios
FLOW	Floating offshore wind
GSP	Grid Supply Point
HGV	Heavy goods vehicle
HUG	Hydrogen User Group
KPI	Key performance indicator
LAEP	Local Area Energy Plan
LDP	Local Development Plan
LGV	Light goods vehicle
LPG	Liquified petroleum gas
LSOA	Lower Layer Super Output Area
LULUCF	Land use, land use change and forestry
NAEI	National Atmospheric Emissions Inventory
NESO	National Energy System Operator
NGED	National Grid Electricity Distribution
NGET	National Grid Electricity Transmission
NO_x	Nitrogen oxides
NZIW	Net Zero Industry Wales
OPEX	Operational expenditure
OS	Ordnance Survey
PV	Photovoltaic
RAG	Red, amber, green
REPD	Renewable Energy Planning Database
REPEX	Replacement expenditure
RESP	Regional Energy Strategic Planner
RLCEA	Renewable and Low Carbon Energy Assessment
RSL	Registered Social Landlords
SAP	Standard Assessment Procedure
SIC	Standard Industrial Classification
SRN	Strategic Road Network
SWIC	South Wales Industrial Cluster
WIMD	Welsh Index of Multiple Deprivation
WWU	Wales and West Utilities
ZEVIS	Zero Emission Vehicle Infrastructure Strategy

3 Local Context & Energy System

This section provides an overview of the local context from which this LAEP is being delivered, including geographic considerations, demographics and socio-economic factors.

3.1 Geographic Context

Neath Port Talbot is in the South West region of Wales and covers 2% of Welsh land area. It consists of 34 electoral wards and can be divided into two main areas:

- **The Coastal Corridor:** A coastal strip extending around Swansea Bay where the main centres of population, employment and the M4 corridor are located.
- **The Valleys:** Characterised by river valleys, upland plateaus and mountains. The Valleys are rural in aspect and contain scattered communities throughout.

To provide highly detailed modelling results, the Neath Port Talbot boundary was broken down using the areas served by primary substations, resulting in 14 modelling zones. Producing results at this substation level supports National Grid Electricity Distribution (NGED) with grid reinforcement planning. The zone areas and the reference names used for these zones are shown in Figure 3-1. As substation zones are not geographically aligned with local authority boundaries, substation areas at the edge of Neath Port Talbot may be adjusted to account for overlap with neighbouring areas. As a result, names of these zones are for reference only and may not best represent the exact area. Details of substation overlap is given in Appendix B – Primary Substation Zones.

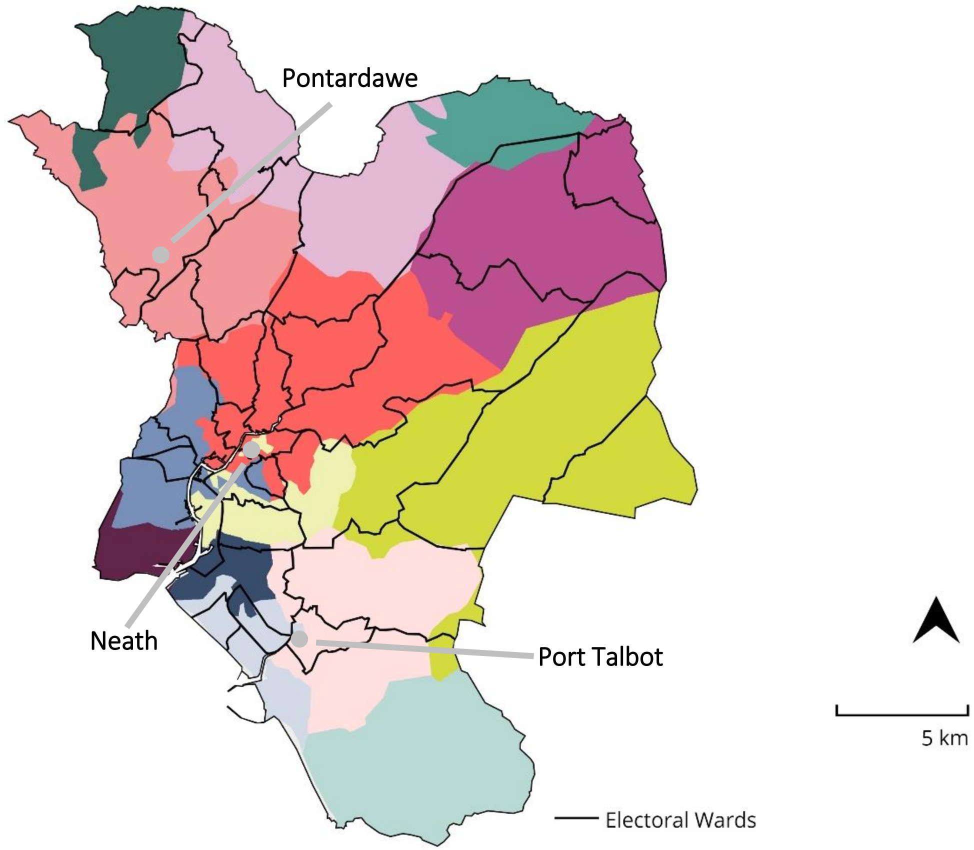


Figure 3-1: Neath Port Talbot Ward Boundaries and Substation Modelling Zones (Contains Ordnance Survey (OS) data © Crown copyright and NGED data)

	Substation Zone		Substation Zone
	Abercrave		Llandarcy
	Aberpergwm		Pontardawe
	Briton Ferry Primary		Pyle Primary
	Caerau Primary		Travellers Rest Primary
	Commercial St Neath		Victoria Road
	Gwaun-Cae-Gurwen		Wern
	Jersey Marine		Ynys Street

3.2 Characteristics of the Local Area

3.2.1 Population & Housing

In 2021, the estimated population was 141,900 which is 4.6% of the total population in Wales (1). The region is densely populated with approximately 313 people per km^2, double the national average of 149 people per km^2 (2).

In 2018, on average fuel poverty affected 7,000 households (or 11%) of the population in Neath Port Talbot, 1% lower than the national average at the time of the data being released (3). However, since then, more recent Welsh-wide fuel poverty data has been published, indicating that up to 45% of Welsh households could be in fuel poverty following the energy price cap increase of April 2022 (4)

In parallel, as of 2019, 15% of Neath Port Talbot is within the 10% most deprived areas in Wales (5). The LAEP presents an opportunity to tackle fuel poverty and alleviate deprivation across the region by improving the energy efficiency of homes.

3.2.2 Economic & Growth Plans

The Replacement Local Development Plan (LDP) for Neath Port Talbot (2023 – 2038) is currently in draft and proposes growth plans for 4,600 new homes by 2038 and 230,000 m^2 of non-domestic floor space (6). This includes 99,000 m^2 of offices, 95,000 m^2 of industrial buildings and 36,000 m^2 of warehouses. Key development areas proposed in the plan include Port Talbot, Baglan Moor, Neath and Llandarcy.

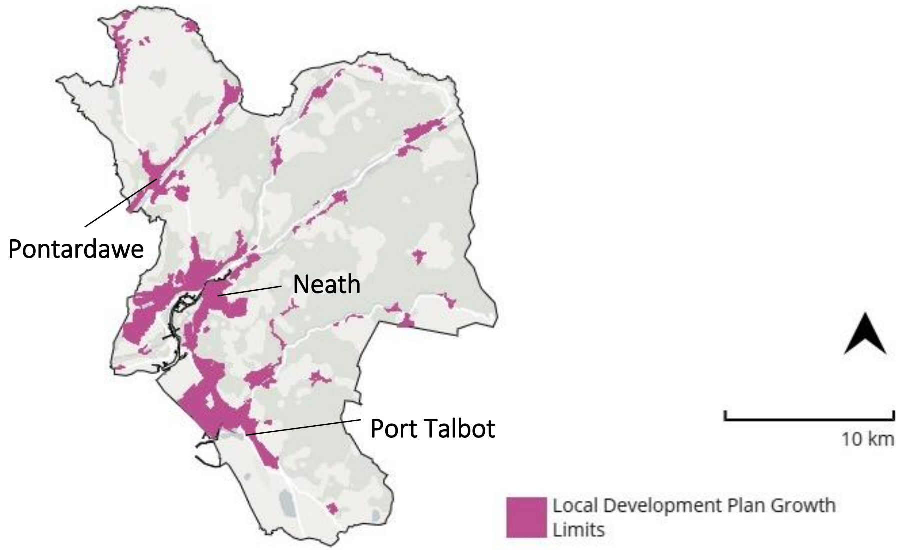


Figure 3-2: LDP Growth Limits (Contains OS data © Crown copyright)

Future development sites could consider integrating low carbon energy sources like solar panels and district heat networks to enhance the efficiency of energy distribution within new developments. Additionally, incorporating energy-efficient design principles and standards in new construction can significantly contribute to lowering the overall energy demand.

In 2022, 3.5% of all people in Neath Port Talbot were classified as unemployed, which is aligned with the national average of 3.8% (1). Large shares of jobs are in manufacturing (18%), Health (12%) and Wholesale and Retail Trade (14.7%) (1). The employment base is predominantly along the coastal corridor around the active industrial area, including Port Talbot Steelworks.

3.3 Policy

Decarbonisation ambitions across the region have transcended into policy, aiming to reduce carbon emissions from energy use across sectors. The following section outlines relevant national, regional, and local strategies and targets relevant to the LAEP.

3.3.1 National Context

Both the Welsh Government and UK government have set net zero 2050 emission targets and share responsibility for setting national energy policy impacting Neath Port Talbot. A key component of the UK's 2050 Net Zero Strategy is the ambition that 100% of electricity will come from 'low carbon sources by 2035', outlining plans to scale up heat pump deployment and renewable energy generation (7).

The UK Hydrogen Strategy additionally forecasts that between 250 to 460 TWh of hydrogen will be required by 2050, comprising around 20-35% of overall UK energy consumption (8). In 2023, the UK government made a strategic decision to allow public blending of hydrogen up to 20% in the gas grid. A further strategic decision will be made in 2026 on whether hydrogen can be fully used for heating.

The Industrial Decarbonisation Strategy sets out the UK governments' approach for decarbonising industry, recognising that 70% of the UK industrial energy demand is for heat (9). The report states that steelworks at Port Talbot and Scunthorpe together make up around 15% of total industrial emissions. The target of fuel switching of 50 TWh by 2035 places an emphasis on cluster sites like Port Talbot to achieve a transition to low carbon processes, or carbon capture and storage (CCS).

Within Wales, the Net Zero Wales Plan (10) sets out 123 policies and proposals aimed to achieve net zero 2050 and deliver a 37% reduction in emissions by 2025 to deliver upon Carbon Budget 2 (11). Key commitments include:

By 2025	By 2030
• Retrofitting 148,000 homes • All new affordable homes built to net zero carbon standards • Increase the proportion of heat that is electrified by 3%	• Produce 70% of Wales' electricity from renewables by 2030, including 1 GW to be 'locally owned'

Recent updates to net zero ambitions include plans to increase this 70% renewable generation target to 100% by 2035 (12).

Future Wales: The National Plan 2040 sets out a bold vision for a sustainable and low carbon future in Wales, with a strong focus on low carbon technologies (13). It identifies:

- Ten areas where large scale wind farms would be "acceptable in principle". One of these areas covers a large portion of north Neath Port Talbot.
- Port Talbot and Neath as district heat network priority areas

The Wales Transport Strategy outlines the future for transport which includes a focus on electrification, including ambitions for buses to be zero emission by 2035 (14). The delivery strategy is included within the Electric Vehicle Charging Strategy for Wales which predicts that Neath Port Talbot will require 34,110 electric car chargers by 2030 (15).

The Well-being of Future Generation (Wales) Act outlines seven holistic goals to increase the well-being in Wales (16). It provides a legal-binding framework for public bodies to ensure sustainable decision-making. These goals include focusing on a prosperous, healthy, resilient, equal, cohesive, globally responsible Wales, as well as promoting Welsh culture and language. LAEPs can assist with several broader societal objectives that align with the outcomes of the Well-being Act. By giving priority to strategies that ensure all members of the community have access to reasonably priced and dependable energy and that fuel poverty and energy security issues are addressed, LAEPs improve social equity. Additionally, LAEPs can play a role in supporting health and well-being by reducing exposure to air pollution and other health hazards associated with the energy sector, and by promoting active transportation and other healthy behaviours. Critically, the main purpose of LAEPs is to combat climate change and safeguard the environment from the negative effects of energy use, contributing to a globally responsible Wales with a resilient energy system powered by renewable technologies.

Figure 3-3: The Seven Well-Being Goals (16)

3.3.2 South West Wales Regional Context

The South West Wales region comprises the local authorities of Neath Port Talbot, Carmarthenshire, Swansea and Pembrokeshire. The South West Wales Energy Strategy is a regional strategy that outlines six priorities to deliver a 55% reduction in energy system emissions across the region by 2035 to meet national and regional net zero ambitions (17).

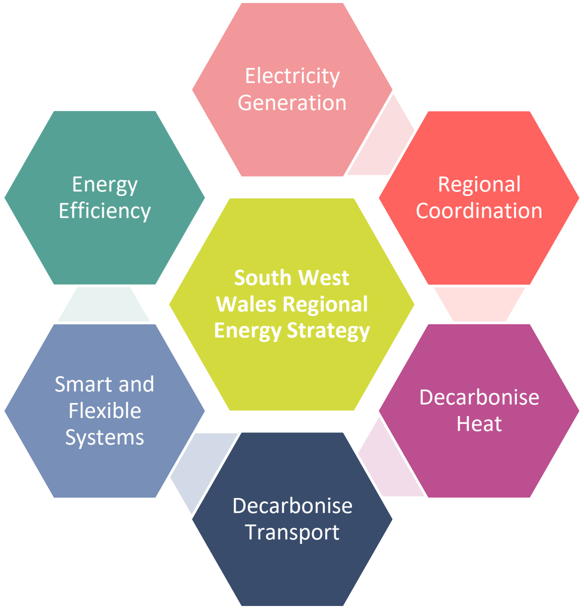


Figure 3-4: Six Prioritises Outlined in the South West Wales Energy Strategy (17)

The main purpose of the LAEP is to support the decarbonisation of the energy sector within Neath Port Talbot, directly contributing to this 55% emission reduction target. An estimated additional 16,000 jobs and a Gross Value Added of nearly £1.6bn for the region could be achieved, some of which could be located within Neath Port Talbot. The region's total energy demand is dominated by the commercial and industrial sector (68% of total demand), making it a key decarbonisation area.

The South West Wales Regional Economic Delivery Plan sets out an ambitious route map for the development of the region's economy for the next ten years, emphasising that collaborative working is key to achieve 2030 net zero ambitions (18). It sets out a mission to make South West Wales a UK leader in renewable energy and the net zero economy.

3.3.3 Neath Port Talbot's Local Context

Neath Port Talbot Council declared a climate emergency in 2022, committing to develop a net zero carbon approach as soon as practically possible (19). The Corporate Plan 2022-2027 echoes net zero ambitions outlining plans to build on and increase the region's renewable generation legacy to make the area an exemplar for clean energy in 20 years (20).

The Decarbonisation and Renewable Energy (DARE) Strategy sets out the Council's approach to achieve net zero carbon emissions, highlighting the area's potential for renewable energy generation, particularly from onshore wind (21). It also aims to maximise social, economic and health decarbonisation benefits through focusing on renewable energy. The Strategy sets out a comprehensive programme of priorities, projects and initiatives across three themes: Transport, Buildings and Space and Influencing Behaviour (22). Building on this overarching DARE Strategy, the Council are currently preparing a 2030 Net Zero Carbon Action Plan.

The LDP includes a series of area-wide policies for new development, including those related to climate change and energy (23). A key strategic policy encourages new development to incorporate all forms of renewable energy and energy efficiency measures in all new major development proposals. The replacement LDP is currently in preparation and due to be adopted in 2025 and will be supported by a Renewable and Low Carbon Energy Assessment (RLCEA).

The Neath Port Talbot RLCEA is currently in progress and will be part of the evidence base for the upcoming LDP. It will estimate the scale of renewable resource that is available for use within Neath Port Talbot to provide focus for setting local policy and targets. Key technologies that are being assessed to meet this include onshore wind, ground-mount photovoltaics (PV), biomass resource, anaerobic digestion, energy from waste incineration and hydropower. It will also assess heat network opportunities, inform site allocations for new developments and prioritise areas suitable for standalone renewables. It is due to be published in parallel to the LDP in 2025.

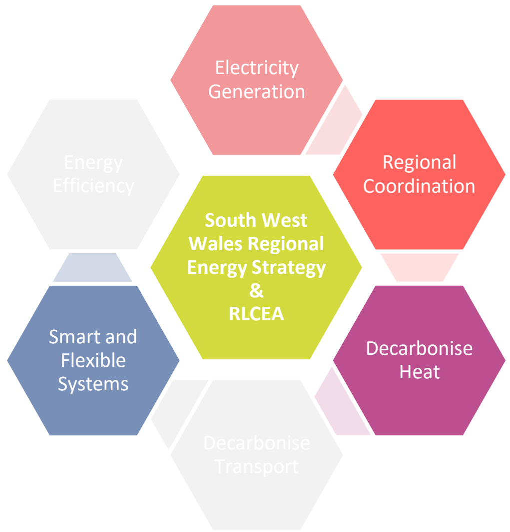


Figure 3-5: Key Regional Alignment Between the Regional Energy Strategy & RLCEA

The Economic Recovery Plan sets out the strategy to grow economic productivity and outputs across Neath Port Talbot and deliver on the key ambitions of the South West Wales Economic Recovery Plan, including to establish the region as a UK leader in renewable energy (24).

The Zero Emissions Fleet Transition Plan identifies Neath Port Talbot Council's aspirations to transition its fleet of 266 vehicles to zero emission alternatives by 2030 (25). Most vehicles identified are likely to be electric which will place additional demands on electricity grid infrastructure.

3.3.5 Existing Programmes

Alongside policy, several programmes of work have been established that aim to support energy system decarbonisation across South West Wales and within Neath Port Talbot.

3.3.5.1 Swansea Bay City Deal

The Swansea Bay City Deal is an investment of up to £1.3bn in nine major programmes and projects across the Swansea Bay City Region encompassing Carmarthenshire, Swansea, Neath Port Talbot, and Pembrokeshire (26). The deal is being led collaboratively by all four local authorities within the South West region, presenting an opportunity to enhance regional relationships and deliver collectively upon LAEP ambitions. The programmes and projects have been themed across economic acceleration, life science and well-being, energy, smart manufacturing and digital. The most relevant initiatives to the LAEP are outlined in detail in the following sections and include Homes as Power Stations and Supporting Innovation and Low Carbon Growth.

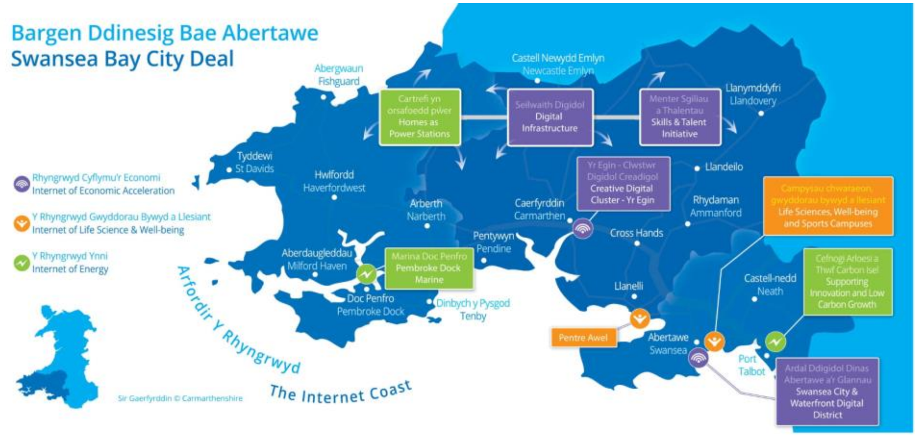


Figure 3-6: Swansea Bay City Deal Projects (26)

3.3.5.2 Homes as Power Stations

Homes as Power Stations is part of the portfolio of major programmes and projects set out within the Swansea Bay City Deal (27). The project aims to integrate energy efficiency design and renewable technologies into the development of new build homes and promote retrofit programmes carried out by the public, private and third sectors. Key ambitions include:

- Facilitate the uptake of renewable technologies in at least 10,300 properties (7,000 retrofit, 3,300 new build) within five years to increase affordable warmth and reduce fuel poverty
- Improve residents' health and well-being
- Reduce burden on health and social services

To maximise delivery efficiency, the project will be linked to other housing improvement programmes such as the Welsh Government's Optimised Retrofit Programme (27). In parallel, there will be a more holistic focus on connected ambitions and critical success factors such as developing a sustainable regional supply chain, monitoring and evaluation, skills development, an education and dissemination programme, and a financial incentive scheme.

3.3.5.3 Supporting Innovation & Low Carbon Growth

The Supporting Innovation and Low Carbon Growth £58.7mn programme is made up of seven inter-linked projects under four themes with a central aim to support the creation of a decarbonised and innovative economy (28). With a targeted focus on the Port Talbot Waterfront Harbourside area, this programme, led by Neath Port Talbot Council, is projected to be worth £6.2mn a year to the local economy (28). Key projects include:

- An energy positive Technology Centre building on Baglan Energy Park with the excess energy from renewable technologies converted into hydrogen locally to be used to fuel hydrogen vehicles.
- A specialist facility which will support the steel and metals industry in Port Talbot, Wales and the UK, while reducing its carbon footprint.
- Decarbonisation projects including a low emission vehicle charging network, as well as air quality monitoring.
- An Industrial Futures project to address the gap between demand and supply for businesses and available land in the Port Talbot Waterfront Enterprise Zone.

3.3.5.4 Celtic Freeport

The Celtic Freeport in Milford Haven and Port Talbot has been chosen as one of Wales' first freeports, helping to create tens of thousands of new jobs in future green industries (29). Freeports are special areas within the UK's borders where different economic regulations are applied with the ambition of boosting development in that area. The freeport aims to attract significant inward investment, including £3.5bn in the hydrogen industry as well as the creation of 16,000 jobs, generating £900mn in Gross Value Added by 2030, and £13bn by 2050 (29). There is also the potential for the site to unlock up to 24 GW of floating offshore wind, equating to roughly the same capacity as the entire UK's current offshore wind output potential (30).

Figure 3-7: Celtic Freeport based in Neath Port Talbot (31)

3.3.5.5 Steelworks Decarbonisation

The Port Talbot Steelworks is the largest steelmaker in the UK. The UK government has agreed to invest up to £500mn to help Port Talbot Steelworks to be decarbonised, with Tata Steel investing £750mn to support the process (32). In 2021, Tata Steel outlined intentions to "make a substantial contribution to the UK's goal of achieving carbon neutrality by 2050" (33). Key elements of the strategy include switching from using blast furnaces to electric arc furnaces which can be powered using renewable energy, and producing recycled rather than virgin steel. At a company-wide level, one of Tata Steel's strategic objectives is focused on Leadership in Sustainability which includes specific long-term goals on carbon emissions along with a decarbonisation roadmap (34). Goals are categorised by timescale and includes:

- Short Term (by 2025) – Shifts in Business Models
- Mid-Term (up to 2030) – Capitalising Circularity
- Long-Term (2030-2050) - Explore and invest in the development of deep decarbonisation technology

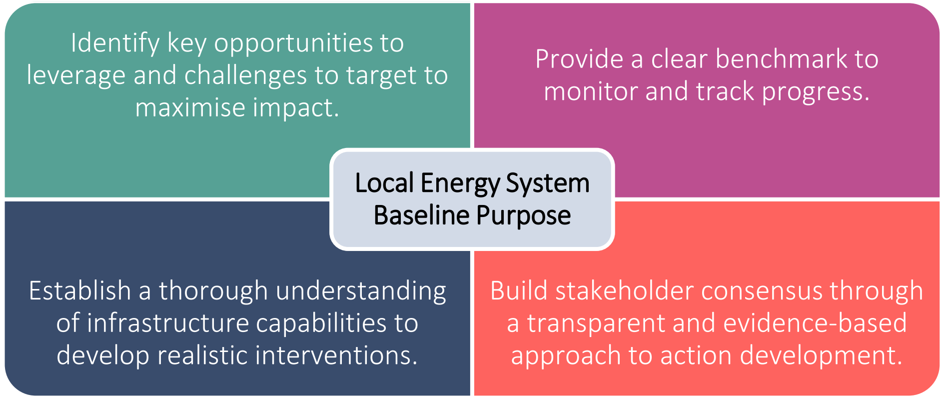
3.3.5.6 Green Industries Investment Zone

The Swansea and Carmarthenshire Green Industries Investment Zone is integrated within the South West Wales Industrial Cluster (SWIC) and the Celtic Freeport, and aims to connect the region's energy generation potential and industrial strengths to support long-term sustainable economic growth (35). It builds on existing activity, connecting Freeport locations in Pembrokeshire and Neath Port Talbot to truly capitalise and maximise the region's research and development assets.

3.4 Local Energy System Baseline

3.4.1 Introduction

Building on the net zero ambition vocalised within the region's policies, strategies and existing programmes, a critical step within the LAEP process is developing a robust understanding of the current energy system. Establishing an emission baseline across sectors, and reflecting on historic emission trajectories, supports identifying key challenges and opportunities within the current system, tailoring interventions to target specific areas to maximise impact. Additionally, the baseline serves as a benchmark against which progress towards net zero can be measured, providing a platform for quantifying emissions reductions, and evaluating intervention success. As a result, LAEP actions are relevant, realistic, intentional and verifiable.



This section will explore and analyse historical emission trends and carbon budgets to establish the current context for delivery. This will include a breakdown of the domestic and non-domestic building stock, as well as reflecting on current and historic patterns of energy demand. Relevant infrastructure, such as energy networks, have been modelled based on primary substation zones to offer granular insights into the future systems resilience (e.g. capacity and demand assessments to understand renewable potential).

3.4.1.1 Scope & Steelworks

Local Area Energy Planning does not consider aspects of the energy system that are expected to be overseen by central government, or non-energy sources of greenhouse gas emissions. For instance, scope for the transport sector includes only road transport with shipping, aviation, rail and the strategic road network (SRN) excluded as they are considered to be national rather than local.

As per the general LAEP scope, the SRN, which includes trunk roads and motorways, has been eliminated from emissions analysis. However, it has been considered in terms of future energy demand forecasting. This is to inform the energy network and infrastructure investment need to support it.

The Port Talbot Steelworks emissions are in scope of the LAEP, but have been provided separately due to its large and unique nature, and uncertainties about the future. The Steelworks is currently one of the largest emission sources in the UK (greater than all other emission sources in Neath Port Talbot), and recent announcements suggest that it is moving away from its mostly coal powered blast furnaces and instead to electric arc furnaces requiring electricity.

The industrial sector has been excluded from energy demand analysis as the Department for Business, Energy and Industrial Strategy (BEIS) 2019 sub-national final energy statistics do not accurately portray the full extent of industrial demand, likely due to the unique presence of the steelworks.

3.4.2 Current & Historical Emissions

3.4.2.1 Historical Emissions & Carbon Budgets

A carbon budget sets a maximum limit on the total amount of Welsh emissions permitted over a 5-year period. Each budget is set at a level consistent with meeting the 2050 net zero target with a baseline year of 1990 (36).

- Carbon Budget 1 (2016-2020) is set at 23% below the baseline
- Carbon Budget 2 (2021-2025) is set at an average 37% reduction from the baseline
- Carbon Budget 3 (2026-2030) is set at an average 58% reduction.

Further targets set by the Welsh Government as part of the carbon budgets include:

- 63% reduction by 2030
- 89% reduction by 2040
- and at least 100% reduction by 2050 (net zero).

For the purpose of the LAEP and modelling, 2019 has been used as the baseline year, since it was the last year in the available dataset that was unaffected by COVID-19. Neath Port Talbot's energy use and emissions trajectory between 2005 and the 2019 baseline have been analysed to understand current and previous trends, which can help to inform anticipated future behaviours and continued progress.

Over the past 15 years, Neath Port Talbot's emissions have decreased by 50%, largely caused by the decarbonisation of the electricity grid rather than reduction in energy use.

In 2019, total emissions were 744 kt CO_2e based on the Greenhouse Gas National Emissions Statistics (37). Of this, 91% were emissions from energy use totalling 681 kt CO_2e, which excludes waste, agricultural livestock and soils, and Land Use, Land Use Change and Forestry (LULUCF). As mentioned, emissions from the Port Talbot Steelworks have been excluded from this analysis but are in the region of 6-6.5 Mt CO_2e.

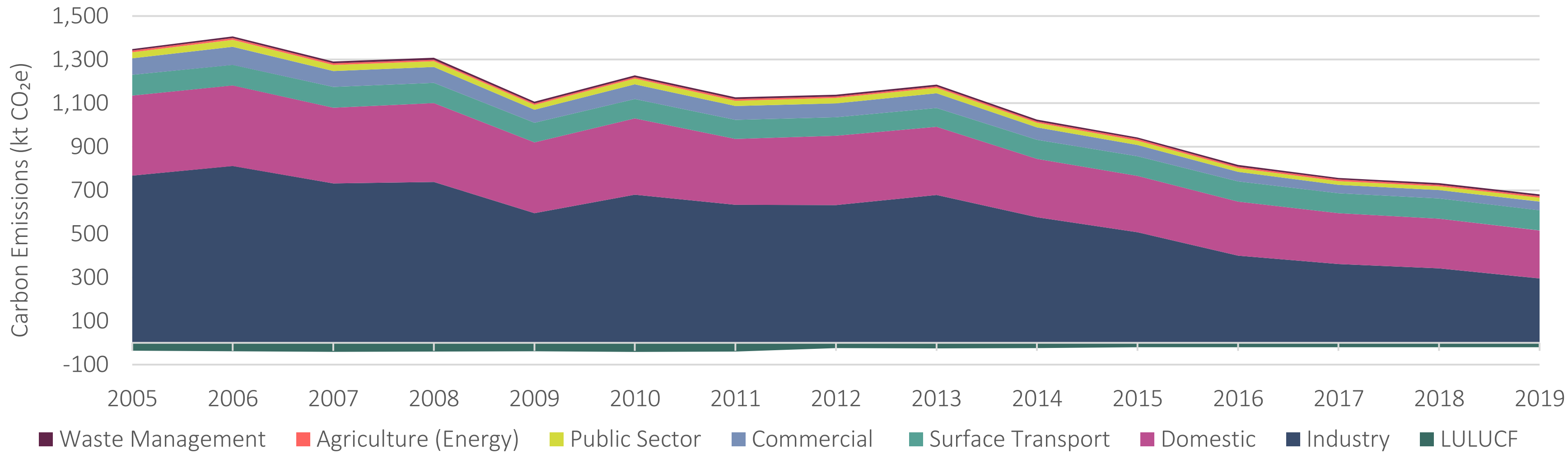


Figure 3-8: Neath Port Talbot's Territorial Greenhouse Gas Emissions Estimates 2005-2019 (kt CO_2e) (excluding landfill, Port Talbot Steelworks and non-energy agricultural emissions)

3.4.2.2 Historical Emissions by Sector

Historical emissions have been analysed further by breaking down trajectories by sector. Figure 3-9, Figure 3-10 and Figure 3-11 show how electricity emissions decline at a greater rate from 2012 onwards. This is likely due to the decarbonisation of the electricity grid, resulting in a lower carbon intensity of the electricity supply as shown in the charts (37). Note that carbon intensity data is only available from 2008 – 2019.

In 2019, the majority of emissions came from industry, which was closely followed by the domestic sector. As shown in Figure 3-9 the industrial sector (excluding the Steelworks), has experienced a significant reduction in carbon emissions at 61%, equating to an average of 6% per year since 2005. In 2019, industrial emissions totalled 296 kt CO_2e or 31% of total emissions.

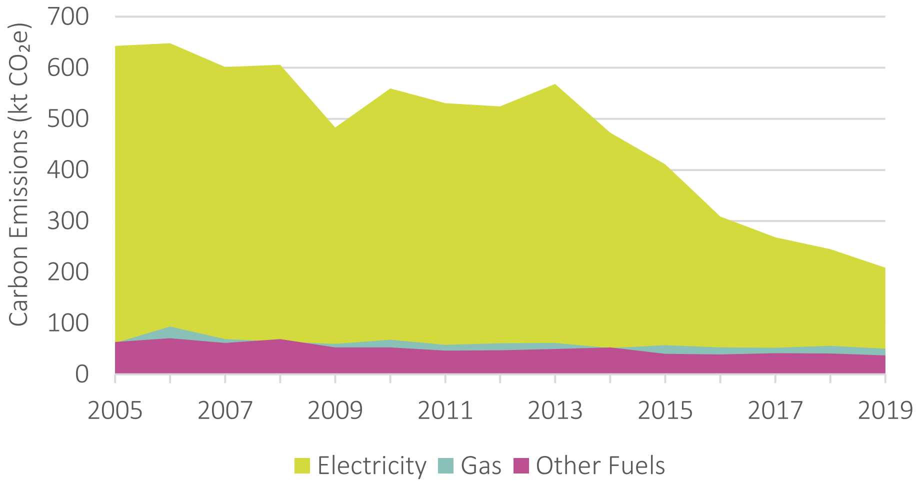


Figure 3-9: Industry Sector Greenhouse Gas Emissions Estimates 2005 – 2019 (kt CO_2e) (Excluding Port Talbot Steelworks Emissions) (37)

Domestic emissions totalled 220 kt CO_2e in 2019, 23% of total emissions. This decreased by 40% between 2005 and 2019 at an average of 3% per year.

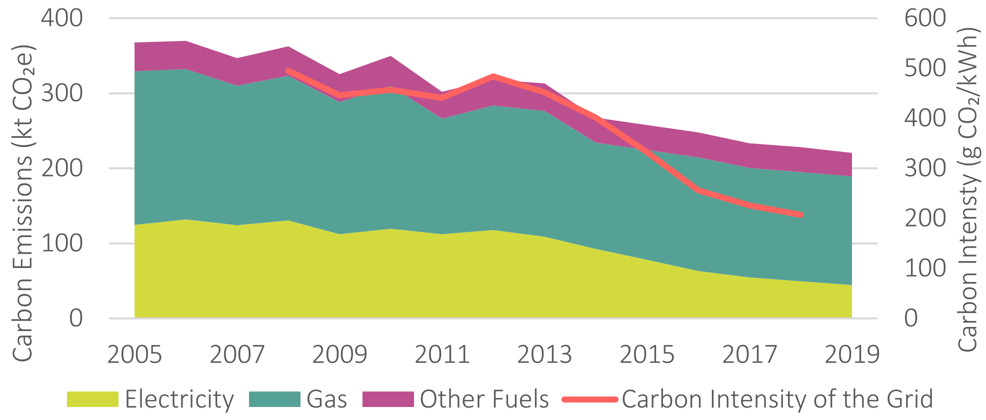


Figure 3-10: Domestic Sector Greenhouse Gas Emissions Estimates 2005 – 2019 (kt CO_2e) (37)

Surface transport only makes up 12% of Neath Port Talbot's total emissions. This is largely due to most transport emissions being from the SRN which are not included in the LAEP scope. Figure 3-11 shows that surface transport emissions have not experienced a significant decrease over the past 15 years at only 4%.

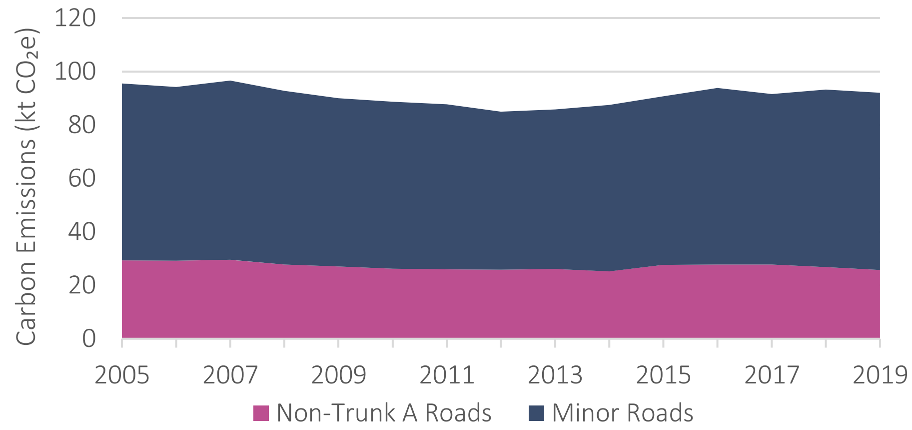


Figure 3-11: Road Transport Greenhouse Gas Emissions Estimates 2005-2019 (kt CO2e) by Road Type (excluding the SRN) (37)

3.4.3 Energy Demand Profile

3.4.3.1 Current Energy Demand

Neath Port Talbot used an estimated 4,000 GWh of energy in 2019 (excluding the Steelworks) (38). This is slightly lower than the Welsh local authority average of 4,200 GWh. As seen in Figure 3-12, Neath Port Talbot's highest energy demand comes from road transport and domestic properties. Neath Port Talbot also has a relatively small agricultural and rail energy use. As there are limitations to the industrial energy data (as previously explained, and detailed in Section 3.4.4.4.1) and industrial and commercial energy is combined within this dataset, both have had to be excluded from this graph.

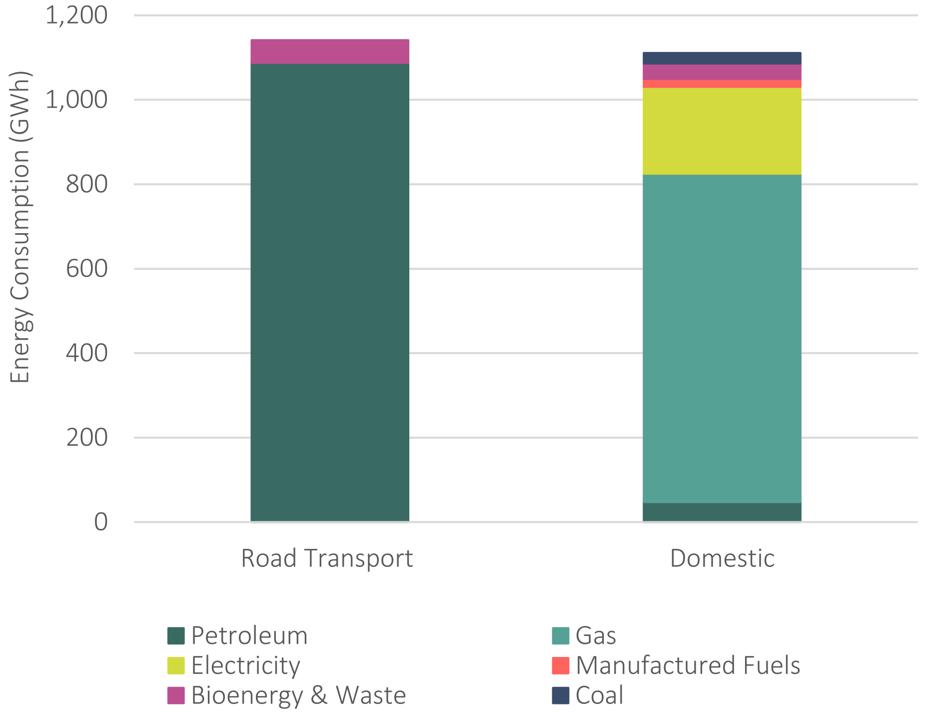


Figure 3-12: 2019 Energy Use in Neath Port Talbot by Sector (Excluding Industrial, Commercial & Other) (38)

3.4.3.2 Historical Energy Demand

Neath Port Talbot's energy demand (excluding industrial and commercial) has experienced a decrease over the past 15 years because of a notable reduction in domestic energy demand. This could be due to increases in energy efficiency measures and technology advancements (e.g. smart meters) that can influence energy demand patterns. Figure 3-13 shows historical energy use broken down by sector. It should be noted that it is not possible to break down the total energy use by fuel type due to the limitations with the industrial data.

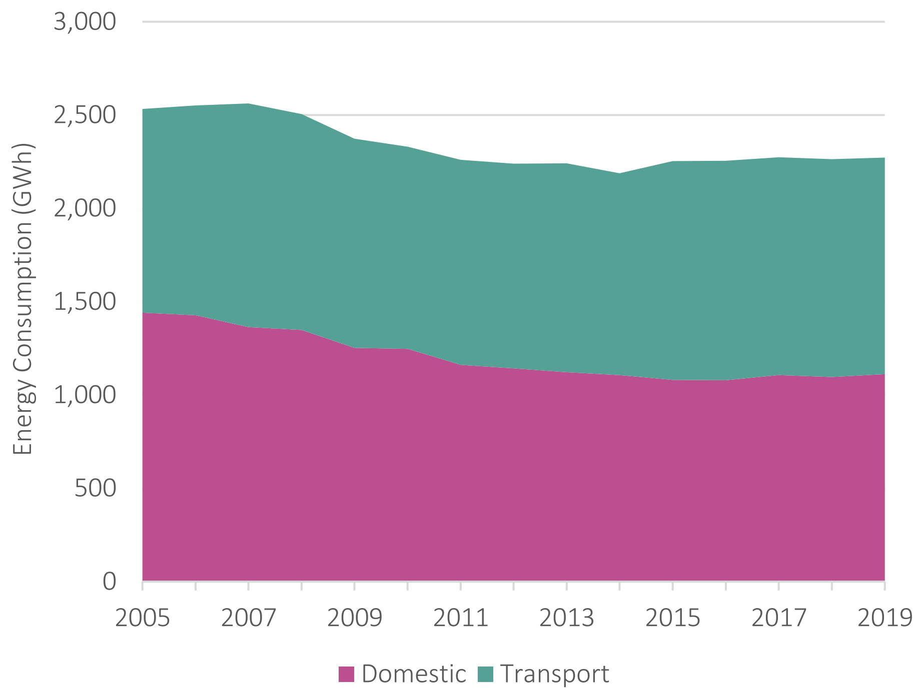


Figure 3-13: Historical Energy Use by Sector (Excluding Industrial, Commercial & Other)

3.4.4 Domestic and Non-Domestic Sectors

3.4.4.1 Domestic Building Stock

An estimated 65% of domestic properties in Neath Port Talbot have an Energy Performance Certificate (EPC) which reflects the energy efficiency of a household on a scale from A – G (39). Of the available EPCs, 43% are rated A – C (C tends to be the minimum for energy efficiency targets), and 57% (or 23,269) are rated D – G, suggesting significant need for retrofitting. Figure 3-14 shows which areas in Neath Port Talbot have the highest proportion of energy inefficient domestic properties (D – G) (40).

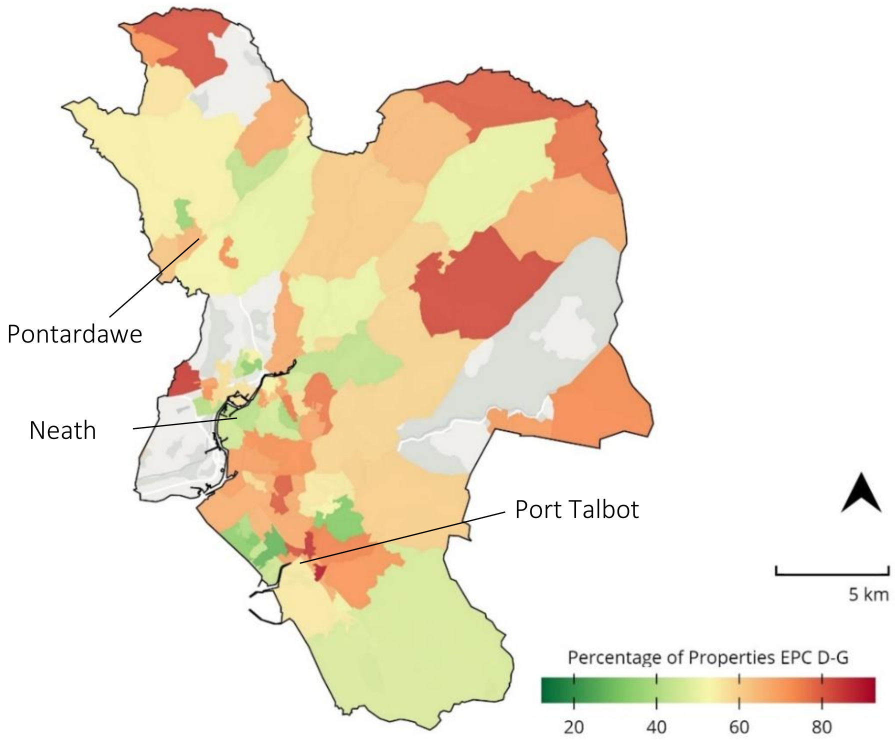


Figure 3-14: D – G EPC Ratings in Neath Port Talbot (Contains OS data © Crown copyright) (40).

A property's build type and fabric structure can impact its energy efficiency, carbon footprint and the efficiency measures it is suitable for. For example, detached houses tend to have a lower efficiency than flats due to the number of exposed walls and therefore higher retrofit costs. 77% of all dwellings in Neath Port Talbot are houses, 15% are flats, 7% are bungalows and 1% are maisonettes. It is estimated that 12% of all properties with cavity walls do not have the basic fabric upgrade measure of cavity wall insulation. Furthermore, 18% of properties are assumed to have insufficient loft insulation, which is a simple and cost-effective way to improve energy efficiency.

The age or listed status of a property will also impact its efficiency and suitability for retrofit. Buildings which are in a conservation area, have a listed status or are old and have a traditional construction type may require more specialised or bespoke methods of retrofit to improve their energy efficiency without damaging or altering the building's character. The number of buildings which are listed for each substation area are shown in Table 3-1.

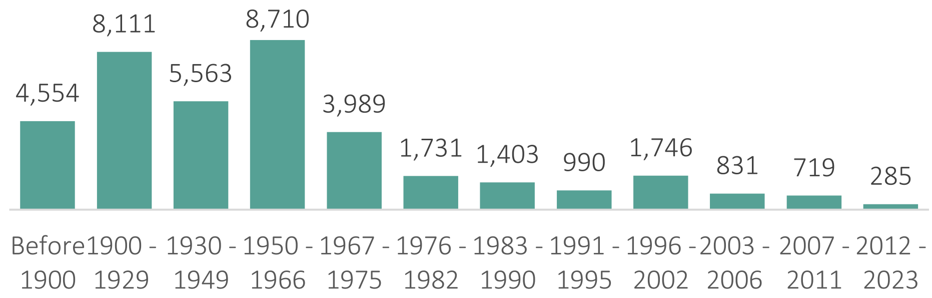


Figure 3-15: Construction Age of Properties in Neath Port Talbot

80% of Neath Port Talbot's dwellings were built before 1976, with 12% built before 1900, and 35% between 1900 and 1949. 48% were built between 1950 and 2002 and only 5% since 2003.

Primary Substation Zone	Average EPC Rating	Number of Listed Buildings	Percentage Gas Boilers	Percentage Oil Boilers
Abercrave	D	0	61%	25%
Britton Ferry Primary	D	13	93%	0%
Caerau Primary	D	34	95%	0%
Commercial St Neath	D	87	91%	1%
Gwaun-Cae-Gurwen	D	6	60%	23%
Aberpergwm	D	39	86%	3%
Llandarcy	D	33	80%	1%
Pontardawe	D	29	79%	2%
Pyle Primary	C	52	85%	2%
Jersey Marine	C	1	56%	0%
Travellers Rest Primary	D	11	72%	13%
Victoria Road	D	10	92%	0%
Wern	D	44	90%	0%
Ynys Street	D	30	90%	0%

Table 3-1: Average EPC Ratings by Primary Substation Zone

A B C D E F G	Highest values	Lowest values

3.4.4.2 Non-Domestic Building Stock

According to AddressBase data, 6% of properties in Neath Port Talbot are non-domestic with 90% of these being commercial properties and 10% industrial. Of the commercial properties, 22% are workshops, 19% are small shops and 16% offices.

The majority of energy demand from commercial buildings is from space heating and hot water use, which can be decarbonised with electrification or alternative fuels. Industrial buildings, meanwhile, are more challenging due to the higher energy demands and generally high temperature or bespoke processes. For many industrial processes, decarbonisation solutions are not commercially available or are prohibitively expensive.

Only 22% of non-domestic properties in Neath Port Talbot have an EPC rating, and therefore coverage of data on non-domestic building energy efficiency is poor. Of those with data, 40% are rated A – C and 60% rated D – G. This would suggest that generally non-domestic properties have a higher energy efficiency than domestic properties, although improved data would be needed to understand the true status of the building stock and identify properties with significant need for energy efficiency measures.

3.4.4.3 Domestic Energy Demand

The domestic sector accounts for 48% of Neath Port Talbot's total energy demand at 1,110 GWh in 2019. Figure 3-16 shows this broken down by fuel type. 780 GWh of total domestic energy demand is from gas and 210 GWh is from electricity (38).

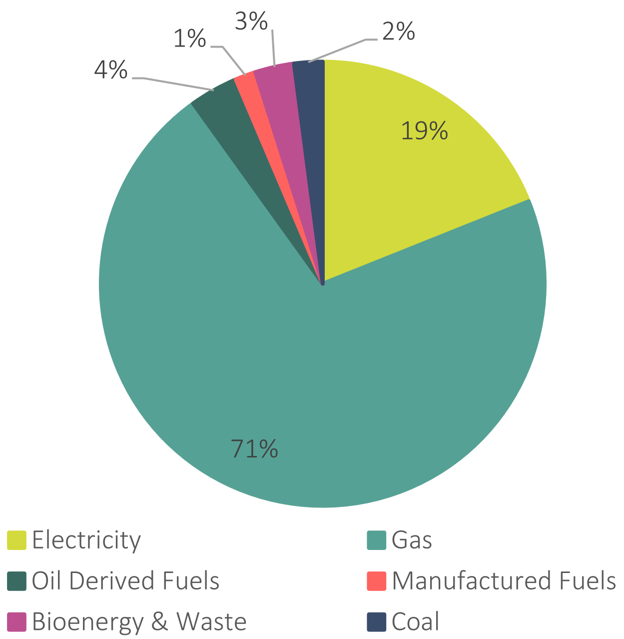


Figure 3-16: Domestic Energy Demand by Fuel Type 2019 (38)

The domestic sector shown in Figure 3-17 has experienced a 23% decline in energy demand. This is largely as a result of a reduction in gas consumption of 28%, which could be due to gas boiler efficiency improvements. Electricity consumed by the domestic sector in Neath Port Talbot has not experienced any significant change over time.

It is notable that only a small proportion of energy demand (29%) is from non-gas fuels which is a result of most properties in Neath Port Talbot (93%) being connected to the gas network. Gas fuelled homes have wet heating systems, which are more suitable for heat pumps and district heat network connections. A significant number of properties in Neath Port Talbot also have a secondary heating system. According to EPC data, it can be estimated that around 52% of domestic properties have a secondary heating system which includes electric heaters, wood logs and coal (39). This is important to take into account as some secondary heating sources use fuels that are deemed as less sustainable such as liquefied petroleum gas (LPG), oil and solid fuels.

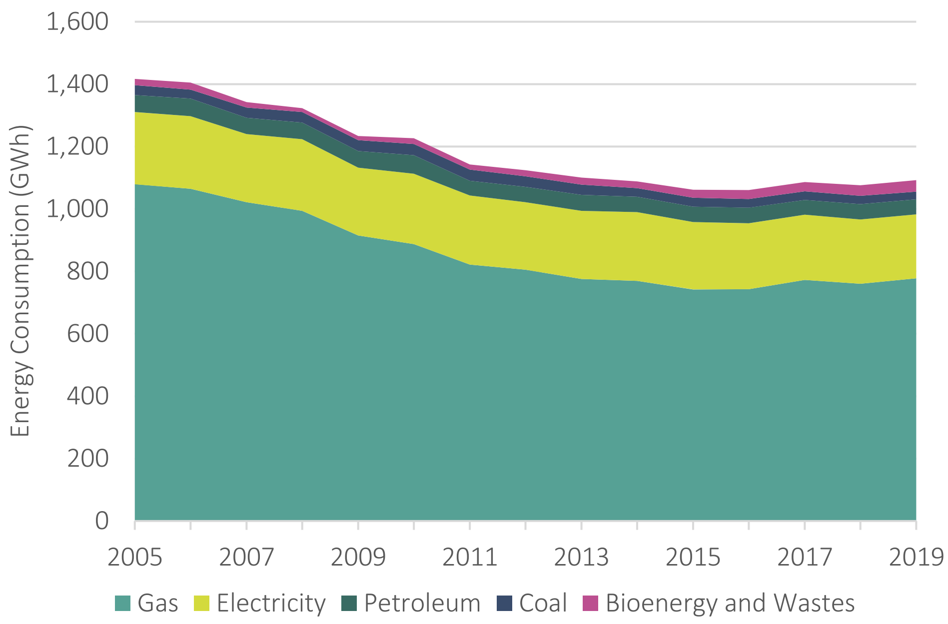


Figure 3-17: Neath Port Talbot's Historical Energy Use by Fuel 2005 – 2019 (38)

3.4.4.4 Industrial & Commercial Energy Demand

BEIS subnational statistics do not accurately portray the extent of industrial energy demand, likely due to the presence of the Port Talbot Steelworks. This is highlighted in Table 3-2 which presents a comparison between the BEIS industrial energy demand statistics and the Port Talbot Steelworks annual energy consumption. Therefore, it is not possible to state the exact figures for industrial and commercial energy demand from this dataset.

3.4.4.4.1 Industrial Energy Demand

As the BEIS subnational statistics do not fully account for industrial energy demand, the BEIS National Atmospheric Emissions Inventory (NAEI) and the Tata Steel annual sustainability report have been used to estimate industrial energy demand in Neath Port Talbot. The NAEI dataset provides locations of large industrial CO_2 emitters which can be used to estimate energy use (41). This is indicative only to understand the magnitude of demand.

Neath Port Talbot is a large industrial hub, with ten estates and significant steel production. As shown in Figure 3-18, the NAEI identifies two industrial high carbon emitters within the local authority boundary: the Port Talbot Steelworks and the Sofidel paper and printworks which emits ~22 kt CO_2 per year.

The Tata Steel annual sustainability report was used to provide an estimated energy consumption of the Port Talbot Steelworks (42). According to this, the Port Talbot Steelworks production site has an annual fuel consumption in the region of 21,000 GWh varying with the annual quantity of steel produced. This value assumes an annual output of 3.2 Mt crude steel and 23.5 GJ/tonne of crude steel.

BEIS Total Final Energy Consumption Statistics	Port Talbot Steelworks Annual Energy Consumption
8,990 GWh	~21,000 GWh

Table 3-2: BEIS Subnational Energy Consumption Statistics Compared to Port Talbot Steelworks Annual Energy Consumption

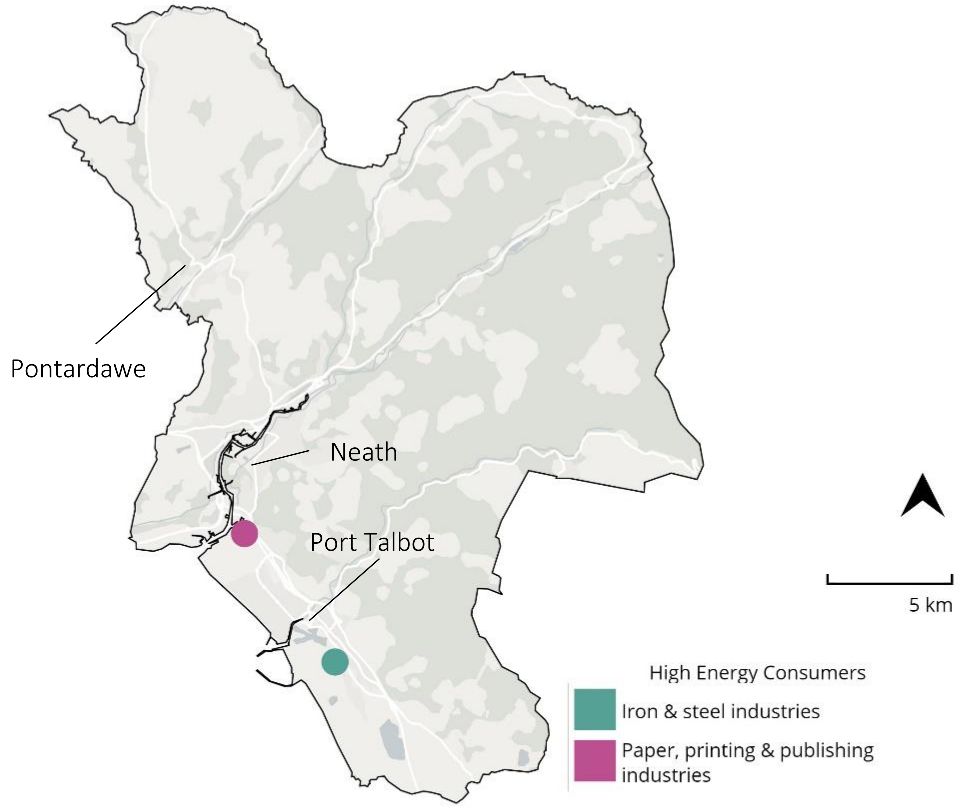


Figure 3-18: Large Industrial Energy Consumers in Neath Port Talbot (Contains OS data © Crown copyright) (41)

Using NAEI emissions data, estimated energy use per industrial site was modelled based on indicative assumptions, to understand the scale of demand from each site. Table 3-3 shows the estimated energy demand of the high industrial energy consumers by substation zone. It should be noted that the energy demand does not include electricity demand, as emissions data only includes onsite combustion and process emissions.

Substation Zone	Process Sector	Emissions (kt CO_2)	Process Energy Use (GWh/year)
Briton Ferry Primary	Paper, Printing and Publishing Industries	22	~120
Victoria Road	Iron & Steel Industries	6,240	~21,000

Table 3-3: Process Sector and Energy Use by Substation (2020)

3.4.4.4.2 Non-Domestic Main Heating Source

The following data refers to non-domestic properties with an EPC rating, which accounts for 22% of total non-domestic properties in Neath Port Talbot. Due to this relatively low data coverage, the results may not be fully representative of the whole non-domestic building stock. Table 3-4 shows the main fuel type across non-domestic properties, with electricity and gas supplying the majority.

Fuel Type	Percentage of Properties
Grid Supplied Electricity	48%
Natural Gas	47%
Oil	2%
Liquified Petroleum Gas (LPG)	1%
Biomass	<1%
Other	2%

Table 3-4: Main Fuel Type of Non-Domestic Properties in Neath Port Talbot (40)

3.4.4.4.3 Non-Domestic Heat Demand

Table 3-5 on the following page shows modelled non-domestic heat demand by substation zone as well as estimated gas, electricity and biomass use. Victoria Road, Commercial St Neath and Briton Ferry Primary zones have the greatest heat demand and energy use. This is unsurprising as these substation zones include key industrial and commercial areas. Victoria Road includes part of Port Talbot, Baglan Industrial Park and Neath Port Talbot Hospital. Briton Ferry Primary includes Briton Ferry, the Sofidel Printworks, Briton Ferry Concrete Plant and Briton Ferry Recycling Centre.

The substation zones with the lowest demand are Abercave, Gwaun-Cae-Gurwen and Travellers West Primary. These areas have limited industry or commerce with Gwaun-Cae-Gurwen being a particularly rural area.

Primary Substation Zone	Heat Demand (MWh/year)	Heat Demand Per Property (MWh/year)	Gas Use (MWh/year)	Electricity Use (MWh/year)	Biomass Use (MWh/year)
Abercrave	790	40	580	0	0
Aberpergwm	5,980	30	4,970	2,710	120
Briton Ferry Primary	20,000	90	19,400	9,140	0
Caerau Primary	5,970	50	5,610	2,900	0
Commercial St Neath	24,200	40	21,500	11,300	1,090
Gwaun-Cae-Gurwen	2,060	20	1,370	589	0
Jersey Marine	17,400	310	17,100	6,950	0
Llandarcy	18,400	30	16,100	8,980	0
Pontardawe	12,800	30	11,100	3,190	0
Pyle Primary	14,700	160	14,600	8,840	0
Travellers Rest Primary	5,840	30	4,670	2,680	0
Victoria Road	26,700	60	25,500	14,500	0
Wern	6,770	40	5,800	3,870	0
Ynys Street	18,300	460	17,000	10,100	0

Table 3-5: Non-Domestic Heat Demand by Primary Substation Zone

Highest values

Lowest values

3.4.5 Road Transport Sector

3.4.5.1 Road Transport Energy Demand

Road transport accounts for 28% of Neath Port Talbot's total energy use at 1,120 GWh as of 2019 (43). As shown in Figure 3-19, most fuel demand comes from diesel at 59%. When analysed over different road types, 41% of fuel consumption occurred on A roads, 37% on motorways and 22% on minor roads. The Welsh average of the proportion of fuel consumption on motorways is 12% so Neath Port Talbot is significantly higher than the average. This is likely due to the M4 which runs along the coastal plain, through Port Talbot.

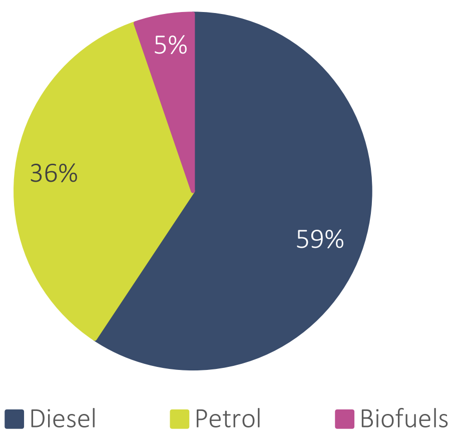


Figure 3-19: Road Transport Energy Demand by Fuel Type in 2019 (43)

Road transport energy demand has increased by 6% over the past 15 years, shown in Figure 3-20. (43). Since 2005, diesel cars have increased from accounting for 21% of road transport energy demand to 38%. In comparison, petrol cars have decreased from 43% to 28%. This is in line with the trend of the 'diesel boom' which was a result of diesel vehicles in Europe being incentivised by the European Automobile Manufacturers Association (ACEA) agreement in 1998 to shift away from petrol-fuelled cars to curb carbon dioxide emissions (44).

Heavy Goods Vehicles (HGVs) accounted for 15% of road transport energy consumption in 2019 and Light Goods Vehicles (LGVs) accounted for 16%. Most LGV fuel consumption is from diesel LGVs, with this increasing by 45% over the past 15 years. Buses continue to account for a small proportion of energy use at 2% of total demand in 2019.

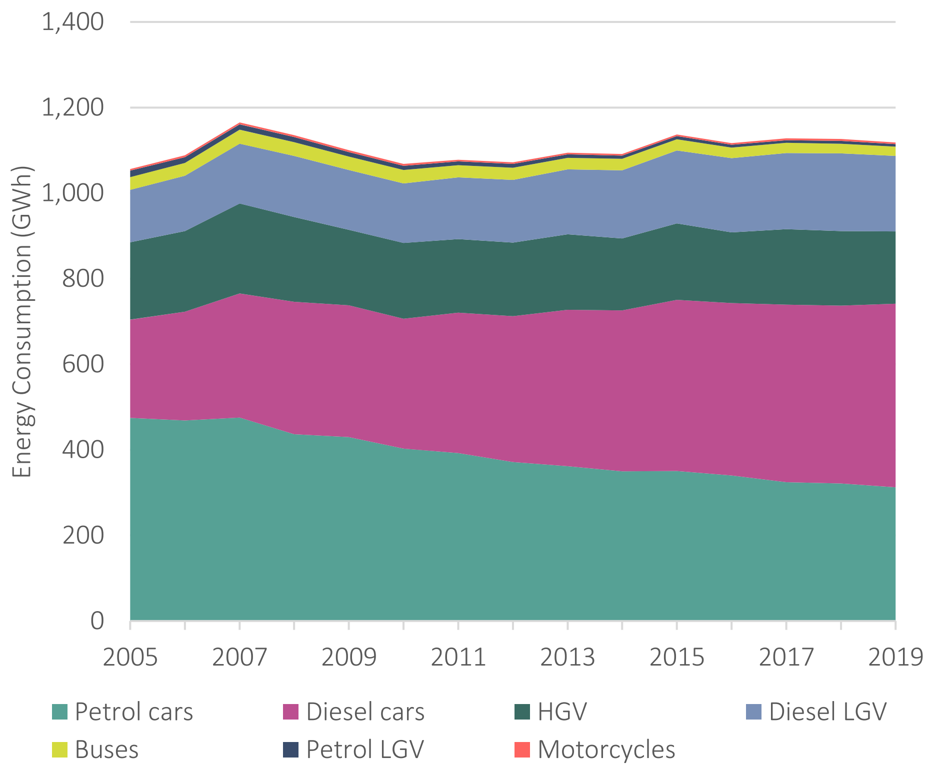


Figure 3-20: Road Transport Energy Consumption by Vehicle Type 2005 – 2019 (43)

3.4.6 Current Energy Generation

Wales remains a net exporter of electricity, generating nearly twice as much electricity as it consumes on an annual basis. Neath Port Talbot is the local authority with the greatest renewable capacity in Wales (45).

Neath Port Talbot has an estimated total energy generation capacity of 487 MW, 86 MW of this is from fossil fuel generation and 401 MW from renewables. 361 MW is from onshore wind, 33 MW from ground-mount solar PV and 6.8 from rooftop PV (46). Figure 3-21 shows renewable generation assets according to the Renewable Energy Planning Database.

There are many key renewable energy generation installations in Neath Port Talbot. The installation with the greatest capacity is Pen y Cymoedd Wind Farm which has a capacity of 228 MW and provides 57% of Neath Port Talbots' total renewable generation. This 76-turbine wind farm can produce enough electricity to power 15% of Welsh homes annually (188,000 homes) (47). As seen in Figure 3-21, this is located in the east of Neath Port Talbot and is within Caerau Primary substation zone. This wind farm became operational in 2017.

Another key onshore wind installation is the Ffynnon Oer Wind Farm which consists of 16 turbines and has an installed capacity of 32 MW, the equivalent of powering 25,500 homes annually. The Maesgwyn onshore wind farm has a 26 MW capacity and was commissioned in 2011.

There is a major biomass site in Neath Port Talbot: Margam Green Energy Plant. This is a wood-fired power station located near Port Talbot which has a capacity of 40 MW.

There are many key ground mount solar installations in Neath Port Talbot including Hendre Fawr Solar Farm 11.6 MW and five other sites totalling 32.9 MW captured on the REPD.

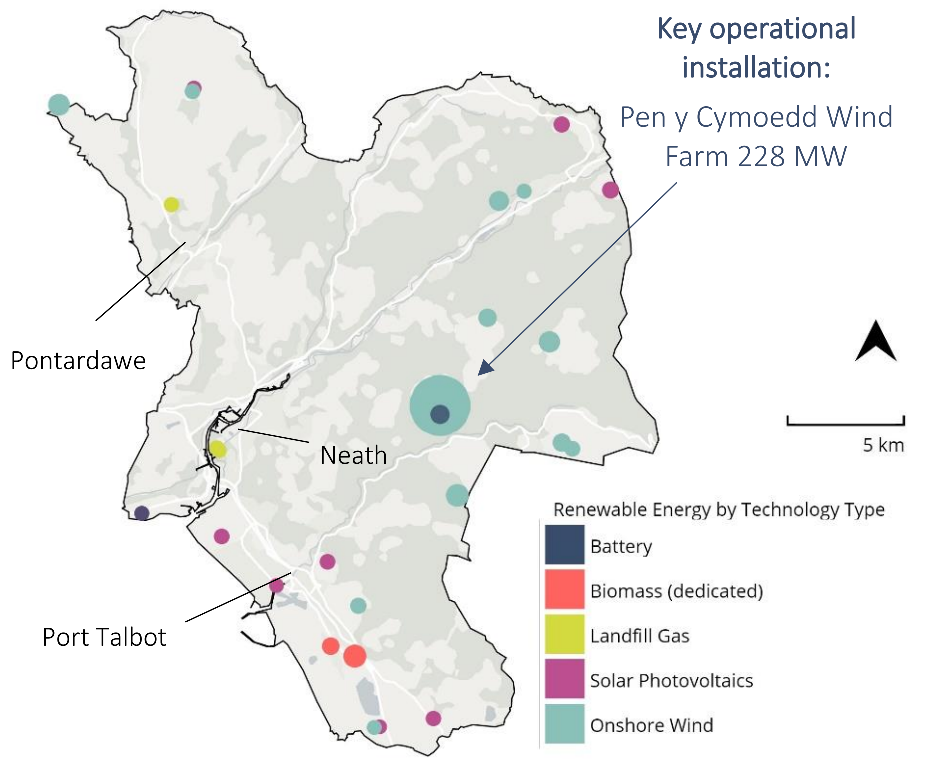


Figure 3-21: Neath Port Talbot's Renewable Energy by Technology (operational, under construction or with planning permissions granter or submitted) (48) (Contains OS data Crown © copyright)

3.4.7 Flexibility

Flexibility refers to the ability of the grid to adapt and respond to changes in electricity supply and demand. It is crucial for several reasons including effective integration of renewable energy sources, managing increases and variations in electricity demand and overall energy system resilience. Data on existing flexibility systems are poor and uptake across the UK is assumed to be limited. However existing programmes of work may increase this in the future. One example of this is Homes as Power Stations which is an extensive regional retrofit initiative that is being delivered under the Swansea Bay City Deal. The design principles and technologies that underpin the programme will contribute to overall grid flexibility by:

- **Energy Generation:** Integrating solar PV panels will reduce the reliance on traditional grid power and potentially lower peak demand.
- **Storage:** Implementing energy storage solutions (e.g. batteries and thermal heat storage systems such as heat pumps) can store excess energy during periods of low demand/high renewable generation supporting grid stability.

The programme aims to facilitate the uptake of renewable technologies in at least 10,300 properties (7,000 retrofit, 3,300 new build) within five years across South West Wales, presenting an incredible opportunity to improve grid flexibility within Neath Port Talbot.

3.4.8 Storage

3.4.8.1.1 Hot Water Storage

It is estimated that around 24,000 homes in Neath Port Talbot could have hot water storage, mainly in the form of hot water cylinders. This can provide an effective means of storing renewably generated power (such as from solar thermal or PV panels) and off-peak energy use. They are relatively cheap and therefore can be an accessible way to reduce heating costs and carbon emissions. When considering that the typical storage size of a hot water cylinder in a 4-bedroom house is 180 L (6.2 kWh/year) (49) then the overall hot water storage capacity across Neath Port Talbot is likely around 4,320 m^3. This is equivalent to 149,000 kWh of heat.

3.4.8.2 Battery Storage

Home battery storage is not yet a widely adopted technology across the UK, although it is anticipated to grow as heating electrifies due to the benefits of managing demand with flexible energy tariffs. Based on Neath Port Talbot’s population and the number of homes with heat pumps or resistance heating, only a small number of homes are likely to have a battery (~20). When considering that the typical battery for a four-bedroom property is 9.5 kWh, this could mean the overall battery capacity in Neath Port Talbot is around 200 kWh.

3.4.8.2.1 Hydrogen Storage

Hydrogen storage is technically challenging and would not be well-suited for domestic applications due to the required space and cost requirements (50). It is however a feasible option for balancing fluctuations in the grid, which is expected to become a more pertinent issue with increasing levels of intermittent renewable generation sources. Converting excess electricity to hydrogen can avoid curtailment, which cost the UK economy over £500mn in 2021 (51). The high level of complexity and uncertainty in this solution means that this has not been modelled as part of this LAEP; however, considerations should be given to grid-level hydrogen storage across all net zero scenarios.

3.4.9 Energy Infrastructure

A region's energy infrastructure is a vital network, channelling essential resources to power homes and fuel businesses. This will become increasingly important as energy demand is likely to increase and move away from the traditional gas grid. Both the electricity and gas networks have been analysed, providing an insight into key opportunities, challenges and considerations for the future energy system.

3.4.9.1 Electricity Network

Decarbonisation efforts (such as the electrification of heat and transport), and growth across the area will place additional strain on the grid. The identification of potential future constraints is an important aspect of LAEPs.

NGED have been heavily engaged in this LAEP and intend to continue working with the Council to realise and align with the LAEP Action Plan. NGED's existing plans accommodate for anticipated constraints across the grid, therefore this LAEP aims to assess demand beyond the expected anticipated amount. Modelling network flow is complex due to the nature and flexibility of the network infrastructure, and therefore the results given are indicative only and will undergo more thorough analysis from NGED.

Due to the significance of grid infrastructure on future systems, this LAEP uses primary substation distribution areas as the geographical zones of analysis. This enables outcomes to be mapped directly onto grid impact, both at primary and secondary substation level, and therefore aligned with potential network infrastructure restrictions and plans.

Both demand and generation capacity have been analysed, across primary substations and Bulk Supply Points (BSP). Demand headroom is essential to ensuring consumers can access sufficient electricity for their demand needs. Generation headroom will be key to accommodate future growth in electricity demand, including connecting new renewable electricity assets to the grid. Current generation connection applications face major delays due to the recent growth in renewables and the outcomes of the LAEP intend to support improving this process for the area.

3.4.9.2 Bulk Supply Points

Six BSPs connect to Neath Port Talbot's primary substations; although as the network is not based on local authority boundaries, three of the main BSPs are shared with neighbours. As shown in Figure 3-22, using a red, amber, green (RAG) assessment, all BSPs have available demand headroom. Data is not available on the capacity of the BSP to the north of the area (Ystradgynlais Grid). The interconnection of the network across different local authorities has been considered when modelling future energy systems and accounting for development and using available capacity.

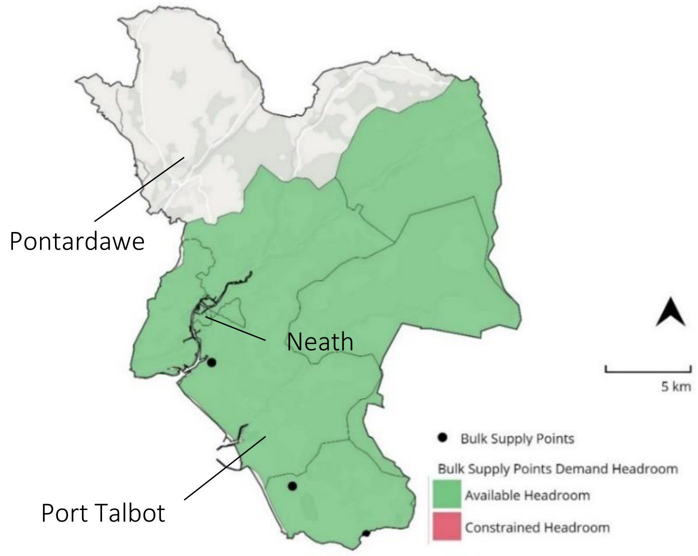


Figure 3-22: Bulk Supply Point Demand Headroom (RAG assessment), (Contains OS data © Crown copyright and NGED data)

In terms of generation capacity, there are a number of areas in Neath Port Talbot that have constrained generation headroom. As shown in Figure 3-23, four BSP areas have constrained generation headroom. This includes Briton Ferry Grid at -12 MVA and Pyle BSP at -110 MVA generation headroom. Understanding these constraints can be key to planning renewable generation build-out and additional infrastructure investment which may be needed.

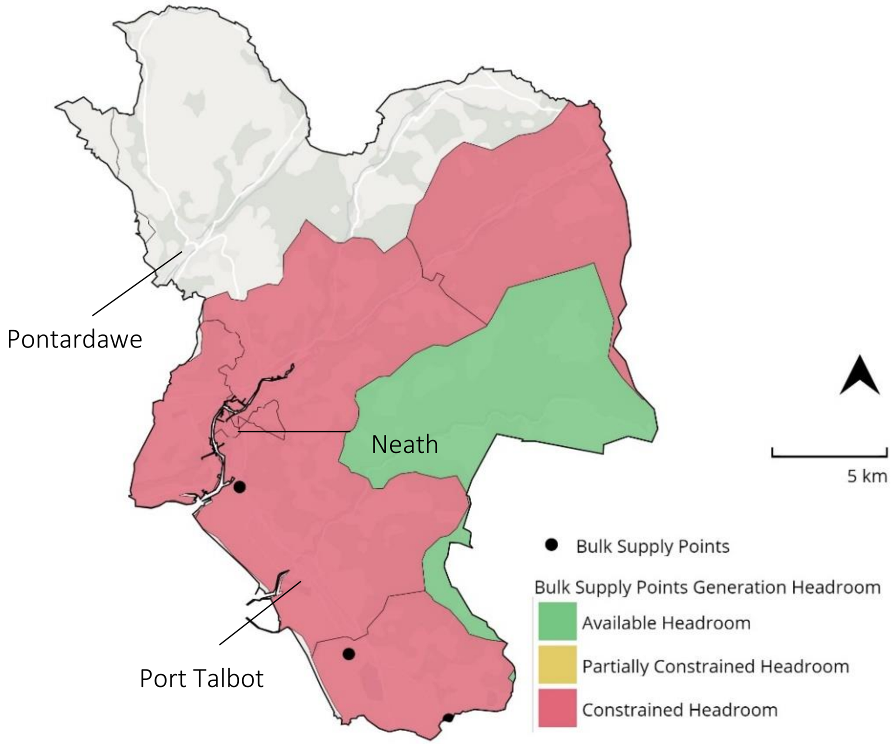


Figure 3-23: Bulk Supply Point Generation Headroom (RAG assessment), (Contains OS data © Crown copyright and NGED data

3.4.9.3 Primary Substations

The electricity network in Neath Port Talbot is served by 14 primary substations. The analysis shown in Figure 3-24 indicates that there is good capacity across most of the local authority. However, there is some significant constraint on the grid in the northern area. Notably, some of the primary substations also serve areas in neighbouring local authorities, and therefore their future demand will need to be considered by the Distribution Network Operator (DNO) for any capacity upgrades.

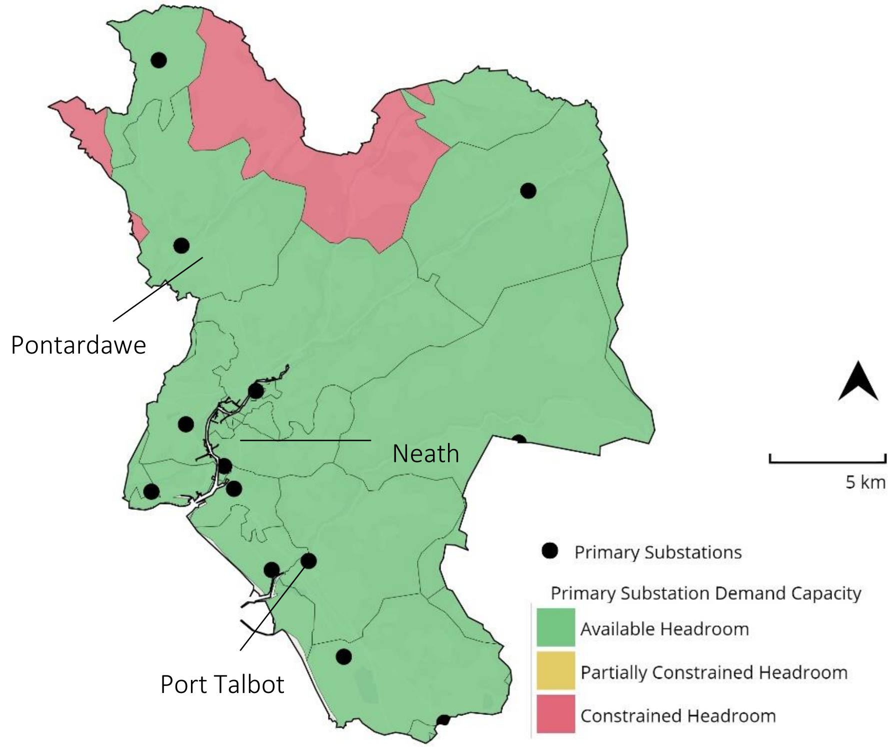


Figure 3-24: Primary Substation Demand Capacity (RAG assessment) (Contains OS data Crown © copyright and NGED data)

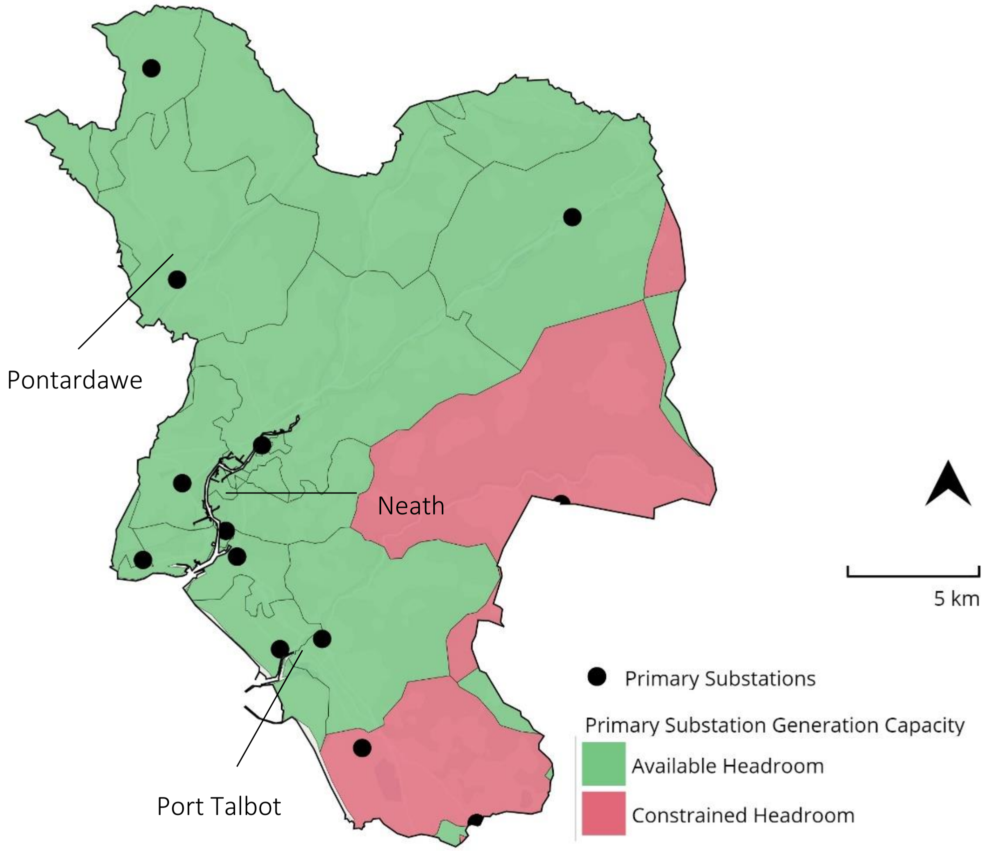


Figure 3-25 shows primary substation generation headroom in Neath Port Talbot. Three primary substations are constrained at generation level: Caerau Primary with a generation headroom of -19 MVA, Pyle Primary at -35 MVA and Aberpergwm Primary at -10 MVA. A lack of generation headroom can cause delays and additional cost when connecting new renewable generation assets.

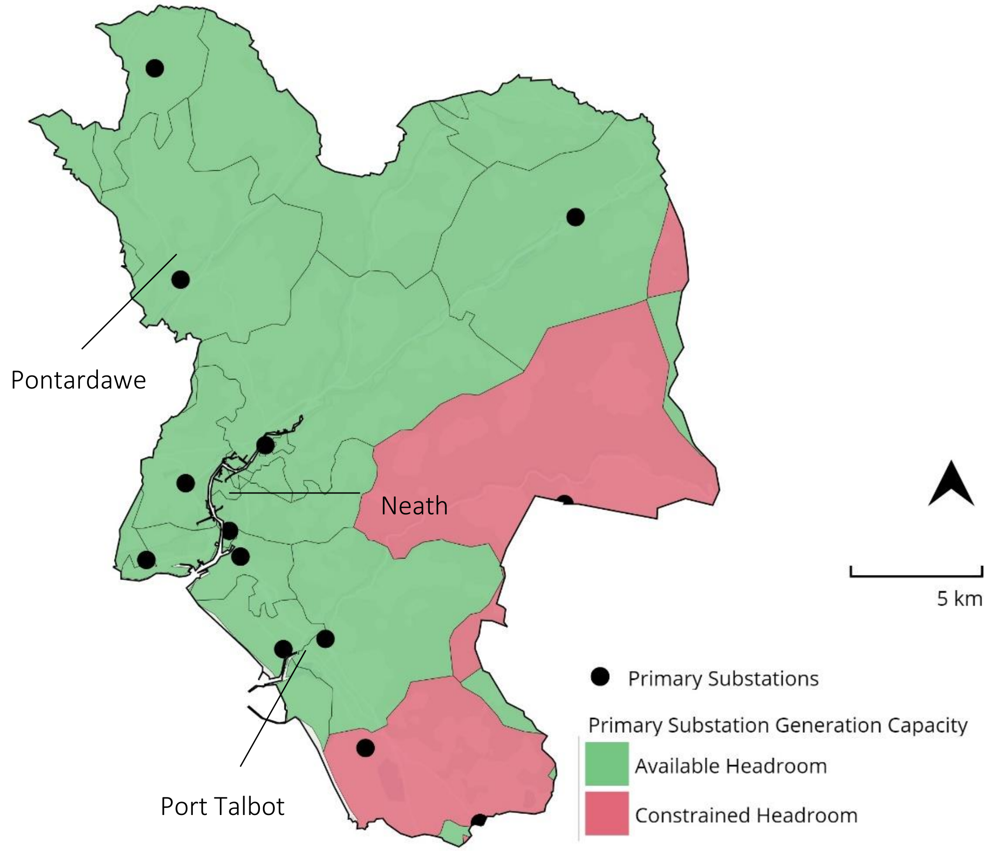


Figure 3-25: Primary Substation Demand Capacity (RAG assessment) (Contains OS data Crown © copyright and NGED data)

3.4.9.4 Upstream Constraints & Planned Existing Upgrades

Upstream constraints refer to limitations or challenges in the electricity transmission system that occur closer to the point of electricity generation. Constraints may arise when there is limited capacity in the transmission lines. Figure 3-26 shows the upstream demand capacity of the primary substation areas in Neath Port Talbot. Of the substations with available data, all have available upstream demand headroom.

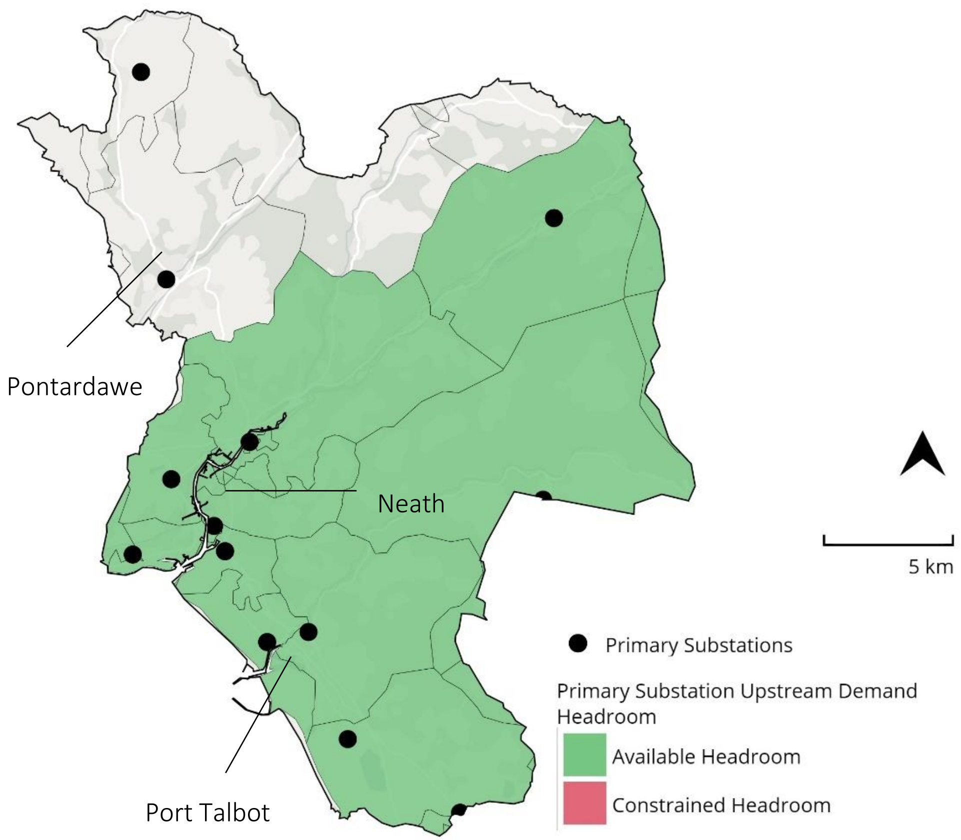


Figure 3-26: Primary Substation Upstream Demand Capacity (RAG assessment) (Contains OS data Crown © copyright and NGED data)

The National Grid has seen a quadrupling in applications to connect to the British power system in the last four years. In the South West (which includes the South West Wales region), there are over 30.7 GW of signed generation contracts for projects that are proposed to be built over the coming years (52). According to the National Grid Embedded Capacity Register, there are 36 proposed connections in Neath Port Talbot at a total of 539 MW registered capacity (53). 47% of these are solar PV and 22% of these are onshore wind. Connections above 1 MW by technology are shown in Figure 3-27. The size of the points is proportional to installed capacity (MW). It is also clear from Figure 3-27 that most primary substations with available data have constrained upstream generation headroom. This can create potential limitations for connecting new renewable generation assets.

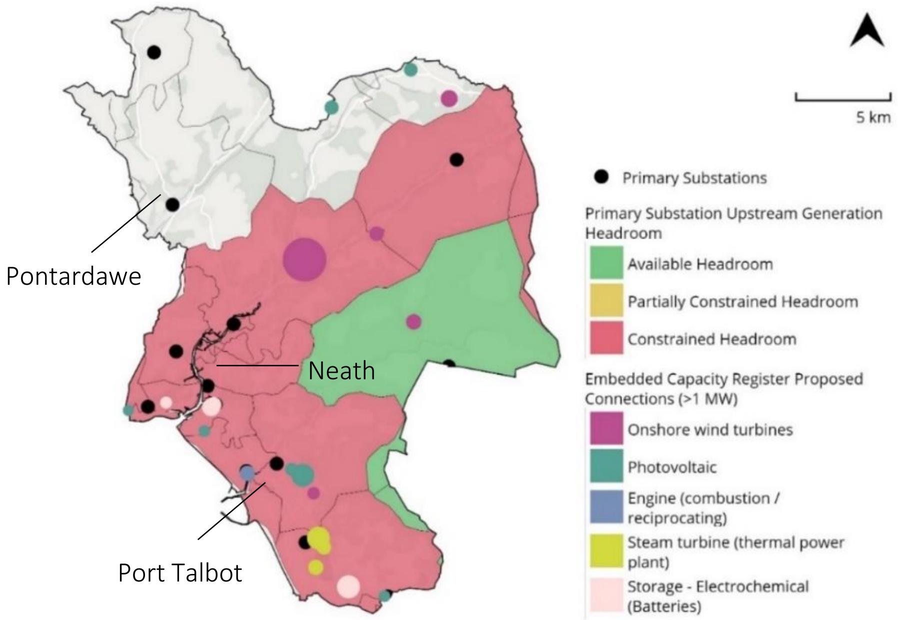


Figure 3-27: Primary Substation Upstream Generation Headroom and Planned Renewable Connections (53) (Contains OS data Crown © copyright and NGED data)

NGED has produced Network Development Reports which cover areas of the extra high voltage and 132 kV distribution networks where developments are expected on the 0 – 10-year window (54). There is one distribution network in this report that distributes to Neath Port Talbot: Swansea North grid supply point (GSP), shown in Figure 3-28.

This GSP is the largest of nine GSPs in South Wales which supplies a total of 345,000 customers. This is constrained on the demand side with thermal overload. To alleviate the projected overloads at Swansea North GSP, a reinforcement strategy is proposed that considers the complex nature of the Carmarthenshire and West Wales 132 kV network.

It should be noted that NGED's Network Development Reports are currently being refreshed for publish in May 2024, with these outlining planned reinforcements to increase both the generation and demand headroom of the network feeding Neath Port Talbot.

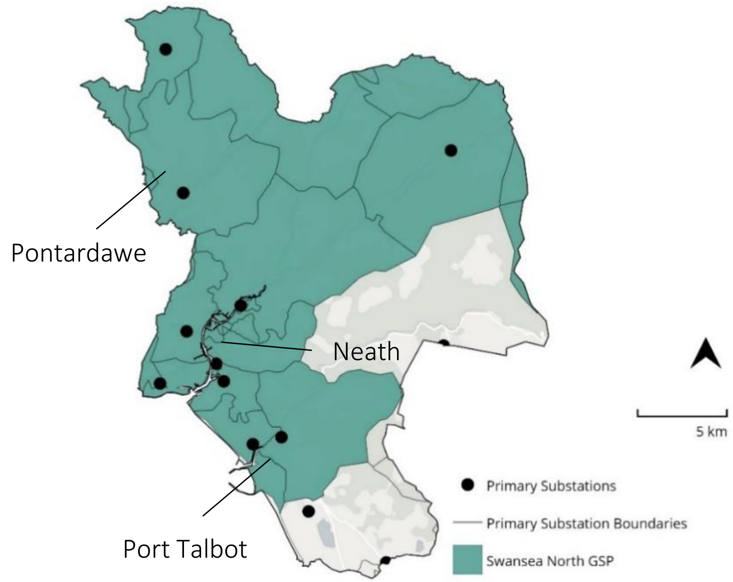


Figure 3-28: Swansea North GSP and Primary Substation Connection Areas in Neath Port Talbot (Contains OS data Crown © copyright and NGED data)

3.4.9.5 Gas network

Gas distribution infrastructure in Neath Port Talbot (such as gas mains and connections) is owned and managed by Wales and West Utilities (WWU). Figure 3-29 shows the approximate pipeline networks and areas served by the gas distribution network in Neath Port Talbot.

As previously mentioned, Neath Port Talbot has a relatively low proportion of properties that are not connected to the gas network. The Welsh average is 12%, higher than Neath Port Talbot's average of 7%.

Figure 3-30 shows the proportion of properties not connected to the gas network by Lower Layer Super Output Area (LSOA). All LSOAs in Neath Port Talbot are connected to the gas network, with only two, rural areas, having a significantly high proportion of properties not connected. Off-gas grid heating tends to be more expensive. Transitioning to a low carbon heat source such as heat pumps may be a more attractive option for off-gas grid, rural properties to reduce costs.

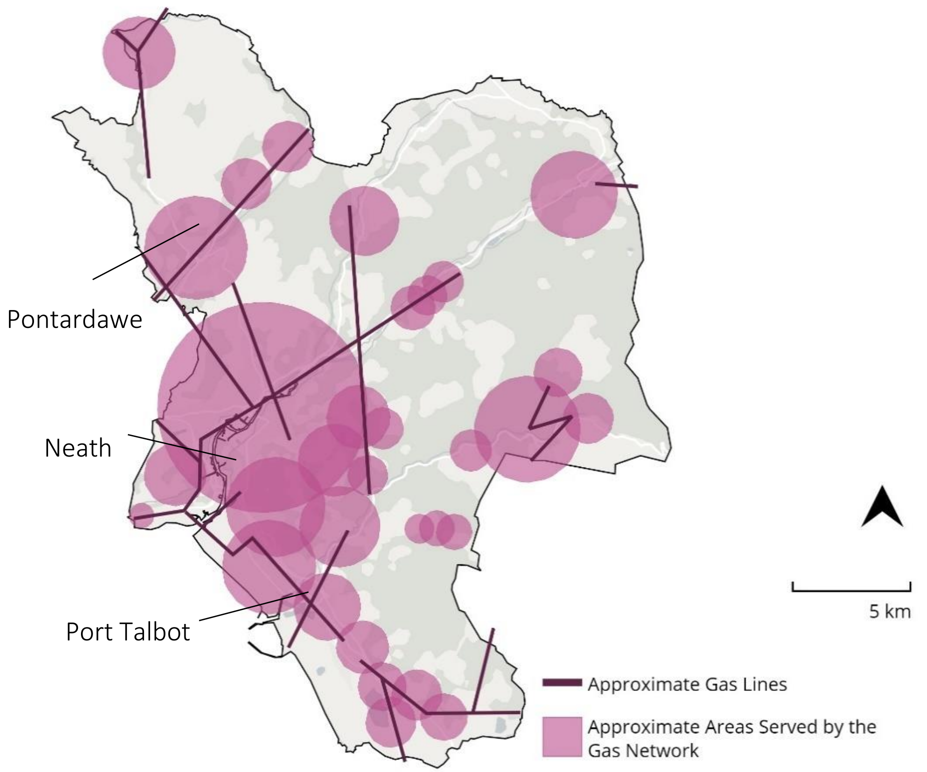


Figure 3-29: Approximate Areas Served by the Gas Distribution Network (Contains OS data © Crown copyright and WWU data)

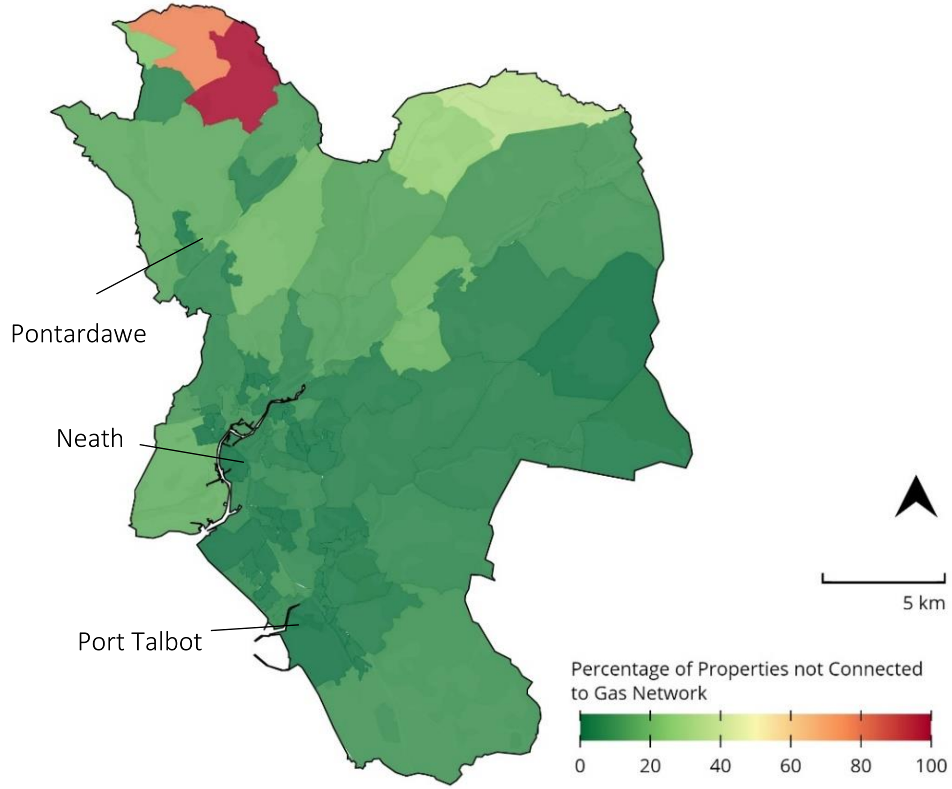


Figure 3-30: Percentage of Properties not Connected to the Gas Network in Neath Port Talbot by LSOA (55) (Contains OS data Crown © copyright)

3.4.9.6 Hydrogen

SWIC is the second largest emitting industrial cluster in the UK (56). As a result of the heavy industry presence around South West Wales, there is a significant amount of activity exploring the production, distribution and usage of hydrogen in the region. In particular due to the recent freeport status of Port Talbot, the area could be key for future hydrogen distribution throughout Wales and across to England.

WWU are exploring the feasibility of a dedicated hydrogen distribution pipeline, HyLine Cymru (see Figure 3-31), which would run from Milford Haven, through Carmarthenshire, over to Port Talbot (57). HyLine Cymru could unlock opportunities for hydrogen fuel switching across Neath Port Talbot and collaboration with the neighbouring authorities, promoting innovation, fostering knowledge sharing and actively decarbonising industrial clusters across the region.

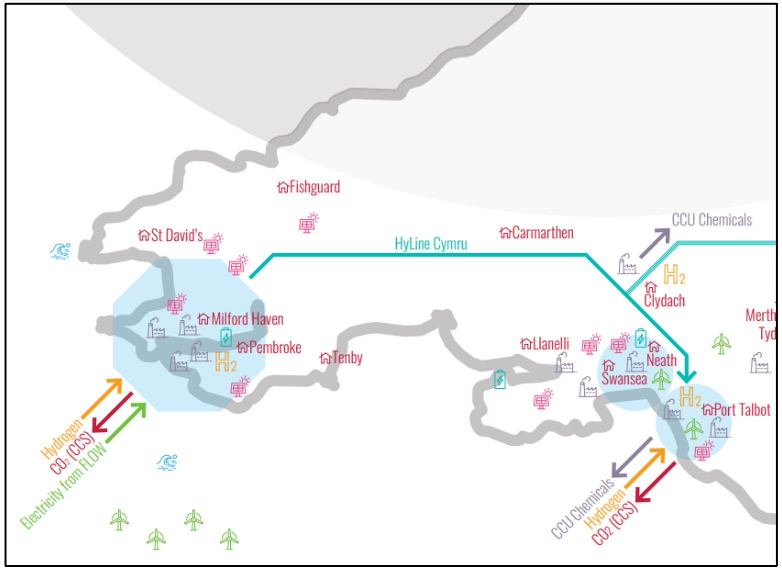


Figure 3-31: Proposed HyLine Cymru Hydrogen Distribution Pipeline (57)

4 The Vision

This section presents a comprehensive vision for Neath Port Talbot's future energy system, delineating the essential characteristics it will need to achieve net zero. It outlines a potential pathway towards this goal, which is used to develop and support a detailed action plan. Section 6 describes those actions, their implementation steps and the pivotal stakeholders for the transition.

The LAEP has developed this future vision through three key stages of modelling and analysis, shown in Figure 4-1 and described below:

- **2050 Energy System:** The first stage involved modelling the future energy demand and generation in 2050, under a variety of technology and policy scenarios. A full explanation of all scenarios is given in Section 4.1. This modelling defined the future energy demand and the required capacity of different technologies to meet it, based on various influencing factors such as anticipated growth, technological development or behavioural changes. These findings were discussed with key stakeholders; the two most likely scenarios were selected and developed further in the next stage.
- **Net Zero Pathways:** The second stage involved determining a viable Net Zero Pathway between the baseline and 2050. The pathways were analysed using a techno-economic model to explore key factors such as total cost, energy demand and carbon emissions over time and determine targets and milestones. The two pathways were compared against a 'Do Nothing' counterfactual. The preferred pathway was chosen through presentation of the pathway findings based on local priorities, risks and benefits. This final pathway is presented in the following sections, including the recommended interventions and deployment rate, which was then used to develop an extensive action plan.
- **Action Plan:** Finally, functioning as a dynamic delivery pipeline, the Action Plan translated the identified milestones into tangible, implementable actions. This serves as a strategic plan, detailing the key initiatives and measures required to achieve the set targets within the Net Zero Pathways.

Figure 4-1 below shows how the development and modelling of the 2050 energy system leads into the net zero pathways and action plan.

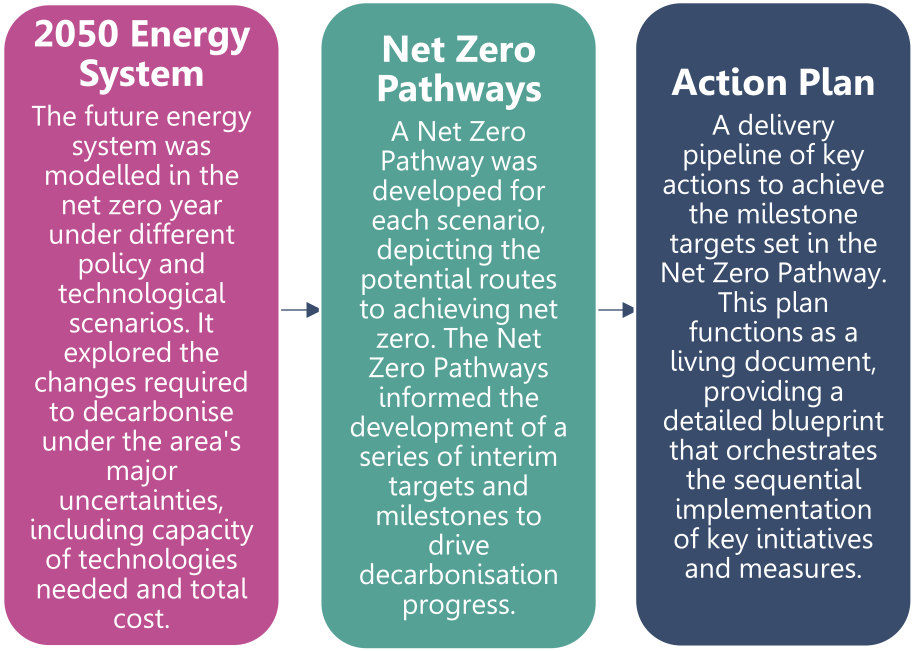


Figure 4-1: Relationship Between the Modelling of the 2050 Energy System, Net Zero Pathways, and Action Plan

4.1 2050 Energy System

Initially, four scenarios were developed to model the energy system in 2050:

- Widespread Engagement
- Widespread Hydrogen
- Maximum Electricity Demand
- Minimum Electricity Demand

These are explained across the following section.

These scenarios were built through stakeholder engagement with experts across the local authority. This developed a narrative of what would be the major influencing factors on the energy system in 2050, and the likely impacts of different policy and technological scenarios.

Throughout the process of developing the scenarios and the later agreed pathways, a regional approach was applied across South West Wales. This ensured alignment and consistency of narrative and assumptions between the three LAEPs being developed, while also aligning with the scenarios previously modelled in Pembrokeshire's LAEP. Examples of this include consistency of data and references used for assumptions as well as also integral modelling aspects, such as how the use of hydrogen vehicles would expand from the current trial across Neath Port Talbot and Swansea.

The intention of modelling different scenarios is twofold. Scenarios can develop narratives around the major uncertainties which may be outside of the council's control. For example, this could be the success of or policy decisions on the development of technologies (e.g. hydrogen for heating) or engagement with behavioural change (e.g. shifting to active travel away from personal vehicles). Scenarios can also be used to test sensitivity of the energy system to specific stresses to understand resilience. For example, this could test how the system would cope if population growth exceeded projections, or how resilient the grid is to excess demand. Both types of scenarios were used to develop this LAEP.

4.1.1 Widespread Engagement & Widespread Hydrogen

Two scenarios were used to develop a narrative around uncertainties for the energy system, while achieving net zero. These were broadly separated into Widespread Engagement and Widespread Hydrogen, with the primary difference being the extent of the role of hydrogen in the future energy system. Widespread Hydrogen assumes that hydrogen is used as much as possible across all sectors, with the change occurring at system level, therefore removing decision for the local public. Widespread Engagement assumes a more balanced, mixed approach to the energy system; however this relies on more public engagement and behavioural changes to adopt new heating technologies. Note that these scenarios are not binary in practice, meaning a combination of solutions from both could be employed in the future. An overview is shown in Figure 4-2.

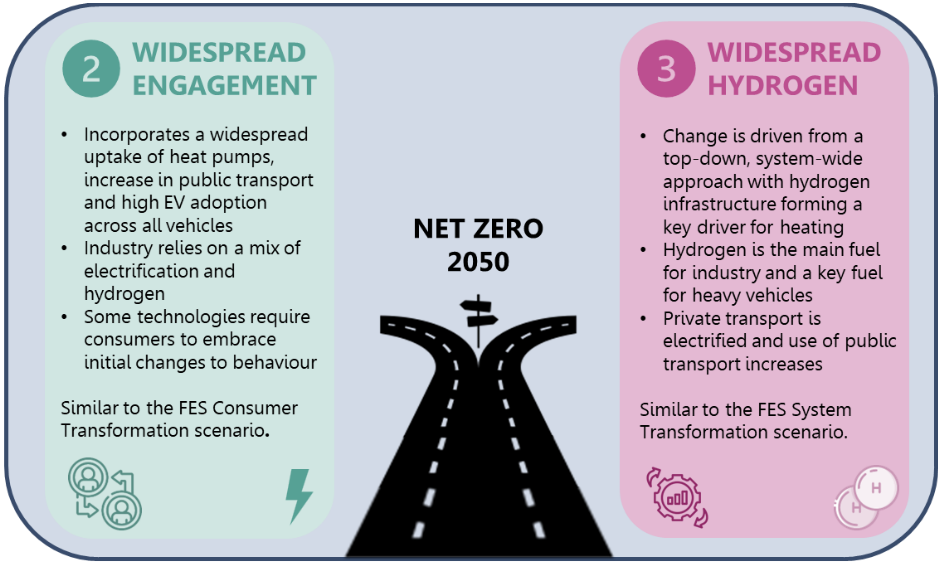


Figure 4-2: Summary Differences Between the Two Net Zero 2050 Scenarios

Hydrogen is currently discussed as a key potential energy source for many sectors, including building heating, transport and industry. It is a clean fuel in terms of carbon emissions, only producing water vapour when burned and can be produced through electrolysis using renewable energy. However, hydrogen-fuelled technology is at a relatively early stage compared to electrification, and its widespread use would require major, national infrastructure changes. There is also wide uncertainty around the maximum capacity to produce hydrogen in the UK, which risks dependency on international imports or could cause competition with the already high demand for renewables. Projections of costs are also high, and many experts believe hydrogen should be prioritised for areas which are difficult to electrify.

Widespread electrification is also not without its challenges, requiring considerable upgrades to the National Grid electricity network to be able to support the additional demand and generation. It will also require significant public engagement as buildings and homes will need to transition away from the traditional boilers to heat pumps or heat networks.

An early decision between electrification and hydrogen for heating and transport allows for a well-planned, phased approach to the modifications, reducing disruption and costs. The UK Government is due to make a final decision on hydrogen for heating in 2026, meaning many local authorities are uncertain as to whether they should be progressing hydrogen development. Both options have therefore been tested in these two scenarios.

The three largest differences between the two main narrative scenarios are:

- Heat pumps are the primary heating source in buildings for the Widespread Engagement scenario. Hydrogen for heating is prevalent in the Widespread Hydrogen scenario, which assumes the storage and distribution infrastructure and low carbon supplies are readily available.
- Electricity is used for lower temperature industrial processes in the Widespread Engagement scenario, with hydrogen being considered if the process requires a temperature that is too high for electricity. (Note all industry in Neath Port Talbot was low enough temperature for electrification). Hydrogen is the sole fuel for industrial processes in the Widespread Hydrogen scenario.
- Heavy transport (HGV and buses) are mostly electrified in the Widespread Engagement scenario, with a small number transitioning to hydrogen. HGVs and buses are fully hydrogen-powered in the Widespread Hydrogen scenario.

Widespread Hydrogen is largely predicated on the gas network transitioning to hydrogen, which could support the roll-out of hydrogen for heating, transport, and industry. WWU have suggested that gas networks along the planned HyLine Cymru route could be prioritised for this transition, which would include Neath Port Talbot. Due to the impending decision on hydrogen for heating, there is currently no guarantee that the gas network transition would take place. Nevertheless, it is recommended that Neath Port Talbot collaborate with WWU to be up to date on developments and to accelerate their transition towards hydrogen technologies, should the hydrogen for heating decision be positive.

The delivery mechanisms of domestic and non-domestic heat decarbonisation would vary considerably between the Widespread Engagement and Widespread Hydrogen scenarios, based on the transition to heat pumps or hydrogen boilers. Heat pumps require a connection to the electricity grid, of which an estimated 99.7% of properties across the UK currently have (58). Notwithstanding the complex nature of grid reinforcement, the primary limitations of heat pumps are therefore financial and supply chain related; ensuring that households and businesses are able to affordably purchase and operate a heat pump. Grant funding such as the Boiler Upgrade Scheme (BUS) are in place to help resolve this. Going forward, the UK government must therefore ensure that local authorities have sufficient funding streams available to continue the roll-out of heat pumps. As retrofit reduces energy demand, combined targeting of retrofit and heat pump roll-out would also help to abate the higher running costs of heat pumps relative to gas boilers. These areas are outlined in Section 5: Intervention Areas.

The delivery of hydrogen boilers is predicated on the repurposing of the gas network for hydrogen and retrofitting appliances to be hydrogen ready. The Iron Mains Replacement Programme aims to replace all gas mains with plastic piping by 2030 (59), which will be a significant step in making hydrogen for heating feasible. Following this, the pipework connecting the trunk mains to users, and the internal pipework and appliances in buildings must all be upgraded, which will be a considerable undertaking. Though hydrogen boilers are not expected to be more expensive than traditional gas boilers, their operation may pose a significant problem, as hydrogen is expected to be significantly more expensive than gas or electricity. Funding would therefore be required as a delivery mechanism for increasing the uptake of hydrogen boilers when consumers could instead invest in a heat pump.

4.1.2 Maximum Electricity & Minimum Electricity

In addition to the two narrative scenarios, a secondary set of scenarios were modelled in 2050 to investigate what the minimum and maximum demand on the electricity grid might be. They represent the potential extreme range of electricity demands in 2050 to inform network reinforcement planning, which is a critical enabler for the net zero transition.

As these scenarios are not realistic pathways to net zero, they are not modelled in the pathway analysis; instead, being used as a stress test on the 2050 energy system to help ensure of its robustness. These scenarios are shown in Figure 4-3.

Figure 4-3: Summary Differences Between the Two Sensitivity 2050 Scenarios

4.1.3 2050 Energy System Modelling

The 2050 energy system was modelled across multiple sectors, based on the LAEP's scope. For the most part, this is based on elements which are either in the control of the local authority area, or have a direct impact on the energy system.

The following sectors were modelled for Neath Port Talbot:

- Population growth
- Building energy demand (heat and electricity)
- Road transport (rail and maritime are outside of the LAEP scope)
- Industry
- Renewable generation
- Network infrastructure (gas and electricity grid).

An overview of the scenario variables and assumptions across the sectors are shown in Table 4-1. For all scenarios, 2050 was assumed to be the net zero target year, in line with national ambition.

For each sector, assumptions around uptake, dependencies and local nuances were included through stakeholder workshops, to develop realistic and evidence-based assumptions. Where possible, these assumptions also align with other existing local and national documentation and targets. Further detail on the specific interventions modelled across each sector is given in Section 5.

As a general assumption in the modelling, all heat pumps in the building sectors were considered to be air source heat pumps (ASHP). These are more versatile than ground source or water source heat pumps, with lower spatial requirements and investment costs. This means that the potential penetration rate of ASHPs is significantly larger than ground or water source heat pumps. This is reinforced by current statistics; ASHPs accounted for 80% of all heat pump sales in Europe in 2020 (60).

However, it is recognised that for some of these buildings a ground source heat pump could be equally suitable. Ground source can offer higher efficiencies but tend to have higher capital expenditure (CAPEX). Further data on space availability and technical assessment of suitability for a ground source heat pump would be needed to determine a realistic number of suitable buildings. Due to the space constraints it is expected that penetration would be much lower than ASHPs and therefore impact on total costs and energy demand would be limited.

4.1.4 2050 Energy System Sensitivity Findings

The outputs of the modelled scenarios included projected total energy demand, generation, technology capacities and deployment levels by 2050. The findings for the two sensitivity scenarios, Maximum and Minimum Electricity Demand, are presented in this section.

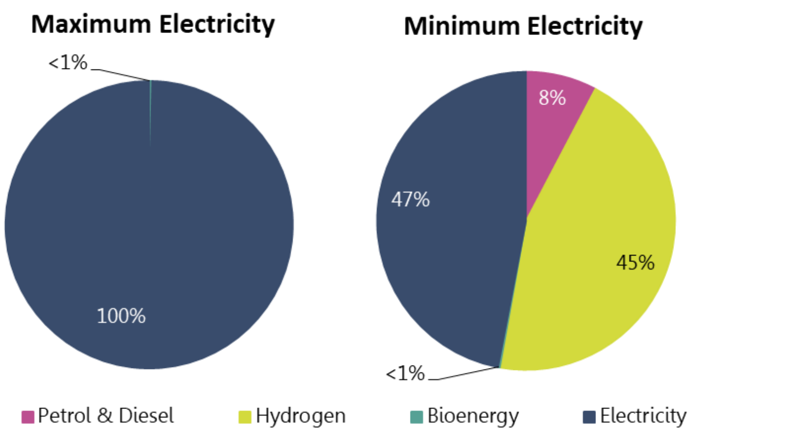


Figure 4-4: Energy Split for the Maximum Electricity and Minimum Electricity Scenarios in 2050

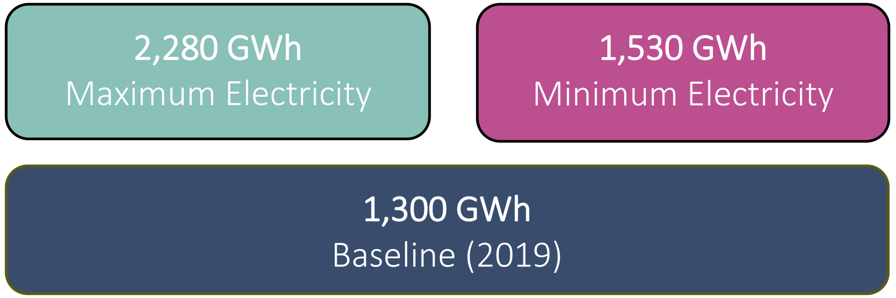


Figure 4-5: Total Electricity Demand in the Maximum and Minimum Electricity 2050 Scenarios against the Baseline

The Maximum Electricity scenario had a 50% higher total electricity demand than that of the Minimum Electricity scenario. However, both scenarios show a significant increase compared to the baseline. This presents that future electricity demand will be at least 20% higher than current levels, and highlights the importance and dependency of adequate resilience in the electricity grid for net zero. This will require some upgrades to provide larger connections to areas which do not currently have enough capacity for the projected electrification of heat, transport and industry.

The largest contribution to the electricity demand in both scenarios is from road transport (75% in the maximum scenario). The uptake of electric vehicles (EV) sees a significant increase in vehicle charging, in particular, for heavier vehicles which have much lower efficiency than electric cars. This should be considered for areas with high charging demand, such as motorway service stations and bus depots.

The outcomes for the two narrative scenarios were reviewed by the lead stakeholder group. It was decided to carry both the Widespread Engagement and the Widespread Hydrogen scenarios forwards due to the large uncertainty on the decision on hydrogen for heating. As this is outside of the Council's control it was deemed as important to review the future energy system and the required pathway for either decision outcome. The end year outcomes for both scenarios are presented in the pathway analysis and outcomes.

Variable	Widespread Engagement	Widespread Hydrogen	Maximum Electricity Demand	Minimum Electricity Demand
Net zero date	2050			
Growth projections	Standard	Standard	High	Low
Fabric retrofitting	Shallow at a minimum, deep retrofitting for public sector properties	Shallow at a minimum, deep retrofitting for public sector properties	None	Shallow at a minimum, deep retrofitting extensive
Hydrogen for heating	No (Heat pumps are prioritised)	Yes (100% of gas grid demands for heating switch to hydrogen)	No (100% of heating demands switch to electricity)	Yes (100% of gas grid demands for heating switch to hydrogen)
Heat networks	Where suitable	No	No	No
Hydrogen for industry	Hydrogen assumed where electrification is not possible (e.g. high temperature processes)	100% industry fuel demands met by hydrogen	Hydrogen assumed where electrification is not possible (e.g. high temperature processes)	100% industry fuel demands met by hydrogen
Road transport	Moderate mode shift to public transport, 100% vehicles electrified	Moderate mode shift to public transport, 100% small vehicles electrified, HGVs and buses switch to 100% hydrogen	No mode shift, 100% vehicles electrified	Some mode shift, 100% small vehicles electrified, but heavier vehicles and buses switch to 100% hydrogen
Consumer flexibility – demand side response (DSR) and in-home energy storage	DSR and in-home storage uptake where suitable	DSR and in-home storage uptake where suitable	No	DSR and in-home storage uptake where suitable
Onshore renewables (onshore wind, ground-mount PV)	Where suitable	Where suitable	No	Where suitable
Building integrated renewables (rooftop PV)	Where suitable	Where suitable	No	Where suitable

Table 4-1: Key Modelling Parameter Differences Between the Net Zero Scenarios

4.2 Net Zero Pathways

The two chosen scenarios were analysed further to explore a feasible pathway to meet net zero, against a counterfactual.

4.2.1 Do Nothing

The 'Do Nothing' scenario was introduced for the Net Zero Pathway modelling, and projects the future energy system based on only the existing committed initiatives and policies. It represents the counterfactual future if no further local or national targets or ambitions are made and therefore highlights the importance of the LAEP. Key examples of policies included in this scenario are:

- Future Homes Standard and agreed EPC targets
- Ban on fossil fuel boilers in new-build homes from 2025
- Ban on new gas and oil boilers from 2035
- Ban on petrol and diesel cars from 2035

Likewise, targets which are not tangible or finite are also not included and therefore the UK 2050 Net Zero target is not guaranteed through this scenario. It is assumed that current commitments will not change or be delayed further.

'Do Nothing' is similar to the National Grid Electricity System Operator (ESO's) Future Energy Scenarios (FES) 'Falling Short' (61). The FES are a UK-wide set of scenarios exploring the potential outcomes for the energy system based on various uncertainties. As the 'Do Nothing' scenario was not modelled in Section 4.1, final year assumptions for technology capacities and volumes are drawn from the Falling Short scenario.

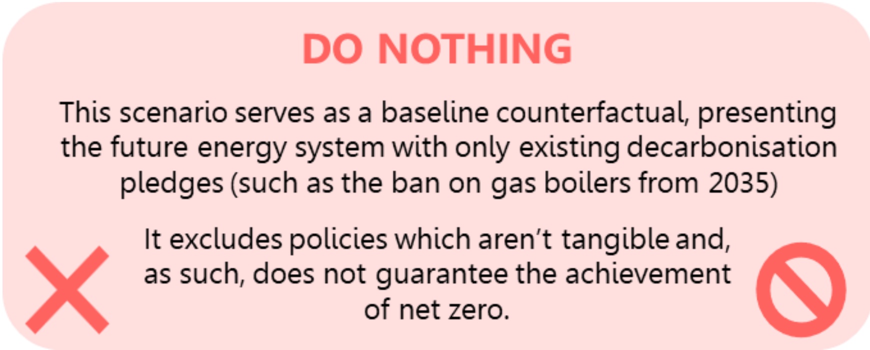


Figure 4-6: Summary of the 'Do Nothing' Pathway

4.2.2 Net Zero Pathway Development

The two scenarios and counterfactual were subsequently translated into Net Zero Pathways. The pathway models the transition from the baseline to 2050 and calculates the cumulative carbon emissions, costs, and other social parameters on an annual basis. This provides an insight as to how the transition to net zero in each scenario will be manifested, and identifies the pace of change required to achieve the 2050 energy system.

This includes estimation of the penetration of a low carbon technology into the energy system, such as the projected transition of EVs, or the required installation rate of interventions to support decarbonisation, such as the required roll-out of building retrofit. Calculating the capacity or number of different technologies on an annual basis enables the identification of measurable steps and interim milestones, and assesses the cost and wider infrastructure required to strategically deliver decarbonisation.

4.2.3 Pathway Modelling Assumptions

This section outlines some key assumptions used in the pathway modelling for the two main scenarios.

4.2.3.1 Uptake Projections

Where available, any interim targets or existing programmes of work across the sectors were used to project growth in a technology or intervention. For example, the Welsh Government's target to have low carbon buses by 2035. Where interim targets do not exist, uptake projections of technologies were based on wider market trends.

The FES has uptake projections for various technologies, such as heat pumps and EVs, which is based on anticipated supply chain and technological developments, and public engagement. Where a FES projection or local targets did not exist, a typical S-curve projection was used.

Table 4-2 to Table 4-6 below outline the projections used for each technology, under each sub-sector modelled in the pathway analysis. A description of the projection is provided, which includes the consideration of any national or local interim targets as described above.

Technology	Domestic Projection Description
New Buildings	In line with the Local Development Plan
Shallow Retrofit	S-curve; uptake will increase as supply chain matures and implementation becomes cheaper
Deep Retrofit	Linear; targeted roll-out, with 100% of council-owned buildings deep retrofitted by 2030
Heat Pumps	Immediate use in new builds. For existing buildings, FES Leading the Way, amended to account for the delayed ban to gas and oil boilers from 2025 to 2035
Hydrogen Boilers	FES System Transformation
Heat Networks	S-curve; domestic buildings will not be key connections for heat networks and will therefore connect gradually over time as they become more prevalent
Direct Electric	Assumed same uptake as heat pumps as some buildings transition from gas but are unsuitable for alternatives
Biomass Boilers	S-curve; off-gas grid properties that switch to biomass will increase over time as new oil and gas boilers are banned
Oil Boilers	Small decline before 2035 through targeted action; increased rate of decline after 2035 following ban

Table 4-2: Domestic Buildings Technology Projections in Pathway Model

Technology	Non-Domestic Projection Description
New Buildings	In line with the Local Development Plan
Shallow Retrofit	S-curve; uptake will increase as supply chain matures and implementation becomes cheaper
Deep Retrofit	Linear; targeted roll-out, with 100% of council-owned buildings deep retrofitted by 2030
Heat Pumps	FES Leading the Way, amended to account for the delayed ban to gas and oil boilers from 2025 to 2035
Hydrogen Boilers	FES System Transformation
Heat Networks	Rapid linear increase from 2025-2030 as buildings connect in phases over a short period of time, followed by a slow linear increase as additional buildings connect to the working networks
Direct Electric	Assumed same uptake as heat pumps as some buildings transition from gas but are unsuitable for alternatives
Biomass Boilers	S-curve; off-gas grid properties that switch to biomass will increase over time as new oil and gas boilers are banned
Oil Boilers	Small decline before 2035 through targeted action; increased rate of decline after 2035 following ban

Table 4-3: Non-Domestic Buildings Technology Projections in Pathway Model

Technology	Transport Projection Description
New Vehicles	Based on modelled future transport demand for interim years from Transport for Wales model
EV Cars	FES EV Cars Consumer Transformation (Widespread Engagement and Hydrogen); Falling Short (Do Nothing)
EV LGVs	FES EV LGVs Consumer Transformation (Widespread Engagement and Hydrogen); Falling Short (Do Nothing)
EV HGVs	FES EV HGVs Consumer Transformation (Widespread Engagement); Falling Short (Do Nothing)
EV Buses	Linear until 2035 Transport for Wales decarbonisation target
Hydrogen HGVs	FES Hydrogen HGVs System Transformation
Hydrogen Buses	Linear until 2035 Transport for Wales decarbonisation target

Table 4-4: Transport Technology Projections in Pathway Model

Technology	Industry Projection Description
Electricity/Hydrogen	Industrial sites transition to electricity or hydrogen in 2035

Table 4-5: Industry Technology Projections in Pathway Model

Technology	Renewable Projection Description
Rooftop PV/ Ground-mount PV/ Onshore Wind	S-curve; uptake will increase as projects are supported by initiatives such as the LAEP, assumption that the DNO generation connection process improves

Table 4-6: Renewable Technology Projections in Pathway Model

4.2.3.2 Assumptions for 2050

The modelled net zero scenarios for 2050 were used to assume the split of technologies in the final year. These splits have been detailed in Appendix C – 2050 Scenario Technology Uptake Assumptions. The breakdown of heating technology splits for the domestic and non-domestic sub-sectors is also shown in Figure 4-7 and Figure 4-8 below.

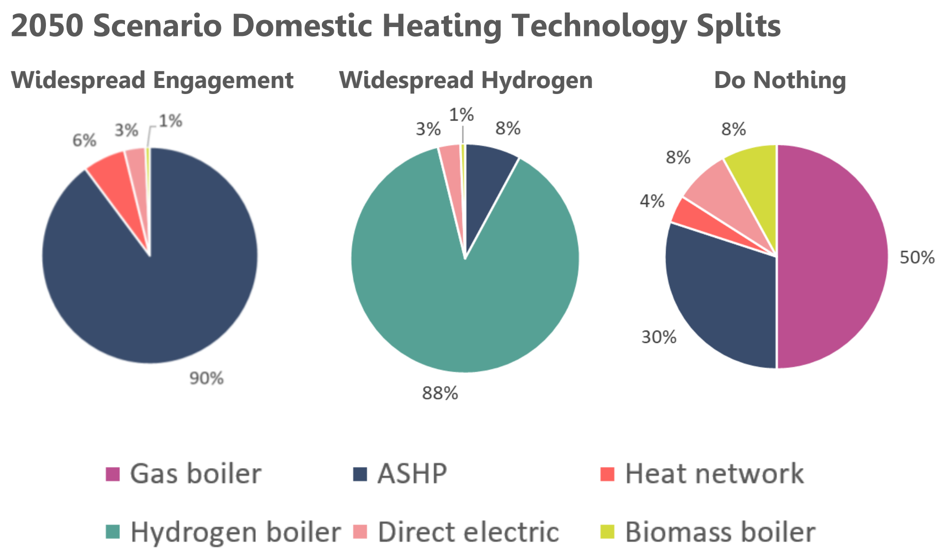


Figure 4-7: 2050 Scenario Domestic Heating Technology Splits

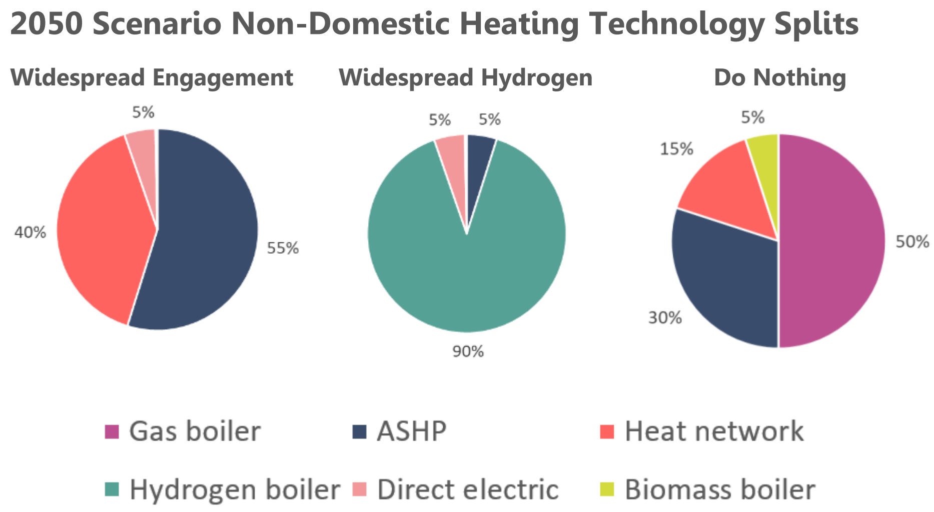


Figure 4-8: 2050 Scenario Non-Domestic Heating Technology Splits

To create a holistic view of the cost of the future energy system, and to compare the impacts of earlier adoption of decarbonisation, the calculations included costs from both low carbon technologies and fossil fuel technologies from the baseline until 2050. Costs were considered from a system-wide perspective, including all costs across the public and private sectors and cost to consumers.

Costing assumptions for CAPEX, operational expenditure (OPEX), replacement expenditure (REPEX), and fuel were used in a techno-economic model to compare the different scenarios. All assumptions used for the techno-economic model are shown in Appendix D – Techno-economic Model Costing Assumptions.

A discount rate of 3.5% is assumed for the model (62), in addition to a fixed annual inflation of 2.87% (63).

Fuel costs are taken from the UK government's Green Book (62) where available. The full list of references used for fuel costs is shown in Appendix E – Fuel Cost Assumptions.

4.2.4 Scenario Cost Benefit Analysis

A cost benefit analysis was carried out based on the modelled outputs to determine a preferred pathway. Table 4-7 below outlines the five primary themes that were analysed.

Analysis	Description
Carbon	Carbon emissions (kt CO_2e) were calculated for each pathway, to determine the rate of decarbonisation and the overall total carbon emitted. A pathway with lower total carbon emissions was deemed to be better.
System Cost	The overall cost of decarbonising the system under the given scenario was calculated. This includes investment costs incurred by the consumer, such as in purchasing a heat pump or EV, in addition to wider system costs such as the installation of EV charging points. Given the uncertainty of many future technologies, this analysis is most appropriately used to compare the relative costs of the scenarios. A lower relative cost indicates fewer financial barriers for meeting the pathway.
Health	The social costs on human health, productivity, well-being, and the environment caused by emissions was calculated following the Green Book's supplementary guidance (62). A cumulatively lower cost presents how decarbonisation is having a positive impact on well-being.
Job Creation	The number of temporary and permanent jobs created from each scenario was calculated following the Welsh Government's Regional Energy Strategies Technical Annex B: Economic Modelling (64). A greater number of jobs indicate a more significant economic opportunity in the scenario.
Consumer Bills	The cost to consumers regarding both investment in new technologies and bills was calculated to analyse which scenario would have the most positive effect on consumers. This relates to the wider impacts on an individual's finances and fuel poverty risk. Due to uncertainties around technology and fuel costs, this was given as a relative figure against a counterfactual instead of an absolute cost.

Table 4-7: Scenario Cost Benefit Analysis Themes

4.3 Net Zero Pathway Evaluation

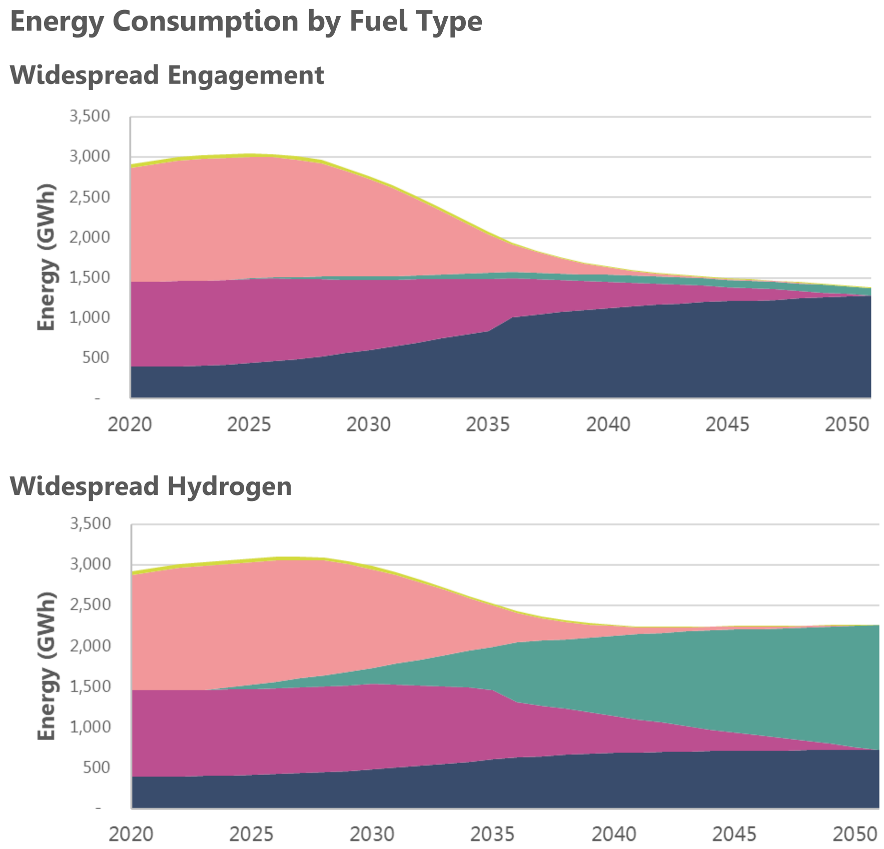
This section provides the analysis of the modelled scenarios, following the themes outlined in Table 4-7.

4.3.1 Energy Mix

The energy mix of the three scenarios from the present year to the net zero year of 2050 is shown in Figure 4-9 below. These figures highlight the change in fuel consumption over time across all sectors, predicated on technology changes such as the transition from gas boilers to heat pumps in Widespread Engagement, or to hydrogen boilers in Widespread Hydrogen. The gives a high-level view of the energy system across the different scenarios.

The Widespread Engagement scenario sees a transition predominantly to electricity, with electrification of building heating, transport and agricultural machinery. 20% of HGV and bus transport transitions to hydrogen, which represents the entire hydrogen demand in this scenario. This transition is already underway with hydrogen bus trials in both Neath Port Talbot and Swansea, which are being fuelled by green hydrogen (65). The overall decrease in energy consumption, and compared to the Widespread Hydrogen scenario, is primarily due to the high efficiency of heat pumps.

The Widespread Engagement scenario sees a transition predominantly to electricity, with electrification of building heating, transport and agricultural machinery. 20% of HGV and bus transport transitions to hydrogen, which represents the entire hydrogen demand in this scenario. This transition is already underway with hydrogen bus trials in both Neath Port Talbot and Swansea, which are being fuelled by green hydrogen (65). The overall decrease in energy consumption, and compared to the Widespread Hydrogen scenario, is primarily due to the high efficiency of heat pumps.



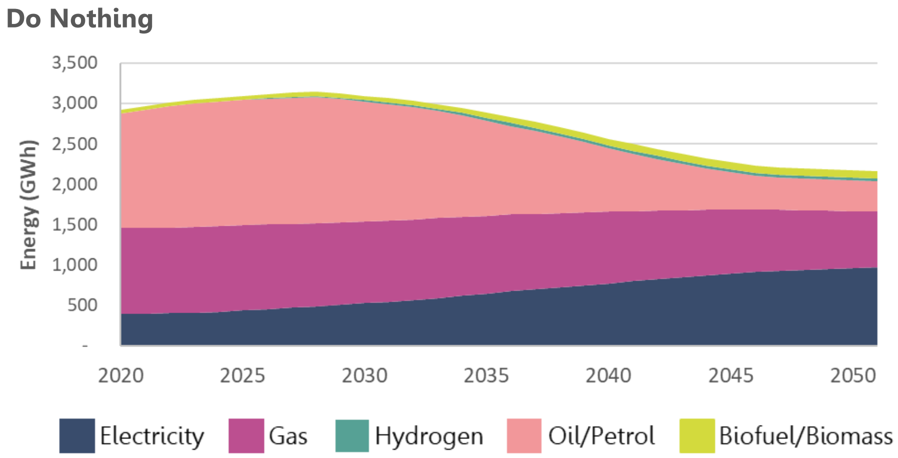


Figure 4-9: Energy Consumption in each Scenario's Pathway

The Widespread Hydrogen scenario has a more balanced transition towards electrification and hydrogen, with the majority of gas properties installing hydrogen boilers and off-gas grid areas moving to heat pumps. Buses, HGVs, and industry also transition to hydrogen.

Do Nothing sees a slower uptake of heat pumps and EVs as the respective bans on fossil fuels are put in place, with fossil fuels still being present in the energy mix in 2050.

4.3.2 Greenhouse Gas Emissions

The emissions impact of the pathways has been modelled based on CO_2e or carbon dioxide equivalent emissions. This quantifies all greenhouse emissions, not just those of CO_2. This is collectively referred to as carbon emissions.

As the transition away from fossil fuels occurs over the duration of the pathway, the quantity of carbon emissions released reduces until net zero is met in 2050. Although net zero is the main goal of most decarbonisation plans, the cumulative emissions and their impact should also be considered and opportunities to decarbonise earlier than 2050 should be prioritised. The impact of these cumulative emissions is presented in Section 4.3.4.

The decarbonisation of Neath Port Talbot's energy system is heavily dependent on the electricity grid decarbonising, which is targeted by 2035 through the deployment and connection of renewables across the UK. The Green Book (62) outlines the predicted grid carbon intensity up to 2100. The annual carbon emissions of the three pathways, and the grid carbon intensity are shown in Figure 4-10 below.

The decarbonisation trajectory of both net zero scenarios roughly follows that of the gas grid, with peak emissions occurring around 2026. Following this, extensive and accelerated decarbonisation occurs. Both scenarios are modelled to reach net zero by 2050. The Widespread Engagement scenario has a faster transition away from carbon emissions, as heat pump uptake is already underway and is predicted to accelerate. It is assumed that hydrogen and the required infrastructure will not be readily available until post 2030.

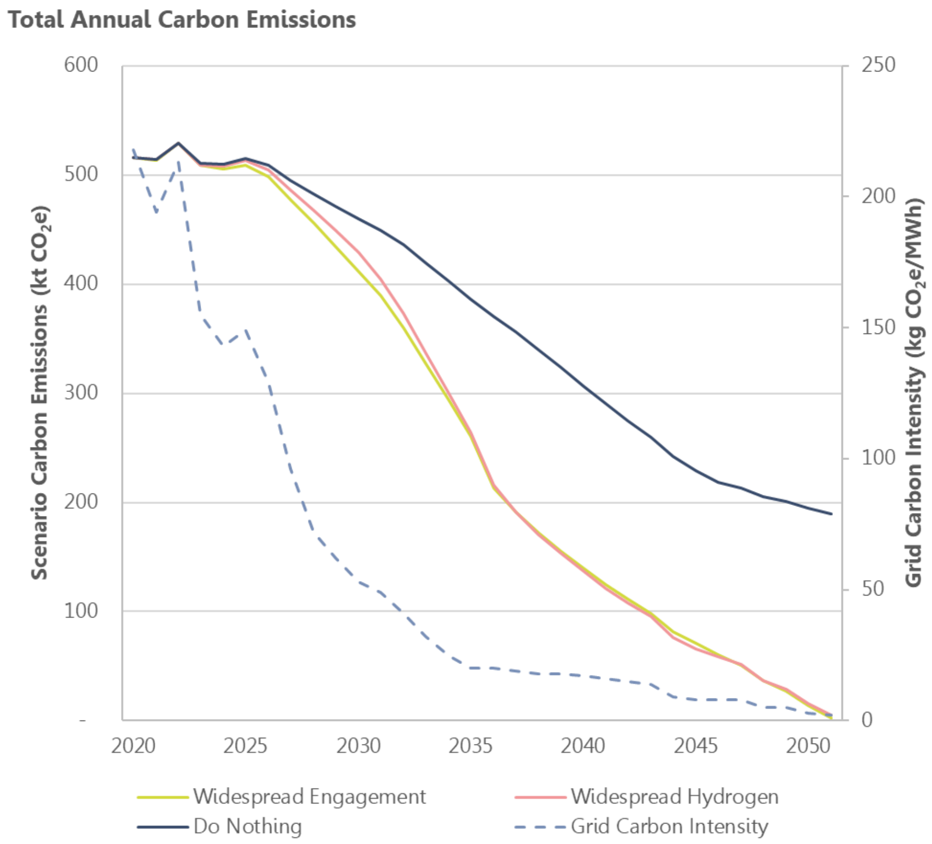


Figure 4-10: Carbon Emission Pathways of all Three Scenarios

However, fast deployment of hydrogen technologies will be required as soon as it is widely available as a fuel, both for technological reasons and to make up for the delay compared to electrification. This is particularly true for the gas grid where groups of buildings will need to transition to hydrogen in phases, therefore ensuring buildings are fully 'hydrogen ready' will need to happen quickly. This has been assumed, although the speed of this build out is not guaranteed. 'Do Nothing' does not reach net zero, as gas boilers and petrol vehicles are still used, and industry does not switch away from fossil fuels.

Between the baseline and final year, the Widespread Engagement and Widespread Hydrogen scenarios save ~3,300 kt CO_2e, and ~3,200 kt CO_2e respectively compared to the 'Do Nothing' scenario.

A limitation of this model is the assumption that hydrogen is generated using electrolysis with grid electricity at an efficiency of 70% (66), and therefore its carbon intensity is directly tied to that of the electricity grid. This is not a guarantee, as globally hydrogen is currently reliant on production through steam methane reforming, which is an emissions intensive process. Sufficient future capacity for zero carbon hydrogen to meet the global demand is uncertain and will depend on technological advances and market development. Should it take longer to establish a sufficient supply of low carbon hydrogen to Wales, the overall carbon emissions for the Widespread Hydrogen scenario would be higher.

The sub-sector breakdown of the carbon emissions trajectories is shown in Figure 4-11 below.

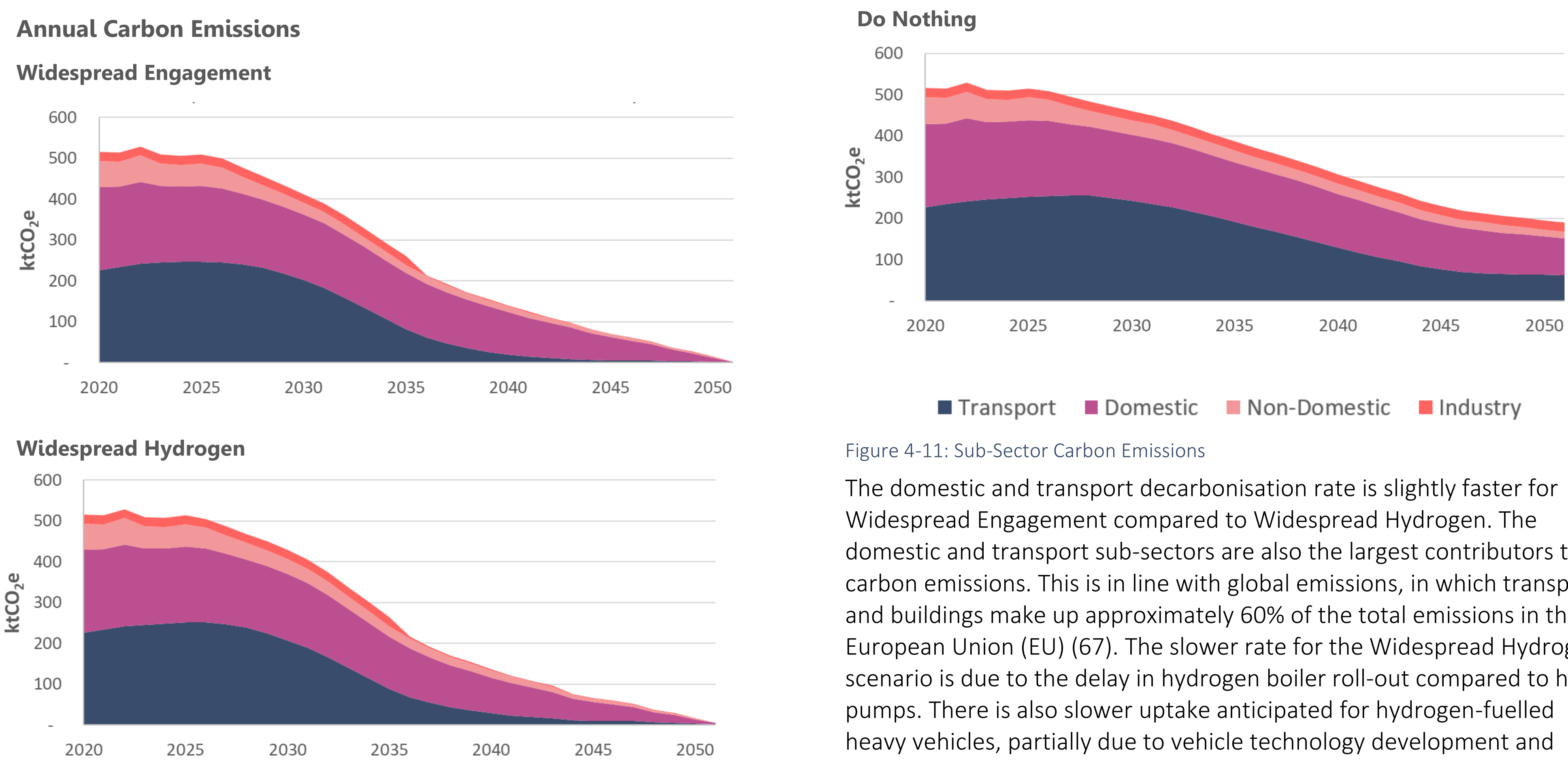


Figure 4-11: Sub-Sector Carbon Emissions

The domestic and transport decarbonisation rate is slightly faster for Widespread Engagement compared to Widespread Hydrogen. The domestic and transport sub-sectors are also the largest contributors to carbon emissions. This is in line with global emissions, in which transport and buildings make up approximately 60% of the total emissions in the European Union (EU) (67). The slower rate for the Widespread Hydrogen scenario is due to the delay in hydrogen boiler roll-out compared to heat pumps. There is also slower uptake anticipated for hydrogen-fuelled heavy vehicles, partially due to vehicle technology development and supply of adequate low carbon hydrogen.

4.3.3 System Cost

The cumulative cost of the three pathways is shown in Figure 4-12 below.

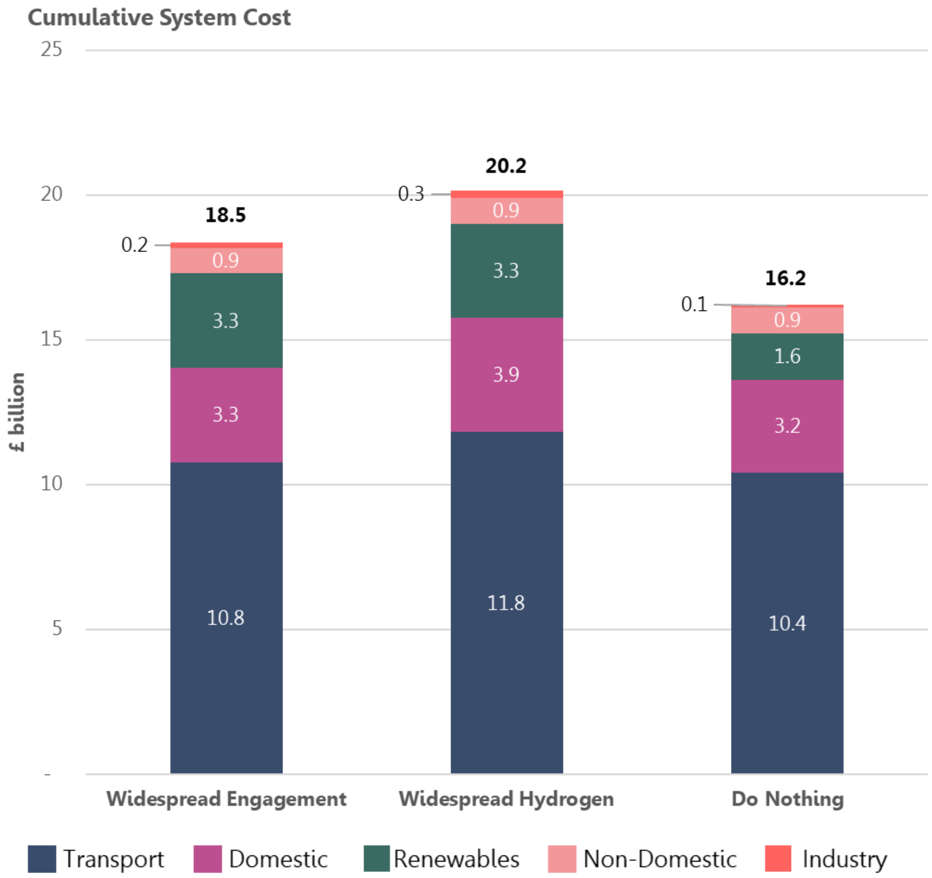


Figure 4-12: Cumulative System Cost of the Pathways by Sub-Sector

These costs represent the total system cost, and therefore include both fossil fuel and low carbon technologies during the transition period up to 2050 and the cost incurred to both the public and private sectors. Overall, the cost of the Widespread Hydrogen scenario is ~9% higher than the Widespread Engagement scenario. This is the trend across most sectors and is mostly driven by the higher cost of hydrogen fuel and the earlier state of development of hydrogen technology, increasing the CAPEX. Both net zero scenarios are more expensive than the counterfactual, highlighting the need for grants, funding and strategic planning to most effectively decarbonise. It must be highlighted that these costs are highly uncertain, as the price variations of the different technologies and fuels are challenging to predict, and are influenced by a multitude of variables.

Transport has the largest cost which is largely made up of the cost of new cars and buses due to the high volume in Neath Port Talbot. The 'Do Nothing' scenario also has high costs for transport, due to the similarly high uptake of EVs and the investment required for the charging infrastructure ahead of the transition happening.

Low carbon HGVs are considerably more expensive than the fossil fuel equivalents, particularly for hydrogen vehicles, but as the volumes are much lower than cars, buses, and LGVs this is not significant in the overall costs. Note that the cost of vehicles does not account for secondary markets of EVs, which will significantly reduce costs for consumers.

The cost of the domestic sector in the Widespread Hydrogen scenario is ~8% higher than that of the Widespread Engagement scenario, which is largely due to the cost of hydrogen fuel being higher than that of electricity. Hydrogen boilers are predicted to be cheaper than heat pumps, even including the internal retrofitting required inside each building; however, the ongoing running costs offsets the saving on initial investment.

Note that the price associated with industry is only based on fuel consumption and does not account for the transition to new equipment. The transition is likely to be unique and therefore costs hold a high level of uncertainty. Likewise, the cost associated with upgrading the electricity grid, decommissioning the gas grid, or constructing a hydrogen network are not considered, as there is too much uncertainty surrounding these variables and how the cost of them would be covered.

4.3.4 Health

Decarbonisation improves air quality due to the reduction in harmful emissions such as NO_x and particulate matter. This benefit can be quantitatively assessed following the Green Book's supplementary guidance (62), which measures the social cost on human health, productivity, well-being, and the environment due to emissions. A cumulatively lower cost presents how decarbonisation is having a positive impact on well-being. The cost of air quality damages for the three pathways are shown in Figure 4-13 below.

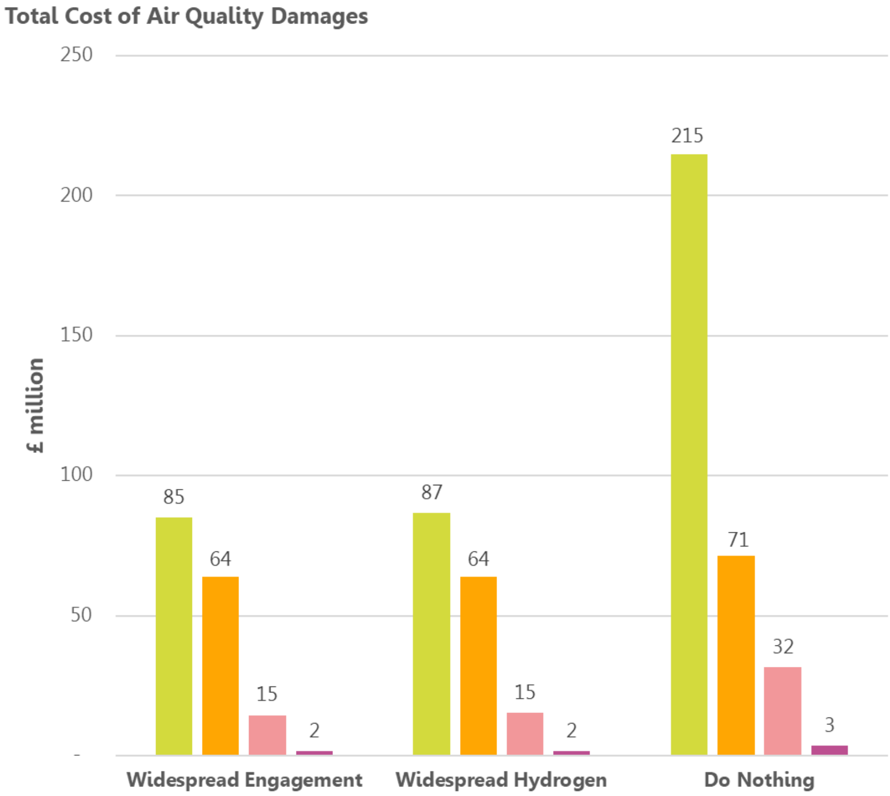


Figure 4-13: Cumulative Air Quality Damages of the Pathways by Sub-Sector

The domestic sector is the largest contributor to air quality damages – note that this is because the Tata Steelworks has been separated from this analysis. The impact of the Steelworks is shown in Figure 4-14. Gas, oil and biomass all produce harmful emissions locally during combustion and these results reflect the large number of boilers across Neath Port Talbot. As the 'Do Nothing' scenario is slower to transition away from boilers, the cumulative damages are far greater. This is a clear co-benefit of decarbonisation; a faster transition will result in lower health risks. However, as biomass boilers are likely to be used in a net zero future and their air quality impact is very variable, they should not be recommended for more urban areas.

The air quality damage savings in the transport sub-sector is less impactful, as the 'Do Nothing' scenario transitions towards EVs, albeit at a slower rate. These outputs highlight the importance of the future gas and oil boiler ban for existing homes and the Future Homes Standards for new builds, as the emissions they generate in urban areas is detrimental to human health and the environment.

Overall, Widespread Engagement saves £150mn worth of air quality damages compared to 'Do Nothing', which is equivalent to a 50% reduction.

Figure 4-14 presents the air quality cost of Port Talbot Steelworks in relation to the rest of the local authority. The figure presents the projected air quality cost through to 2050 if the Steelworks continued to use majority coal and some gas. It also presents the reduced cost if the Steelworks successfully decarbonises (as proposed, through electrification) by 2035, and presents the relative emissions across all other sectors in Neath Port Talbot under the 'Do Nothing' scenario. This presents the significant scale of emissions from the Steelworks which dwarfs any other sectors and the risk that poses to local health due to air quality. It highlights the importance of the Steelwork's decarbonisation for the local area, beyond just achieving net zero.

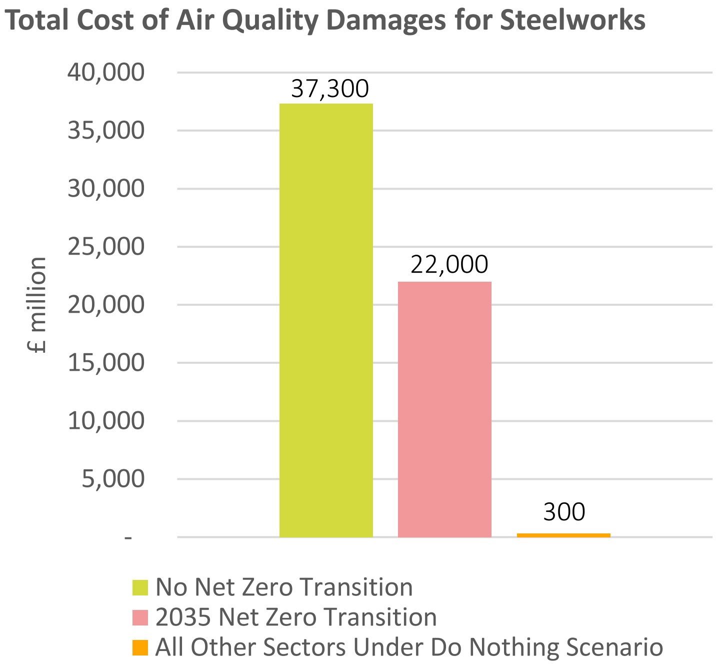


Figure 4-14: Cumulative Air Quality Damages of Port Talbot Steelworks Compared to the Rest of Neath Port Talbot

4.3.5 Job Creation

The net number of temporary and permanent jobs generated from each pathway is shown in Figure 4-15 and Figure 4-16 below.

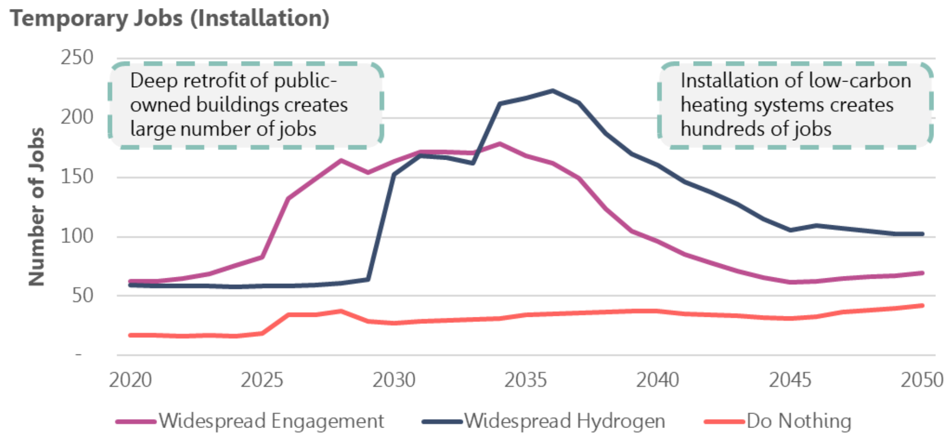


Figure 4-15: Temporary Installation Jobs Created in each Pathway

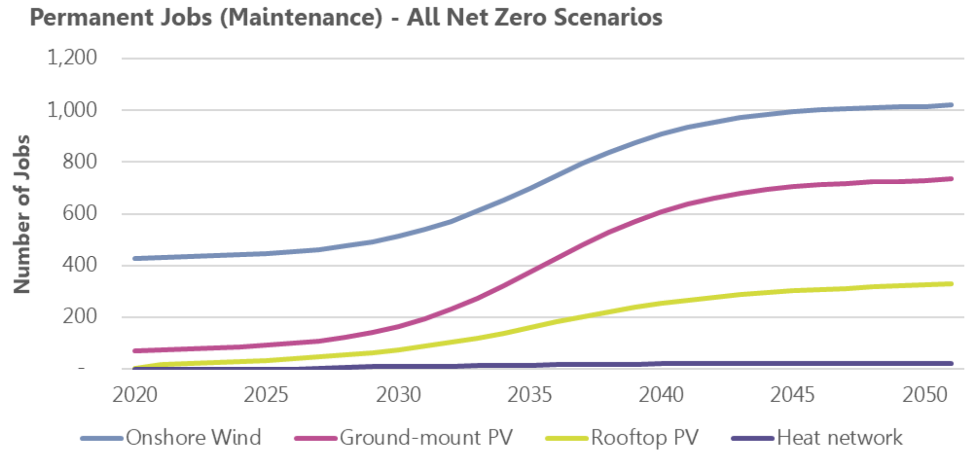


Figure 4-16: Permanent Maintenance Jobs Created from the Net Zero Pathways (Widespread Engagement & Widespread Hydrogen)

The large number of temporary jobs between 2020 and 2030 are due to the targeted deep retrofitting of public sector buildings and registered social landlords (RSLs). Deep retrofit is a highly skilled process which can provide threefold heat savings compared to shallow retrofit; therefore, requiring significantly more installation workers. Following guidance from the Welsh Government's Regional Energy Strategies Technical Annex B: Economic Modelling (64), the large cost of deep retrofit generates a proportionately large number of employment opportunities.

The remaining temporary jobs are associated with the installation of low carbon heating technologies such as heat pumps and hydrogen boilers. Internal building pipework and domestic appliances will also need to be retrofitted to be suitable for hydrogen, which will further generate jobs.

This presents a significant opportunity to upskill those currently working in the installation of fossil fuel heating systems to adapt to the decarbonised market.

Neath Port Talbot has a modest potential for renewables; and as such, there is an opportunity for an increase in permanent employment in this sector. Onshore wind is shown to already be mostly saturated in the region; however, there is considerable potential for both ground-mount and rooftop PV. Permanent jobs are associated with the maintenance and upkeep of PV arrays, wind turbines, and heat networks. The findings suggest that should Neath Port Talbot fully develop their renewable potential, up to 2,000 new jobs would be created in the net zero scenarios.

4.3.6 Consumer Bills

4.3.6.1 Investment and Bills

The impact on consumer bills from different heating technologies was investigated across a variety of technology combinations to explore the impact on both initial investment and fuel costs. Due to the uncertainties around future energy costs this is intended to be an indicative magnitude change relative to the counterfactual, rather than an absolute value.

Figure 4-17 below shows the cumulative savings that each archetype would make against a counterfactual gas boiler property with no retrofit. These savings include the initial investment CAPEX for each technology, in addition to the operational and fuel costs for the 30-year period until 2050. Any archetype with a positive saving would therefore have a payback period within the 30-year pathway, whereas any archetype with a negative saving would mean consumers are paying more than the current standard. This was used to understand the potential financial implications for consumers.

Shallow retrofit, which represents the average need for measures such as loft and cavity wall insulation across the building stock, was shown to save consumers with a gas boiler just 2% over the 30-year period. When paired with an ASHP however, the saving was far more at 10%. This presents how key retrofit will be with heat pump roll-out. Shallow retrofit can offer significant wider benefits in terms of comfort and health, with minimal disruption.

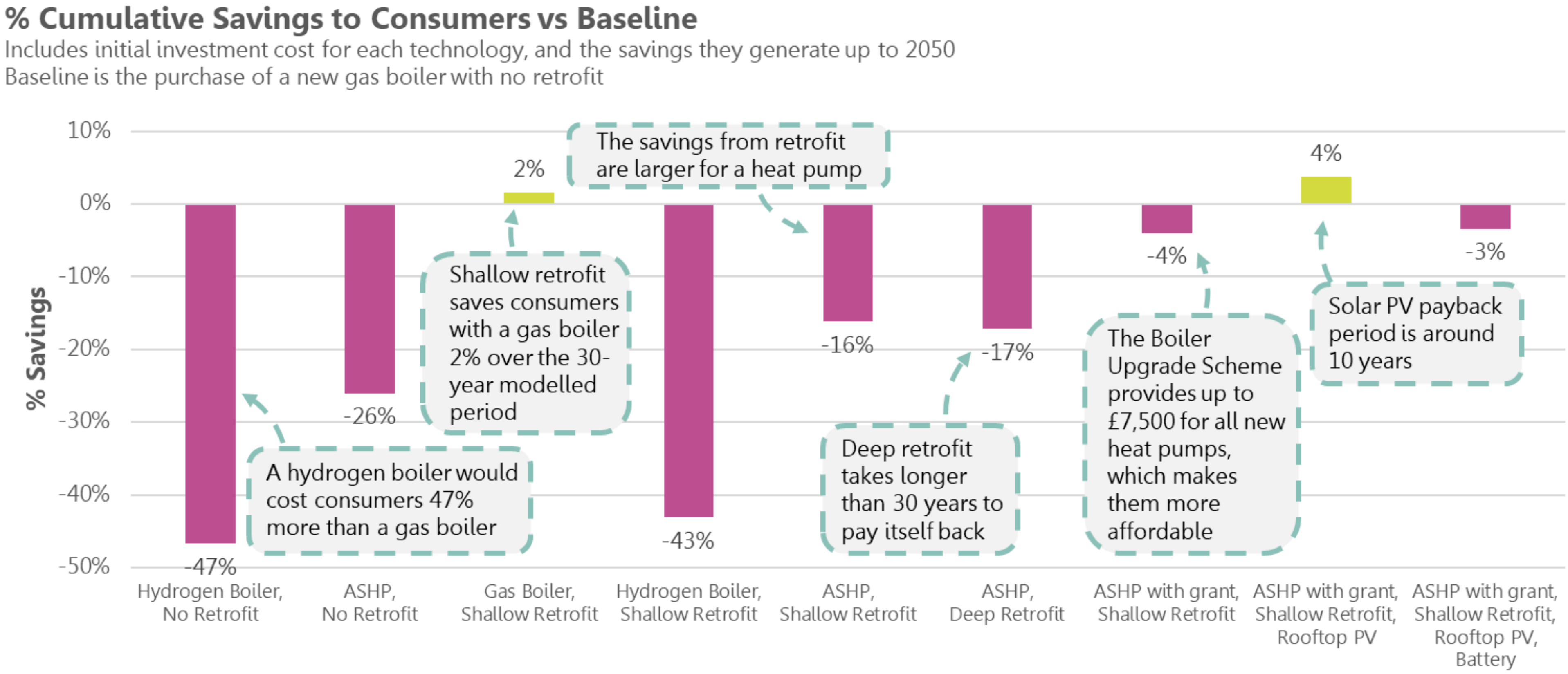


Figure 4-17: Cumulative Consumer Bills Savings Including Initial Investment Cost for Each Technology

Hydrogen boilers are expensive for consumers due to the projected high cost of hydrogen, which is considerably more expensive than electricity or gas. Initial installation of hydrogen boilers, which includes the cost of retrofitting building pipes and hydrogen appliances, could be subsidised, and technological advances may enable a decrease in hydrogen fuel cost. Without this, Widespread Hydrogen would have a negative impact on consumer bills and poses a significant risk to increase fuel poverty.

Though the initial investment cost of a heat pump without grant funding is more than that of an initial hydrogen boiler installation, the expected decrease in electricity price makes it more affordable in the long run. With the current funding available for heat pumps, the initial investment cost is significantly lower than for a hydrogen boiler. Nevertheless, without funding, heat pumps are still a technological barrier for many households which cannot afford the initial investment, or the higher short-term fuel costs. The BUS, paired with shallow retrofit, makes the long-term investment close to parity to the counterfactual. The BUS provides up to £7,500 off a new heat pump, which makes the initial CAPEX more accessible, and shortens the payback period.

Combining the above scenario with rooftop PV provides the archetype with positive savings over the counterfactual, due to PVs high return on investment, which pays itself back in around ten years. The initial investment into this archetype is significant however, requiring an additional £3,000 in the starting year.

The integration of home energy storage such as a battery is complementary to the electrification of heating and the installation of solar PV. For PV generation, it enables the storage of excess solar energy generated during the day for use at night, enhancing energy independence and maximising generation.

Batteries also enable the shifting of energy use to times of lower overall grid demand. This process, also known as DSR can collectively shift demand away from peak times to help to reduce congestion on the electricity grid. Increasingly, energy providers are offering more competitive deals for demand shifting (where a consumer chooses to use energy outside of peak times), including the use of specific hourly tariffs for services such as flexible EV charging. This may involve a consumer allowing a smart system to control the charging time between set hours in response to an energy price signal. Long-term, this can offer significant savings for the consumer. As this is an evolving concept, this has not been considered in the modelling.

In the modelled scenario however, the battery system is not financially rewarding for consumers. This is partially due to the forecasted drop in future electricity prices (62) which decreases the financial benefit of self-generated electricity, and the omission of flexible or variable energy tariffs. As a result, the high CAPEX investment of a battery, which on average is around £4,500 (68), does not model to pay itself back. As battery technology develops, they are expected to become cheaper. Combined with the increasing introduction of smart tariffs and market reaction to any significant change in electricity prices this outcome would be more positive. It is recognised the high-level modelling in this LAEP may not be complex enough to truly capture the future potential benefit.

4.3.6.2 Only Bills

Figure 4-18 presents the difference in annual energy bills in the year 2050 for the different archetypes without consideration of the initial investment. This provides a perspective without the uncertainty of cost of technologies in the future or availability of grants or funding.

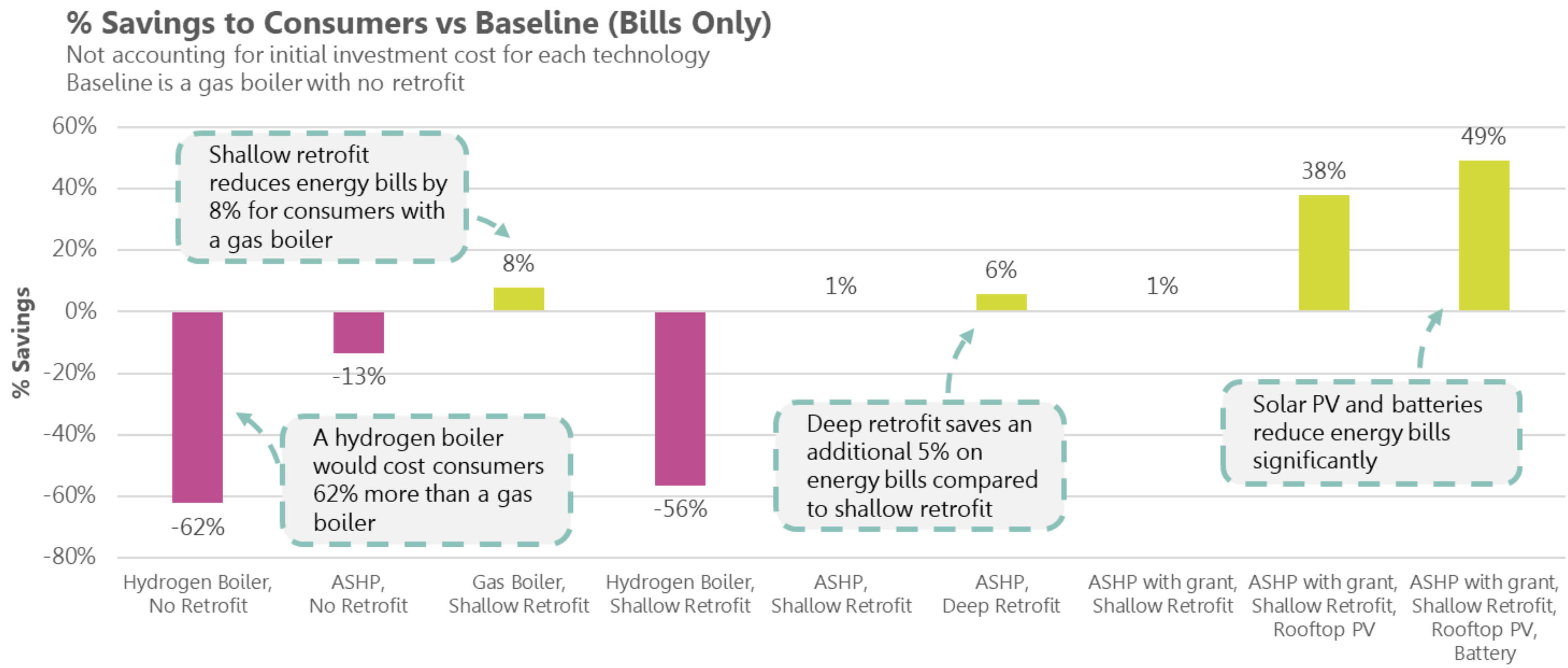


Figure 4-18: Annual Consumer Bills Savings in 2050

This view highlights the advantage of installing rooftop PV and a battery, which when combined with a heat pump and shallow retrofit can provide bill savings of 40% relative to the counterfactual. Switching to an ASHP with no additional retrofit or PV system could be the reality for many households, and in this modelling, it presents a higher bill cost than a gas boiler counterfactual. This highlights the challenges posed by the large discrepancy between the cost of gas and electricity. There are increasing numbers of proposals to tackle the key differences, such as electricity being subject to carbon taxes and electricity bills tending to host wider policy costs, neither of which are applied to gas.

Overall, this analysis suggests that under a Widespread Engagement scenario, consumers bills could be close to parity if not an improvement on the counterfactual. Under a Widespread Hydrogen scenario however consumers could expect higher prices and a lot of uncertainty as the global market for hydrogen forms. It would be expected that in the long-term, the market would adapt and push down the cost of hydrogen; however, the timescales on this are unknown and are an inherent risk.

4.3.7 Selecting a Preferred Pathway

A RAG analysis of the three scenarios against each of the five analysed themes is provided in Table 4-8. This was used to compare the three scenarios and determine which of the two main scenarios provided a preferred pathway to reach a net zero energy system. This was based on the evidence gathered from the modelling as well as consideration of stakeholder engagement and the policy and technical challenges surrounding both scenarios. Whilst a preferred pathway is selected, it is recognised that many uncertainties remain and the LAEP should continue to evolve over time to adapt to any major changes which could impact this decision. Likewise, the Action Plan has been developed with consideration of this uncertainty, and the actions reflect the need to be able to adapt and prepare for different eventualities.

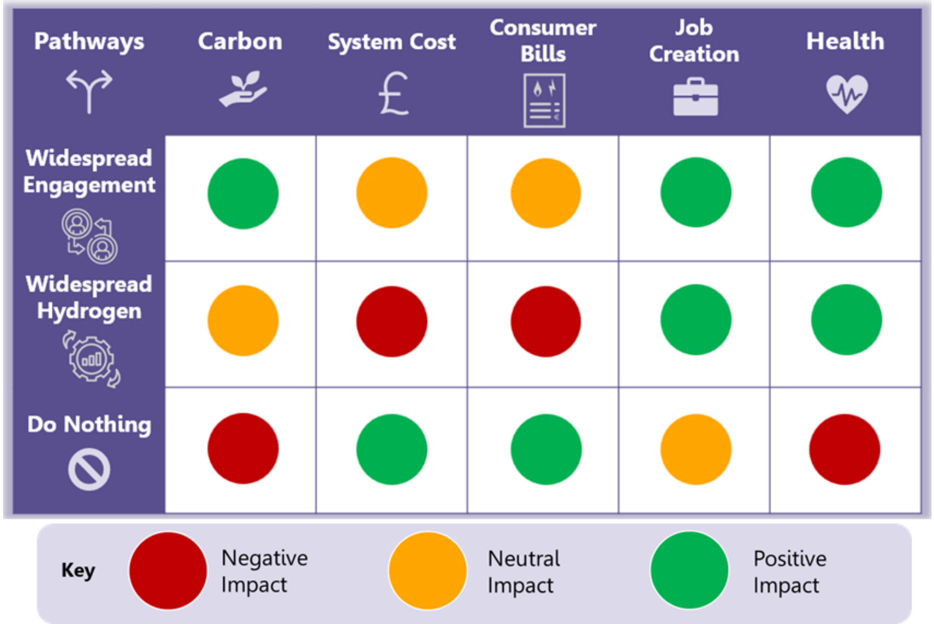


Table 4-8: RAG Analysis of the Three Scenarios against the Five Themes

The Widespread Engagement scenario has significant advantages over the Widespread Hydrogen scenario and has been selected as the preferred pathway. This includes but is not limited to:

- Over 100 kt CO_2e additional carbon savings
- 9.5% lower system cost
- £2mn savings in air quality damages (note this doesn't include the Steelworks)
- Considerable consumer bill savings using heat pumps instead of hydrogen boilers

The most significant difference between these scenarios is the use of hydrogen for heating, and these outcomes highlight the risk that this solution could present in terms of system cost, cost to consumer and delay in emissions saving. Electrification for heating is therefore the primary recommendation, although the action plan has been developed to support the progression of the use of hydrogen, and prepare for the ultimate decision from the UK government.

This also does not intend to soften the extent of the challenge faced through mass electrification. Extensive grid reinforcement will be required. Connection delays are currently restricting renewable development with substantial reform planned to overhaul the current connection application process, and the cost of decommissioning the gas grid is currently estimated to be significant.

The interventions discussed in Section 5 and the actions in Section 6 have therefore been predominately based on the Widespread Engagement scenario. However, it is recognised throughout that hydrogen will still play a vital role in the future energy mix, notably in industry. The decision on hydrogen for heating ultimately lies with the UK government and councils must be prepared for either eventuality.

4.3.8 Sensitivity

A sensitivity analysis was conducted on three variables:

- Retrofit: the assumed % energy savings from retrofit measures was analysed, as consumers may choose to heat their home to a higher temperature once energy efficiency is improved, otherwise known as comfort taking
- Grant funding: the availability of the BUS is analysed, to determine its significance on the investment requirements of consumers
- Fuel cost: the price of electricity and hydrogen were varied to assess its effect on consumers and the overall system cost

4.3.8.1 Retrofit / Comfort Taking

Comfort taking is the result of consumers sacrificing some of the savings from their efficiency improvements to heat their homes to higher comfort levels. This means the modelled energy efficiency gains from retrofit is slightly overestimated. To account for comfort taking, the total energy savings were reduced by 15%. The impact of comfort taking on consumer bills (including the initial CAPEX cost for retrofit) is shown in Figure 4-19 below. The value is relative to the counterfactual scenario of a building with a gas boiler and no retrofit.

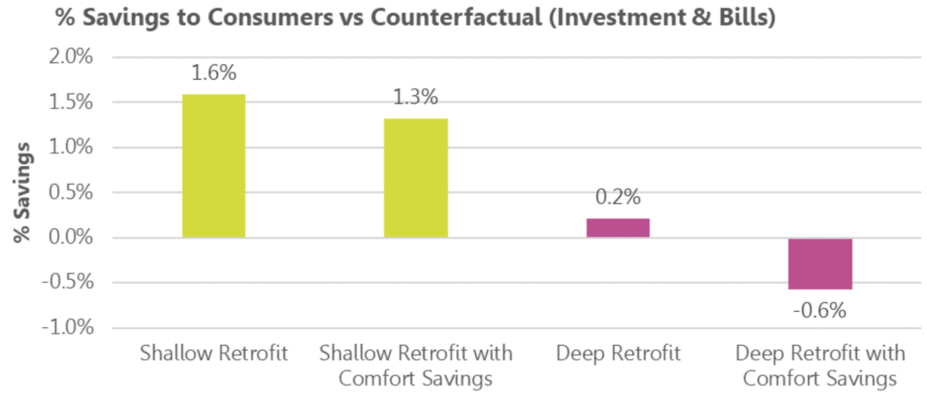


Figure 4-19: Comfort Taking Sensitivity on Consumer Bills

The savings to consumers for shallow retrofitting decreases from 1.6% to 1.3%, when accounting for comfort taking. The additional expense of deep retrofitting increases from 0.2% to 0.6%. Deep retrofitting is considerably more expensive than shallow retrofitting, meaning the payback period is longer (30 years, vs 4 years).

The increased heating due to comfort takings also increases carbon emissions; the cumulative emissions from buildings in the Widespread Engagement scenario over the 30-year period increases by ~20 kt CO_2e, which is equivalent to an increase of 0.44%. This is not a considerable amount, highlighting how comfort takings are a minor consideration.

Although comfort takings are expected to reduce financial savings of retrofit, and increase carbon emissions, its sensitivity on these variables is minor.

4.3.8.2 Grant Funding

The BUS provides up to £7,500 grant funding towards a heat pump. The funding for this scheme is confirmed until 31 March 2028, meaning the UK Government could choose to stop or reduce funding towards it after this date. Section 4.3.6 investigated the financial effect of a household with and without the grant funding, showing its importance for consumers. Figure 4-20 below shows the effect of the availability of funding on consumer bills over the 30-year modelled period. This is the same effect as a varying heat pump CAPEX. The % savings are relative to a gas boiler.

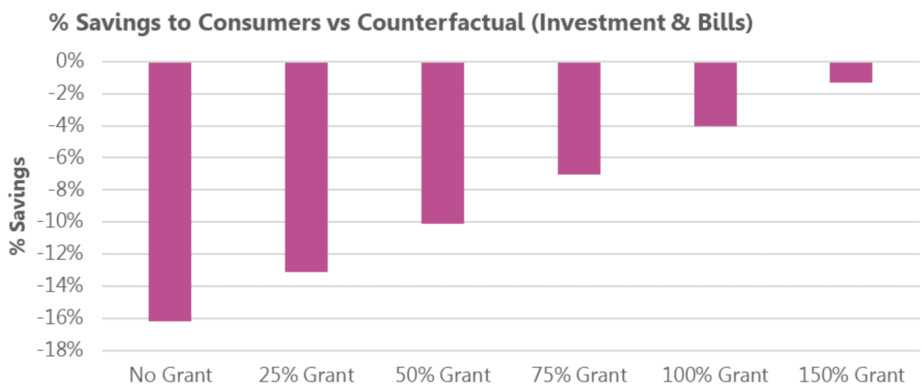


Figure 4-20: Boiler Upgrade Scheme Funding Sensitivity on Consumer Bills

The BUS has a significant impact on the financial viability of heat pumps for domestic consumers. A grant of 150% represents funding that is sufficient to offset the entire capital cost of a heat pump. This highlights how the difference in gas and electricity prices over the 30-year period decreases substantially, and the high efficiency of a heat pump compared to a gas boiler further reduces the effect of this disparity.

Overall, this highlights the importance of future funding streams after the current end date of the BUS of 31 March 2028, or a significant decrease in heat pump prices to ensure the net zero 2050 target is met without financial pressure on consumers.

4.3.8.3 Fuel Cost

The most significant expected sensitivity is that of fuel costs; the cumulative fuel cost for the Widespread Engagement and Widespread Hydrogen scenario is ~£4.5 bn and ~£6 bn respectively, across all sub-sectors. The Green Book (62) contains price projections for many fuels, including gas, electricity, and petrol – these were used in the model for the scenario evaluation. The BEIS Hydrogen Production Costs 2021 Annex (69) was used to project hydrogen prices. As observed in recent years, fuel prices are heavily influenced by global political affairs, which cannot be accounted for in these projections. The effect of an increase and decrease in the price of electricity and hydrogen was therefore investigated, to assess the sensitivity of these parameters.

Figure 4-21 below shows the effect of a varying price of electricity and hydrogen on consumer energy bills across the 30-year modelled period, including initial investment costs. The values represent typical household archetypes with a hydrogen boiler or a heat pump, with shallow retrofit, relative to the counterfactual of a gas boiler without retrofit.

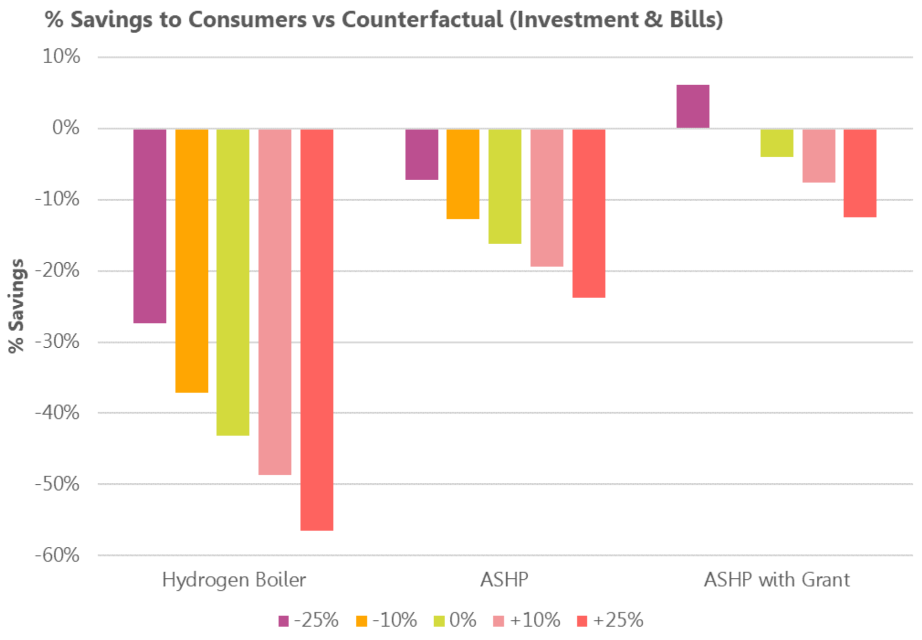


Figure 4-21: Hydrogen and Electricity Fuel Price Sensitivity on Consumer Bills

Notwithstanding CAPEX costs for the heating technologies, a 10% change in the price of electricity causes a change of 5% in the energy bills of a heat pump in 2050, relative to a gas boiler. A 10% change in the price of hydrogen causes a change of 8% in the energy bills of a hydrogen boiler in 2050, relative to a gas boiler. Given the price of electricity increased more than fourfold (400%) following COVID (70), this demonstrates how the effect on consumers can be largely determined by unpredictable external factors. In this case, the price increase occurred as most electricity is generated by gas, which increased in price itself. Nevertheless, given current predictions for the reduction in electricity prices due to the transition towards cheaper generation technologies (wind and solar PV), heat pumps are expected to maintain approximate parity with gas boilers from a consumer bills perspective. This is the case even with fluctuations of up to 25% in the price of electricity. The viability of hydrogen boilers is more sensitive to the price of hydrogen due to its relatively higher fuel cost; although even a large decrease of up to 25% in its cost does not make it more financially viable than a heat pump without grant funding.

Figure 4-22 and Figure 4-23 below show the effect of hydrogen and electricity fuel price on the cumulative system cost as outlined in Section 4.3.3.

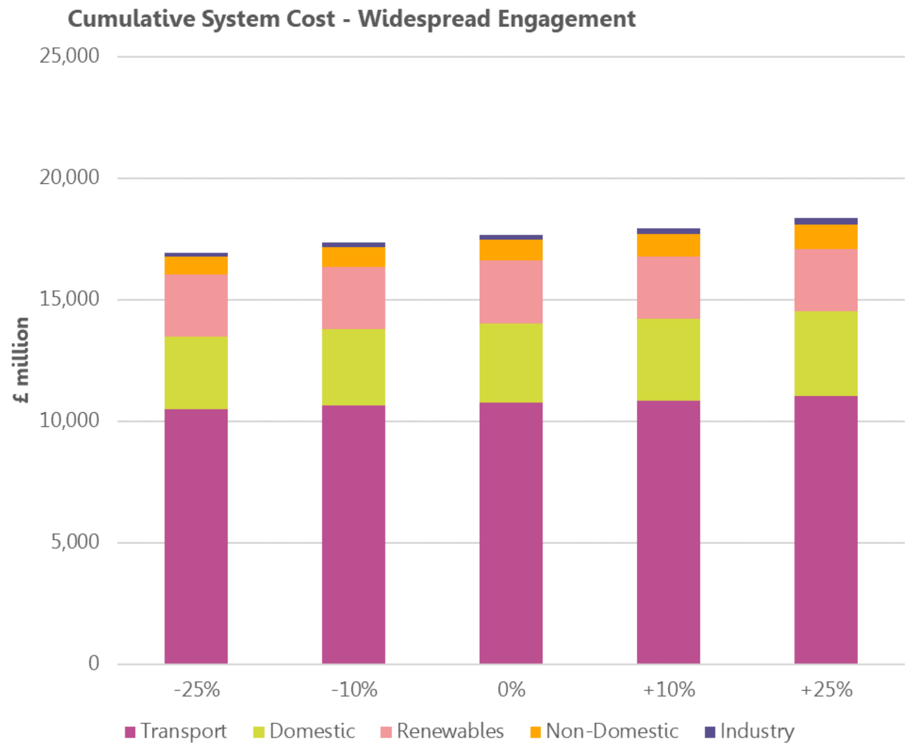


Figure 4-22: Hydrogen and Electricity Fuel Price Sensitivity on Widespread Engagement Cumulative System Cost

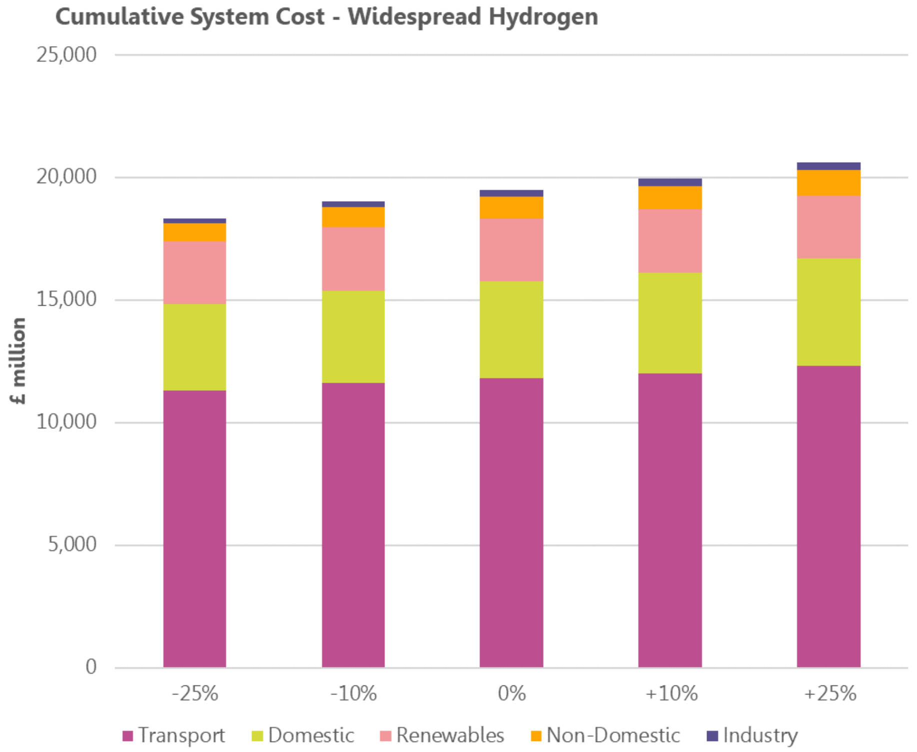


Figure 4-23: Hydrogen and Electricity Fuel Price Sensitivity on Widespread Hydrogen Cumulative System Cost

The effect of electricity and hydrogen fuel prices on the overall system cost is less substantial, as they form a smaller proportion of the total cost. In both scenarios, the cost of fuels accounts for approximately 25% of the overall system cost. The cost of transformation from a system perspective is therefore less sensitive to fuel costs, and would instead be more sensitive to capital investment costs.

5 Intervention Areas

The pathway modelling identified the requirement for interventions across the energy system to achieve net zero by 2050. This has been analysed in detail for each of the sectors against key assessment factors: emissions saving potential, indicative cost and energy reduction. This section discusses the interventions across each of the sectors in more detail, under the Widespread Engagement scenario. Maps are presented for each sector which show the total intervention need for each substation area. Locations in these represent the entire area and therefore are indicative only. Where relevant, this has been supplemented with further spatial information to provide insight into each zone.

The recommendations for interventions were partially developed during the action plan workshops, working with expert stakeholders to understand what was feasible and most beneficial for the local area, whilst considering wider factors such as supply chain and local skills.

Focus Zones have also been identified for each intervention area. These are areas across the local authority where an intervention is particularly suitable or could be prioritised and therefore the area is identified as a key location to target delivery and maximise impact. These zones are considered to be 'low regrets', where intervention action would be recommended regardless of the chosen pathway or wider uncertainties. When finalising these Focus Zones following this initial report, wider considerations should be included, such as:

- Extent of fuel poverty or socio-economic vulnerability
- Existing plans for programmes of work
- Eligibility for funding which should be capitalised
- Opportunity for strategic roll out due to specific characteristics such as types of building
- Support from wider stakeholders, such as areas which could be impacted by HyLine Cymru

Depending on data suitability and type of zone, Focus Zones have either been represented on an LSOA level (for ease of spatial referencing) or as indicative point locations. However, it would be recommended to review each individual Focus Zone in detail before finalising the spatial extent.

5.1 Energy Efficiency in Buildings

Domestic buildings are responsible for around a third of Neath Port Talbot's energy demand and will be a key target for decarbonisation. In this LAEP, both domestic and non-domestic buildings are considered across two intervention areas: fabric retrofit and heating. Although the detail of these interventions is given separately, they are complementary interventions and should be targeted as a package.

5.1.1 Measure Overview

Fabric retrofit of buildings is the process of improving the insulation to increase thermal efficiency. It has multiple benefits including:

- Energy bill savings
- Reduced carbon (for high carbon heating) or demand on the electricity grid (for low carbon heating)
- Improved efficiency of heat pumps (which operate better when supplying lower output temperatures)
- Substantial health benefits due to reduced fuel poverty, air quality and thermal comfort for the occupier.

5.1.1.1 Domestic Buildings

Almost two thirds of the buildings in Neath Port Talbot have an EPC of D or below, highlighting the need to improve overall energy efficiency.

The potential for domestic retrofitting was modelled across the building stock using EPC data where available to analyse the existing fabric of each building. This informed the building's characteristics such as age and build type, and for some specific attributes e.g. if a building has cavity walls and therefore is suitable for cavity wall insulation. This data was used to assess which buildings could receive each retrofit measure and identify where buildings may need more bespoke or extensive measures.

Shallow:
Measures which payback within 10 years and offer high energy savings for relatively low cost.

Deep:
Longer payback, higher upfront investment.
(e.g. internal/external wall insulation, double/triple glazing, underfloor insulation)

Recommended as a minimum for all of Neath Port Talbot's building stock, where suitable.

Recommended for 20% of buildings: all public buildings (by 2030) and some privately owned buildings.

Figure 5-1: Domestic Retrofit Assumptions across Neath Port Talbot

Recommendations around retrofitting of buildings are constantly evolving. Retrofit implementation should be considered on an individual building level to ensure measures do not result in additional issues such as rising damp or reduced ventilation. The modelling provided here is an overview of the building stock and provides a broad average of suitable measures and the resulting impact on efficiency and total cost. It is recognised that not all buildings will be able to receive these measures (such as listed buildings, or traditional build types) and this is accounted for in the analysis. For these buildings, it would be recommended to undertake a specialised retrofit study and plan.

To assess the extent of the demand, retrofit measures were separated into two categories, shallow and deep. This was decided based on the ease of the intervention (the level of disruption to the building owner), combined with the payback period (how quickly the energy savings repay the investment cost).

Shallow retrofit includes measures where payback is less than 10 years, and disruption is low, e.g. loft insulation and cavity wall insulation. These are seen as effective measures which have a relatively low capital investment compared to the thermal improvement to the building. Therefore, shallow retrofit is recommended to be applied to all buildings in Neath Port Talbot which are suitable. Shallow retrofit may also be key for buildings with heat pumps, which have significantly improved efficiency when able to run at lower temperatures. The overall efficiency is a factor of age, building type and type of radiators or underfloor heating.

Deep retrofit has much higher upfront costs and payback period, but also has a much higher impact on energy savings. This includes measures such as internal or external wall insulation and double/triple glazing. Technological developments mean newer ASHPs can operate effectively without deep retrofit (71). Some building owners may have a preference to deep retrofit; however it is not financially viable to assume all households should need to, without significant retrofit funding.

As a result, the use of deep retrofit should be strategic and targeted at particularly low efficiency buildings and for its wider benefits on comfort, fuel poverty and health. Therefore, deep retrofit has been assumed for 20% of buildings, which includes social housing, public buildings and a minority of building owners. This figure is considered achievable given the typologies specified; nevertheless, grant funding or other incentives would help meet this target, by increasing the number of domestic building owners that choose to deep retrofit.

5.1.1.2 Non-Domestic Buildings

The potential for non-domestic retrofitting is less certain due to the variability of non-domestic buildings. Retrofitting also covers heating, cooling and electricity efficiency measures.

Literature reviews informed the retrofit potential (percent energy saved) and cost for different retrofit measures and these were applied as appropriate to different non-domestic building use types (such as commercial, warehouses, offices etc). Assumptions were also made around the average eligibility of a given building type. For this reason, figures provided presenting the number of non-domestic buildings suitable for retrofit are high level estimates used to indicate scale of action required. These have therefore have not been disaggregated to shallow and deep for the outputs.

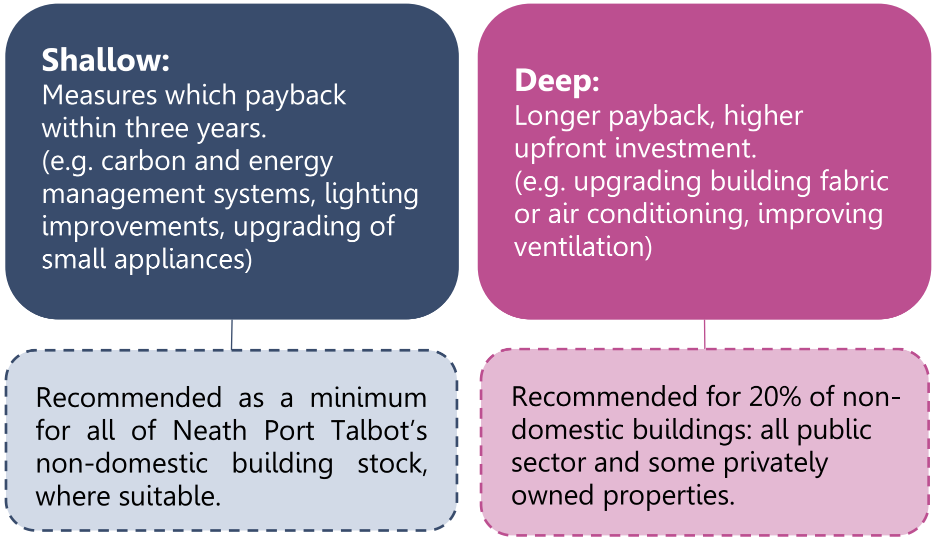


Figure 5-2: Non-Domestic Retrofit Assumptions across Neath Port Talbot

5.1.2 Existing Targets

Improving energy efficiency in buildings features heavily in national policy. The Future Homes Standard, due for adoption in 2025, sets out plans for new builds to adopt low carbon energy technologies and the Net Zero Wales Plan (72) outlines ambitions for all new affordable homes built to be built to net zero carbon standards by 2025. Therefore, no retrofit need is assumed for new builds.

Across social housing, the Welsh Housing Quality Standard (73) specifies that stock must all be EPC C by 2030. Exact dates for the target of EPC A are uncertain, however all social housing landlords must produce an 'energy pathway' to assess what must be done to achieve EPC A. This is intended to recognise that EPC A may not be technically or financially viable for some properties.

5.1.3 Cost and Impact

5.1.3.1 Domestic Buildings

The total cost of both shallow and deep retrofit of domestic buildings across the local authority is ~£48mn and the overall investment curve is presented in Figure 5-3. The majority of the investment is leading up to the ban on gas and oil boilers, in line with replacing these heating systems with heat pumps and rolling out retrofit simultaneously. The pathway aims for majority of buildings to be retrofitted and therefore heat pump ready by 2040, with cost significantly dropping off after this period.

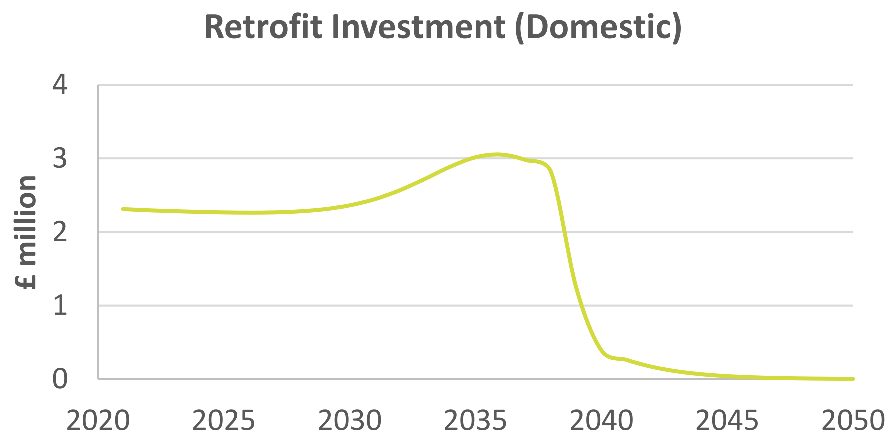


Figure 5-3: Projected Investment Costs for Domestic Building Energy Efficiency

TOTAL COST | **Shallow: £7.6mn** | **Deep: £40.1mn**

The high upfront retrofit costs are a key barrier for implementation, however funding schemes, such as the Optimised Retrofit Programme, can support local authorities and social housing landlords with delivery. Ongoing funding and innovative financing mechanisms will be key to ensure an equitable transition, as well as ensuring consumers are well educated on the retrofit options available to them.

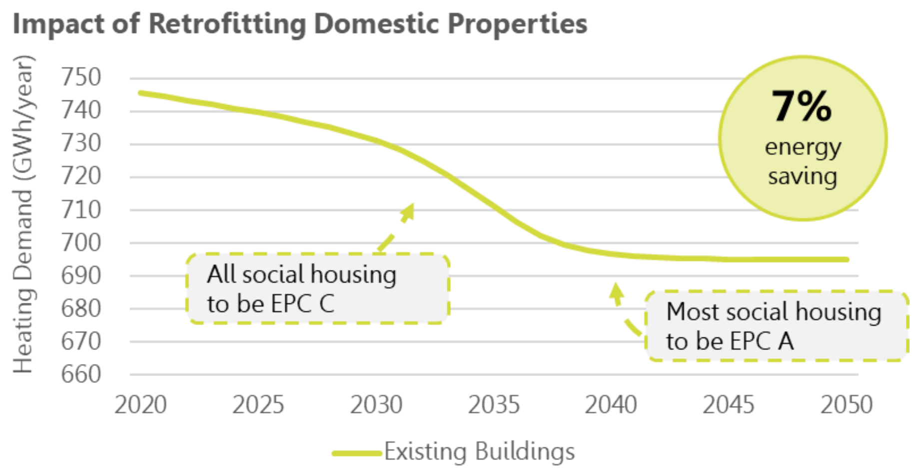


Figure 5-4: Impact of Domestic Retrofitting on Energy Demand

Overall, the proposed retrofit implementation would result in a 7% energy saving across Neath Port Talbot's domestic building stock. This occurs mainly up to 2035, as shallow retrofit is aimed to be implemented prior to the ban on gas and oil boilers, to increase properties' efficiency when heat pumps are installed.

5.1.3.2 Non-Domestic Buildings

The total cost of non-domestic retrofit is £91.5mn. For deep retrofit in particular, in line with the Council's 2030 net zero target, this cost is anticipated before 2030. This requires a significant period of investment, as shown in Figure 5-5.The subsequent drop and peak present shallow retrofit roll-out accelerating.

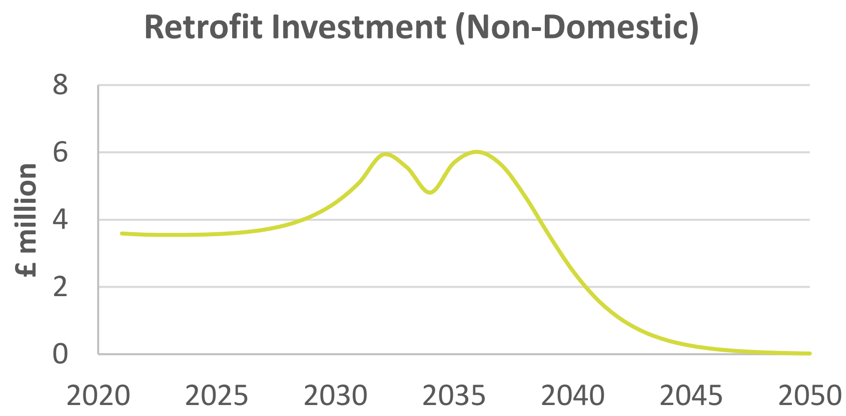


Figure 5-5: Projected Investment Costs for Non-Domestic Building Energy Efficiency

TOTAL COST | **Shallow: £48.3mn** | **Deep: £43.1mn**

The cost of retrofitting will mainly fall to private building owners, although majority of the measures will provide energy savings and will therefore be cost effective. Deeper measures are mainly anticipated on public sector buildings as they aim for net zero by 2030 and therefore target a large reduction in energy demand.

Overall, retrofitting results in a 14% energy saving, which would have a significant impact on overall energy demand.

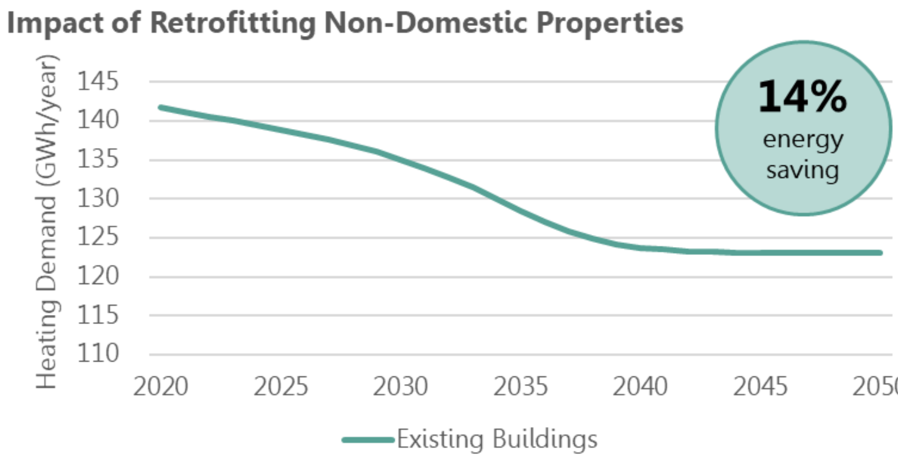


Figure 5-6: Impact of Non-Domestic Retrofitting on Energy Demand

Retrofitting at the scale and pace required will be a challenge due to the skills needed to meet increasing demand and the reliance on the supply chain. However, it also creates a significant opportunity to boost the local economy and stimulate growth across the region, capitalising on economies of scale through rolling out programmes through spatial targeting of streets (e.g. terraced housing). Therefore, creating a long-term skills programme is paramount to ensure these benefits are realised.

5.1.4 Retrofit Focus Zones

Focus zones for building energy efficiency could include areas with ‘no regrets’ or a priority need for action. For retrofit this could be areas with higher fuel poverty or leaky, older building stock, or areas with a high density need for the intervention which could benefit from economies of scale. For example, this could include mass roll-out of measures such as loft insulation, where bulk purchasing of materials could reduce the total cost, or strategic planning of intervention street by street could reduce labour costs.

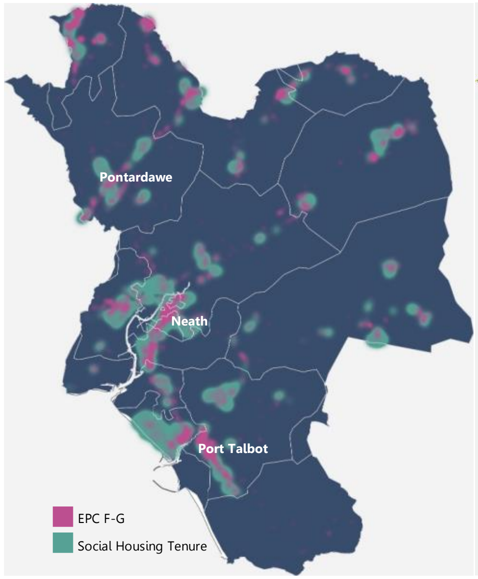


Figure 5-7: Analysis of Where Areas of Social Housing and Poor EPC Score Could Benefit from Retrofit

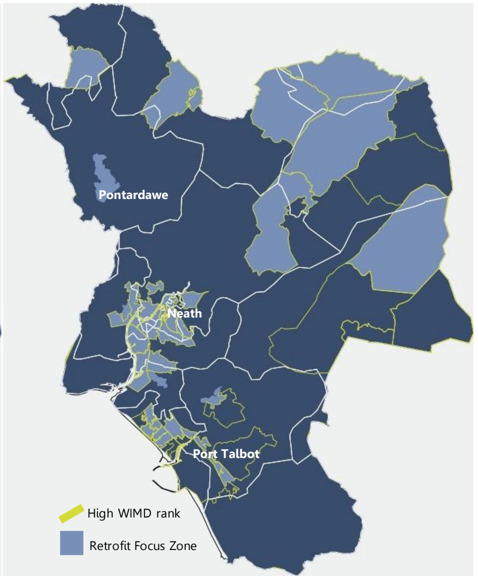


Figure 5-8: Retrofit Focus Zones

Additional factors should also be considered when targeting focus zones, such as alignment with existing programmes like Swansea Bay City Deal's Homes as Power Stations or aligning with areas where Registered Social Landlords (RSLs) are already targeting social housing.

As previously mentioned, non-domestic building data does not provide sufficient accuracy to be presented on an individual building level and therefore non-domestic retrofit zones have not been created. Buildings need to be considered on a case-by-case basis with the building owners and any other stakeholders to determine potential for measures, and therefore mapping this spatially is challenging and less effective.

Further analysis was carried out to determine potential domestic building Focus Zones. Data used included the Welsh Index of Multiple Deprivation (WIMD) ranking of areas, the density of homes with the lowest EPC (F or G) and areas with a high density of social housing (5).

This combination of data suggests areas where poor energy efficiency could be impacting deprivation, particularly through fuel poverty, as shown in Figure 5-7.

Figure 5-8 presents potential locations for focus zones from the analysis, including areas which are in the 30% most poorly ranked for WIMD. Figure 5-9 gives a detailed overview of the number of buildings suitable for retrofit across the modelled primary substation zones, including the development areas where new builds are anticipated.

Three key actions have been developed around energy efficiency as result of these findings. These support the findings from the analysis and are complementary to the identified Focus Zones. They also recognise the wider enabling factors required such as an established and local retrofit and low carbon heating supply chain. Further detail on these actions is provided in Section 6.

PRIORITY ACTIONS

4. Create a Behaviour Change Campaign to Increase Uptake of Retrofit and Low Carbon Heating

5. Develop a Fuel Poverty Programme to Support a Just Transition to Net Zero

6. Develop a Programme for the Electrification of Public Sector Owned Non-Gas, Fossil Fuelled Buildings to Increase Uptake of Low Carbon Heating

Further to installing retrofit, simple at home solutions can be effective and cheap methods of tackling energy efficiency. Examples include draughtproofing and behaviour change initiatives such as demand response management, turning off unused appliances and temperature regulation.

The modelling results presenting a long-term overview of where all technologies should be rolled out is given in Table 5-1 and Figure 5-9.

Zone	Domestic Properties		Non-Domestic Properties
	Shallow Retrofit	Deep Retrofit	Shallow or Deep Retrofit
Abercrave	520	150	20
Gwaun-Cae-Gurwen	1,160	450	60
Aberpergwm	2,475	700	120
Travellers Rest Primary	2,789	840	140
Commercial St Neath	8,880	2,510	470
Pontardawe	3,650	1,140	220
Llandarcy	4,440	1,380	330
Caerau Primary	1,850	780	100
Wern	2,940	1,000	120
Jersey Marine	2,200	270	30
Briton Ferry Primary	2,515	640	160
Ynys Street	5,680	1,550	310
Victoria Road	5,170	2,310	300
Pyle Primary	420	70	40

Table 5-1: Proposed Number of Properties with Retrofit Interventions Across Zones

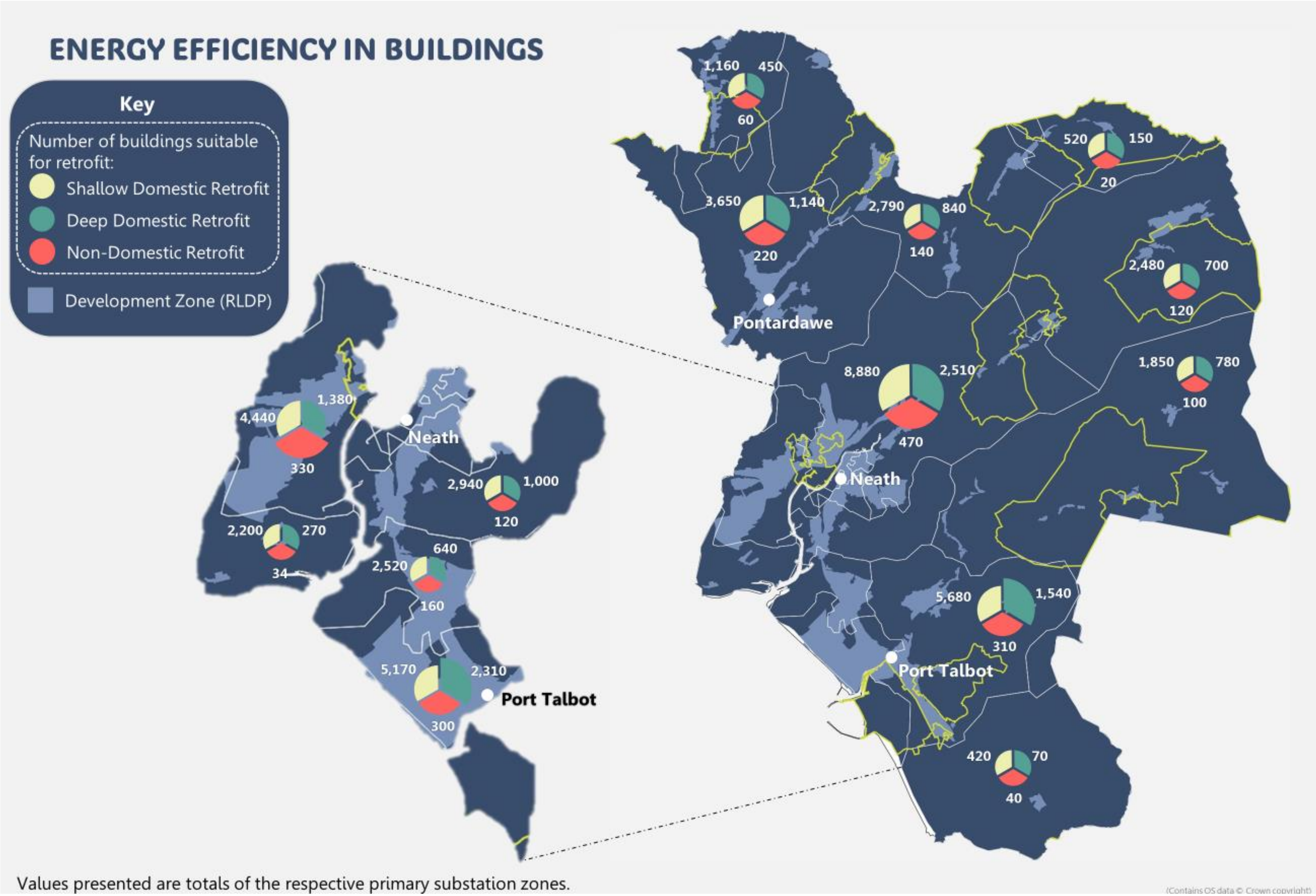


Figure 5-9: Energy Efficiency Interventions Map

5.2 Heating in Buildings

5.2.1 Measure Overview

5.2.1.1 Domestic Buildings

Neath Port Talbot will require a mass replacement of current heating technologies (mainly gas and oil boilers) with decarbonised alternatives to reach net zero. Currently, 30% of Neath Port Talbot's emissions are from domestic buildings. Buildings were analysed for suitability of five low carbon heating technologies: ASHPs, hydrogen boilers, biomass boilers, heat networks and direct electric heating. During the selection of the preferred pathway, it was deduced that widespread ASHPs were more cost-effective and suitable than hydrogen and therefore hydrogen boilers have not been included in this final building stock pathway.

Overall the most suitable and lowest cost solution for most domestic properties will be ASHPs. Newer products can achieve a high efficiency in almost all building types and without extensive need for retrofitting (74) and models are increasingly smaller in size and therefore can be placed in most homes. It is recognised that the efficiency of heat pumps increases with the energy efficiency of homes, reducing costs to consumers. Therefore, this intervention is recommended to be implemented in alignment with the retrofit intervention. This assumes shallow retrofit in all buildings which will reduce electricity bills and therefore risks to fuel poverty.

Heat networks could be a key factor in heating decarbonisation in Wales and by design are suitable for only certain areas where buildings have sufficiently high density and heat demand. For this reason, they have limited suitability for domestic properties which have relatively smaller demands than non-domestic properties and therefore aren't always financially viable for connection. It would be recommended to consider initial suitability of heat networks based on non-domestic building demand to ensure financial viability. Following this, domestic connections could be considered based on the network route in a second, more detailed review.

Some buildings may not have a wet heating system (which is required for heat pumps or a heat network), may have limited space availability for a heat pump or may be particularly challenging to retrofit. For these buildings the lowest cost option may be direct electric or resistance heating. The efficiency of these systems is considerably lower than heat pumps (100% efficiency vs 350%) causing higher running costs; therefore this measure is only recommended when others are not possible.

Buildings which currently have biomass boilers have been assumed to mostly retain them as well managed biomass is low carbon. However, the burning of biomass in boilers can cause significant local air quality issues. This should be considered when planning this technology and roll-out in urban areas should be avoided.

The overall split of heating technologies for domestic properties in Neath Port Talbot is shown in Figure 5-10.

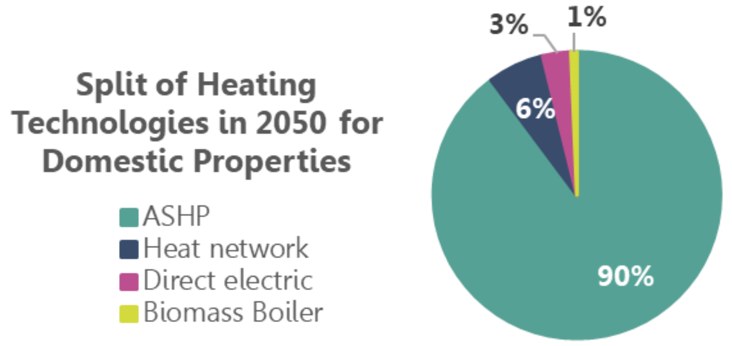


Figure 5-10: Split of Domestic Building Heating Technologies in 2050

5.2.1.2 Non-Domestic Buildings

A similar mix of heating technologies was considered for non-domestic buildings. Non-domestic buildings can have less standardised heating demands and therefore suitability of different technologies can be far more varied than domestic. The split of heating technologies is shown in Figure 5-11.

District heat networks could supply up to 40% of the non-domestic heat demand in Neath Port Talbot. Networks connect multiple buildings to a single hot water network, which can be supplied by a low carbon heat source and provides space heating and hot water to the buildings. Non-domestic buildings tend to be more suited to heat networks due to their larger heat demands (compared to domestic properties) which can offset the high cost of connection. It is important for the number of connections and scale of heat demand to payback the capital cost in a reasonable time period for investors.

Generally, network suitability is reliant on availability of anchor loads – large, non-domestic buildings with a high likelihood of connection which can improve financial viability of the overall network and make it less sensitive to future connections or vulnerable to uncertain connections. Large heat pumps are a key technology for heat networks, which means that relatively low temperature heat sources can be used and boosted to provide heating for homes and non-domestic buildings. Examples of heat sources include bodies of water (lakes or rivers), heat extracted from sewer networks or waste industrial heat.

Heat network pipes run underground across busy urban areas and therefore have a high investment cost and are disruptive to install. Pricing mechanisms for customers can be complex and ensuring financial viability of the entire scheme can be challenging, particularly if waste or low carbon heat is not readily available. Areas such as Neath and Pontardawe have a high density of buildings, which improves the financial viability of a network scheme. To determine the viability of a heat network, buildings and existing infrastructure in the area will require analysis to ascertain the viability of connection. This is dependent on factors such as energy efficiency (and therefore heating temperature requirements), metered heating data and willingness of building owners to connect.

Air source heat pumps are the largest supply of non-domestic heat in the future energy system, with their scalability and ability to provide both heating and cooling making them particularly suitable to a wide range of non-domestic properties. They also integrate effectively with other building assets such as solar PV or thermal storage, enabling the building to use energy flexibly and benefit from variable tariffs.

Direct electric or resistance heating tends to be more suitable for non-domestic, rather than domestic properties, where buildings may need irregular heating demand which is inefficient for heat pumps, or may require different temperatures across the building, which can be more precisely controlled with resistance heating. It also tends to be easier to install and operate than larger complex systems.

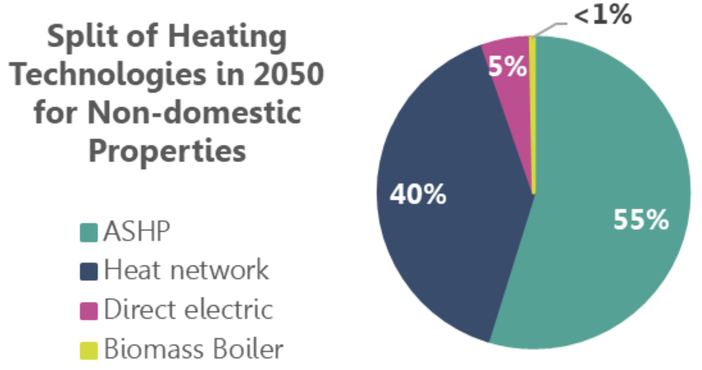


Figure 5-11: Split of Non-domestic Building Heating Technologies in 2050

5.2.2 Existing Targets

Recent governmental decisions have pushed back targets on decarbonised heating. Therefore, fossil fuel boilers are anticipated to be banned from 2035 (subject to further changes). The Future Homes Standard (75) suggests that fossil fuel boilers will be banned in new builds from 2025, which includes hydrogen-ready boilers. Therefore, it is assumed that all new builds should be built with heat pumps.

Figure 5-12 presents the deployment rate of the main heating technologies across the area for both domestic and non-domestic buildings. Fossil fuel-based heating systems are gradually replaced as they come to the end of their technical lifespan and low carbon heating becomes cheaper and more accessible. The transition to heat pumps in existing buildings is therefore assumed to happen before 2035, at a slower rate, as heat pumps become more competitive with gas boilers as homes benefit from the BUS grant.

Initial priority targeting of oil boilers due to their higher emissions levels also causes an initial decline. After the 2035 ban, both gas and oil boiler decline more rapidly, with the heat pump transition accelerating. The cost of this transition is supported by access to the BUS grant for heat pumps; however, will require engagement and support between the Council and the local communities to mobilise the shift.

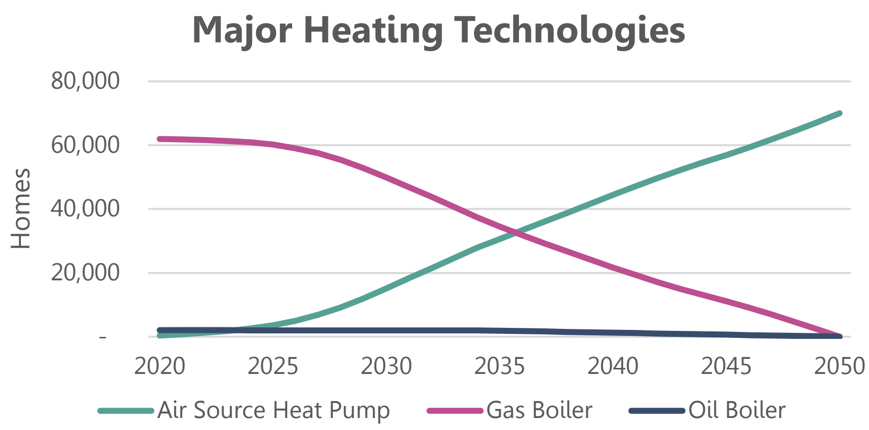


Figure 5-12: Rate of Deployment of Major Building Heating Technologies

Figure 5-13 presents the minor heating technologies' deployment rate. Heat network planning involves multiple stages as it is a major infrastructure project and therefore accelerated efforts from this LAEP aren't anticipated to take effect until late 2020s. Build out and connection is likely to occur in phases of buildings across multiple different networks, resulting in a swift uptake and completion by 2040. Buildings which are in a potential heat network zone were assumed to connect provided they were over a minimum heat demand threshold.

Biomass boiler uptake is small and occurs in line with the ban of fossil fuel boilers for a small proportion of rural properties. Direct electric heating rises after the ban takes place, as the only option for some buildings.

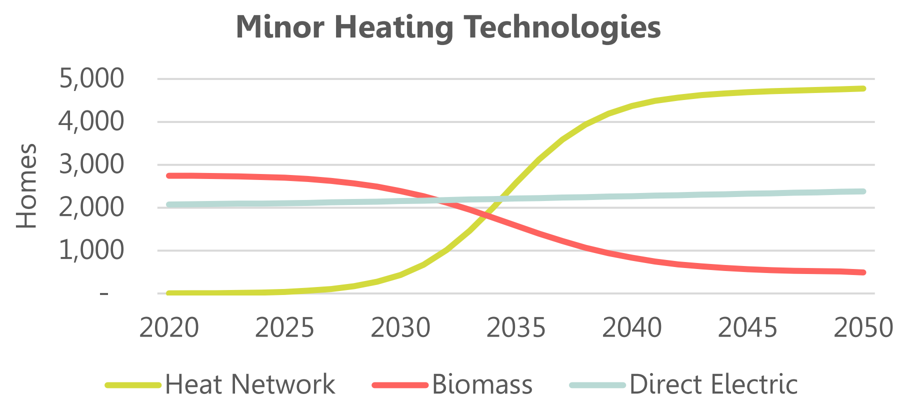


Figure 5-13: Rate of Deployment of Minor Building Heating Technologies

5.2.3 Cost and Impact

The total cost of heat decarbonisation is £650mn, which includes the cost of assumed shallow and deep retrofitting. This is far more significant for domestic buildings due to the relatively higher volumes.

5.2.3.1 Domestic Buildings

The investment required for decarbonisation of domestic buildings is shown in Figure 5-14. Cost is in line with the anticipated ramp up of low carbon heating technologies up to 2035 and the ban on gas boilers, which results in the highest investment around that period. As more homes transition to air source heat pumps the annual investment needed drops, however the continued development of new builds provides a steady demand throughout.

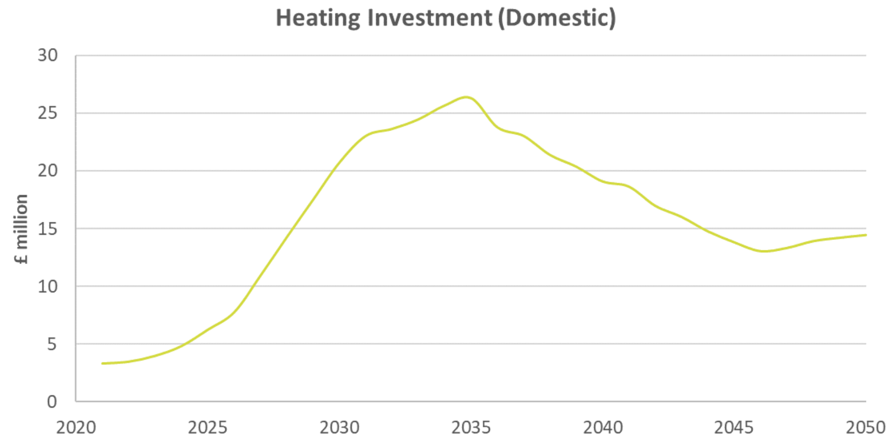


Figure 5-14: Projected Investment Costs for Domestic Heating Decarbonisation

The total cost for decarbonisation of domestic heating, including the cost of retrofit, is £511mn. The BUS grant could offer up to £180mn between 2025 and March 2028 (the official end of the scheme). This presents the opportunity for early decarbonisation, by profiting from the availability for the grant. It also highlights the future challenge for the transition as the ban comes into place, unless additional funding is made available. The cost of low carbon heating is falling; heat pumps are becoming increasingly more affordable as they benefit from production scale-up and natural technological progression. It cannot be expected for home or building owners to pay a considerably higher price for low carbon solutions, and therefore parity with current gas boiler prices and benefits is required.

5.2.3.2 Non-Domestic Buildings

As shown in Figure 5-16, non-domestic buildings require a large initial investment for heat network schemes, which have very large CAPEXs. The earliest this is anticipated would be from 2025, with heat networks being planned and developed in stages over the subsequent years. This is an ambitious roll out of the initial infrastructure by 2030 and some connections are envisaged to occur after this period.

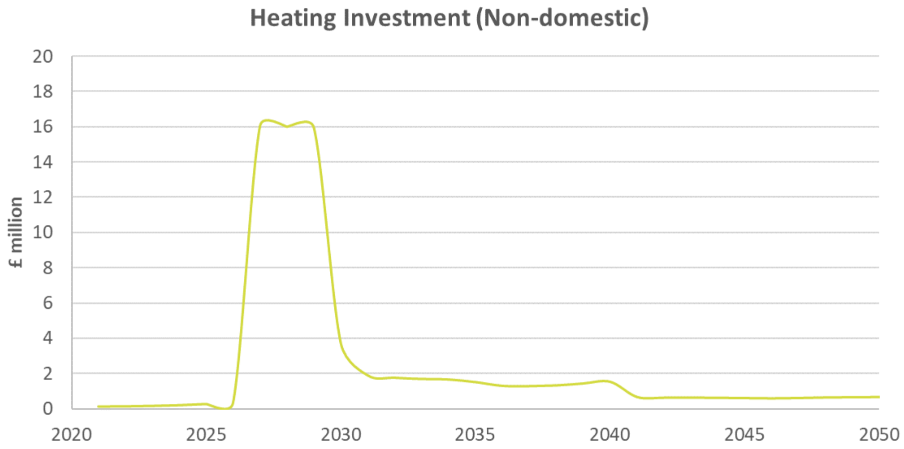


Figure 5-16: Projected Investment Costs for Non-Domestic Heating Decarbonisation

Heat networks remain a costly investment and therefore are not always the most suitable solution for an area. This will be determined through rigorous analysis prior to any detailed planning of a scheme. For schemes which are viable, heat networks are becoming increasingly more attractive as an investment as their use in the UK increases and investors are more confident in their long-term financial viability, proven by many successful real-life examples.

It is not anticipated that many non-domestic buildings will decarbonise independently before 2030, with most cost for individual heating systems occurring after 2035, due to the ban on gas and oil boilers.

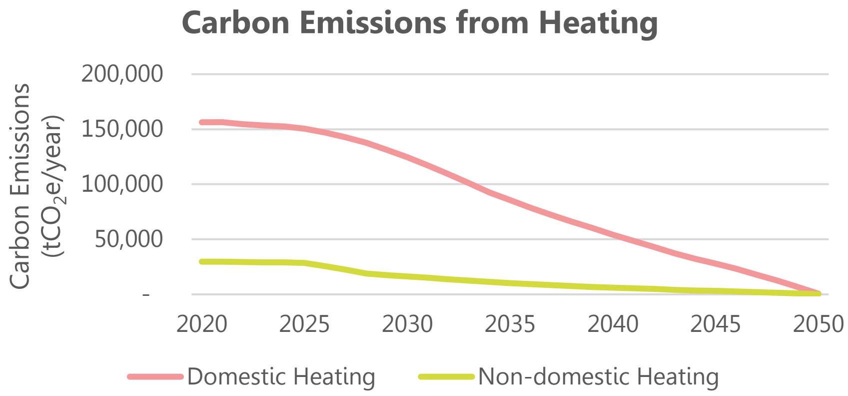


Figure 5-15: Carbon Emissions Trajectory from Building Heating

Figure 5-15 presents how the carbon emissions from heating are set to decrease in line with gas and oil boiler ban in 2035, which is responsible for the majority of the heating carbon footprint. Non-domestic buildings share a much smaller proportion of the carbon emissions, and are set to decrease steadily to 2050 as businesses introduce net zero ambitions and realise the additional benefits of low carbon heating.

Figure 5-17 demonstrates the major role that electricity will play in 2050 fuel demand for building heating. However, the overall fuel demand remains much lower than the baseline cumulative demand of gas and oil. This is due to the high efficiency of heat pumps and heat networks, which offer threefold higher efficiencies than boilers.

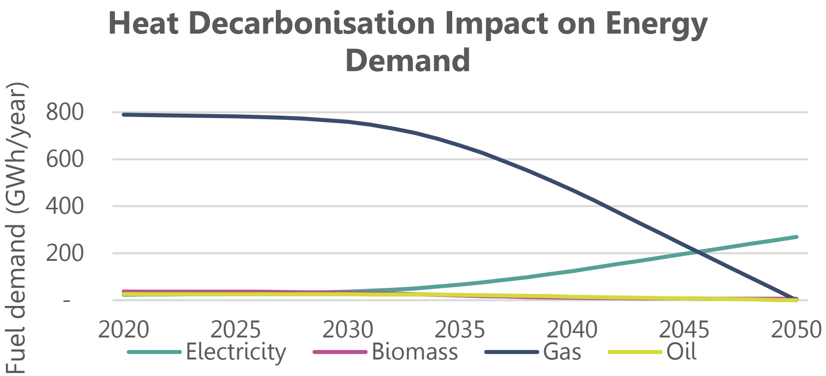


Figure 5-17: Energy Demand Trajectory from Different Heating Fuels

5.2.4 Heating Focus Zones

5.2.4.1 Domestic Buildings

Various factors impact the suitability of a low carbon heat technology and the deployment strategy in a given area, guiding the development of Focus Zones. For example, technologies such as heat networks or biomass boilers are restricted to specific areas, whereas others such as ASHPs can benefit from concentrated mass roll-out.

ASHPs are suitable in any location and for almost all building types. Due to the higher carbon impact and typically higher cost, it can make sense to prioritise homes with oil boilers for initial targeting. Suitable Focus Zones for areas with a high density of oil boilers are shown in Figure 5-18.

The area and surrounding villages around Gwaun-Cae-Gurwen, as well as along the Dulais Valley, have a large numbers of recommended heat pumps in areas with a high number of oil boilers. These rural and valley areas could be prioritised for early engagement programmes with building owners to understand the benefits and funding opportunities for heat pumps.

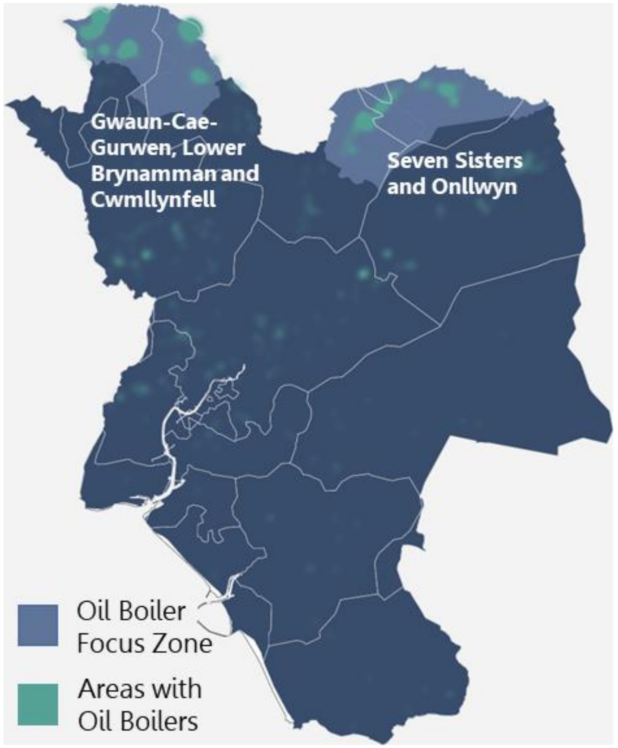


Figure 5-18: Focus Zones for Decarbonising Oil Boilers

5.2.4.2 Non-Domestic Buildings

Focus Zones for non-domestic buildings have been developed for areas with potential for a heat network. Potential zones have been identified around central Neath and Pontardawe where heating demand is dense, as shown in Figure 5-19 as well as an industry-based network around Port Talbot, and a campus network for Swansea University Bay Campus. Either network could also extend to other commercial neighbouring buildings. Neath and Pontardawe could potentially connect up to 880 and 250 properties respectively.

Other areas show some potential for heat networks, although these would be small networks with just a few buildings and therefore may not be financially viable. A further review of building data would be required for these areas before progressing any to a feasibility study.

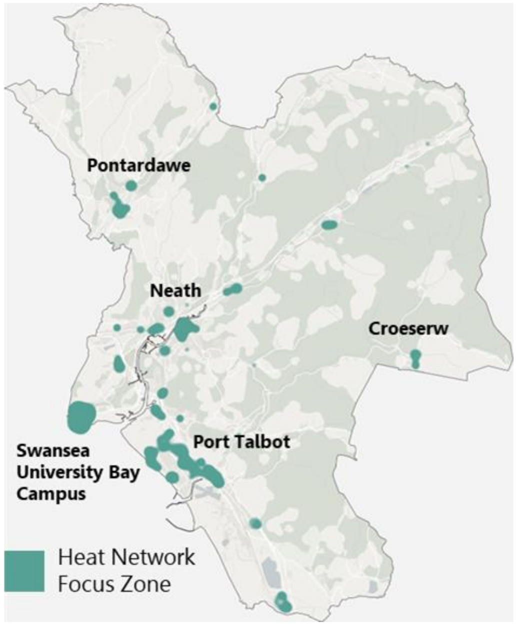


Figure 5-19: Heat Network Focus Zones

Following identification of high heat demand density, low carbon heat sources must be located. This could be from waste heat sources (such as industrial sites or incinerators) or from low carbon heat sources. Typical sources include bodies of water, rivers, sewer networks or geothermal heat. Low temperature heat sources would be increased using heat pumps, supplying buildings with space heating and hot water at high efficiencies.

Heat networks have a high upfront cost due to the scale of infrastructure development required and therefore most networks are reliant on 'anchor loads' to have a sufficiently high heat demand to payback the high costs at a suitable rate for investors. These are typically buildings with a large heat demand and preferably are public sector buildings; this provides a more reliable stakeholder and gives confidence in future connection, although private sector connections can be equally suitable.

For all clusters identified it is recommended to carry out a further review of any which show adequate potential to be developed further through a feasibility study. This will be included in the upcoming RLCEA.

5.2.4.3 All Buildings Actions and Implementation

PRIORITY ACTIONS

4 Create a Behaviour Change Campaign to Increase Uptake of Retrofit and Low Carbon Heating

5 Develop a Fuel Poverty Programme to Support a Just Transition to Net Zero

6 Develop a Programme for the Electrification of Public Sector Owned Non-Gas, Fossil Fuelled Buildings to Increase Uptake of Low Carbon Heating

A key action around creating a behaviour change campaign has been developed, which would be in line with engaging with areas with a high number of oil boilers, to convey the benefits of decarbonisation and encourage near-term adoption.

The modelling results presenting a long-term overview of where all technologies should be rolled out is given in Figure 5-20, Figure 5-21 and Table 5-2.

Zone	Number of ASHPS		Number of buildings connected to a heat network	
	Domestic	Non-Domestic	Domestic	Non-Domestic
Abercrave	800	20	-	-
Gwaun-Cae-Gurwen	1,900	110	-	-
Aberpergwm	3,550	130	140	110
Travellers Rest Primary	4,490	290	40	20
Commercial St Neath	13,400	550	550	330
Pontardawe	6,420	390	130	120
Llandarcy	8,220	530	160	210
Caerau Primary	3,270	120	30	50
Wern	4,850	110	80	120
Jersey Marine	250	10	2,160	50
Briton Ferry Primary	3,920	230	180	70
Ynys Street	9,000	360	330	250
Victoria Road	9,660	340	480	290
Pyle Primary	660	30	<10	60

Table 5-2: Proposed Domestic Heating Interventions Across Zones

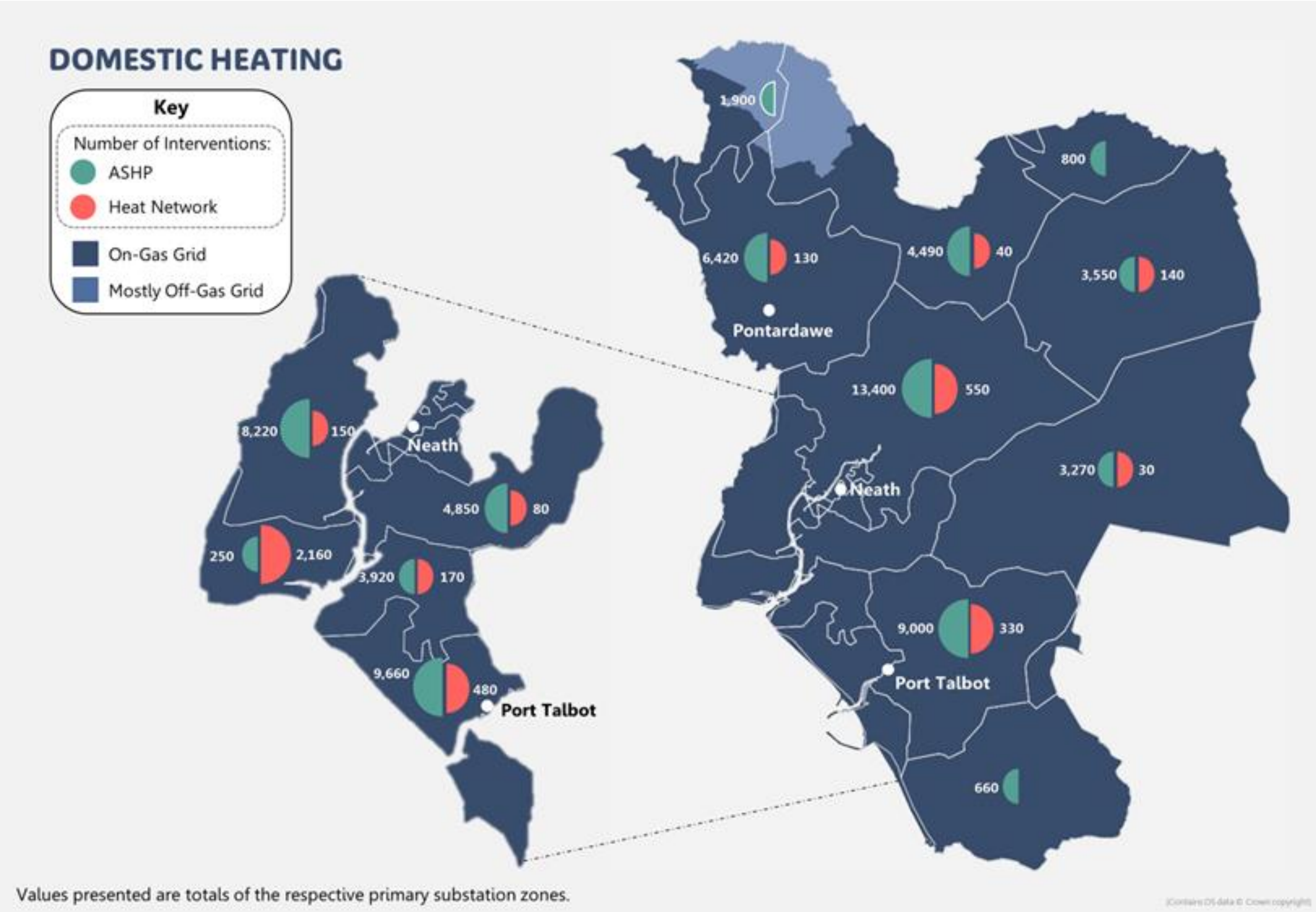


Figure 5-20: Domestic Heating Decarbonisation Interventions Map

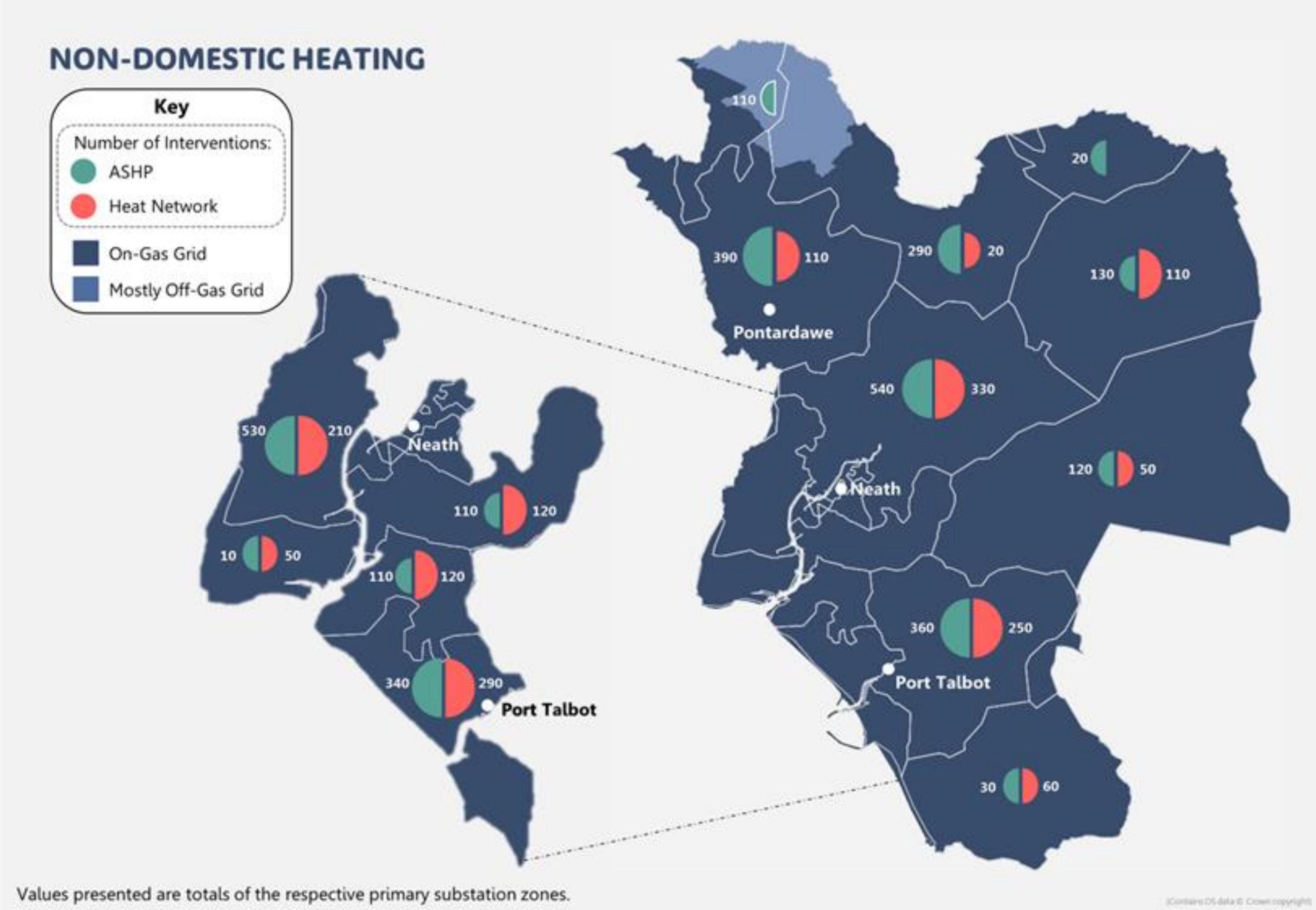


Figure 5-21: Non-domestic Heating Decarbonisation Interventions Map

5.3 Road Transport

In line with the Wales Transport Strategy, the policy priority under any future pathway will be reducing the need to travel in private vehicles, and instead favour walking, cycling and public transport. Low carbon vehicles, whilst important, will sit below an emphasis on "mode shift" (the transition from the use of private vehicles to more sustainable modes) as shown in the Sustainable Transport Hierarchy, Figure 5-22 (76).

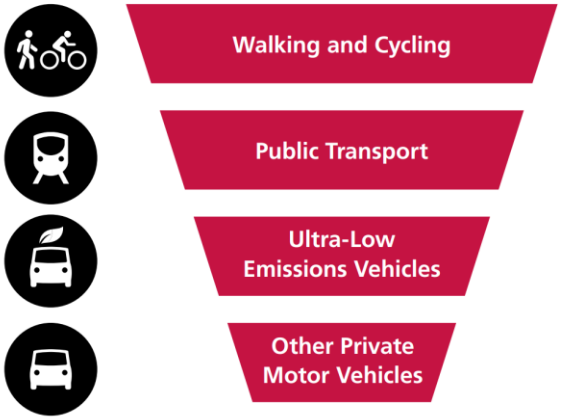


Figure 5-22: Sustainable Transport Hierarchy, as defined by the Wales Transport Strategy (76)

Support to improve public transport will reduce the number of cars and improve congestion in major urban areas. However private vehicle use will still be significant. The decarbonisation of transport is expected to be led by electrification, with EV already representing ~15% of all UK cars sold (77). Adequate electric chargepoint infrastructure will be crucial to support and continue the rapid growth, with owners requiring confidence in both battery range and accessibility of charging everywhere they travel.

5.3.1 Measure Overview

Road transport decarbonisation was considered across cars, LGVs, HGVs and buses. Emissions analysis does not include the SRN due to the nature of accounting for an area's emissions boundary; however for the purpose of calculating the total energy demand for transport and the resulting infrastructure requirement, the SRN has been included.

Analysis of transport involved using transport models to estimate future vehicle mileage projections through to 2050. This is based on the daily mileage of different vehicle types across the area. As previously described, uptake rates of low carbon vehicles were also assumed, which when combined presents the anticipated growth in transport and transition to decarbonisation. It was assumed that most vehicles would transition at the end of their average ownership lifespan.

While cars and vans are expected to move to 100% electric, hydrogen could be an alternative for heavier vehicles such as buses and HGVs. Due to the higher uncertainty around hydrogen-fuelled vehicles and to account for the expanding hydrogen bus trials, it has been assumed that 20% of heavy vehicles will be hydrogen-fuelled and the remainder electrified.

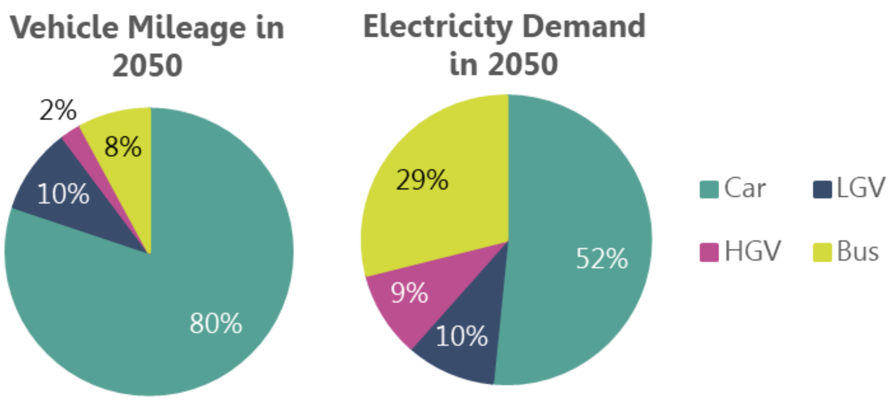


Figure 5-23: Split of Vehicle Mileage and Electricity Demand in 2050

Modal shift is important for decarbonisation, traffic issues and road safety in Neath Port Talbot. It is recognised that the existing public transport systems for the valley and rural areas have limitations in terms of convenience and use of services, and funding. Therefore, significant changes will be needed to realise a large transition from private to public transport.

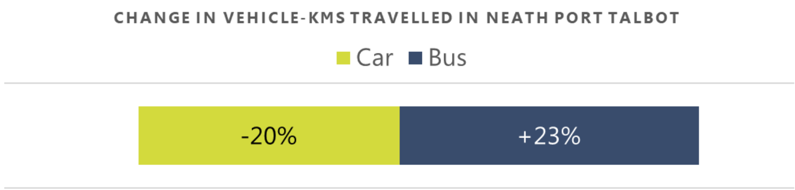
Cars represent the highest vehicle mileage and therefore energy demand in 2050, despite the relatively high efficiency of electric vehicles. Buses represent only a small share of the mileage despite modal shift; however, are responsible for 33% of future electricity demand due to the large energy demand of electric buses and their relatively poor efficiency compared to cars.

Access to EV charging is both an enabler and blocker from EV uptake. Domestic, workplace and public EV charging was assumed, including an uptake rate and the total cost. For buses, it was assumed that charging would need to happen at depots, with the majority occurring overnight. However, it was also assumed that some form of induction charging would also be available by 2050, enabling buses to 'top-up' their state of charge at bus stops and helping to spread the demand on the electricity grid. As this technology is nascent, the contribution to overall demand was assumed to be low.

As Neath Port Talbot has a large industrial area and also hosts some of the key access roads to the rest of South West Wales, charging for HGVs will be key for distribution. It was assumed that service stations which currently have HGV parking and refuelling would need to adapt to offer charging facilities. It is recognised that new charging stations may also be planned which currently aren't known, and therefore this should be considered when reviewing the charging demand spatial analysis.

5.3.2 Existing Targets

Welsh Government modal shift targets include a 10% decrease in the car miles travelled per person by 2030 (11) and an increase in the trip mode share of public transport from 5% (current) to 13% by 2040. The Wales Transport Strategy also aims to increase journeys made by public transport, walking or cycling from 32% to 45% by 2040. These ambitions have been extrapolated to interpret a 2050 modal shift and have been represented in terms of vehicle-kms.



Neath Port Talbot Council aims for its own car fleet to be net zero by 2030. The Welsh Government aims for public buses to be decarbonised by 2035 (14).

The ban on internal combustion engines is expected to start in 2035, and therefore an accelerated transition is expected to happen from this point, although growth in EVs is already strong and therefore the market shift does not rely on this ban.

The Welsh Government has predicted the future charging need for each local authority, including 34,410 chargers in Neath Port Talbot by 2030 (15). This will continue to increase slightly past 2030, as all dwellings will require access to a charger by 2050, to support the 100% EV penetration. This is assumed to happen through mainly off-street parking and some on-street charging availability.

5.3.3 Cost and Impact

The total cost to decarbonise Neath Port Talbot's transport sector is £7.5bn. This includes CAPEX, OPEX and REPEX costs, and excludes the costs of new petrol and diesel cars between the baseline and 2050, which amounts to an additional £3.2bn.

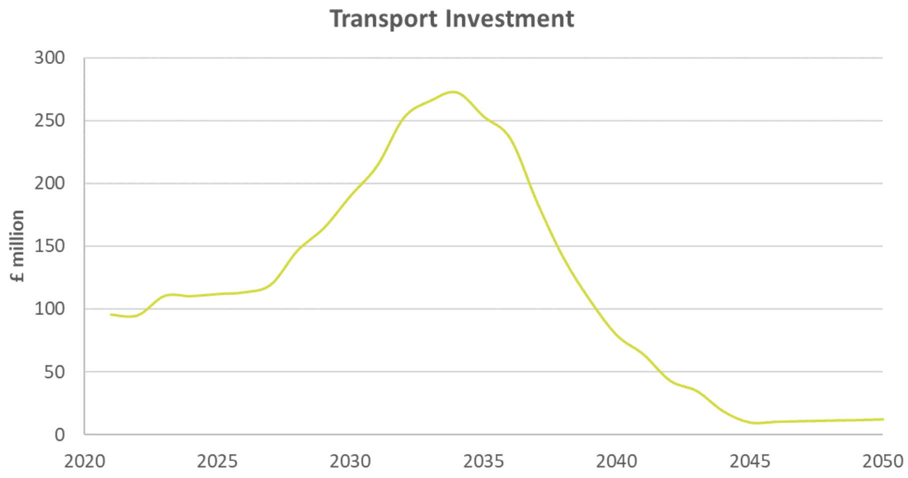


Figure 5-24: Projected Investment Costs for Transport

Most of the cost is associated with new cars and LGVs which drives much of the required investment as the 2035 petrol and diesel ban approaches, shown in Figure 5-24. The high volume in Neath Port Talbot makes this a significant part of the total cost, as shown in Figure 5-25. EVs currently tend to be a higher price than conventional engines although this does not account for secondary markets of EVs, which will significantly reduce costs for consumers.

Adequate charging infrastructure will be essential to support the adoption of EVs and this will need to happen ahead of anticipated demand. Accelerated roll-out of charging infrastructure is expected to happen up to 2030.

Low carbon heavy vehicles are considerably more expensive than the fossil fuel equivalents, but as the volumes are much lower than cars and LGVs this is not quite as significant in the overall costs. Aside from the Council's fleet, the low carbon HGVs will need to be provided by private investment and will rely on the provision of adequate charging infrastructure across the SRN.

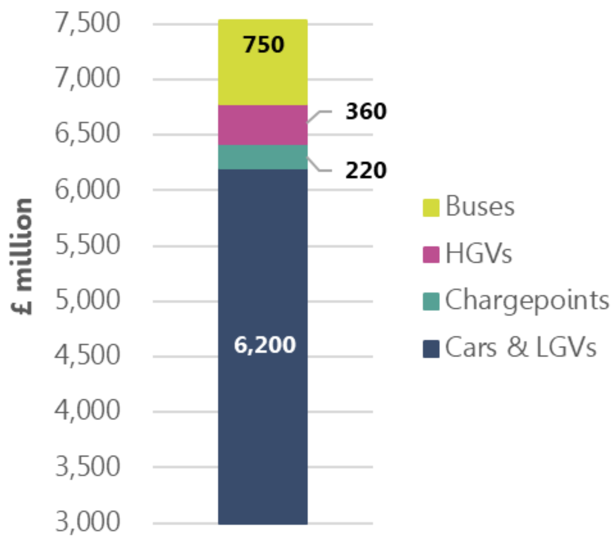


Figure 5-25: Total Cost of Transport Decarbonisation

Decarbonisation of buses will be a significant cost to bus operators who already operate on restricted budgets. Funding support and initiatives to increase public transport use will be necessary to achieve the net zero 2035 goal.

Figure 5-26 presents the uptake rate of different types of low carbon vehicles. The 2035 net zero bus goal causes buses to be the first to decarbonise, modelled by a linear uptake rate which projects the accelerated approach which will be needed to achieve the target. Cars and LGVs follow a typical S-curve trend as the market offers an increasing range of models at affordable prices. Uptake of electrified HGVs is slower as the technology is at an earlier stage of development. However, close to full transition is expected just after 2040.

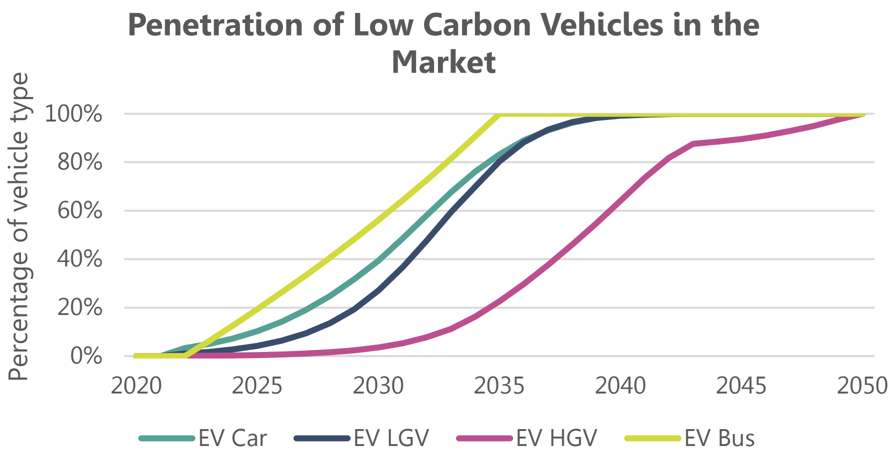


Figure 5-26: Penetration of Low Carbon Vehicles in the Market

Carbon emissions roughly follow the inverse of this trend, as shown in Figure 5-27. Buses are the first to decarbonise, with LGV footprint reaching close to zero shortly after, partly due to the smaller volume relative to cars. Cars are responsible for most emissions but decarbonise quickly as the market improves. Based on anticipated trends in EV uptake, and reliant on the planned EV charging infrastructure, cars could be close to net zero before the ban on petrol and diesel, which may be needed to incentivise the final few combustion engines. HGV decarbonisation is the slowest to progress.

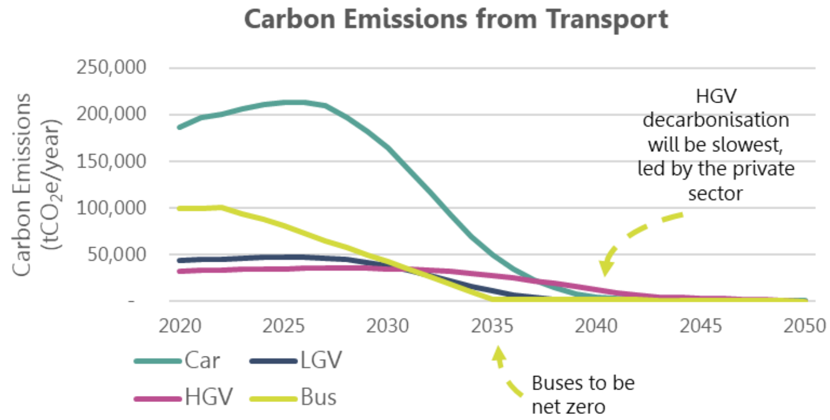


Figure 5-27: Carbon Emissions from Transport

The total energy demand for transport in 2050 is 420 GWh/year. This is a third of the baseline demand due to the higher efficiency of EVs. However, this will represent a considerable demand on the electricity grid and will require extensive planning to ensure that grid capacity is sufficient in the main charging hotspots.

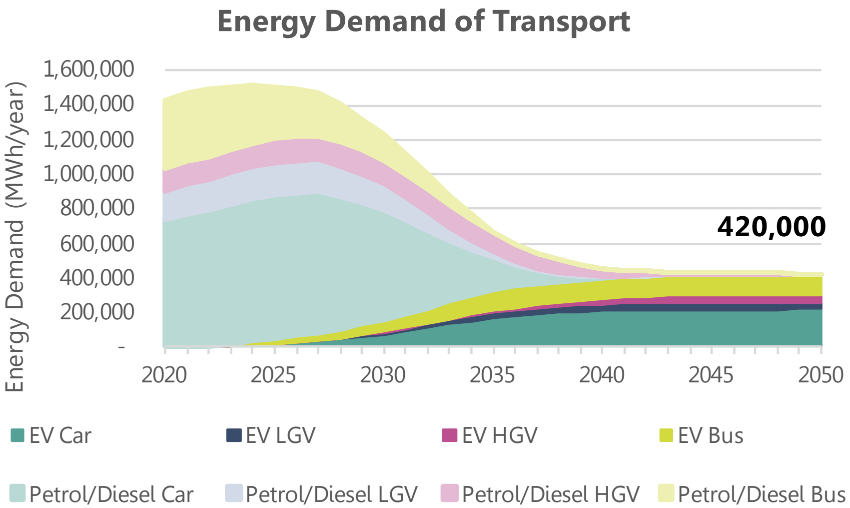


Figure 5-28: Energy Demand of Transport to 2050

5.3.4 Transport Focus Zones

Focus Zones have been used to identify key locations for charging infrastructure based on anticipated demand. Non-domestic charging infrastructure needs to be planned strategically for high-traffic areas. This includes 'destination' locations such as town centres, where public chargepoints should be integrated with car parking, and through-traffic hotspots - key points along the SRN such as service stations.

Whilst high traffic areas should be prioritised to support the early uptake of EVs, it is also important to ensure access for rural communities by installing chargers in key public areas and car parks. Public awareness and engagement campaigns will support the installation of domestic charging where off-street parking is available, and would be recommended in more rural areas where there are fewer public or workplace chargers available.

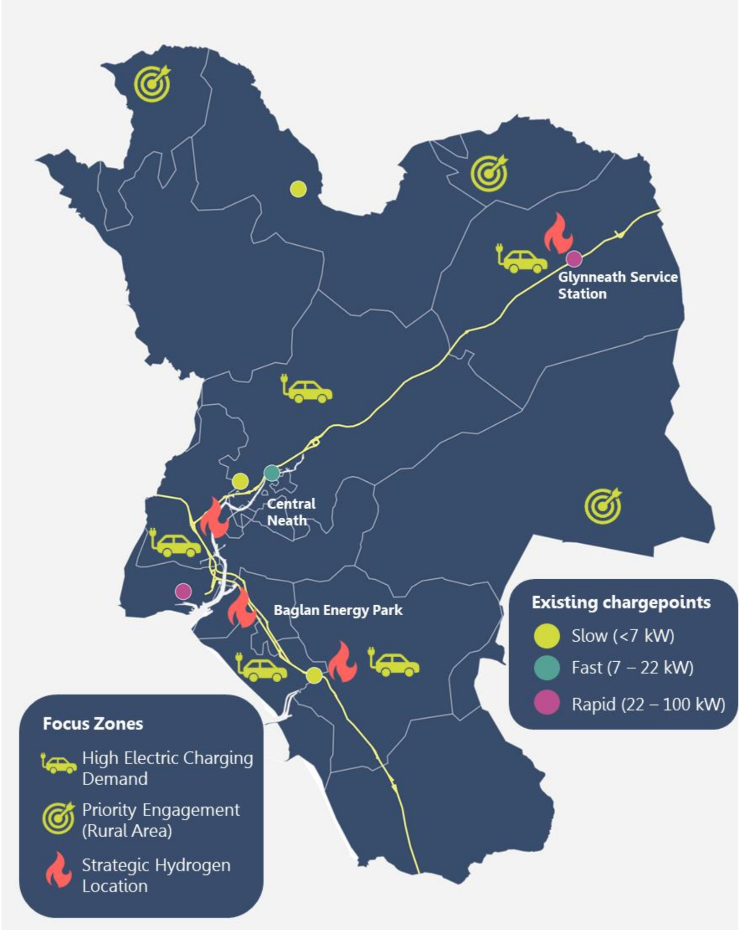


Figure 5-29: Transport Focus Zones

The industrial area around Baglan Energy Park could be key to low carbon transport infrastructure. Potential future use of hydrogen around the industrial sites and any future hydrogen generation could make it key for refuelling, as shown by its current use for the Hydrogen Bus Trials station. It is also home to bus depots which will need considerable electricity demand. Network upgrade requests for the industrial site should incorporate future transport needs.

PRIORITY ACTIONS

7 Develop Holistic Community Transport Provision in Valley Areas to Enable Sustainable Rural Travel

8 Facilitate Low and Zero Carbon Vehicle Uptake to Decarbonise Public Fleets

9 Enhance Active Travel and Public Transport to Reduce Reliance on Personal Motorised Vehicles

Three key actions were developed around low carbon transport. This includes specific action to transition the Council's own fleet to low carbon transport as well as targeted action to support increased use of public transport. There is also recognition that more rural areas require increased support in terms of public transport, as well as access to low carbon vehicles. Therefore an action to develop low carbon community transport is also suggested.

The modelling results presenting a long-term overview of where all technologies should be rolled out is given in Table 5-3 and Figure 5-30.

Zone	EV Charging Demand (MWh)	Number of EVs
Abercrave	6,800	690
Aberpergwm	35,700	2,100
Briton Ferry Primary	19,200	8,320
Caerau Primary	15,300	760
Commercial st Neath	63,200	16,860
Gwaun-Cae-Gurwen	9,700	1,860
Jersey Marine	7,600	5,140
Llandarcy	30,100	17,030
Pontardawe	27,800	6,670
Pyle Primary	13,500	8,440
Travellers Rest Primary	16,400	610
Victoria Road	114,700	2,550
Wern	23,000	150
Ynys Street	39,800	11,600

Table 5-3: Proposed Road Transport Interventions Across Substation Zones

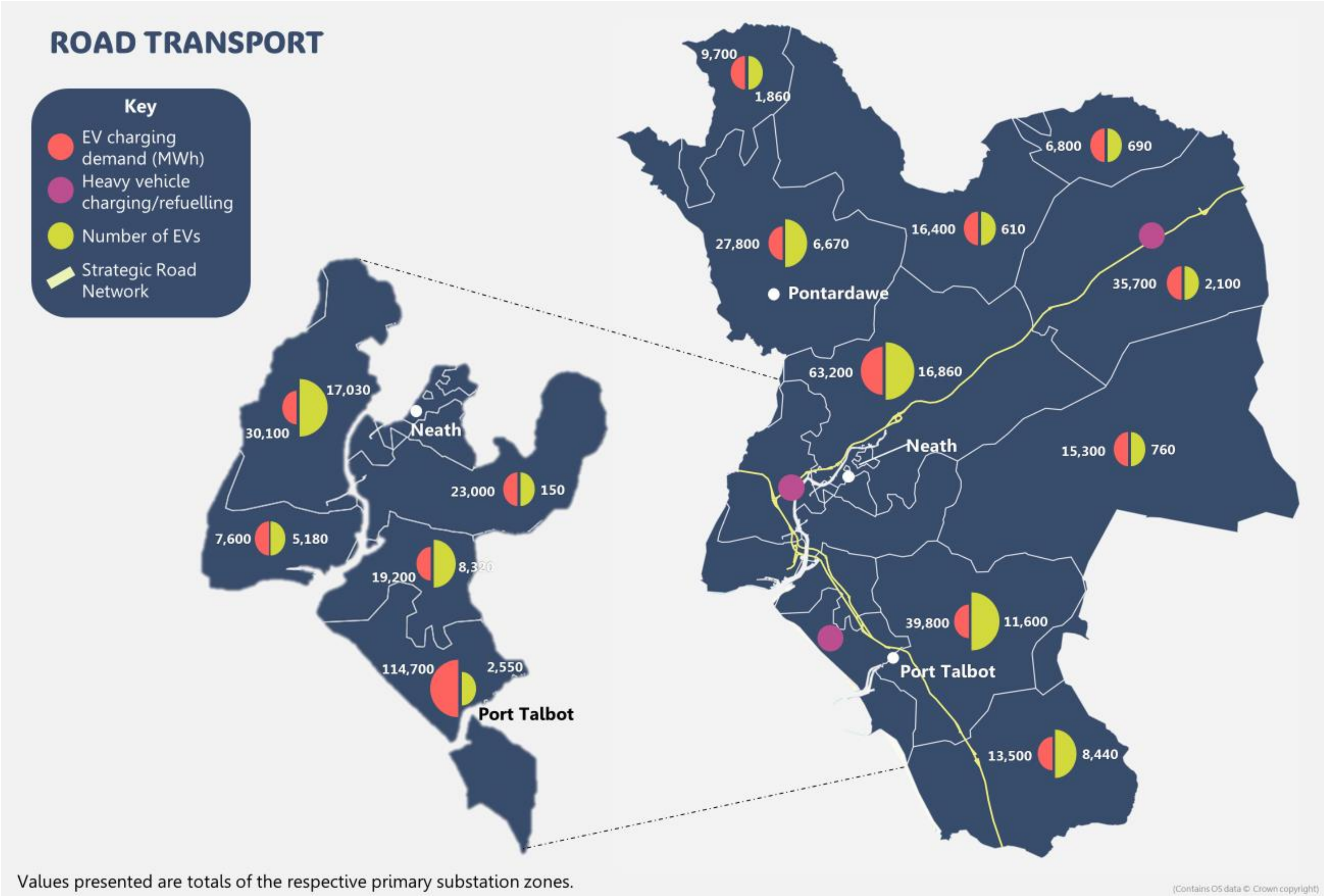


Figure 5-30: Transport Interventions Map

5.4 Renewable Generation

Neath Port Talbot currently has the largest renewable energy capacity in Wales, with a large onshore wind resource (46). Through this LAEP, the Council has set 2050 ambitions for 740 MW additional capacity, with large growth in ground-mount and rooftop PV. This potential (1,700 MWh) outweighs the future energy demand (1,300 MWh), even despite the large demand from electrification.

5.4.1 Measure Overview

Potential for additional renewable generation was analysed across onshore wind, ground-mount PV and rooftop PV. This was conducted using standard renewable potential assessments, and in line with the ongoing findings from the RLCEA, which accounts for suitability of land, protected land and ecological constraints.

Modelling an optimistic uptake is beneficial to understand areas with the highest potential and strategically plan additional renewables. It also informs NGED of areas with constrained connection capacity which may require upgrades to enable further installations.

Self-sufficiency of renewables in Neath Port Talbot is not assumed to be a direct requirement for decarbonisation. This is due to the UK Government's commitment to a net zero National Grid by 2035. However, localised energy generation could offer a faster pathway to net zero, additional energy security, independence and a major source of income for local supply chain, developers, building and landowners.

5.4.2 Existing Targets

The initial renewables potential analysis does not account for all of the wider factors which influence the final uptake of renewables, such as land use and ownership, planning and grid constraints. Therefore the final ambition was assumed to be 50%, 15% and 25% of the total theoretical potential for onshore wind, ground-mount PV and rooftop PV, respectively. These values were decided with engagement with the Council and are still intentionally ambitious, presenting an optimistic renewable build out. It is recognised that renewable generation is influenced by many complex factors and assurance of benefit to the local area and importantly, the rural and farming community is paramount.

Rooftop PV has multiple co-benefits for the building owner and therefore uptake is recommended for all eligible buildings. As shown through the Consumer Bills insights in Section 4.3.6, a PV installation on a building could offer significant savings, offsetting the cost of electricity but also providing revenue from selling back to the grid through incentives such as the Smart Export Guarantee.

5.4.3 Cost and Impact

Total investment cost
£565mn

Neath Port Talbot's renewable energy ambition is
1,140 MW

Neath Port Talbot has significant potential for 1,140 MW of renewables across the three technologies, as shown in Figure 5-31.

Rooftop PV has the largest potential for growth, with relatively low current uptake. Following this is ground-mount PV, which also has relatively low build out compared to onshore wind. Wind power already has a reasonable build out and is a major contributor to Neath Port Talbot's position as highest local authority renewable capacity in Wales. This is still predicted to be the largest contributor to the overall capacity in 2050, although resultingly will have less growth than the other two. Figure 5-35 presents how much renewable generation is available currently and the ambition for the future across each of the modelled areas.

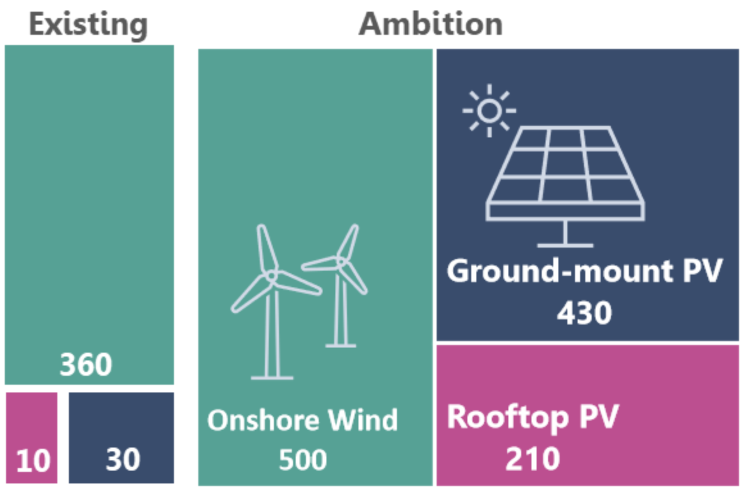


Figure 5-31: Split of Renewable Generation Potential (MW)

Additional renewable generation could offer significant emissions savings if implemented prior to the decarbonisation of the National Grid. As this national decarbonisation occurs, emissions savings from local renewables will decrease compared to grid imported energy. However as this is a target rather than a guarantee, projected electricity carbon factors do not present a net grid in 2035.

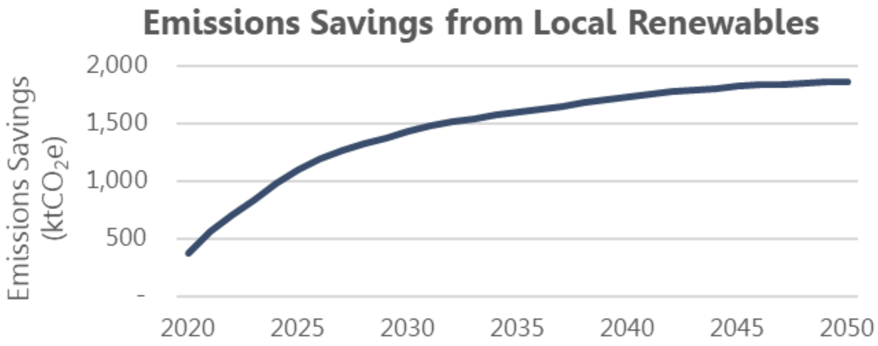


Figure 5-32: Emissions Savings from Local Renewables

Figure 5-33 presents the comparison of the total generation potential against the projected demand. Generation could exceed demand by 90% if maximised and therefore could be a significant revenue stream. This is a 2.8x increase compared to the current capacity.

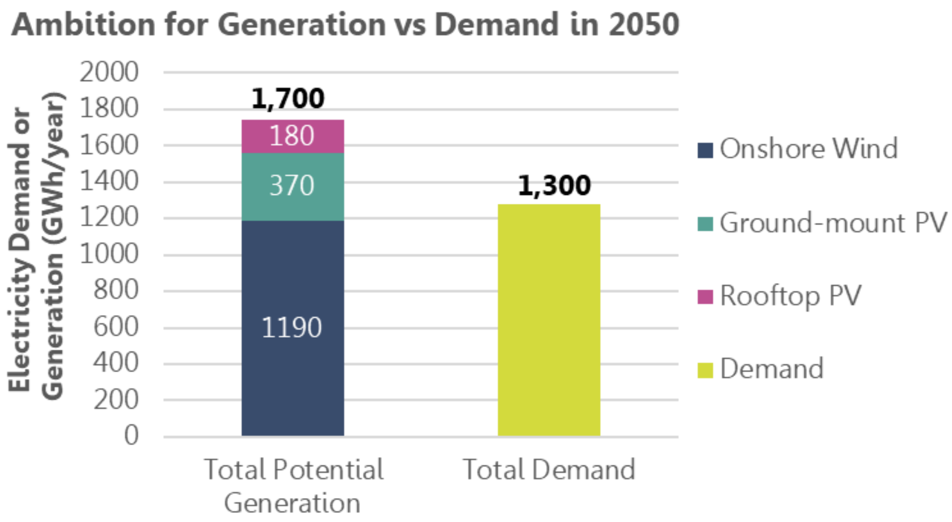


Figure 5-33: Ambition for Electricity Generation vs Demand

5.4.4 Renewable Generation Focus Zones

The Focus Zones for renewable generation present areas with a high potential for growth in each technology type. Areas with high potential for rooftop PV have been highlighted for engagement campaigns to encourage uptake by building owners. Part of this will be educating and informing on the associated benefits.

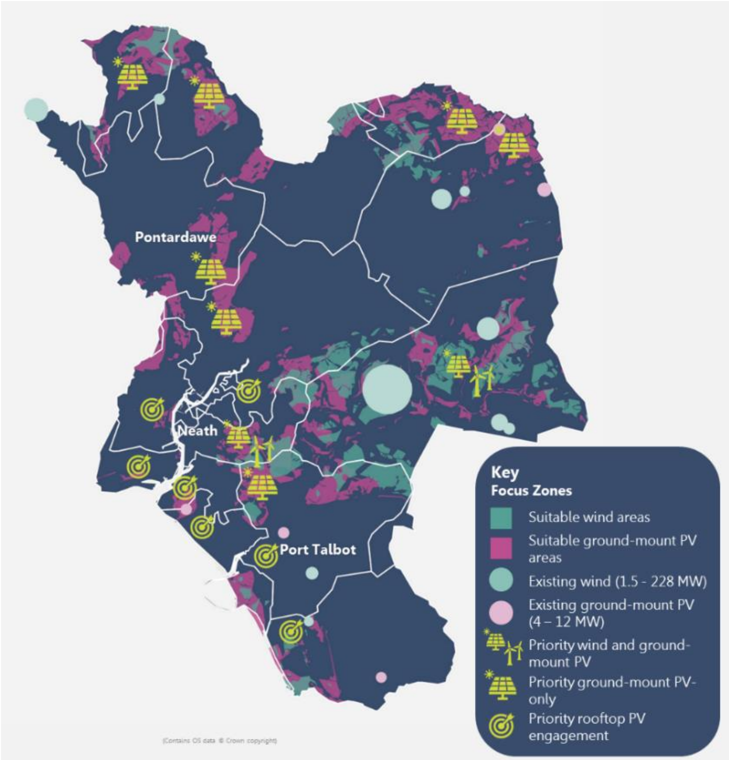


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Figure 5-34: Renewable Generation Focus Zones

Three priority actions have been developed around renewable generation. A major one of these is to continue collaboration with National Grid (National Grid Electricity Transmission (NGET) and NGED) to ensure forward planning of renewables implementation to allow the grid operators to plan grid infrastructure accordingly. The actions also intend to increase system resiliency, with an action for development of microgrid projects and the increase of energy storage and flexibility programmes. Both of these are intended to encourage and integrate with community energy schemes, empowering the local community to own and harness their own energy.

PRIORITY ACTIONS

10 Continue Collaboration with Electricity and Gas Network Operators to Foster a Robust Future Energy System

12 Develop a Support Programme for Community Energy Microgrid Projects to Increase Energy System Resilience and Efficiency

13 Develop a Storage and Flexibility Financial Incentives Programme to Increase Energy System Resilience

The modelling results presenting a long-term overview of where all technologies should be rolled out is given in Figure 5-35 and Table 5-4.

Zone	Onshore Wind (MW)	Ground Mount PV (MW)	Rooftop PV (MW)
Abercrave	30	260	2
Aberpergwm	30	160	10
Briton Ferry Primary	-	30	20
Caerau Primary	340	490	10
Commercial st Neath	10	240	30
Gwaun-Cae-Gurwen	30	190	3
Jersey Marine	-	10	20
Llandarcy	-	70	20
Pontardawe	40	220	10
Pyle Primary	10	90	20
Travellers Rest Primary	20	340	10
Victoria Road	10	90	30
Wern	60	170	10
Ynys Street	50	240	20

Table 5-4: Renewable Potential Capacity (Including Existing Capacity) Across Zones

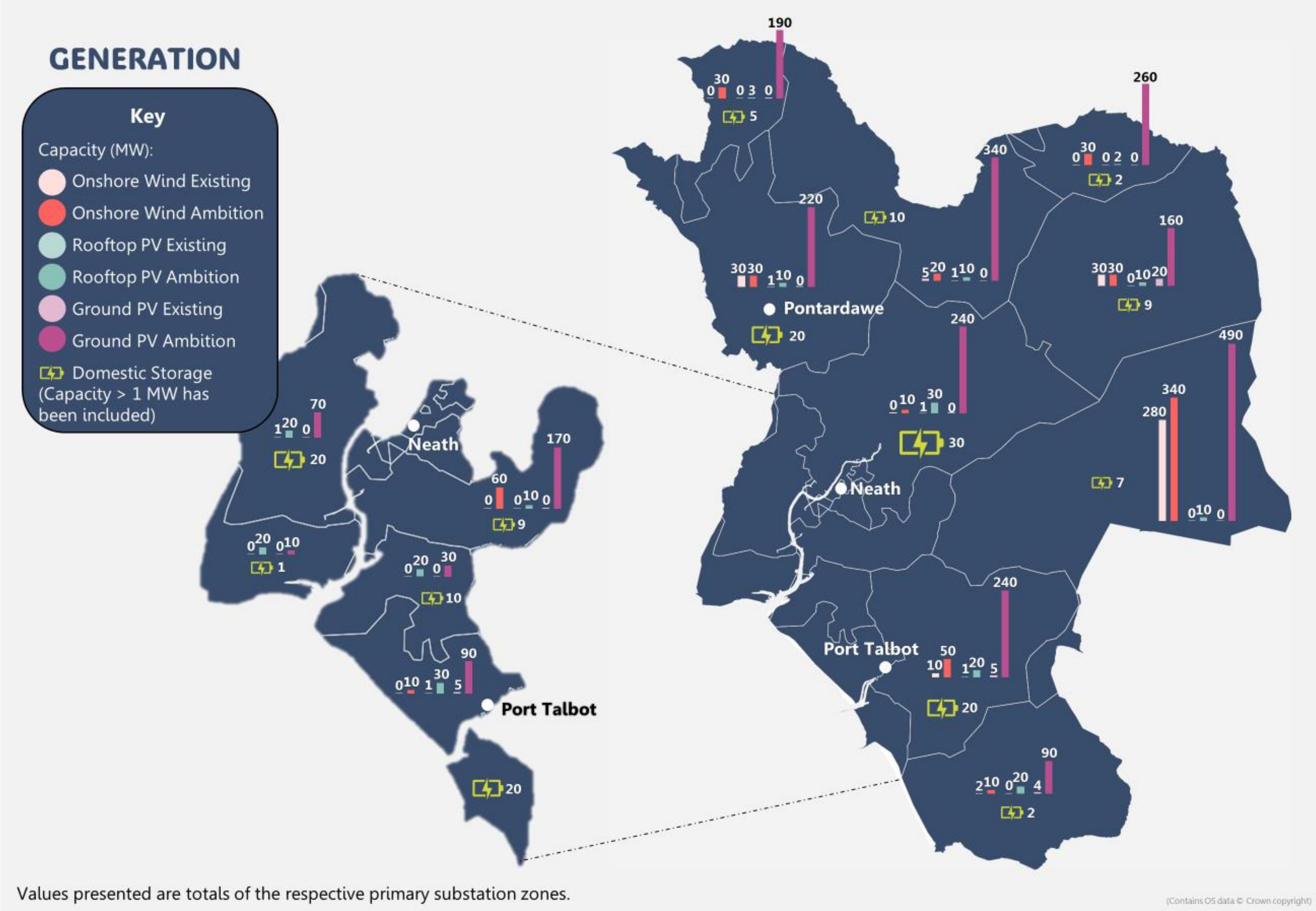

Figure 5-35: Renewable Generation Interventions Map

5.5 Industry

The decarbonisation of heavy industry is challenging, both technically and economically. Alternative, low carbon technologies (particularly for high temperature processes) are expensive, and the supply chains are less well developed than other sectors. The cost and timelines of grid connections can also be an impediment to electrification.

The transition to decarbonise heavy industry is predicted to be slower than other sectors due to the lack of formal targets and anticipation of unique challenges across the sector. The fuel switching of heavy industry (electrification or hydrogen) could occur from the late 2020s. The availability of grid connection and hydrogen will be key considerations.

5.5.1 Measure Overview

Two large industrial sites in Neath Port Talbot were identified based on NAEI: the Sofidel Paper Mill in Baglan Energy Park, and the Port Talbot Steelworks. Paper mills typically do not require very high temperature processes meaning that electrification could be feasible. There are several routes to the decarbonisation of industry, including improving process and material efficiencies. Electrification and hydrogen are two key options:

Industrial Electrification: As the grid decarbonises, the electrification of industrial processes opens up an avenue for decarbonisation. Electrification is seen as challenging, as the supply chain of technologies is less well developed than incumbents, and the costs of the technologies, the grid connection and electricity itself is high. However, electrification could offer energy efficiency benefits, particularly with the development of high temperature heat pumps.

Hydrogen for Industry: Due to the challenges of electrification, particularly for high temperature processes, hydrogen is seen as a key enabler for industrial decarbonisation. However, the cost and availability of hydrogen needs to be considered. The HyLine Cymru project being investigated by WWU could unlock hydrogen for the Port Talbot industrial area by transporting it from Milford Haven where large-scale hydrogen production has been proposed.

5.5.2 Existing Targets

Key bodies represent industry in the South of Wales including Net Zero Industry Wales (NZIW) and the SWIC. They will be essential support services to assist in the industrial transition. SWIC have a net zero ambition for 2040, which will likely support most industries across the area to transition to low carbon energy during the 2030s. If successful, HyLine Cymru is anticipated to be available between 2030 and 2040.

Wales also sits in the Western Gateway region and therefore can lean on this wider area which encompasses Western England and South Wales.

5.5.3 Cost and Impact

The future of heavy industry in Neath Port Talbot is uncertain, so the future energy demands, and the cost of the transition has not been included in the analysis of this LAEP. However, the decarbonisation options could be considered.

The current method of steel production at the Port Talbot Steelworks is the Blast Furnace – Basic Oxygen Furnace method which requires coal in the blast furnace to remove the oxygen from iron ore. Steel production can be decarbonised in several ways including:

- Applying CCS on existing blast furnace plants
- Using hydrogen to remove oxygen from the iron ore in a Direct Reduction Ironmaking process
- Switching to a recycled steel plant using electric arc furnaces

Recent announcements on the Steelworks confirm that it is moving away from its current production route to recycled steel electric arc furnaces (78).

5.5.4 Industrial Focus Zones

Costs and energy demand for industrial decarbonisation are highly uncertain and therefore have not been quantified in this LAEP. However, as Port Talbot is one of the UK's major industrial areas and a key part of the local authority's identity, it is undeniably a Focus Zone of the future.

There is opportunity for a virtuous exchange of goods and materials within industrial clusters such as South Wales. Port Talbot was identified as a 'Clean Growth Hub' in SWIC's 2023 cluster plan due to the presence of the Steelworks, its deep-water port, plans for Floating Offshore Wind (FLOW) turbine assembly, and the recent planning application from Lanzatech for a sustainable aviation fuel plant (79) (80). These industrial activities can complement each other by a circular exchange of materials and a shared energy infrastructure.

In 2023, Port Talbot received official status as a freeport, which is a considerable achievement for the area and is likely to attract significant investment and jobs. The port has also been identified as a potential carbon capture and storage hub, by using the port for CO_2 shipping. This could unlock wider decarbonisation opportunities in the area.

Although current plans centre around the electrification of the Steelworks, hydrogen could still play a major role in Port Talbot, with opportunities from HyLine Cymru, and for production, use in other industry, and distribution through the freeport.

Two key actions were developed to support the decarbonisation of industry. This includes an energy engagement forum, which may build on the existing bodies to ensure the LAEP's actions are supported and a support programme for the region.

PRIORITY ACTIONS

14 Establish an Industry Engagement Forum to Identify and Progress Energy-Related Opportunities

15 Encourage the Uptake of Decarbonisation Support Programmes to Facilitate the Decarbonisation of Light, Medium and Heavy Industry

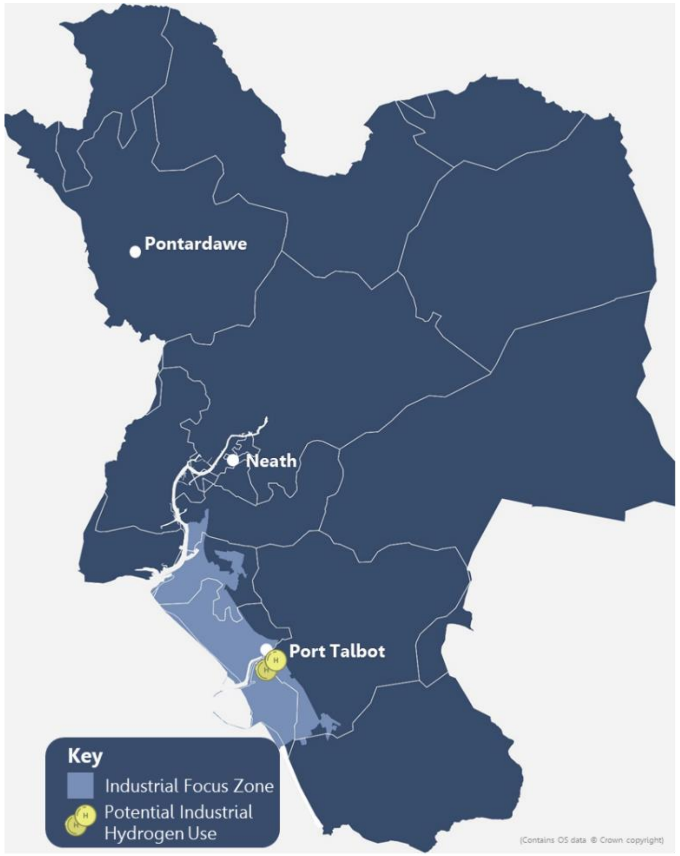

Figure 5-36: Industrial Focus Zones

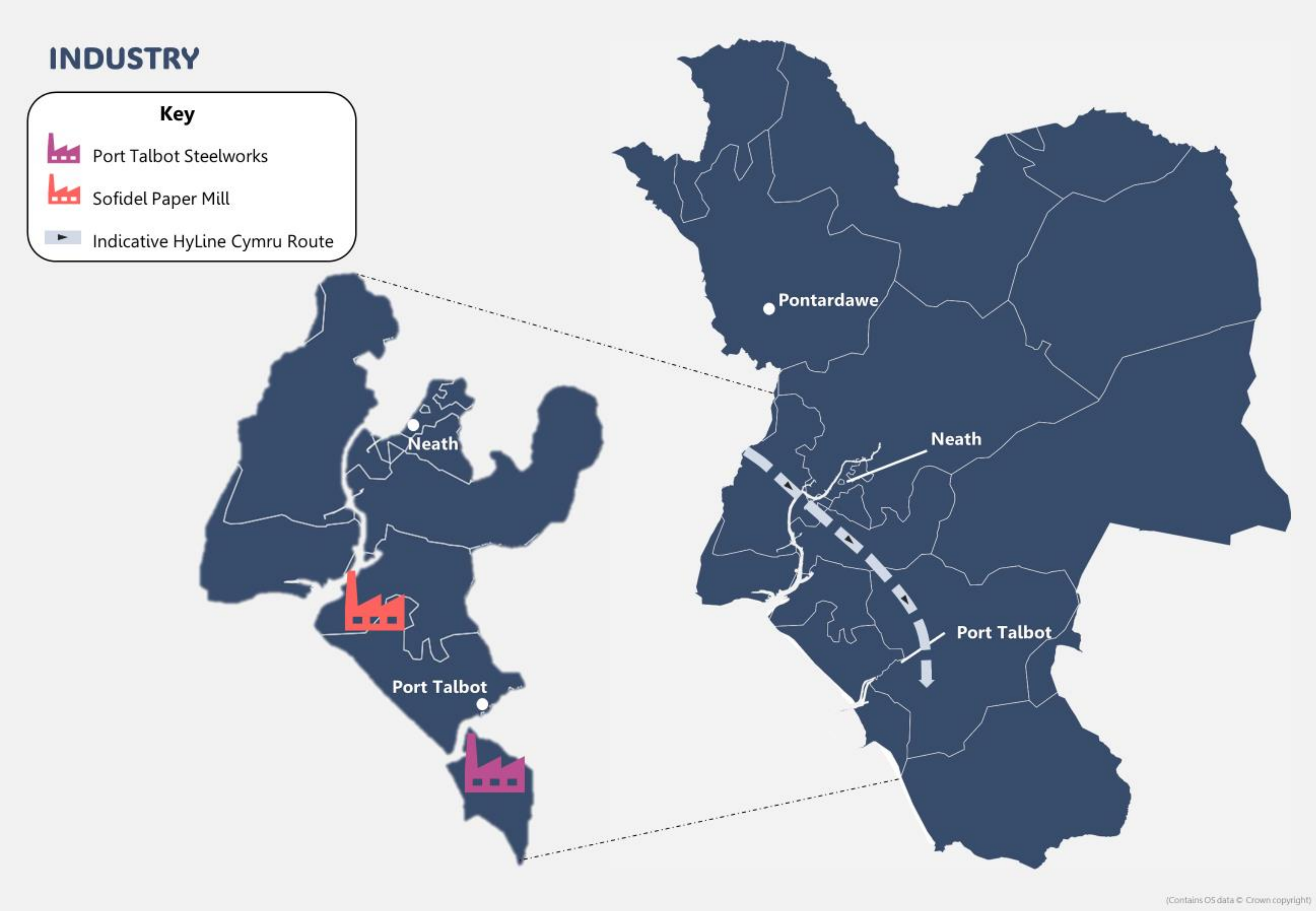

Figure 5-37: Industrial Interventions Map

5.6 Network Impacts

The resiliency of the electricity grid will be paramount to decarbonisation, to be able to support the considerable increase in electricity demand as many sectors electrify. In some areas, the future demand will exceed the current capacity of the grid and upgrades will be required. Advanced planning of upgrades across multiple projects and sectors will reduce delays and can help to reduce and spread costs by considering the demand holistically instead of for individual applications.

Renewable generation connection currently faces challenges due to long wait-times for projects to be connected into the grid. This is also because of planning around capacity limits, and considerable work is being done by National Grid and DNOs to address the issues with the current system and find a feasible solution. Again, forward planning of renewables holistically will also help this.

Despite the current plans to electrify the Steelworks, hydrogen could still play a key role in the area if used within the wider industry hub or for heavy vehicles. The potential use of hydrogen could be planned strategically to enhance the associated potential economic opportunities and reduce the distribution and infrastructure costs. This includes the possibility to tap into the existing gas grid at desired locations, as a hydrogen distribution network, should the grid be repurposed.

The opportunity around the development of HyLine Cymru, plus the freeport status, could provide a valuable source of hydrogen and distribution to Neath Port Talbot. Plans around HyLine Cymru and further developments of the potential for hydrogen's use across industry and transport should be drawn together to understand how shared infrastructure could be developed.

5.6.1 Measure Overview

The modelled hourly electricity consumption for each sector was analysed to determine the overall peak electricity demand in 2050. This was conducted for each primary substation area. This was also repeated for energy generation, accounting for demand consumed locally.

The peaks were compared to the current estimated capacity of each primary substation, as per NGED's data. This gave an indication of where future demand may exceed current capacity. As this modelling is indicative and uncertain, the analysis was performed as a RAG assessment to identify areas with a moderate or high risk of needing an upgrade.

It is also important to note that this peak demand has accounted for demand reduction measures such as flexibility services and retrofitting of buildings. Although grid upgrades will be unavoidable in some areas, demand reduction and energy efficiency measures should be maximised to reduce the peak as much as possible.

Potential capacity constraints which could arise from decarbonisation actions will be considered when planning the future energy system due to the anticipated increase in electrification and therefore strain on the local grid. NGED are proactively investing in their network to support the load growth forecast within their Distribution Future Energy Scenarios (DFES) and this LAEP provides additional supporting evidence to justify investment in the distribution network to resolve the network constraints.

The intention of this analysis is to highlight areas which are likely to need upgrades in the future, so that NGED can engage with stakeholders for those areas and forward plan infrastructure improvements.

5.6.2 Cost and Impact

Modelling grid infrastructure power flows is highly complex and is conducted by specialists at NGED. Complexities include the possibility to adjust infrastructure connections to allow for additional demand or generation, opportunity for alternative measures which avoid the need to upgrade, which must be considered for a given area based on multiple factors and the wide range of potential costs of upgrades. Therefore the identification of a constrained area through this analysis does not guarantee the need for an upgrade and the costs of grid infrastructure upgrades are very uncertain.

However, high level estimates have been calculated for the purpose of this LAEP to suggest the scale of investment needed. This is based on assumptions around upgrades required for both the additional demand and generation. This assumes that the demand would require upgrades to the low voltage network (33kV and 66kV) and generation would require upgrades to the extra high voltage network (132kV).

These costs are indicative only to understand the scale of investment required, and additional analysis will be carried out by NGED following this LAEP to gain more accurate insight into future network costs. The costs provided by NGED following more detailed analysis should be taken in preference to the values stated here.

To meet additional electricity demand needs, it is estimated that £10-20mn of investment will be needed across the distribution network. For generation, £200-300mn could be needed, depending on the final uptake of the total renewables ambition. Distribution network operators are actively using Load Management Schemes to more actively manage network loading across the electricity system. This allows greater amounts of generation to be connected without triggering all of the reinforcement, which may further reduce this figure.

Finally, a large portion of these costs will be paid by private developers and therefore not all cost will be borne by bill payers. This will be through general investment costs to connect developments, as well as funding the costs to connect from the new site to the grid where they are the sole asset, which can be significant distances.

5.6.3 Network Focus Zones

Areas showing capacity issues for the electricity network have been designated as Focus Zones, as shown in Figure 5-39 and Figure 5-40 for demand and generation. These areas are more at risk of exceeding grid capacity and therefore engagement with stakeholders in these zones will be essential moving forwards to monitor future demand and generation.

Opportunities for these Focus Zones include reinforcement considerations, but could also include wider measures which avoid the cost of grid upgrades. Examples include investment in energy storage capacity (such as hydrogen or battery storage), or energy flexibility planning. This could potentially avoid reinforcement whilst also creating a local asset for the area and creating more energy resilience and security.

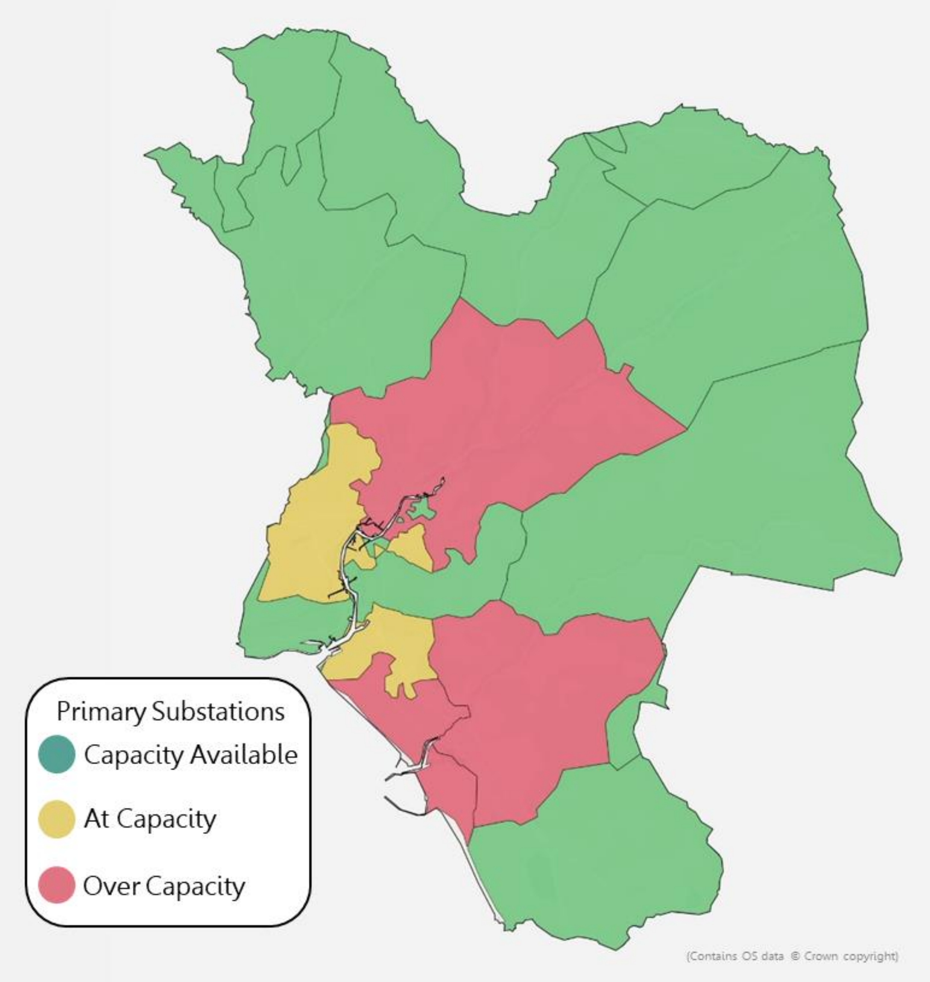

Figure 5-39: Electricity Network Future Demand Capacity

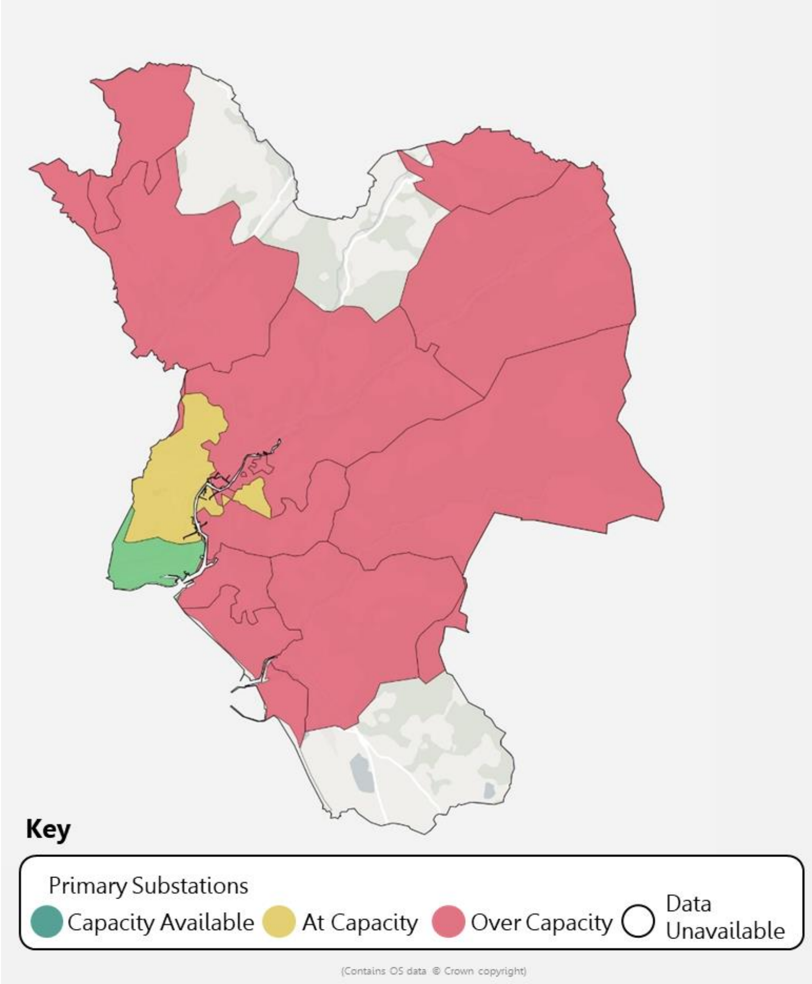

Figure 5-40: Electricity Network Future Generation Capacity

Focus Zones have also been developed to present areas where hydrogen could be needed across the different sectors and strategic, spatial planning would be effective. This includes key hydrogen vehicle refuelling points, areas which could host hydrogen bus depots, hotspots for industry and the freeport. These areas and any corresponding programmes and opportunities should be discussed through engagement with WWU and industry bodies such as SWIC.

Opportunities for these Focus Zones include reinforcement considerations, but could also include wider measures which avoid the cost of grid upgrades. Examples include investment in energy storage capacity (such as grid-level hydrogen or battery storage), or energy flexibility planning. Grid level storage has multiple benefits, particularly when coupled with increasing renewable generation capacity; it can reduce operating costs by increasing the grid's ability to absorb renewable energy and reduce curtailment of renewables, reduce generation costs by contributing to supply security, and offset the need for reinforcement investments (81). Energy storage could therefore reduce reinforcement costs whilst also creating a local asset for the area and creating more energy resilience and security. The type of reinforcement that is appropriate would likely be considered on a case-by-case basis, as certain substations are already highly constrained, meaning energy flexibility via storage alone may be insufficient for meeting increased demands. Hydrogen storage may be well-suited near areas where it can be directly used in other processes, such as in industry or heavy transport, whereas battery storage may be better placed in substations servicing highly urbanised areas.

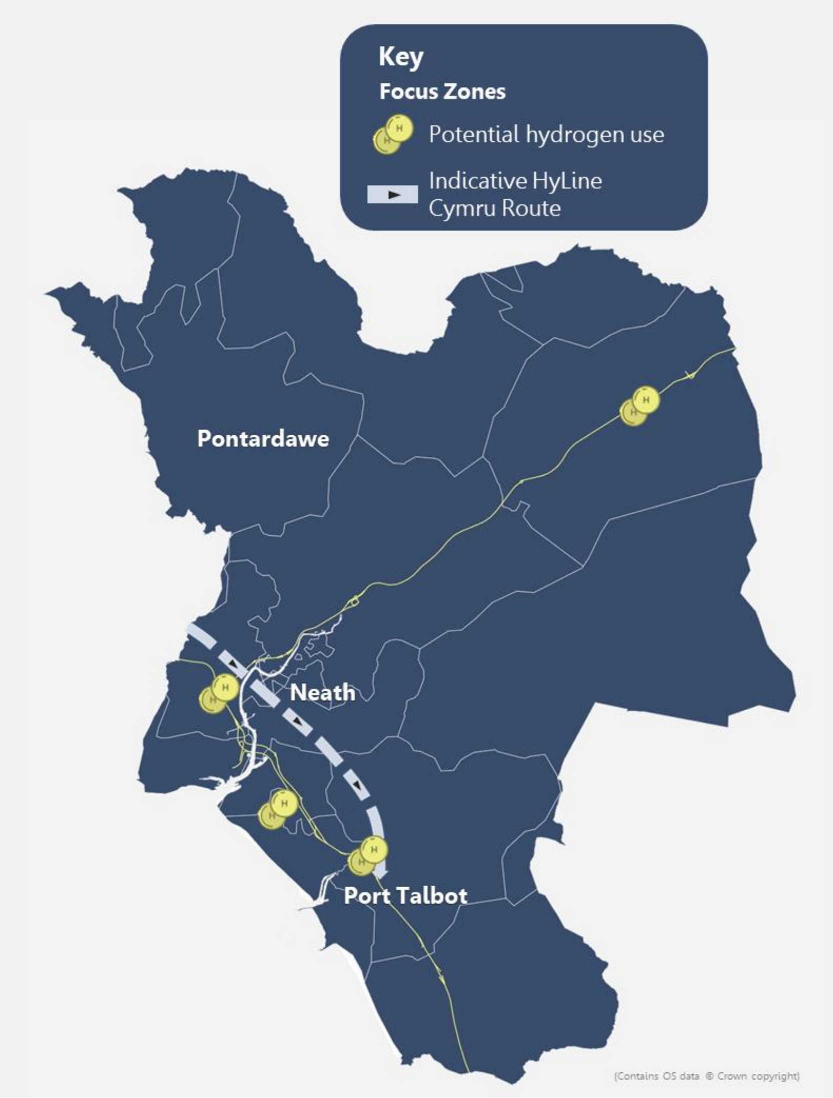

Figure 5-41: Hydrogen Focus Zones

5.7 Implementation Progression Targets

The required implementation pace of technologies to meet the final net zero energy system was derived from the pathway modelling. This provides cumulative targets that would need to be met to ensure that an adequate rate of transition is occurring. This has been provided for the built environment, such as building decarbonisation and transport. It has not been provided for industry, as this is highly uncertain and is anticipated over the time period 2030 – 2040, although the rate of change is unknown. It has also not been provided for large-scale renewable installation. This is partially due to the current connection challenges for the grid and the uncertainty around how these will develop. It is also because, as described in Section 5.4, the full anticipated build out of renewables is unknown and the values presented are only an ambition, not a target.

These rates are challenging and will require significant action immediately to meet the interim 2030 goals. If targets are missed, it may have knock-on impacts for the uptake rate (such as with EV charger build out and adoption of EVs by the public), or in other cases it could be offset by faster uptake in later years.

For many interventions, roll-out has been modelled using S-curves which account for a slow build to an accelerated need for action and then a tapering off towards 2050. In many cases, this reflects the development of a reliable and sufficient supply chain and skilled workforce to implement new technologies. It may also reflect the anticipated market drivers such as falling costs as technologies become more mainstream.

Metrics for the number of retrofitted buildings, heating technology and rooftop PV installations are shown in Table 5-5 below. Low carbon vehicle metrics have been provided in terms of percentage of vehicles on the road.

Metric	2020	2025	2030	2035	2040	2045	2050
Retrofitted Domestic Buildings	800	5,100	14,100	45,800	71,200	75,900	77,700
Retrofitted Non-Domestic Buildings	70	450	1,150	3,100	4,700	5,100	5,300
Domestic Heat Pumps	370	3,570	15,170	30,630	44,450	56,940	70,020
Non-Domestic Heat Pumps	10	120	550	1,170	1,750	2,300	2,880
Domestic Buildings Connected to a Heat Network	<10	40	430	2,580	4,370	4,690	4,780
Non-Domestic Buildings Connected to a Heat Network	-	-	1,480	1,730	1,950	2,030	2,100
Domestic Oil Boilers	2,100	2,000	1,990	1,880	1,270	650	-
Non-Domestic Oil Boilers	120	125	130	120	90	50	-
Domestic Gas Boilers	62,000	60,180	49,890	34,560	21,650	11,090	-
Non-Domestic Gas Boilers	3,700	3,830	2,090	1,410	820	420	-
Domestic Rooftop PV Number of Installations	3,000	3,500	7,000	13,000	19,000	22,000	23,000
Non-domestic Rooftop PV Capacity (MW)	3	13	30	70	100	120	130
% Electric Cars	-	10%	39%	83%	100%	100%	100%
% Electric LGVs	-	4%	27%	80%	99%	100%	100%
% Electric Buses	-	18%	49%	80%	80%	80%	80%
% Electric HGVs	-	-	3%	22%	60%	79%	80%
% Hydrogen Buses	-	5%	12%	20%	20%	20%	20%
% Hydrogen HGVs	-	1%	2%	4%	6%	12%	20%

Table 5-5: 5-Year Cumulative Implementation Target Metrics for Building Retrofit, Heating Technologies, and Transport for Widespread Engagement

6 Action Plan

6.1 Action Plan Purpose

The LAEP document acts as a catalyst for future initiatives, informing upcoming projects, policies, and strategies. The Action Plan's purpose is to provide clear direction, channelling the broader focus on decarbonisation into a set of collective actions. Some actions aim to deliver measurable results within the next 3 – 5 years, empowering and demonstrating success. Others are multi-year programmes, contributing to long-term success and guiding Neath Port Talbot toward the Net Zero Pathway targets.

The Action Plan does not replace existing net zero strategies, workplans, or statutory documents but rather complements and supports their delivery. Collaborating on these workstreams aims to enhance the effective use of member organisations' resources, prevent duplication of effort, scale programmes for securing investment, and establish clearer working structures to support knowledge transfer and the sharing of information and best practices.

The remainder of this section provides additional details for the LAEP's Action Plan. It is important to note that the purpose of the Action Plan is not to prescribe an exact process or steps to reach net zero but rather to identify direction that guides the correct trajectory and ensures the involvement of relevant stakeholders in future projects and decisions. Moreover, the time period will be subject to significant changes and uncertainties across technology, policy, and markets that cannot currently be predicted. Therefore, the Action Plan is intentionally flexible and will require regular updates to adapt to the evolving environment.

6.2 Action Plan Process

The Action Plan has been developed to outline a set of realistic and tailored example steps that both build on and accelerate Neath Port Talbot's net zero transition. It draws insights from the future modelled scenarios the key sectoral milestones defined within the Net Zero Pathway (see section 4.2). The success of the Action Plan hinges on collaboration, encompassing neighbouring local authorities, regional bodies, national government, educational institutions, businesses, community groups and residents. Therefore, these actions stem from an extensive stakeholder engagement process (see Figure 6-1). Co-producing 15 priority actions in collaboration with key stakeholders sought to ensure that the final set of actions build on local and regional expertise and knowledge.

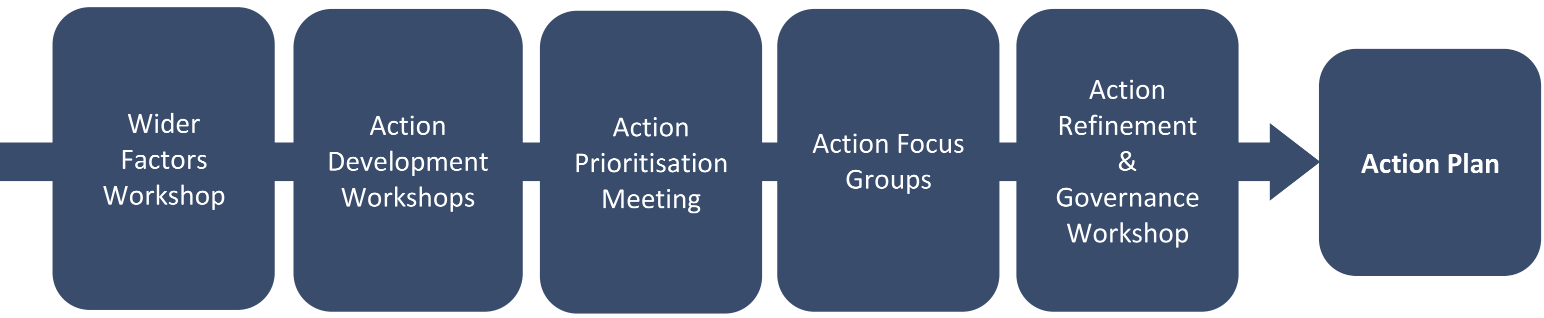

Figure 6-1: Action Plan Stakeholder Engagements

Continued buy-in and collaboration will be vital to propel the actions forward and maximise success. Following the publication of LAEP, it will be necessary to transform the headline actions into specific projects and opportunities. Ensuring the involvement of relevant stakeholders during the development process is vital.

6.3 Action Plan Overview

An overview of the actions is outlined in Table 6-1. Due to the urgency of the climate emergency, it is proposed that all actions are mobilised quickly. However, it is recognised that some actions are more complex than others. Therefore, each action has been allotted a time frame, as follows:

- **Short-Term:** Actions which can be successfully implemented over two years.
- **Medium-Term:** Actions which can be successfully implemented or scaled over two to five years.
- **Long-Term:** Actions which can be successfully implemented or scaled over five years or more.

Sector	No.	Action
Crosscutting Enabling Actions	1	Establish a Regional Steering Group to Enable the Delivery of LAEP Outcomes
	2	Support Long-Term Green Skills Programmes to Enable the Delivery of Decarbonisation Measures
	3	Embed LAEP Learnings into Wider Council Processes and Communications to Enable the Delivery of LAEP Outcomes
Building Efficiency, Retrofit and Heating	4	Create a Behaviour Change Campaign to Increase Uptake of Retrofit and Low Carbon Heating
	5	Develop a Fuel Poverty Programme to Support a Just Transition to Net Zero
	6	Develop a Programme for the Electrification of Public Sector Owned Non-Gas, Fossil Fuelled Buildings to Increase Uptake of Low Carbon Heating
Transport	7	Develop Holistic Community Transport Provision in Valley Areas to Enable Sustainable Rural Travel
	8	Facilitate Low and Zero Carbon Vehicle Uptake to Decarbonise Public Fleets
	9	Enhance Active Travel and Public Transport to Reduce Reliance on Personal Motorised Vehicles
Generation and Networks	10	Continue Collaboration with Electricity and Gas Network Operators to Foster a Robust Future Energy System
	11	Support the Zero Emission Vehicle Infrastructure Strategy to Address Future Needs of Hydrogen-Fuelled Vehicles in the Region
	12	Develop a Support Programme for Community Energy Microgrid Projects to Increase Energy System Resilience and Efficiency
	13	Develop a Storage and Flexibility Financial Incentives Programme to Increase Energy System Resilience
Industry	14	Establish an Industry Engagement Forum to Identify and Progress Energy-Related Opportunities
	15	Encourage the Uptake of Decarbonisation Support Programmes to Facilitate the Decarbonisation of Light, Medium and Heavy Industry

Table 6-1: Overview of the Action Plan

The Action Roadmap on the following page provides an overview of the sequential implementation of the priority actions.

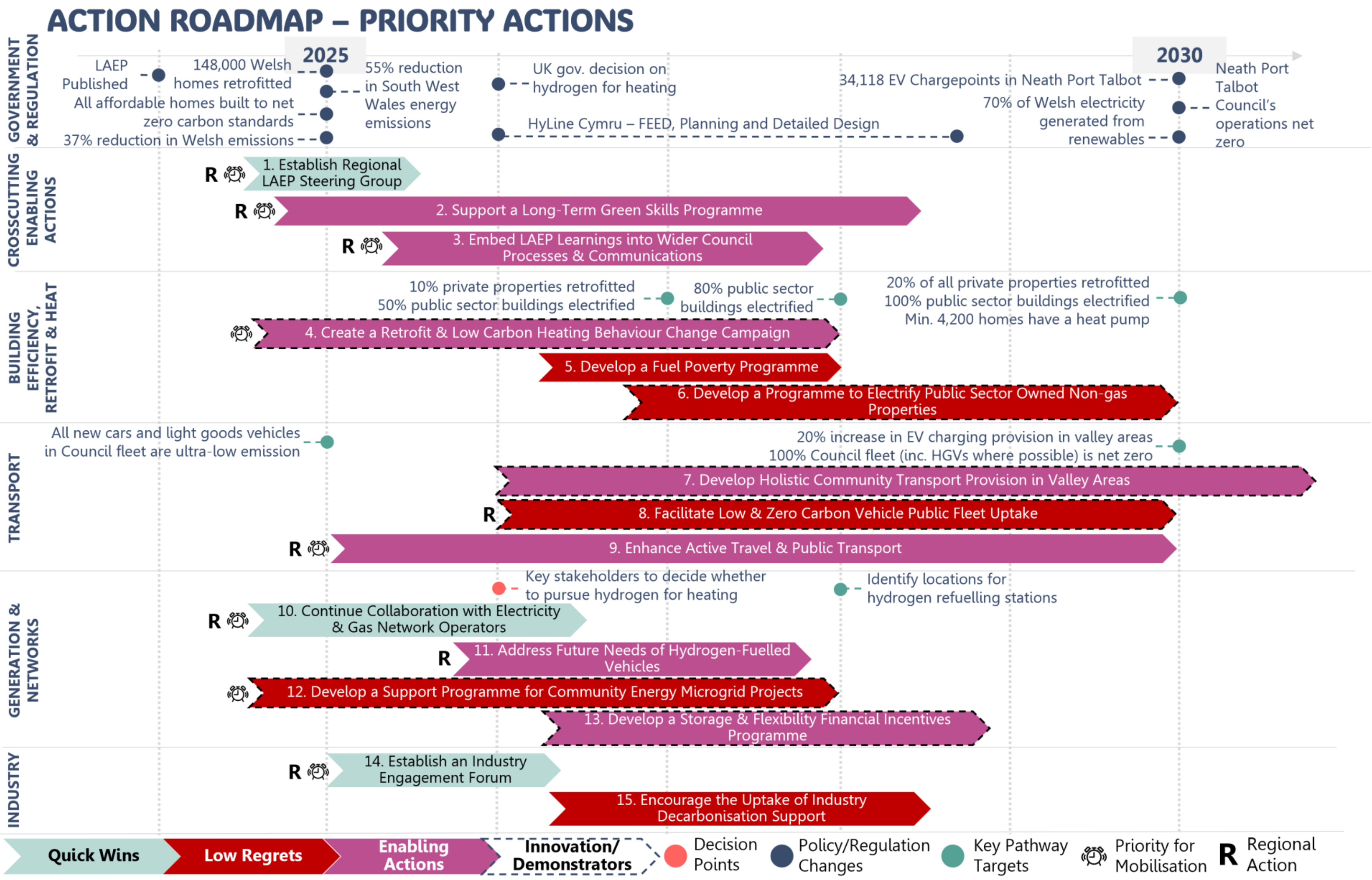

Figure 6-2: Action Roadmap

6.4 Crosscutting Enabling Actions

The crosscutting enabling actions represent a commitment to a holistic approach, recognising that sustainable outcomes are the product of collaboration, awareness, and continuous skill development. Through these interconnected efforts, Neath Port Talbot will be positioned to navigate the challenges of the energy transition, fostering a resilient, informed, and skilled community ready to embrace the opportunities of a low carbon future.

Action 1: Establish a Regional LAEP Steering Group to Enable the Delivery of LAEP Outcomes	
Overview	Establish a Regional LAEP Steering Group for effective LAEP action implementation. The group will align actions from the four LAEPs, mobilise and oversee the actions at a programme level, delegate ownership, provide funding support (which is to be aligned with the Regional Directors' Group), and progress monitoring. Operational support will come from the new regional project management team and the dedicated Regional Energy Team, reporting directly to the influential South West Wales Energy Core Group.
Timescale	Short-term
Location	South West Wales-wide
Example Implementation Steps	1. Establish a dedicated regional project management team to service the needs and activities of the Regional LAEP Steering Group. 2. Define the group's aim, Terms of Reference, structure, and scope. 3. Ensure alignment and integration of the LAEP Steering Group with the Regional Directors' Group. 4. Incorporate the Regional Energy Strategy as a foundational evidence base for funding discussions and decision-making within the Steering Group. 5. Collaborate with the Regional Directors' Group to provide funding support for the Steering Group. 6. Define the role and responsibilities of the Regional Energy Team in supporting the Steering Group. 7. Develop a reporting structure that ensures regular communication and updates between the Steering Group and the South West Wales Energy Core Group. 8. The Steering Group to perform regional review of the four LAEPs in South West Wales to understand and review all actions, and understand which actions can be mobilised regionally.
Suggested Key Stakeholders	Neath Port Talbot, Carmarthenshire, Swansea and Pembrokeshire Councils, existing Regional Directors' Group, regional project management team, Regional Energy Team, South West Wales Energy Core Group, NGED, WWU.
Co-benefits	• Promotes synergy, efficiency, and informed decision-making in LAEP implementation. • Fosters increased collaboration and knowledge exchange among stakeholders.
Costs	~£30,000 – £50,000
Risks & Dependencies	• Complexity in coordinating activities among the Regional Director's Group, project management team, and the South West Wales Energy Core Group.

	• Regular updates required to ensure alignment with evolving strategic priorities. • Sufficient representation of stakeholders.
Key Performance Indicators (KPIs)	• Regional LAEP Steering Group is mobilised by the end of Q3 2024. • Review of actions conducted by the end of Q4 2024.

Action 2: Support Long-Term Green Skills Programmes to Enable the Delivery of Decarbonisation Measures	
Overview	Continue advancing existing skills programmes in Neath Port Talbot, such as the Swansea Bay City Deal's Supporting Innovation and Low Carbon Growth Programme (which Neath Port Talbot Council leads and is actively pursuing funding for a Net Zero Centre of Excellence Skills Academy). The aim is to proactively increase the availability of regional local and in-house expertise for the effective delivery of net zero, from a low carbon and renewable technology perspective.
Timescale	Medium-term
Location	South West Wales-wide
Example Implementation Steps	1. Collaborate with key stakeholders (such as the regional skills body), to expand on the skills mapping exercise initiated by the Swansea Bay City Deal. Evaluate the current green skills within the regional workforce in relation to future requirements. 2. Identify existing initiatives, such as the Freeport Skills Programme, and pinpoint gaps that could impede the successful implementation of net zero, specifically concerning low carbon and renewable technology. 3. Identify how barriers can be unblocked (such as developing a fast-track programme for retrofit assessors and providing accessible, bite-sized training that is available at convenient times and 'on the job', developing relationships with local garages to address lack of EV focus, greater engagement with young people/future decision makers, etc). 4. Develop collaborations or partnerships with stakeholders, such as: a. Local educational institutions: To enable the design and implementation of training programmes that align with industry needs, fostering collaboration between academia and industry. b. Training Providers: Such as NPTC Group of Colleges, to harness and progress ongoing efforts in this area. c. Net Zero Skills in South Wales Project: To align and cross pollinate ideas, expertise and resources. d. National Construction Company: To support skills development and training. e. WWU and NGED: To embed knowledge of future network and hydrogen skills and training requirements into the programme, based on their current work with EU Skills and the Institution of Gas Engineers and Managers.

	5. Develop a prioritised action plan for key green skills to include a pipeline of upcoming requirements so the scale of opportunity can be communicated to the market. 6. Facilitate the expansion of the Supporting Innovation and Low Carbon Growth Programme to bolster the broader regional skills plan in partnership with Carmarthenshire and Swansea Councils. This entails aligning with the regional skills development vision and leveraging established programmes in Neath Port Talbot. 7. Establish the proposed Net Zero Centre of Excellence Skills Academy, with a regional outlook that is driven by industry needs.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot, Carmarthenshire and Swansea Council, existing regional skills group, further and higher educational institutions, Net Zero Skills in South Wales Project team, trade body associations, Building Research Establishment (BRE) housing consortiums, national government, NGED, WWU.
Co-benefits	• Strengthened local supply chain. • Enhanced local employment opportunities. • Fosters a sense of community involvement and support for low carbon initiatives.
Costs	~£450,000 — £500,000
Risks & Dependencies	• Existing lack of focus on continual professional development within industry. • Addressing accessibility challenges and customising training approaches to align with industry preference (e.g. on-site and blended learning approach). • Breaking silos and increasing knowledge sharing between traditional construction and retrofit approaches. • Aging workforce. • Significant shortage of trainers.
KPIs	• Complete a green skills gap analysis by the end of Q2 2025. • Develop a prioritised action plan for key green skills by end of Q2 2026. • First new courses available across the region for academic year 2027/2028.

Action 3: Embed LAEP Learnings into Wider Council Processes and Communications to Enable the Delivery of LAEP Outcomes	
Overview	Embed the principles of net zero and LAEP outcomes into Council processes and public communications. This action aims to create a culture of awareness and understanding within the Council, aligning with net zero and LAEP goals. By integrating these outcomes into decision-making processes and public communications, the objective is to drive behaviour change and encourage wider organisations and the community to engage in sustainable practices.
Timescale	Short-term
Location	South West Wales-wide

Example Implementation Steps	**Embed net zero and LAEP outcomes into wider Council processes:** 1. Initiate climate awareness training for Council staff, ensuring that it is updated to include the most recent net zero and LAEP outcomes and targets. 2. Develop clear and measurable objectives for employees related to net zero and LAEP outcomes, ensuring alignment with individual roles and responsibilities. 3. Establish a framework for quantifying the climate impact of council decisions and integrate tools or methodologies to enable the measurement and assessment of carbon emissions. In addition, provide guidance on how to consider and prioritise low carbon alternatives in decision making processes. 4. Conduct a thorough review of the existing procurement strategy and identify opportunities to include criteria that encourage sustainable and low carbon practices. Integrate mechanisms to stimulate decarbonisation, such as preference for low carbon materials. 5. Consider how a circular economy can be encouraged. 6. Align the above tasks with the forthcoming climate change, decarbonisation and energy team to ensure that behaviour change is cross-directorate and embeds elected members into the process. 7. Expend support for wider organisations to encourage them to embed net zero outcomes into their processes. **Embed net zero and LAEP outcomes into public communications:** 1. Develop a regional Climate Change Communications Plan that emphasises the goal of raising awareness about climate change, the significance of regional efforts toward net zero and LAEP outcomes, and is suited to address misinformation in real time. 2. Conduct a comprehensive analysis (that includes consulting community groups and education institutions) to identify prevalent myths and misconceptions related to climate change and net zero (such as concerning EVs and heat pumps). 3. Develop a fact-based response document with counterarguments, ensuring accuracy and clarity in addressing common misconceptions. 4. Ensure the public is aware that this is a legitimate campaign. Consider replicating successful advertising strategies employed by others (such as Coventry City Council) and embed in Welsh media if possible.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot, Carmarthenshire and Swansea Councils, existing energy-focused regional group, Council teams, national government, elected members, Council directorates, community groups, education institutions.
Co-benefits	• Reinforces sustainability commitments, building trust within the community. • Fosters innovation and industry leadership by institutionalising net zero and LAEP principles to cultivate a culture of awareness and understanding of sustainable practices. • Encourages buy-in for the LAEP and resulting programmes.
Costs	~£100,000 — £150,000

Risks & Dependencies	• Resource and budgetary constraints to implement sustainable practices. • Lack of skills and knowledge. • Competing priorities for council teams.
KPIs	• All council teams have completed awareness training by the end of Q4 2025. • Myth busting document developed by end of Q4 2026. • A framework to quantify the climate impact of Council decisions is implemented by end of Q2 2026.

6.5 Building Efficiency, Retrofit and Heating Actions

The following actions have been developed to enable delivery of the required building efficiency, retrofit and heating interventions detailed in the LAEP. The ensuing actions, including the creation of a behaviour change campaign, the development of a fuel poverty programme and a programme for the electrification of public sector owned non-gas, fossil fuelled buildings. This orchestrated effort not only addresses the immediate challenges of the energy transition but positions Neath Port Talbot to facilitate a just transition. This section outlines the pivotal steps taken to bolster a community that is not only informed but also benefit from building efficiency and heating measures.

Action 4: Create a Behaviour Change Campaign to Increase Uptake of Retrofit and Low Carbon Heating	
Overview	Develop behaviour change initiatives for residential and commercial properties. The dynamic campaign should be designed to inform, educate and cultivate transformative shifts in behaviour concerning energy efficiency, retrofit practices, and the adoption of low carbon technologies. The initiative should aim to instigate a positive and lasting transformation in behaviour, contributing to a more energy-efficient and environmentally conscious community.
Timescale	Medium-term
Location	Neath Port Talbot-wide with an initial focus on non-gas, fossil fuelled buildings. These are buildings which do not use gas, and instead use other polluting fuels.
Example Implementation Steps	1. Prioritise non-gas, fossil fuelled residential and commercial properties initially, due to their typically higher carbon emissions and the uncertainty around hydrogen for heating. 2. Collaborate with the Homes as Power Stations project team (who promote renewable energy generation within new builds and existing properties), to join up communication efforts where possible. 3. Conduct an analysis of the target audiences to understand their current energy usage patterns, preferences, and potential barriers to behaviour change, dividing the target audience into segments. 4. Develop engaging and persuasive messages that highlight the benefits of energy efficiency, retrofit measures, and low carbon technologies. Emphasise the positive impact on the environment, cost savings, and overall well-being.

	5. Identify and showcase successful case studies from similar regions or contexts. Highlight real-world examples to instil confidence, demonstrate feasibility, and exhibit the tangible benefits for end users. 6. Extend the campaign to address on-gas grid residential and commercial properties.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot and Carmarthenshire Councils, energy-focused regional group, communications teams, community energy groups, elected members, national government, Swansea Bay City Deal project team.
Co-benefits	• Cost savings for consumers. • Health benefits from transitioning away from boilers and improved thermal comfort. • Stimulated local economy if subsequent work is procured locally. • Enhanced climate awareness.
Costs	~£150,000 – £200,000
Risks & Dependencies	• Resistance to change due to financial barriers, limited awareness and negative misconceptions of emerging technologies. • Skills gap within supply chain to deliver at scale and shortage of accredited installers to build consumer trust. • Changes in national policy and decision-making. • Equitable and accessible engagement mechanisms.
KPIs	• Develop audience-tailored behaviour change campaign for non-gas, fossil fuelled domestic and non-domestic properties by end of Q2 2025. • Minimum 50% non-gas, fossil fuelled properties informed through marketing campaign by end of Q4 2025. • 10% of properties undertake retrofit by end of Q4 2027.

Action 5: Develop a Fuel Poverty Programme to Support a Just Transition to Net Zero	
Overview	Develop a fuel poverty programme that undertakes a fresh review of fuel poverty and affordable warmth levels within Neath Port Talbot. Through this action, Neath Port Talbot aims to build a resilient and inclusive strategy that not only alleviates fuel poverty but also ensures that the net zero transition benefits all members of the community, fostering a sustainable and equitable future.
Timescale	Short-term
Location	Identified 'at risk' areas in Neath Port Talbot. These are areas within retrofit focus zones that have a high WIMD ranking and poor dwelling energy efficiency.
Example Implementation Steps	1. Conduct a review of existing fuel poverty programmes in the area, in addition to fuel poverty and affordable warmth levels in Neath Port Talbot in 'at risk' areas. Include a gap analysis utilising the latest available datasets including fuel poverty data, energy performance metrics, health data, and information on existing energy improvement initiatives. 2. Identify specific areas and demographics with the highest need for interventions, exploring correlations between fuel poverty and other socio-

	economic factors to develop a nuanced understanding of the challenges faced by different communities. 3. Evaluate the impact of current energy markets, considering the transition to net zero, and project the effects on low-income households and vulnerable populations, with a focus on the period through 2035 and beyond. 4. Explore potential linkages between fuel poverty and the transition to EVs, particularly addressing the impact on individuals who may be categorised as "travel poor". 5. Review the utilisation of available funding and current grant funding for various technologies identifying gaps in funding provision. 6. Engage with local communities to gather qualitative insights into their unique challenges and aspirations. Seek feedback from residents, community organisations, and relevant stakeholders to ensure the fuel poverty programme addresses the real needs of Neath Port Talbot's citizens. 7. Develop and promote the programme to ensure the energy transition benefits vulnerable populations, ensuring an inclusive approach to the net zero journey.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot Council, elected members, energy efficiency/savings and fuel poverty organisations, community groups with fuel poverty focus (such as Awel Aman Tawe), national government, health organisations energy suppliers.
Co-benefits	• Positively impacts health. • Facilitates a just transition. • Encourages an equal distribution of benefits.
Costs	~£150,000 – £175,000
Risks & Dependencies	• Dependence on accurate and up-to-date datasets for effective analysis. • May require sustained funding for long-term programme success. • Evolving and dynamic energy markets may cause the requirement for regular updates to the programme. • Requires cross-department collaboration.
KPIs	• Identify specific areas to target by end of Q3 2026. • Develop programme by end of Q2 2027. • 100% targeted properties informed of the programme by end of Q3 2027.

Action 6: Develop a Programme for the Electrification of Public Sector Owned Non-Gas, Fossil Fuelled Buildings to Increase Uptake of Low Carbon Heating	
Overview	Develop a funded programme which focuses on the early transition to electrification for non-gas, fossil fuelled buildings that are within a sphere of influence of the council (such as social housing, council owned and other public sector buildings). Through the programme, the council aims to instigate an inclusive electrification strategy that addresses immediate needs and lays the foundation for a sustainable, low carbon future in the broader community.

Timescale	Medium-term
Location	Neath Port Talbot-wide
Example Implementation Steps	1. Explore potential grant opportunities, partnerships, and budget allocations. Collaborate with relevant stakeholders to initiate adequate financial support. Ringfence the funding once acquired. 2. Identify non-gas, fossil fuelled buildings within the Council's sphere of influence and prioritise buildings based on factors such as energy consumption, age, and community impact. 3. Conduct energy audits for the selected buildings and understand electrification needs. 4. Evaluate which electrification technologies are suitable for the selected buildings, considering factors such as cost-effectiveness, energy efficiency, and environmental impact. 5. Develop a detailed programme outline, specifying timelines, milestones, and deliverables. Include mechanisms for monitoring and evaluating the programme's effectiveness. 6. Incorporate a pilot initiative demonstrating the exemplary electrification of a public building as a showcase for this building typology.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot Council, Public Health Board, national government, registered social landlords, community groups (such as Awel Aman Tawe), private sector partners, national government, NGED.
Co-benefits	• Improved indoor air quality and health outcomes. • Creation of employment opportunities through the implementation of the electrification programme, stimulating the local economy. • Enhanced awareness and understanding of clean energy alternatives, enhancing environmental responsibility within the community.
Costs	~£50,000 – £150,000 (initial cost, excluding internal capital costs which may come forward though business cases).
Risks & Dependencies	• Funded programme terms/cycles are not long enough to deliver outcomes. • Challenge of effectively communicating the benefits of electrification to the affected residents. • Learning curve of residents and building users to ensure the systems are used properly and optimally. • Some buildings may not be suitable for electrification, and some may require fabric retrofitting for improved performance before electrification. Coordinating the roll-out of retrofitting with electrification could potentially lead to delays in the process.
KPIs	• 100% of energy audits complete by end of Q2 2027. • 50% of buildings electrified by end of Q4 2026. • Social housing compliance increased to EPC C (Standardised Assessment Procedure (SAP) 72) by 2030 (in accordance with Welsh Housing Quality Standard 2023).

6.6 Transport Actions

The following actions support the need to decarbonise transport. They include a commitment to advancing sustainable mobility, recognising that transformative outcomes arise from proactive measures. By improving access to sustainable transport, promoting the uptake of low and zero carbon vehicles in public fleets, and bolstering active travel and public transport, Neath Port Talbot is positioned to substantially reduce dependence on personal motorised vehicles, fostering a greener and more accessible transportation landscape.

Action 7: Develop Holistic Community Transport Provision in Valley Areas to Enable Sustainable Rural Travel	
Overview	Develop plans and projects to initiate holistic community transport provision in rural, valley areas. The aim of this action is to comprehensively address the community's transport needs, therefore fostering a holistic and well-rounded transport provision that enhances accessibility, inclusivity, connectivity, and overall community well-being.
Timescale	Long-term
Location	Valley areas (Vale of Neath, Dulais Valley, Afan Valley, Swansea Valley and Upper Amman Valley)
Example Implementation Steps	1. Engage with the local community (including businesses) to understand the existing sustainable transport provision in the target areas such as gaps in community needs, opportunities and barriers. 2. Assess the suitability of a range of options to connect existing community hubs (such as those focused on shared working spaces and multifunctional areas for events and classes) to sustainable transport. This could include: a. EV charging provision at community hubs (factoring in considerations such as dwell times, secondary economic benefits to local businesses, and ensuring safety and security during dwell time). b. Evaluate options for minibus and bus routes to optimise community connectivity. c. Plan for active travel routes and secure cycle storage facilities to promote sustainable commuting options. 3. Collaborate with the wider local community to understand the appetite for options such as: a. Assess the potential for charger-sharing initiatives. b. Explore the feasibility and demand for community car schemes. 4. Consider and integrate community energy schemes into the planning process, exploring synergies between community transport and sustainable energy initiatives. 5. Collaboratively prepare plans (including a pilot) to increase sustainable transport in valley areas.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot Council, Transport for Wales, community transport groups and associations (such as Taith Co-op), chargepoint operators, car sharing organisations (Such as Charge Place Wales) local community, local businesses.
Co-benefits	• Fosters an inclusive and just transition. • Increased connectivity in valley areas.

	• Air quality improvements. • Reduced traffic and congestion. • Economic benefits for local businesses.
Costs	~£100,000 – £1mn (dependent on service footprint)
Risks & Dependencies	• Lack of active community participation will hinder the success of the action. • The technical implementation of EV charging provision and integration with community hubs may face unforeseen challenges. • Community schemes and rural public transport is challenging and there may always be a significant reliance on cars. • The scheme may need permanent funding due to lack of demand.
KPIs	• 100% of plans produced by end of Q4 2026. • 20% increase in EV charging provision in valley areas by end of Q4 2029. • Census 2031 reports ≥25% reduction in personal motorised vehicle travel for journeys that are less than 5km in Neath Port Talbot (to be published 2033), by 2033.

Action 8: Facilitate Low and Zero Carbon Vehicle Uptake to Decarbonise Public Fleets	
Overview	Continue to facilitate the transition to low and zero carbon buses and HGVs in the fleets of Neath Port Talbot Council and other public bodies through a structured programme for fleet transition. This programme should establish a clear roadmap for transitioning public transport fleets, and incorporating strategic milestones, funding exploration, technology testing, collaborative efforts, and community education to ensure an impactful shift towards low and zero carbon options.
Timescale	Medium-term
Location	Neath Port Talbot-wide
Example Implementation Steps	1. Develop and implement a structured programme with clear milestones to guide the transition process. This should include how each vehicle group will be transitioned and in which priority order. 2. Identify and secure funding sources for the acquisition of new vehicles which may include: a. Pooling resources for larger-scale funding initiatives between the Council and other public bodies. b. Explore the effect of franchising and linking with wider Western Gateway activities around hydrogen infrastructure and hydrogen vehicles. c. Explore the City Deal funding available for hydrogen-fuelled waste vehicles. 3. Establish pilot schemes (such as the ongoing pilot of hydrogen buses) to test different technologies and gather data on performance, cost and efficiency. 4. Enhance collaboration by: a. Taking a regional approach to gain efficiencies and economies of scale.

	b. Engaging in collaborative discussions with bus operators to understand their challenges and opportunities, and jointly plan and implement the replacement process. c. Continue links with HyCymru, the Welsh Hydrogen Trade Association. d. Engage with public bodies to understand and support existing net zero plans.
Suggested Key Stakeholders	Regional LAEP Steering Group, existing transport-focused regional group, Neath Port Talbot, Carmarthenshire and Swansea Councils, public bodies, national government, Transport for Wales, transport-focused charities, higher education institutions, employers, NGED, WWU, hydrogen associations.
Co-benefits	• Improved air quality. • Enhanced and developed stakeholder relationships. • Driving innovation. Increased support of public transport services.
Costs	• ~£30,000 – £50,000
Risks & Dependencies	• Uncertainty surrounding infrastructure and logistics (e.g. refuelling infrastructure/locations, vehicle availability and security of hydrogen supply). • Limited supply chain skills. • High upfront costs and ongoing funding support required. • Public perceptions regarding the safety of hydrogen fuels.
KPIs	• All new cars and light goods vehicles in the public sector fleet are ultra-low emission by Q4 2024 (aligned with Welsh Government target). • Structured transition programme developed by the end of Q2 2025. • Council fleet including HGVs (where possible) are net zero by Q4 2029.

Action 9: Enhance Active Travel and Public Transport to Reduce Reliance on Personal Motorised Vehicles	
Overview	Enable active travel initiatives and funding, and enhance public transport to foster a greener and more efficient transportation landscape with reduced reliance on motorised vehicles. The action aims to encompass strategising, advocating, and implementing measures to create a more sustainable and efficient transportation ecosystem.
Timescale	Long-term
Location	Neath Port Talbot-wide
Example Implementation Steps	**Enabling active travel initiatives and funding:** 1. Review the emerging Regional Transport Plan (2025 – 2030) and the recommendations provided in the Active Travel Network Map and develop funding and resource plans to support the delivery of priority active travel initiatives. 2. Facilitate access to national funding for active travel initiatives in non-urban areas by advocating for: a. The extension of the Welsh Government's Active Travel Act guidance to include rural areas and travel to leisure and recreational activities.

	b. The review and potential expansion of the definition of Built-Up Area (BUA) to offer more support to rural areas. c. Working with Sustrans, Welsh Government and Transport for Wales to set national standards to design active travel around those who are not enthusiasts (e.g., safe and secure storage, changing facilities, easy transfer from between sustainable modes of transport). Support and enhance public transport: 1. Review the emerging Regional Transport Plan (2025 – 2030) and develop funding and resource plans to support the delivery of public transport initiatives. 2. Explore how to best support the South Wales Metro project, to enhance sustainable and efficient transportation. 3. Collaborate with local transport providers to understand how public transport services can be enhanced to increase patronage. 4. Develop and launch targeted awareness campaigns to promote the benefits of using local public transport.
Suggested Key Stakeholders	Regional LAEP Steering Group, existing transport-focused regional group, Council transport and planning teams, national government, Transport for Wales, Sustrans, transport charities, community groups (such as Taith Co-op), higher education institutions, large employers, cycle-to-work providers.
Co-benefits	• Public health benefits due to shift in active transport modes. • Reduced traffic congestion. • Improved air quality.
Costs	Starting from ~£300,000 (upper limit dependent on contribution to transport improvement).
Risks & Dependencies	• Current lack of adequate cycling infrastructure or poorly maintained cycle paths. • Current barriers to use of active travel routes which need to be addressed, such as adequate storage, drying and changes facilities at destinations. • Annual funding making it difficult to have certainty over delivery of projects. • Public perception of active travel and public transport.
KPIs	• Requests to extend the Active Travel Act guidance submitted by end of Q4 2025. • Awareness campaign launched by end of Q2 2026. • Census 2031 reports ≥25% reduction in personal motorised vehicle travel for journeys that are less than 5km in Neath Port Talbot (to be published 2033), by 2033.

6.7 Generation and Networks Actions

The following actions underscore Neath Port Talbot's commitment to a future-proofed energy system. By collaborating with key entities (such as NGED and WWU), the county aims to leverage expertise and resources to fortify its energy infrastructure. Additionally, engagement with the Zero Emission Vehicle Infrastructure Strategy (ZEVIS) positions Neath Port Talbot to meet the evolving needs of hydrogen-fuelled vehicles, aligning with the region's forward-looking energy vision.

Action 10: Continue Collaboration with Electricity and Gas Network Operators to Foster a Robust Future Energy System	
Overview	Deepen collaboration with National Grid Electricity Transmission (NGET), NGED and WWU to catalyse the development of new and reinforced electricity grid infrastructure, and enable planning for gas network reinforcement or removal as early as possible. The aim of this action is to ensure reliability and to meet the demands of the evolving energy landscape. This entails building on the existing relationship with enhanced ongoing dialogue, improved connections, and streamlined planning processes.
Timescale	Short-term
Location	South West Wales-wide
Example Implementation Steps	1. NGET, NGED and WWU to establish dedicated contacts to support LAEP actions. 2. Regional energy officers appointed as a permanent link between the Council and NGET, NGED and WWU. 3. Establish a regular forum/working group for ongoing dialogue between the Council, NGET, NGED and WWU and foster an environment of open communication to exchange insights and address challenges collaboratively. 4. Consider how to integrate the new roles of Regional Energy Strategic Planner (RESP) and National Energy System Operator (NESO). 5. Invite NGED and WWU to attend all Consortium of Local Authorities in Wales (CLAW) meetings. 6. Work towards improving cross industry relationships between NGED, WWU, framework energy suppliers and meter operators etc. 7. Work with WWU to establish gas network demand requirements (including for hydrogen), to enable planning for reinforcement or network removal as early as possible. 8. Conduct engagements to identify and mitigate potential electricity network planning and connections process bottlenecks through proactive planning and coordination. 9. Aim to develop streamlined planning processes to expedite the approval and implementation of new grid infrastructure.
Suggested Key Stakeholders	Regional LAEP Steering Group, regional Council energy teams, wider Council teams, elected members, NGET, NGED, WWU, energy framework owners.
Co-benefits	• Grid resilience (e.g. fewer power cuts and disruptions). • Improved process for deployment of renewable projects. • Strengthened regional relationships.
Costs	~£10,000 – £20,000

Risks & Dependencies	• Funding availability to implement any actions. • Changes in regulations or legislation from the UK or Welsh Government (e.g. energy nationalisation, decarbonisation ambition). • Maintaining consistent communication and participation levels.
KPIs	• Dedicated contacts appointed by end of Q2 2024. • Regular forum/working group operational by end of Q4 2024. • Requirements to mitigate planning bottlenecks understood by end of Q2 2025.

Action 11: Support the Zero Emission Vehicle Infrastructure Strategy to Address Future Needs of Hydrogen-Fuelled Vehicles in the Region	
Overview	Support the Swansea Bay City Deal project's Zero Emission Vehicle Infrastructure Strategy (ZEVIS), emphasising preparing for the potential adoption of hydrogen-fuelled vehicles. Neath Port Talbot Council is actively engaged with exploring the potential for hydrogen-fuelled vehicles and is adaptable to local, regional and national hydrogen infrastructure demands, to ensure resilience amid hydrogen's evolving landscape.
Timescale	Short-term
Location	Existing HGV suitable locations on the Strategic Road Network (such as Neath service station, central Neath and Baglan Energy Park)
Example Implementation Steps	1. Understand the resource and support requirements for developing ZEVIS, with specific focus on requirements for developing a hydrogen infrastructure section within the strategy. 2. Collaboratively develop a plan for delivering hydrogen infrastructure recommendations within ZEVIS. This may include: a. Collaborate with regional local authorities to understand the likelihood and extent to which hydrogen may be needed and the planning of strategic locations for refuelling on the Strategic Road Network. b. Engage with large producers such as Statkraft, RWE and Marubeni to work understand distribution requirements. c. Identify locations in which refuelling stations could be implemented in the short, medium and long-term, considering co-location with EV charging and public accessibility. d. Engage with WWU to collaboratively develop distribution infrastructure recommendations for hydrogen refuelling, ensuring efficient and widespread accessibility. e. Identify other ways in which hydrogen can provide additional benefits to the area.
Suggested Key Stakeholders	Regional LAEP Steering Group, existing transport-focused regional group, national government, WWU, NGED, industrial cluster groups, hydrogen associations, community groups (such as Ynni Teg).
Co-benefits	• Adaptability to changing technologies and demands. • Economic resilience by staying responsive to market trends.

	• May lead to the development of new industries and job opportunities in the area.
Costs	~£100,000 – £125,000
Risks & Dependencies	• Long-term economic and technological viability reduces investment certainty and overall funding. • Community acceptance. • Regulatory and policy changes (e.g. strategic governmental decisions on hydrogen use). • Efficiencies of hydrogen production.
KPIs	• Resource and support requirements for ZEVIS understood by end of Q4 2025. • Potential locations for hydrogen refuelling stations identified by end of Q4 2026. • Hydrogen refuelling recommendations provided by WWU and integrated into the plan by end of Q4 2026.

Action 12: Develop a Support Programme for Community Energy Microgrid Projects to Increase Energy System Resilience and Efficiency	
Overview	Increase community energy projects by developing a support programme focused on smart, low carbon community energy projects such as rural community microgrid zones. The programme includes setting up and funding a working group to deeply ingrain collaboration with the area's community energy groups. The objective is to cultivate a robust, inclusive, and collective approach tailored to address both current and future energy system challenges.
Timescale	Medium-term
Location	Neath Port Talbot-wide
Example Implementation Steps	1. Set up a working group dedicated to the support and collaboration with all community energy groups and organisations within Neath Port Talbot. 2. Outline a collaboration framework within the working group, emphasising strong communication channels and shared goals among community energy organisations and Council. 3. Explore and secure funding opportunities to support the implementation of smart, low carbon community energy projects. 4. Undertake a holistic mapping and engagement exercise to identify existing and potential community energy and microgrid activity (such as WWU's microgrid project which uses hydrogen to store electricity as an alternative to batteries). 5. Identify suitable zones within rural areas for the establishment of community microgrids. Ensure the selected zones encompass a mix of properties, including domestic (residential), non-domestic (businesses, schools, etc.), and critical infrastructure facilities. 6. Encourage the integration of energy storage systems within the community energy projects to minimise the need for extensive electricity grid upgrades and to provide flexibility in electricity generation.

	7. Set up a pilot project to showcase energy storage systems being integrated within community energy projects. 8. Develop a comprehensive support programme to include an implementation plan outlining steps, timelines, and responsibilities. 9. Establish a monitoring and evaluation framework to track progress and effectiveness of the support programme and projects.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot Council, community energy groups(such as Ynni Teg and Awel Aman Tawe), private sector, NGED, WWU, smart energy technology providers, energy suppliers.
Co-benefits	• Local job opportunities. • Reduced cost of energy for connected residents. • Reduced impact on the electricity grid. • Empowers local communities.
Costs	~£120,000 per annum
Risks & Dependencies	• A lack of community support would impede progress. • The success of community energy projects is often linked to supportive policies and regulations at local and national levels. • Connecting microgrids to the main grid may face technical and regulatory challenges.
KPIs	• Working group set up by end of Q4 2024. • Zones identified by end of Q4 2025. • 50% of target microgrid projects complete by end of Q2 2028.

Action 13: Develop a Storage and Flexibility Financial Incentives Programme to Increase Energy System Resilience	
Overview	Ascertain funding to develop a Storage and Flexibility Financial Incentives Programme. The programme should be aimed at businesses and residents to encourage the uptake of consumer energy storage systems (e.g., thermal or battery systems) and participation in DSR to promote flexible energy use. Furthermore, the initiative should be strategically integrated with community energy opportunities to maximise their collective impact.
Timescale	Medium-term
Location	Neath Port Talbot-wide
Example Implementation Steps	1. Conduct a funding assessment by evaluating potential funding sources, including government grants and rebates, to establish financial incentives for consumer energy storage systems and DSR measures. 2. Engage with local businesses, residents, community groups, and energy regulatory bodies to understand existing barriers to adoption and how they can be overcome. 3. Work with energy suppliers to design a programme that encourages businesses and residents to invest in consumer energy storage systems and actively participate in DSR initiatives. 4. Explore synergies with community energy projects to enhance overall energy resilience and sustainability within the region.

	5. Develop a pilot scheme to test the programme and bolster outreach programmes. 6. Develop outreach initiatives to educate businesses and residents about the benefits of installing consumer energy storage systems and participating in DSR. 7. Implement systems to monitor and assess the effectiveness of the incentive programme, ensuring they align with energy conservation goals and community needs.
Suggested Key Stakeholders	Regional LAEP Steering Group, Neath Port Talbot Council, community energy groups and organisations (such as Cwm Arian Renewable Energy [CARE]), national government, private sector, community energy groups, NGED, smart energy technology providers, energy suppliers, energy regulatory bodies.
Co-benefits	• Enhanced energy resilience. • Increased adoption of low carbon technologies. • Reduction in peak demand, lessening impact on the electricity grid.
Costs	~£60,000 – £100,000
Risks & Dependencies	• Dependant on securing and maintaining adequate funding. • Dependent on the willingness of businesses and residents to adopt new technologies. • Changes in local, regional, or national energy policies may impact the feasibility and structure of the incentive programs.
KPIs	• Programme developed by end of Q3 2026. • Quantification and reporting of avoided energy demand or energy storage from the scheme by end of Q2 2027. • 50% of target participation in the programme by end of Q4 2027.

6.8 Industry Actions

The following strategic industry actions signify a commitment to advancing energy-related opportunities and fostering a greener, more sustainable future. Through collaborative forums and support for light, medium and heavy industry, Neath Port Talbot aims to drive innovation, nurture growth, and accelerate the transition to a decarbonised industrial landscape.

Action 14: Establish an Industry Engagement Forum to Identify and Progress Energy-Related Opportunities	
Overview	Set up an industry engagement forum group that focuses on electrical and gas network/hydrogen opportunities and challenges from an industrial perspective. The group will aim to integrate with and support existing groups, projects, and decarbonisation plans. Additionally, it will actively identify opportunities for collaboration, innovation, and sustainable growth within the industrial sector, fostering a dynamic and cooperative ecosystem.
Timescale	Short-term
Location	Neath Port Talbot-wide
Example Implementation Steps	1. Agree target membership organisations (such as WWU, NGED, Net Zero Industry Wales and South Wales Industrial Cluster alongside other representation from industry and Small Medium Enterprises). 2. Build on existing relationships (such as FLEXIS Industrial Advisory Board) to establish the industry engagement forum group. 3. Define the group's aim, Terms of Reference, structure (such as industry-focused sub-groups), scope and key activity areas. Ensure that it supports and enhances (rather than duplicates) existing work by SWIC, Low Carbon Swansea Bay, WWU's Hydrogen User Group (HUG) and other groups. 4. Mobilise the forum. 5. Identify how the forum will link to, support and integrate with existing groups, projects and decarbonisation plans. 6. Identify possible funding support schemes and planned infrastructure investment. 7. Conduct an exercise to understand electrical and gas network/hydrogen opportunities, challenges and gaps. 8. Identify opportunities for collaboration, innovation, and sustainable growth within the industrial sector, to foster a dynamic and co-operative ecosystem. 9. Provide a communications function to benefit the wider ecosystem, for example, by offering updates on initiatives such as South Wales Industrial Cluster's decarbonisation programme, infrastructure investment plans, and research programme updates.
Suggested Key Stakeholders	Regional LAEP steering group, an existing energy-focused regional group, FLEXIS, Net Zero Industry Wales, other industry groups, hydrogen research facilities, Western Gateway, HyCymru, private sector, WWU, NGED.
Co-benefits	• Promotes knowledge sharing and collaboration. • Integrated support for existing initiatives, strengthening strategic alignment. • Enhanced stakeholder relationships. • Futureproofing of the industrial sector in Neath Port Talbot.

Costs	~£10,000 – £100,000
Risks & Dependencies	• Limited participation and lack of engagement, undermining forum effectiveness and leading to bias. • Overlap with existing groups which duplicates or dilutes efforts. • Resistance to integration due to conflict of interest or competitive advantage. • Maintaining ongoing communication and participation levels. • Funding availability for ongoing activities.
KPIs	• The industry engagement forum is operational by end of Q2 2025. • Opportunities identified by end of Q4 2025. • Communications mechanism set up by end of Q2 2026.

Action 15: Encourage the Uptake of Decarbonisation Support Programmes to Facilitate the Decarbonisation of Light, Medium and Heavy Industry	
Overview	Continue championing the decarbonisation efforts across all sectors of Neath Port Talbot's industries (Light, Medium & Heavy). Propel this initiative through the strategic identification and execution of targeted decarbonisation support (such as the Manufacturing Energy Toolkit and the Supporting Innovation and Low Carbon Growth programme). The aim is to empower diverse industries in their journey towards sustainable manufacturing and decarbonisation.
Timescale	Short-term
Location	Neath Port Talbot-wide
Example Implementation Steps	1. Utilise the working group in Action 14 to champion decarbonisation industry decarbonisation efforts. 2. Research available initiatives such as the Manufacturing Energy Toolkit (which provides roadmaps for energy efficiency) and the Supporting Innovation and Low Carbon Growth Programme (which seeks to enable decarbonisation through an advanced manufacturing and production facility and the Net Zero Centre of Excellence Skills Academy). 3. Identify targeted industries within Neath Port Talbot by Standard Industrial Classification (SIC) code. 4. Evaluate the relevance and applicability of identified initiatives to the target industries within Neath Port Talbot. 5. Develop the required support and communications tools to promote the identified support programmes. 6. Where possible, influence emerging initiatives and programmes within the region, to ensure they are tailored to Neath Port Talbot's industry needs. 7. Collaborate with local industries, businesses, and relevant stakeholders to discuss, promote, and ensure the effective adoption and integration of the decarbonisation support initiatives.
Suggested Key Stakeholders	Regional LAEP steering group, Neath Port Talbot Council, Net Zero Industry Wales, South Wales Industrial Cluster, other industry groups, South Wales Industrial Transition from Carbon Hub, NGED, WWU
Co-benefits	• Stimulates investment and economic growth.

	• Fortifies industry against future environmental regulations and market shifts. • Enhances the region's reputation.
Costs	~£50,000 – £75,000 per annum
Risks & Dependencies	• There is a wide variety of needs across different sectors. • Industry appetite to engage with decarbonisation initiatives. • Challenges in integrating new technologies into existing industrial processes.
KPIs	• Working group set up by end of Q2 2026. • Communications materials developed by end of Q2 2027. • 100% of companies in Neath Port Talbot with relevant SIC codes have been contacted by end of Q4 2027.

6.9 Supporting Actions

While the 15 priority actions are significant, it's recognised that they do not cover all necessary measures for energy system decarbonisation. Moreover, although Neath Port Talbot Council selected 15 priority actions to focus on, it is important to note that the selection of priority actions does not preclude support for initiatives beyond this list or those featured in other Councils' plans. Table 6-2 details additional supporting actions for Neath Port Talbot that were developed by stakeholders during engagements, highlighting the work yet to be undertaken in this domain.

Sector	Category	Supporting Actions
Crosscutting Enabling Actions	Funding	Introduce multi-year funding.
		Develop funding plans with engagement from the private sector.
		Develop fundraising plans for each sector at a regional level.
		Encourage more locally focused procurement.
	Skills	Develop an apprenticeship plan.
		Engage with employers on net zero and net zero skills.
Energy Efficiency, Retrofit & Heat	Heat Networks	Conduct feasibility studies for identified priority areas for heat networks, including waste heat recovery.
	Private Housing Retrofit	Support Tai Tarian in developing a pilot smart home and explore wider uses for engagement.
Transport	Fleet	Continue to pursue the ambitions of the Fleet Transition Strategy by decarbonising council-owned fleet by 2030.
	Active Travel	Encourage cycling uptake with multiple safe cycle routes into town centres and secure cycle lockers at key locations.
		Introduce School Streets.
	EV Uptake	Roll-out chargepoints in council-owned offices and car parks.
		Support and encourage EV car hire and car clubs.
		Encourage use of company car salary sacrifice schemes.
	Heavy Vehicles	Develop a regional Freight Action Plan.
Generation & Networks	Community Energy	Support port improvement works at Port Talbot to enable FLOW.
	Renewables	Identify land ripe for renewable development.
		Encourage participation of local companies when procuring renewable energy projects to retain economic benefits and jobs locally.

		Support existing plans to deploy rooftop solar on council-owned buildings and land, and ensure the plans meet Net Zero Pathway targets.
		Continue to support the RE:FIT programme for retrofit and rooftop PV for non-social housing public sector buildings.
		Utilise the results from the upcoming RLCEA and encourage the development of renewables in these areas.
		Support plans for FLOW turbine construction at Port Talbot.
	Hydrogen	Adopt continuous engagement with WWU to communicate planned changes which may impact the gas network.
		Work with WWU to develop hydrogen re-fuelling infrastructure as part of the gas network.
		WWU to lead creating a working group specifically on HyLine Cymru engagement to support planning and delivery.
	Electricity	Collate and regularly update a register of significant electricity demand and/or generation projects in the Council.
Industry	Industry Decarbonisation	Identify opportunities for Clean Growth Hubs arising from industry transition and develop plans for Harbourside, Margam and Baglan Clean Growth Hubs
		Support a pilot project that focuses on the decarbonisation of industry (e.g., hydrogen, electrification or carbon capture).
		Promote the Local Development Plan.
		Hold discussion with Welsh Government around opportunities for the defunct power station on Baglan Energy Park.
	Collaboration	Maintain membership of SWIC, to gain a seat in discussions about the future direction of industry, and ensure coordinated action.
		Support SWIC's Clean Growth Hubs by incorporating them into the Council's strategic visions and plans.

Table 6-2: Supporting Actions by Sector

6.10 Next Steps

The LAEP sets out the transformative actions and steps required to transition Neath Port Talbot's energy system towards achieving net zero carbon emissions by 2050. To mobilise the actions, the following key next steps have been identified.

6.10.1 Step 1: Regional Review

Neath Port Talbot, Carmarthenshire, Swansea, and Pembrokeshire Councils intend to conduct a comprehensive regional review of the four LAEPs. It is suggested that this takes place in Q3 2024. This involves examining individual actions, identifying opportunities for integration, and determining actionable items that can be effectively mobilised at a regional level. Table 6-3 shows actions that are recommended for regional implementation.

6.10.2 Step 2: Prioritisation

The next step to mobilise action is the establishment of a Regional LAEP Steering Group (see 6.4 Crosscutting Enabling Actions) which is a pivotal step that will enable the implementation of all other actions. The actions can be categorised as follows:

- Quick wins, which can be carried out in the short-term without any major blockers
- Low regret actions, which are considered to be effective regardless of future uncertainties, but may require future enabling actions before they can be progressed
- Enabling Actions, which are those which need to be carried out ahead of time to pave the way for later solutions

While recognising the significance of all actions, it is acknowledged that not all can be mobilised immediately. Table 6-3 shows the action categories and the rationale behind whether the actions should be mobilised as a priority. Referencing the Actions Roadmap and Table 6-3, the group should assess and develop a phased delivery plan to optimise impact and foster a holistic approach.

6.10.3 Step 3: Collaboration

The Regional LAEP Steering Group operates strategically at a portfolio level, overseeing actions crucial for the region's sustainable energy transition. While the group may handle specific actions, its extensive scope requires delegation to suitable parties. This process underscores the active involvement of key stakeholders, emphasising collaborative determination of action owners. Importantly, it necessitates the comprehensive development of actions, going beyond the initial high-level suggestions provided in the LAEP and Technical Annex.

6.10.4 Step 4: Funding & Resource

Once ownership is identified, the subsequent crucial step entails an evaluation of the financial prerequisites and the formulation of a funding and resource strategy for each action. This pivotal stage is to enable the availability of the resources required for the sustained implementation of the LAEP initiatives. Leveraging the insights garnered from stakeholder engagement throughout the LAEP process, the Council can discern and explore relevant funding avenues. Any discerned funding or resource gaps should be promptly communicated to the Welsh Government to ensure seamless support and continuity.

6.10.5 Conclusion

In conclusion, this Local Area Energy Plan (LAEP) for Neath Port Talbot has charted a transformative path toward achieving net zero carbon emissions by 2050. The outlined next steps involve a collaborative regional review, establishment of a crucial Regional LAEP Steering Group, prioritisation based on action categories, fostering collaboration, and strategic funding assessments. These steps collectively form a robust framework to propel the region toward a sustainable and low carbon future.

Sector	No.	Action	Priority Mobilisation	Council Involvement
Crosscutting Enabling Actions	1	Establish a Regional Steering Group to Enable the Delivery of LAEP Outcomes	Yes – This action should be the first action to mobilise. It is an enabling action that will facilitate the execution of all other actions and associated projects.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
	2	Support Long-Term Green Skills Programmes to Enable the Delivery of Decarbonisation Measures	Yes – This is an enabling action that is essential for unlocking the capacity and skills necessary for a successful transition.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
	3	Embed LAEP Learnings into Wider Council Processes and Communications to Enable the Delivery of LAEP Outcomes	Yes – This is an enabling action that is time sensitive. Quick mobilisation is recommended for maximised impact on the Council's carbon emissions.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
Building Efficiency, Retrofit and Heating	4	Create a Behaviour-Change Campaign to Increase Uptake of Retrofit and Low Carbon Heating	Yes – This is an enabling action that should be mobilised quickly to leverage maximise the uptake of current government grants (such as BUS) and reduce fuel costs for residents.	Semi-Regional – Neath Port Talbot and Carmarthenshire Councils have selected this as a priority action.
	5	Develop a Fuel Poverty Programme to Support a Just Transition to Net Zero	No – This is a low regret action that builds off existing work in this space. Therefore, while recognised it is a priority for the area, fuel poverty action is already underway.	Local – This action has been selected by Neath Port Talbot Council only.
	6	Develop a Programme for the Electrification of Public Sector Owned	No – This is a low regret action that will benefit from the implementation of action 4.	Local – This action has been selected by Neath Port Talbot Council only.

		Non-Gas, Fossil Fuelled Buildings to Increase Uptake of Low Carbon Heating		
Transport	7	Develop Holistic Community Transport Provision in Valley Areas to Enable Sustainable Rural Travel	No – This is an enabling action that would benefit from action 9 being mobilised first. The Welsh Government's decision on Active Travel Act requests will influence this action.	Local – This action has been selected by Neath Port Talbot Council only.
	8	Facilitate Low and Zero Carbon Vehicle Uptake to Decarbonise Public Fleets	No – This action is low regret. Initiatives are already being taken to decarbonise the public fleet, so it is less of a priority to mobilise this action.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
	9	Enhance Active Travel and Public Transport to Reduce Reliance on Personal Motorised Vehicles	Yes – This is an enabling action that requires a long lead time to take effect, so should be mobilised as a priority.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action (with some variance).
Generation and Networks	10	Continue Collaboration with Electricity and Gas Network Operators to Foster a Robust Future Energy System	Yes – This is a quick win and should be mobilised quickly for maximised impact.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
	11	Support the Zero Emission Vehicle Infrastructure Strategy to Address Future Needs of Hydrogen-Fuelled Vehicles in the Region	No – This is an enabling action; however it is dependent on the development of the hydrogen sector and will be influenced by the UK government's decision on hydrogen for heating in 2026.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
	12	Develop a Support Programme for Community Energy Microgrid Projects to	Yes – This is a low regret action and there is existing appetite from community energy groups to be involved in new	Local – This action has been selected by Neath Port Talbot Council only.

		Increase Energy System Resilience and Efficiency	Council initiatives, so it is recommended to mobilise quickly.	
	13	Develop a Storage and Flexibility Financial Incentives Programme to Increase Energy System Resilience	No – This is an enabling action however it will benefit from action 12 being mobilised first.	Local – This action has been selected by Neath Port Talbot Council only.
Industry	14	Establish an Industry Engagement Forum to Identify and Progress Energy-Related Opportunities	Yes – This action is a quick win and an enabling action. It could have a high impact on decarbonising the industrial sector. Quick mobilisation is therefore recommended.	Regional – Neath Port Talbot, Carmarthenshire and Swansea Councils have selected this as a priority action.
	15	Encourage the Uptake of Decarbonisation Support Programmes to Facilitate the Decarbonisation of Light, Medium and Heavy Industry	No – This is a low regret action that will benefit from the prior implementation of action 14.	Local – This action has been selected by Neath Port Talbot Council only.

Table 6-3: Action Mobilisation and Council Involvement

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8 Appendix

8.1 A – Overview of Stakeholder Engagement Activities

Stage	Engagement	Purpose
2	1x Stakeholder Engagement Planning Workshop	To conduct stakeholder mapping and develop the Stakeholder Engagement Plan.
3	10 x 1:1s with priority external stakeholders	To provide baseline information on available datasets and policy gaps.
	1x Stakeholder Baseline Review	To share the developed baseline with the core project team and key stakeholders.
4	1x Scenarios Workshop	To explore different potential futures scenarios and agree on the chosen scenarios.
	1x Modelling Approach Meeting	To refine and agree the modelling approach.
	1 x Scenarios & Modelling Technical Session	To further refine and agree the modelling approach and scenarios with WWU.
	1 x Enabling Factors Workshop	To engage with stakeholders on the external factors that needed to be considered within LAEP development.
5	1x Model Outputs Presentation	To present the developed model based on different scenarios.
	1x Scenario Refinement Workshop	Scenarios are explored in more detail and refined/approved.
	1x Non-technical Factors & Pathway Review Meeting	To present the non-technical factors and the pathways for feedback.
6	3x Action Development Workshops	To discuss/develop a long list of actions/projects required to meet the pathway.
	7x Action Focus Groups	To explore a deeper layer of the action plan, ensuring it's robust and suitable for implementation.
	1x Community Involvement Focus Group	To brief community groups on the LAEP process and understand how they would like to be involved in action and project development, post LAEP publication.
	1x Action Prioritisation Meeting	To discuss and develop action/project prioritisation with the core team.
	1x Action Refinement & Governance Workshop	To refine the final actions and identify key stakeholder groups that could be responsible for driving the actions forward.
7	1x Draft LAEP Presentation	To discuss and handover the draft report.
	2x Final Report Presentations	To present the final report to various stakeholders.

Table 8-1: Overview of Engagement Activities and Purpose

8.2 B – Primary Substation Zones

Primary Substation Zone Name	Main Primary Substation Area	Partial, Combined Primary Substation Areas
Pyle Primary	Pyle Primary	Nottage, Llynfi
Victoria Road	Victoria Road	-
Ynys Street	Ynys Street	-
Briton Ferry Primary	Briton Ferry Primary	-
Jersey Marine	Jersey Marine	Swansea Waterfront
Wern	Wern	-
Caerau Primary	Caerau Primary (partial)	Ynysfeio
Llandarcy	Llandarcy	-
Commercial St Neath	Commercial St Neath	-
Pontardawe	Pontardawe	Morriston Primary
Travellers Rest Primary	Travellers Rest Primary (partial)	-
Aberpergwm	Aberpergwm (partial)	Hirwaun Primary
Gwaun-Cae-Gurwen	Gwaun-Cae-Gurwen (partial)	-
Abercrave	Abercrave (partial)	-

Table 8-2: Primary Substation Zone Simplification

8.3 C – 2050 Scenario Technology Uptake Assumptions

Domestic Buildings

		Widespread Engagement	Widespread Hydrogen	Do Nothing
Building Retrofit	None	-	-	100%
	Shallow	80%	80%	-
	Deep	20%	20%	-
Heating Technology	Gas Boiler	-	-	50%
	Oil Boiler	-	-	
	Heat Pump	90%	8%	30%
	Heat Network	6%	-	4%
	Hydrogen Boiler	-	88%	-
	Direct Electric	3%	3%	8%
	Biomass Boiler	1%	1%	8%

Table 8-3: Domestic Building Heating Assumptions for 2050

Non-Domestic Buildings

		Widespread Engagement	Widespread Hydrogen	Do Nothing
Building Retrofit	None	-	-	100%
	Shallow	80%	80%	-
	Deep	20%	20%	-
Heating Technology	Gas Boiler	-	-	50%
	Oil Boiler	-	-	-
	Heat Pump	54.8%	4.9%	30%
	Heat Network	39.9%	-	15%
	Hydrogen Boiler	-	89.8%	-
	Direct Electric	5.0%	5.0%	-
	Biomass Boiler	0.3%	0.3%	5%

Table 8-4: Non-Domestic Building Heating Assumptions for 2050

Transport

		Widespread Engagement	Widespread Hydrogen	Do Nothing
Vehicle Mileage (km/day)	Car	4,783,640		
	LGV	576,028		
	HGV	138,599		
	Bus	470,358		
Vehicle Technology	Petrol/Diesel Car	-	-	20%
	EV Car	100%	100%	80%
	Hydrogen Car	-	-	-
	Petrol/Diesel Bus		-	15%
	EV Bus	80%	-	75%
	Hydrogen Bus	20%	100%	10%
	Petrol/Diesel LGV	-	-	20%
	EV LGV	100%	100%	80%
	Hydrogen LGV	-	-	-
	Petrol/Diesel HGV	-	-	20%
	EV HGV	80%	-	80%
	Hydrogen HGV	20%	100%	-
EV Chargers	Non-domestic	1,850		
	Domestic	32,560 by 2030, 100% of dwellings have access (includes on-street charging) by 2050		
Hydrogen Refuelling	Main refuelling station	4		

Table 8-5: Transport Assumptions for 2050

Industry

Industrial Site	Fuel	Widespread Engagement	Widespread Hydrogen	Do Nothing
Baglan Paper	Electricity	✓		
	Hydrogen		✓	
	Natural Gas			✓

Table 8-6: Industry Assumptions for 2050

Renewables

Technology (MW)		Widespread Engagement	Widespread Hydrogen	Do Nothing
Rooftop PV Potential	Existing Domestic Buildings	60	60	-
	Existing Non-Domestic Buildings	86	86	-
	New Domestic Buildings	23	23	-
	New Non-Domestic Buildings	40	40	-
Ground-mount PV Potential		428	1,460	-
Onshore Wind Potential		502	755	-

Table 8-7: Renewables Assumptions for 2050

8.4 D – Techno-economic Model Costing Assumptions

Technology	Assumption Type	Value	Unit	Reference	Note
Domestic ASHP	CAPEX	900	£/kW	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	Decreases linearly to 630 in 2050 based on the CCC projection of unit cost
Non-Domestic ASHP	CAPEX	980	£/kW	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile%2F1131436%2FRHI_monthly_official_stats_tables_Dec_22.xlsx&wdOrigin=BROWSELINK	Median cost of annual 2022 ASHPs. Decreases linearly to 686 in 2050 based on the CCC projection of unit cost
Domestic Heat network - supply	CAPEX	448	£/MWh_{th}	Based on past project experience	
Domestic Heat network - generation	CAPEX	134	£/ MWh_{th}	Based on past project experience	
Non-Domestic Heat network - supply	CAPEX	448	£/ MWh_{th}	Based on past project experience	
Non-Domestic Heat network - generation	CAPEX	134	£/ MWh_{th}	Based on past project experience	
Domestic Hydrogen boiler	CAPEX	118	£/kW	https://www.energynetworks.org/assets/images/Resource%20library/FINAL_Hydrogen%20cost%20to%20customer_SENT.pdf	
Non-Domestic Hydrogen boiler	CAPEX	88	£/kW	https://www.energynetworks.org/assets/images/Resource%20library/FINAL_Hydrogen%20cost%20to%20customer_SENT.pdf	
Domestic Direct electric	CAPEX	115	£/kW	https://www.gov.uk/government/publications/cost-of-installing-heating-measures-in-domestic-properties	
Non-Domestic Direct electric	CAPEX	115	£/kW	https://www.gov.uk/government/publications/cost-of-installing-heating-measures-in-domestic-properties	
Domestic Biomass boiler	CAPEX	400	£/kW	https://www.gov.uk/government/publications/cost-of-installing-heating-measures-in-domestic-properties	
Non-Domestic Biomass boiler	CAPEX	370	£/kW	https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fassets.publishing.service.gov.uk%2Fgovernment%2Fuploads%2Fsystem%2Fuploads%2Fattachment_data%2Ffile	Median cost for medium (200-1000kW) biomass

				%2F1131436%2FRHI_monthly_official_stats_tables_Dec_22.xlsx&wdOrigin=BROWSELINK	boilers for annual 2022 installations
Domestic Gas boiler	CAPEX	113	£/kW	https://assets.publishing.service.gov.uk/media/5f4e14328fa8f57fba704517/cost-of-installing-heating-measures-in-domestic-properties.pdf	
Non-Domestic Gas boiler	CAPEX	80	£/kW	2050-calculator-tool-wiki.decc.gov.uk	
Domestic Oil boiler	CAPEX	170	£/kW	https://assets.publishing.service.gov.uk/media/5f4e14328fa8f57fba704517/cost-of-installing-heating-measures-in-domestic-properties.pdf	
Non-Domestic Oil boiler	CAPEX	113	£/kW	https://www.theecoexperts.co.uk/boilers/oil-boiler#:~:text=Oil%20boiler%20running%20costs,-Your%20annual%20running&text=Standard%20heating%20oil%20costs%20%C2%A3,running%20cost%20around%20%C2%A31%2C203.	
Ground Mount PV	CAPEX	614	£/kW	https://c2e2.unepccc.org/wp-content/uploads/sites/3/2016/02/kic-innoenergy-solar-pv-anticipated-innovations-impact.pdf	
Rooftop PV	CAPEX	1,300	£/kW	https://www.gov.uk/government/publications/beis-electricity-generation-costs-2020	
Onshore Wind	CAPEX	894	£/kW	https://publications.jrc.ec.europa.eu/repository/bitstream/JRC109894/cost_development_of_low_carbon_energy_technologies_v2.2_final_online.pdf	
EV Car	CAPEX	20,000	£/unit	Electric cars 'will be cheaper to produce than fossil fuel vehicles by 2027' | Automotive industry | The Guardian	Decreases linearly to 15,000 (parity with petrol) in 2030 based on CCC projection
Petrol Car	CAPEX	15,000	£/unit	https://www.theguardian.com/business/2021/may/09/electric-cars-will-be-cheaper-to-produce-than-fossil-fuel-vehicles-by-2027#:~:text=The%20current%20average%20pre%2Dtax,to%20cost%20about%20%E2%82%AC19%2C000.	

EV LGV	CAPEX	150,000	£/unit	Assumed based on HGV and car cost	Decreases linearly to 80,000 (parity with petrol) in 2030 based on CCC projection
Petrol LGV	CAPEX	80,000	£/unit	Assumed based on HGV and car cost	
EV HGV	CAPEX	175,000	£/unit	https://electriccarguide.co.uk/the-electric-hgv-guide/#:~:text=It%27s%20not%20uncommon%20for%20an,%C2%A3200%2C000%20or%20even%20more.	
Petrol HGV	CAPEX	100,000	£/unit	https://electriccarguide.co.uk/the-electric-hgv-guide/#:~:text=It%27s%20not%20uncommon%20for%20an,%C2%A3200%2C000%20or%20even%20more.	
Hydrogen HGV	CAPEX	225,000	£/unit	Assumed based on petrol and EV HGV cost	
EV Bus	CAPEX	350,000	£/unit	Assumed based on petrol bus cost	
Petrol Bus	CAPEX	250,000	£/unit	https://www.london.gov.uk/who-we-are/what-london-assembly-does/questions-mayor/find-an-answer/bus-costs#:~:text=TfL%2C%20however%2C%20estimates%20that%20a,VI%20engine%20costs%20%C2%A3349%2C500.	
Hydrogen Bus	CAPEX	400,000	£/unit	Assumed based on petrol bus cost	
Domestic Hydrogen Installation	CAPEX	3,300	£/building	https://www.energynetworks.org/assets/images/Resource%20library/FINAL_Hydrogen%20cost%20to%20customer_SENT.pdf	
Domestic EV Chargers	CAPEX	1,250	£/unit	https://www.drive-electric.co.uk/guides/charging/how-much-does-it-cost-to-get-an-electric-charger-installed-at-home/	
Non-Domestic EV Chargers	CAPEX	60,000	£/unit	https://www.cranfield.ac.uk/press/news-2023/how-a-uk-hydrogen-car-industry-could-cut-fuel-costs-and-carbon-emissions#:~:text=But%20hydrogen%20refuelling%20stations%20are,US%2475%2C000%20to%20US%24150%2C000.	
Hydrogen Refuelling Station	CAPEX	2,000,000	£/unit	https://www.cranfield.ac.uk/press/news-2023/how-a-uk-hydrogen-car-industry-could-cut-fuel-costs-and-carbon-emissions#:~:text=But%20hydrogen%20refuelling%20stations%20are,US%2475%2C000%20to%20US%24150%2C000.	
Battery Storage	CAPEX	900	£/kWh	https://www.theecoexperts.co.uk/solar-panels/storage-batteries-cost	

Thermal Storage	CAPEX	450	£/kWh	Assumed half of battery storage	
Domestic Shallow Retrofit	CAPEX	15,114,573	£ (if 100% of building were retrofitted)	City Science modelling	
Domestic Deep Retrofit	CAPEX	326,746,873	£ (if 100% of building were retrofitted)	City Science modelling	
Non-Domestic Shallow Retrofit	CAPEX	92,738,770	£ (if 100% of building were retrofitted)	City Science modelling	
Non-Domestic Deep Retrofit	CAPEX	315,506,397	£ (if 100% of building were retrofitted)	City Science modelling	
Gas boiler	Fuel Efficiency	85%	%	https://www.scottishpower.co.uk/blog/how-efficient-is-my-boiler	
Oil boiler	Fuel Efficiency	85%	%	Assumed same as gas boiler	
ASHP	Fuel Efficiency	300%	%	https://www.theecoexperts.co.uk/heat-pumps/cost-guide	
ASHP (no retrofit)	Fuel Efficiency	250%	%	Assumed heat pump at lower EPC is less efficient	
ASHP (new build)	Fuel Efficiency	350%	%	Assumed heat pump at higher EPC is more efficient	
Hydrogen boiler	Fuel Efficiency	85%	%	Assumed same as gas boiler	
Direct electric	Fuel Efficiency	100%	%	https://www.dimplex.co.uk/guide-home-heating/efficiency-electric-heating#:~:text=The%20fact%20is%20that%20electric,the%20room%20for%20one%20hour.	

Biomass boiler	Fuel Efficiency	80%	%	https://usewoodfuel.co.uk/guidance-for-biomass-users/planning-a-biomass-installation/understanding-efficiency/biomass-boiler-efficiency/#:~:text=Manufacturers%20often%20state%20the%20combustion,measured%20over%20a%20whole%20year.	
Petrol Car	Fuel Efficiency	0.70	kWh/km	https://www.iea.org/articles/fuel-economy-in-the-united-kingdom	
Petrol Bus	Fuel Efficiency	2.30	kWh/km	https://www.researchgate.net/figure/Diesel-consumption-for-RTA-buses_fig2_325918532	
Petrol HGV	Fuel Efficiency	2.90	kWh/km	https://www.smmt.co.uk/wp-content/uploads/sites/2/Heavy-CV-Fuel-Consumption-Fact-Sheet.pdf	
Petrol LGV	Fuel Efficiency	1.00	kWh/km	Assumed based on car, bus & LGV fuel efficiencies	
EV Car	Fuel Efficiency	0.13	kWh_e/km	https://octopusev.com/ev-hub/our-guide-to-electric-car-efficiency	
EV Bus	Fuel Efficiency	0.89	kWh_e/km	https://www.zenobe.com/insights-and-guides/0-5m-per-100-buses-per-year-the-impact-of-e-bus-driver-performance-on-operational-costs/	
EV HGV	Fuel Efficiency	1.00	kWh_e/km	https://www.transportenvironment.org/wp-content/uploads/2021/07/20180725_T&E_Battery_Electric_Trucks_EU_FINAL.pdf	
EV LGV	Fuel Efficiency	0.20	kWh_e/km	https://www.greencarreports.com/news/1137981_mercedes-electric-vans-may-raise-the-efficiency-bar-test-suggests	
Hydrogen Bus	Fuel Efficiency	2.13	kWh/km	https://link.springer.com/article/10.1007/s42452-021-04933-6#:~:text=Three%20hydrogen%20production%20pathways%20are,and%209%20KWh%2FKgH2.	
Hydrogen HGV	Fuel Efficiency	2.40	kWh/km	https://theicct.org/publication/fuel-cell-tractor-trailer-tech-fuel-jul22/#:~:text=Depending%20on%20the%20size%20of,and%209.2%20kg%2F100%20km.	

Heat network	Jobs - Permanent	0.21	Net jobs created per GWh heat generated	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Onshore wind	Jobs - Permanent	0.50	Net jobs created per GWh electricity generated	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Ground-mount PV	Jobs - Permanent	1.75	Net jobs created per GWh electricity generated	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Rooftop PV	Jobs - Permanent	1.75	Net jobs created per GWh electricity generated	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Domestic Retrofit	Jobs - Temporary	10.00	Net jobs created per £million invested	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Non-domestic Retrofit	Jobs - Temporary	6.69	Net jobs created per £million invested	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
ASHP	Jobs - Temporary	4.47	Net jobs created per £million turnover	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Biomass boiler	Jobs - Temporary	1.97	Net jobs created per	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	

			£million turnover		
Direct electric	Jobs - Temporary	4.47	Net jobs created per £million turnover	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Heat network	Jobs - Temporary	4.47	Net jobs created per £million turnover	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
Hydrogen boiler	Jobs - Temporary	1.97	Net jobs created per £million turnover	https://www.gov.wales/sites/default/files/publications/2021-11/technical-annex-b-economic-modelling-all-regions_0.pdf	
ASHP	OPEX	2%	% of CAPEX	https://www.checkatrade.com/blog/cost-guides/heat-pump-servicing-and-repair-cost/	£100-200 per year equates to about 2% of CAPEX
Heat network	OPEX	5%	% of CAPEX	https://assets.publishing.service.gov.uk/media/5a802b44e5274a2e8ab4e95d/heat_networks.pdf	~30 £/MWh total, which is about 5% of CAPEX
Hydrogen boiler	OPEX	9%	% of CAPEX	Assumed same as gas boiler	
Direct electric	OPEX	2%	% of CAPEX	Assumed same as heat pump	
Biomass boiler	OPEX	9%	% of CAPEX	Assumed same as gas boiler	
Gas boiler	OPEX	9%	% of CAPEX	https://www.forbes.com/home-improvement/hvac/boiler-service-costs/	£150-500 per year, about 9% of CAPEX
Oil boiler	OPEX	9%	% of CAPEX	Assumed same as gas boiler	
Ground Mount PV	OPEX	2%	% of CAPEX	https://c2e2.unepccc.org/wp-content/uploads/sites/3/2016/02/kic-innoenergy-solar-pv-anticipated-innovations-impact.pdf	Figure 9.2, page 56
Onshore Wind	OPEX	2%	% of CAPEX	Cost development of low carbon technologies	Table 6, page 15
Rooftop PV	OPEX	1%	% of CAPEX	Considered as half of ground mount PV	
Battery Storage	OPEX	0%	% of CAPEX	Assumed no OPEX	
EV Car	OPEX	2%	% of CAPEX	https://www.nimblefins.co.uk/cheap-car-insurance/average-cost-run-car-	£273 spent on maintenance/servicing each year

				uk#:~:text=UK%20car%20owners%20spend%20over,(%C2%A3273%20a%20year).	
EV LGV	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
EV HGV	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
EV Bus	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Hydrogen Car	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Hydrogen LGV	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Hydrogen HGV	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Hydrogen Bus	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Petrol Car	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Petrol LGV	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Petrol HGV	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
Petrol Bus	OPEX	2%	% of CAPEX	Assumed same rate as regular car	
ASHP	REPEX	5%	% of CAPEX	https://www.viessmann.co.uk/en/heating-advice/heat-pumps/do-heat-pumps-need-servicing-regularly.html	20-year lifetime
Heat network	REPEX	3%	% of CAPEX	https://www.london.gov.uk/sites/default/files/the_future_role_of_the_london_plan_in_the_delivery_of_area-wide_district_heating_-_final_report_-_buro_happold_.pdfd	40-year lifetime
Hydrogen boiler	REPEX	7%	% of CAPEX	https://heatable.co.uk/boiler-advice/hydrogen-boilers	15-year lifetime
Direct electric	REPEX	5%	% of CAPEX	https://www.acguyoftampa.com/blog/heating-service/how-long-can-you-expect-your-heater-to-last/#:~:text=They%20have%20different%20lifespan%20averages,to%2020%20years%20or%20more.	20-year lifetime
Biomass boiler	REPEX	4%	% of CAPEX	https://businessenergyscotland.org/guides/biomass-heating-quick-guide/#:~:text=Biomass%20boilers%20can%20provide%20higher,between%2010%20and%2015%20years.	25-year lifetime
Gas boiler	REPEX	7%	% of CAPEX	https://businessenergyscotland.org/guides/biomass-heating-quick-guide/#:~:text=Biomass%20boilers%20can%20provide%20higher,between%2010%20and%2015%20years.	15-year lifetime
Oil boiler	REPEX	7%	% of CAPEX	https://www.plumbingforce.co.uk/how-long-do-boilers-last/	15-year lifespan

EV Car	REPEX	6%	% of CAPEX	https://cascadecollision.com/blog/what-is-the-average-life-of-a-car/#:~:text=In%20the%20past%2C%20the%20average,longer%2C%20up%20to%20300%2C000%20miles.	18-year lifespan
EV LGV	REPEX	7%	% of CAPEX	https://www.tristatetruck.com/blog/posts/what-is-the-average-lifespan-of-a-long-haul-truck#:~:text=Average%20Lifespan%20of%20Semi%20Trucks&text=A%20typical%20semi%20truck%20can,use%20out%20of%20your%20truck.	15-year lifespan
EV HGV	REPEX	7%	% of CAPEX	https://www.tristatetruck.com/blog/posts/what-is-the-average-lifespan-of-a-long-haul-truck#:~:text=Average%20Lifespan%20of%20Semi%20Trucks&text=A%20typical%20semi%20truck%20can,use%20out%20of%20your%20truck.	15-year lifespan
EV Bus	REPEX	8%	% of CAPEX	https://assets.publishing.service.gov.uk/media/623b0fb28fa8f540f3202c12/lifecycle-analysis-of-UK-road-vehicles.pdf	15-year lifespan
Hydrogen Car	REPEX	6%	% of CAPEX	https://cascadecollision.com/blog/what-is-the-average-life-of-a-car/#:~:text=In%20the%20past%2C%20the%20average,longer%2C%20up%20to%20300%2C000%20miles.	18-year lifespan
Hydrogen LGV	REPEX	7%	% of CAPEX	https://www.tristatetruck.com/blog/posts/what-is-the-average-lifespan-of-a-long-haul-truck#:~:text=Average%20Lifespan%20of%20Semi%20Trucks&text=A%20typical%20semi%20truck%20can,use%20out%20of%20your%20truck.	15-year lifespan
Hydrogen HGV	REPEX	7%	% of CAPEX	https://www.tristatetruck.com/blog/posts/what-is-the-average-lifespan-of-a-long-haul-truck#:~:text=Average%20Lifespan%20of%20Semi%20Trucks&text=A%20typical%20semi%20truck%20can,use%20out%20of%20your%20truck.	15-year lifespan
Hydrogen Bus	REPEX	8%	% of CAPEX	https://assets.publishing.service.gov.uk/media/623b0fb28fa8f540f3202c12/lifecycle-analysis-of-UK-road-vehicles.pdf	15-year lifespan
Petrol Car	REPEX	8%	% of CAPEX	https://cascadecollision.com/blog/what-is-the-average-life-of-a-car/	12-year lifespan

				car/#:~:text=In%20the%20past%2C%20the%20average,longer%2C%20up%20to%20300%2C000%20miles.	
Petrol LGV	REPEX	7%	% of CAPEX	https://www.tristatetruck.com/blog/posts/what-is-the-average-lifespan-of-a-long-haul-truck#:~:text=Average%20Lifespan%20of%20Semi%20Trucks&text=A%20typical%20semi%20truck%20can,use%20out%20of%20your%20truck.	15-year lifespan
Petrol HGV	REPEX	7%	% of CAPEX	https://www.tristatetruck.com/blog/posts/what-is-the-average-lifespan-of-a-long-haul-truck#:~:text=Average%20Lifespan%20of%20Semi%20Trucks&text=A%20typical%20semi%20truck%20can,use%20out%20of%20your%20truck.	15-year lifespan
Petrol Bus	REPEX	8%	% of CAPEX	https://assets.publishing.service.gov.uk/media/623b0fb28fa8f540f3202c12/lifecycle-analysis-of-UK-road-vehicles.pdf	15-year lifespan
Onshore Wind	REPEX	5%	% of CAPEX	https://nepis.epa.gov/Exe/ZyNET.exe/P100IL8K.TXT?ZyActionD=ZyDocument&Client=EPA&Index=2011+Thru+2015&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C11thru15%5CTxt%5C00000010%5CP100IL8K.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL	20-year lifetime
Ground Mount PV	REPEX	4%	% of CAPEX	https://energy-efficient-home.campaign.gov.uk/	25-year lifespan
Rooftop PV	REPEX	4%	% of CAPEX	https://energy-efficient-home.campaign.gov.uk/	25-year lifespan
Battery Storage	REPEX	4%	% of CAPEX	https://www.plicoenergy.com.au/blog/how-long-do-solar-batteries-last	15-year lifespan
Thermal Storage	REPEX	4%	% of CAPEX	https://newarkcylinders.co.uk/how-long-do-hot-water-cylinders-last/	15-year lifespan

Gas boiler	Typical Domestic Size	30	kW	https://www.viessmann.co.uk/en/heating-advice/boilers/what-size-of-boiler-do-i-need.html	
Oil boiler	Typical Domestic Size	30	kW	Assumed same as gas boiler	
ASHP	Typical Domestic Size	10	kW	https://www.theecoexperts.co.uk/heat-pumps/cost-guide	
Hydrogen boiler	Typical Domestic Size	30	kW	Assumed same as gas boiler	
Direct electric	Typical Domestic Size	30	kW	Assumed same as gas boiler	
Biomass boiler	Typical Domestic Size	30	kW	Assumed same as gas boiler	
Rooftop PV - domestic	Typical Domestic Size	3.57	kW/dwelling	Based on RLCEA	

Table 8-8: Techno-economic Model Costing Assumptions

8.5 E – Fuel Cost Assumptions

Fuel	Reference	Note
Electricity – Domestic	Green Book	Table 9 – Electricity LRVC, Central Domestic
Electricity – Non-domestic	Green Book	Table 9 – Electricity LRVC, Central Commercial
Electricity – Industrial	Green Book	Table 9 – Electricity LRVC, Central Industrial
Electricity – EV Cars	Green Book	Assumed 60% of the domestic rate plus 40% of the non-domestic rate, based on the location of EV chargers
Electricity – EV LGVs, HGVs, Buses	Green Book	Table 9 – Electricity LRVC, Central Commercial
Hydrogen – Domestic, Non-domestic, Industrial	BEIS Hydrogen Production Costs 2021 Annex	Linear intervals between data points of Central LRVC Industrial
Hydrogen – Transport	https://theicct.org/publication/fuels-eu-onsite-hydro-cost-feb22/	Linear intervals between data points
Biomass	https://assets.publishing.service.gov.uk/media/5a79806340f0b642860d8a1a/5142-bioenergy-strategy-.pdf	Medium supply constraints price scenario (assume fixed £6/GJ)
Gas – Domestic	Green Book	Table 10 – Gas LRVC, Central Domestic
Gas – Non-domestic	Green Book	Table 10 – Gas LRVC, Central Commercial
Gas – Industrial	Green Book	Table 10 – Gas LRVC, Central Industrial
Gas Oil - Domestic	Green Book	Table 12 – Oil LRVC, Central Domestic
Gas Oil – Non-domestic	Green Book	Table 12 – Oil LRVC, Central Commercial
Gas Oil – Industrial	Green Book	Table 12 – Oil LRVC, Central Industrial
Petrol – All Transport	Green Book	Table 13 – Road Fuel LRVC, Central Petrol
Biodiesel	https://www.racfoundation.org/data/price-of-bio-diesel-v-fossil-fuel	Assumed fixed 88 p/L

Table 8-9: Techno-economic Model Fuel Cost Assumptions