Sponsors:

Delivery partners:

Flintshire

Local Area Energy Plan

Flintshire

2024

Mae’r ddogfen hon ar gael yn Gymraeg /
This document is also available in Welsh

Abbreviations

Acronym	Definition or meaning
ANW	Ambition North Wales.
CAPEX	Capital Expenditure.
CCGT	Combined Cycle Gas Turbine.
COP	Coefficient of Performance.
DESNZ	Department for Energy Security and Net Zero.
DFES	Distribution Future Energy Scenarios.
DNO	Distribution Network Operator.
EfW	Energy from Waste.
EPC	Energy performance certificate.
ESC	Energy Systems Catapult.
EV	Electric Vehicle.
FES	Future Energy Scenarios.
GDN	Gas Distribution Network.
GHG	Greenhouse Gas.

Acronym	Definition or meaning
GIS	Geographic Information System.
HGV	Heavy Goods Vehicles.
LAEP	Local area energy planning or Local area energy plan.
LDP	Local Development Plan.
LGV	Light Goods Vehicles.
LSOA	Lower super output area, a small area classification in the UK designed to have a comparable population.
LULUCF	Land Use, Land Use Change and Forestry.
MSOA	Middle super output area, a medium-sized area classification in the UK designed to have a comparable population.
NAEI	National Atmospheric Emissions Inventory.
NGED	National Grid Electricity Distribution.
NZ	Net Zero.

Abbreviations

Acronym	Definition or meaning
REA	Renewable Energy Assessment.
REPD	Renewable Energy Planning Database.
RFI	Request for Information.
RIIO	Revenue = Incentives + Innovation + Outputs, a regulatory framework used by the UK energy regulator, Ofgem.
RSP	Regional Skills Partnership.
RTP	Regional Transport Plan.
SDP	Strategic Development Plan.
SMR	Steam Methane Reformation.
SPEN	SP Energy Networks.
SSE	Scottish and Southern Energy plc.
TfW	Transport for Wales.
WIMD	Welsh Index of Multiple Deprivation.
WWU	Wales and West Utilities.

Note: full definitions for terms used through the report are provided in the glossary at the end of the document.

Sponsors: *Delivery partners:*

Contents

Navigating this report

Home icon
Clicking the Flintshire County Council logo in the top right-hand corner of each page will return the reader to this contents page.

Navigation to Sections
Readers can navigate to every section of the report my clicking on the desired section from this contents page.

Navigation within the report
Throughout this document, clicking on underlined text with take the reader to the page referred to.

This Local Area Energy Plan was prepared by Arup, Carbon Trust and Afallen on behalf of Flintshire County Council and co-ordinated across the region by Ambition North Wales. Energy Systems Catapult is the Technical Advisor for the LAEP Programme in Wales.

The Plan's development was funded by the Welsh Government.

Local Area Energy Plan outline

This plan collates evidence to identify the most effective route for Flintshire to reach a net zero energy system

Overview

As part of this project, two separate documents have been produced. This will ensure the content is accessible to a variety of audiences whilst also making it easier to find information relevant for the reader. These two documents are the:

1. **Local Area Energy Plan** *(this document)* contains the overarching plan, focusing on the Flintshire's area-wide local energy plan and actions.
2. **Technical Report** contains the graphs, charts, maps and supporting data for the results published in the Local Area Energy Plan. It also provides more detail about the approach to modelling and scenario analysis that we took. This report is available upon request.

Achieving the transformation that is needed for the energy system to reach net zero will not be easy and will need a collaborative approach. In this plan, the term "we" has therefore been used to refer to the range of people and organisations in Flintshire who will support the ambition we set out and take action. The Council and Ambition North Wales have taken facilitating roles in developing this LAEP, but we will not deliver the ambition it sets out alone. We have developed this Plan with input from a range of stakeholders, and we hope that you will be inspired by the actions that stakeholders have committed to, to take action to transform our energy system too.

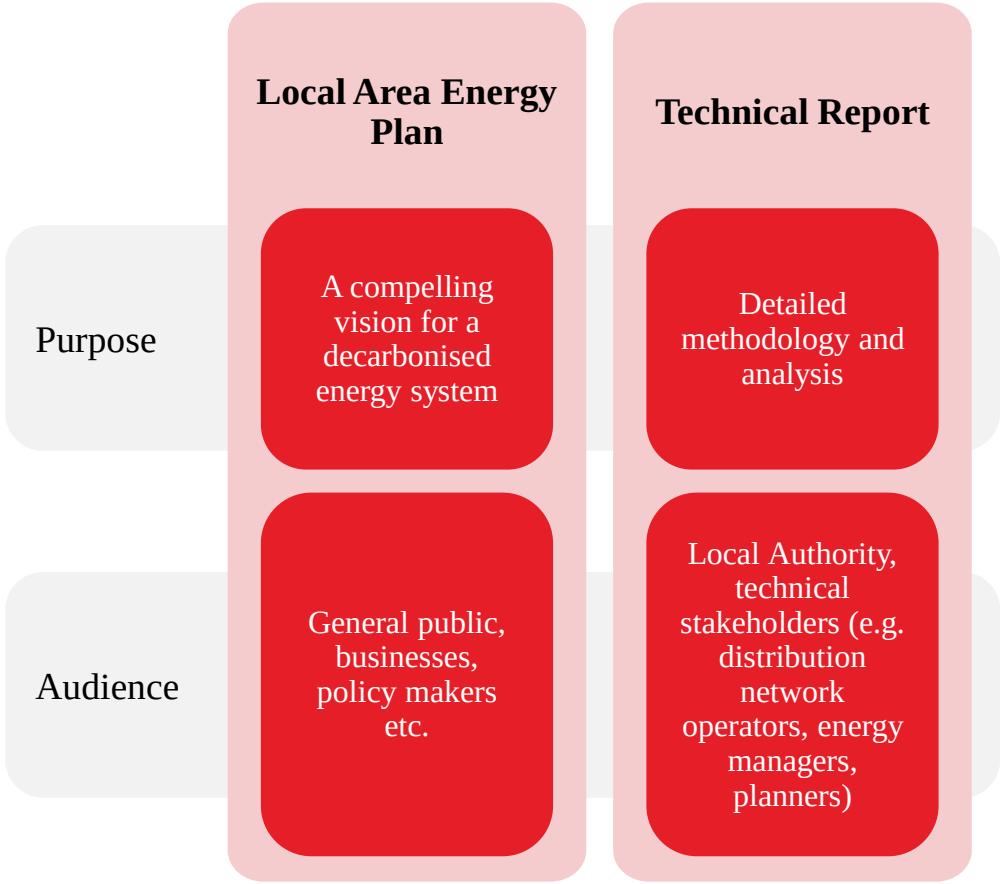


Figure 0.0.1: LAEP and support documents purpose and audience summary

Executive summary
Our vision for a net zero local energy system

The vision for Flintshire's future local energy system is:

Flintshire County Council envisions a sustainable future with a net zero energy system that is affordable and promotes community health, wellbeing, and economic growth. We commit to a clean energy transition that fosters a resilient, inclusive, and prosperous community, ensuring a harmonious balance between environmental stewardship and social progress.

Flintshire's **energy objectives** are collectively agreed and describe what needs to be done to create the enabling conditions needed to deliver this LAEP.

- Support a low-cost and affordable energy system through reducing energy demand and promoting energy efficiency.
- Optimise the use of local renewable energy sources within Flintshire, encouraging local ownership and community participation.
- Promote safe, healthy, and sustainable places to live, work and visit – helping to generate connected and resilient communities
- Create a resilient energy system capable of meeting future energy demands that reduces carbon emissions and protects and enhances Flintshire's natural assets.
- Promote a low carbon economy, providing learning and skills for all to create a prosperous, thriving, resilient Flintshire.

Our **energy propositions** describe what needs to change between now and 2050 to decarbonise Flintshire's local energy system and achieve net zero by 2050.

- Scaling Zero Carbon Buildings
- Decarbonising Transport
- Increasing Local Renewable Generation
- Supporting Green Business
- Maturing Hydrogen
- Reinforcing and Transitioning Energy Networks

Figure 0.0.2: LAEP priority energy proposition areas for Flintshire

Executive summary

Flintshire's energy propositions in more detail

Scaling Zero Carbon Buildings

Supporting and deploying energy efficiency measures across the county to reduce energy demand and costs.

Ensuring buildings are safe, healthy and low carbon in operation and design.

Low regret system components:

- Retrofit
- Heat pumps

Decarbonising Transport

Enabling the rollout of ultra low/zero carbon vehicles across the county and transitioning to a zero carbon council fleet.

Promoting active and sustainable travel within the region.

Low regret system components:

- EV chargers
- Active travel

Increasing Local Renewable Generation

Investigating opportunities for local and community ownership of renewables, providing low cost, clean energy to residents.

Low regret system components:

- Rooftop solar
- Ground-mounted solar

Supporting Green Business

Encouraging and supporting businesses to adopt low carbon measures and reduce energy costs.

Create an attractive environment for sustainable businesses to make base in Flintshire.

Low regret system components:

- Waste heat

Maturing Hydrogen in Industry

Exploring the potential for hydrogen within particular sectors and understand the infrastructure requirements for implementation.

Low regret system components:

- Innovation trials

Reinforcing and transitioning energy networks

Grid reinforcement will be required to accommodate the shift towards electric vehicles and heating.

Even in a low hydrogen scenario the gas grid will require repurposing for hydrogen within some applications.

Low regret system components:

- Flexibility and storage technologies

Figure 0.0.3: Summary of energy propositions

Executive summary

Flintshire's local energy system will need to change significantly to achieve net zero by 2050

Flintshire's local energy system today

- **220** public EV charge points
- **700** heat pumps installed
- **13,000 (35%)** of all domestic properties EPC A-C
- **80MW** ground-mounted solar PV installed capacity
- **2,900** buildings with rooftop solar PV installed (12MW)
- **0 GWh/yr** of industrial hydrogen consumption

What Flintshire's net zero local energy system could look like in 2050

- **Up to 63,800** public EV charge points
- **Up to 95,300** heat pumps installed
- **Up to 37,200** of all domestic properties EPC A-C
- **645MW** ground-mounted solar PV installed capacity
- **99,700** buildings with rooftop solar PV capacity (400MW)
- **Up to 220 GWh/yr** of industrial hydrogen consumption

1 Between 2023 and 2030, we assume a slow but steady uptake of low carbon technologies due to factors such as limited awareness, higher capital costs, and the need for network reinforcement.

2 From 2030 onwards, we assume that deployment accelerates as technologies become more commercially attractive, awareness increases, supply chains develop, and they become more affordable.

3 From 2040 onwards, we assume that low carbon technologies are widely used and tend towards their maximum feasible adoption, which causes the deployment rate to stabilise.

Sponsors:

Delivery partners:

Executive summary

Achieving a net zero local energy system in 2050 aligns with the Well-being of Future Generations (Wales) Act 2015 and could lead to the following

Direct Impacts

Emissions reductions
22 times less GHG emissions than in 2023

Energy savings
1.4 times less heat used in buildings than in 2023

1.6 times less energy used for transport than in 2023

Wider Impacts

Energy security and reliability
Diversified local energy supply improves energy security

Air quality improvements
Reduced fossil fuel combustion from transport, heat and power improves air quality - up to £1,200m of cumulative savings by 2050

Net job creation
Emerging net zero industries attract investment and create high quality local jobs – up to 8,800 net jobs created by 2050

Affordability
Highly insulated homes reduce heat demand, improve affordability and reduce fuel poverty

National Well-being Goals

Wales' Well-being of Future Generations (Wales) Act 2015, well-being goals

Executive Summary
Flintshire's Plan on a page

To support transformation of the energy system, pilot projects may be useful. The map below highlights areas that could provide a useful focus for these pilots.

Figure 0.4 identifies zones with particularly favourable conditions for specific energy components, making them ideal locations for pilot studies. The summary boxes detail the location, opportunity type, potential capacity, required investment for each component, and total investment necessary for both energy component installation and electricity network infrastructure in each zone by 2030. Ranges have been calculated by taking the minimum and maximum results from each future energy scenarios modelled.

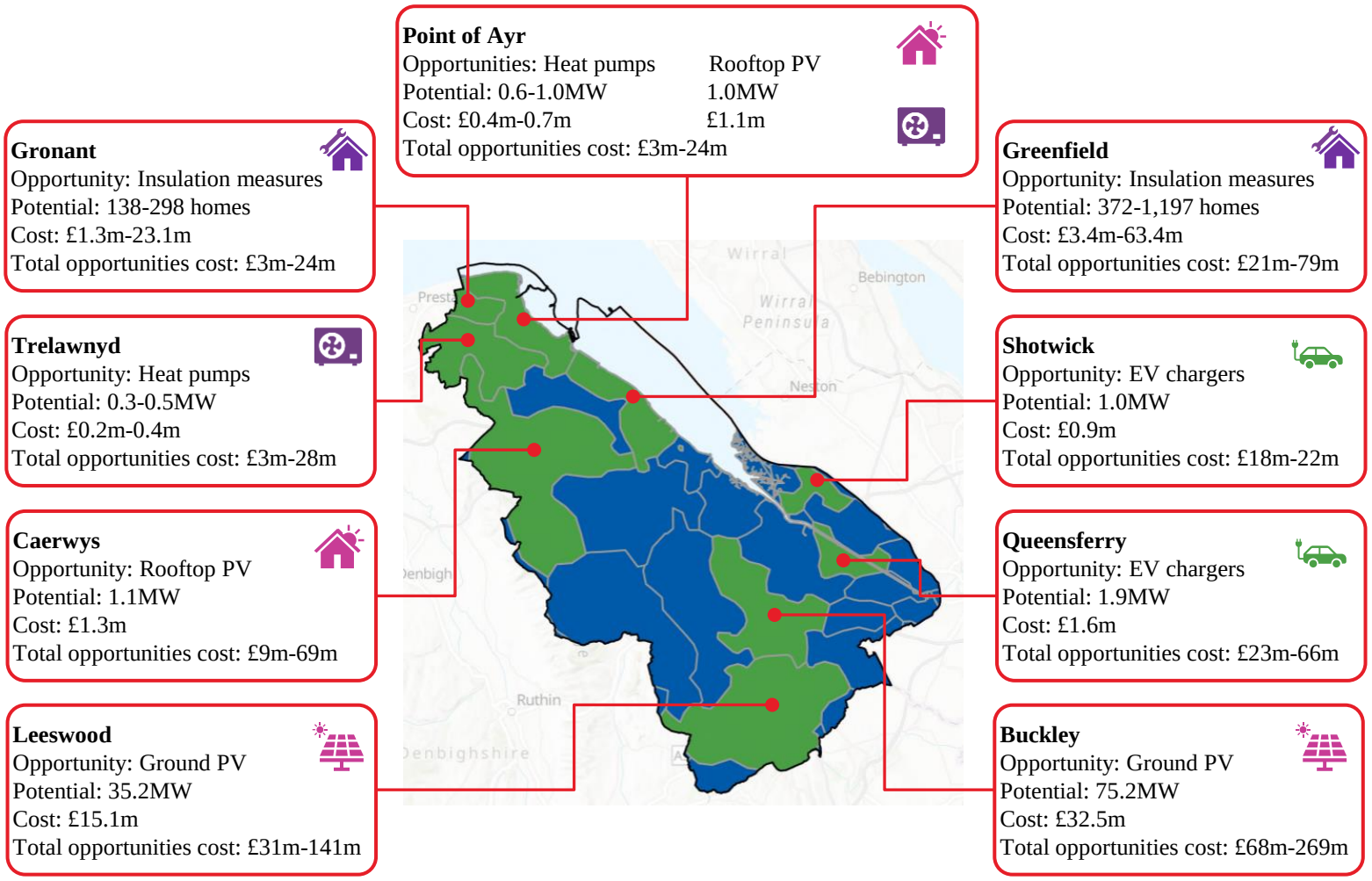


Figure 0.0.4: Flintshire's spatial representation of opportunities, including 2030 ambition and investment (million £) – in High and Low Demand scenarios. Zone boundaries are defined by primary substation service areas.

Executive summary

To deliver the LAEP, we have developed a series of actions and next steps that we'll need to take

Action routemap

Although the exact form of the decarbonised energy system in 2050 is uncertain, there are actions we can take now with relative certainty that will help us maintain the ability to meet our 2050 Net Zero ambition and capitalise on the opportunities that this transition will bring.

Our action routemap takes each energy proposition and outlines critical, enabling actions that we will take collectively alongside our stakeholders in the coming decade, with a particular focus on what we can achieve in the next 5-7 years.

The sequencing of activities in the routemap is highly dependent on the political, regulatory and strategic context it has been created in. Therefore, we expect it to evolve over time and be regularly updated to make sure it stays relevant. Flintshire's routemap can be found in Chapter 4: Action planning.

Next steps

Progressing energy propositions: For each prioritised proposition, we will undertake a series of development activities to progress towards delivery (such as feasibility studies, detailed technical and commercial development, business case, commercialisation and procurement).

Governance: Where possible, we will integrate oversight of LAEP delivery with existing governance structures. We will explore options to appoint a lead officer to guide the delivery of the actions in this plan.

Monitoring: We will work with regional and national partners to develop a monitoring framework which builds on existing processes and helps us understand the progress Flintshire is making towards its committed actions and ambitions set out in this plan.

Engagement & collaboration:
Many stakeholders with an interest and influence over the local energy system have come together to help shape this LAEP, and it is important that this collaboration continues as we deliver this plan. The development of this LAEP has brought those with interest and influence together.

Chapter 1: Introduction

1. Introduction
What is Local Area Energy Planning (LAEP)?

Overview

Definition of a LAEP

A LAEP sets out the changes required to transition an area's energy system to net zero carbon emissions against a specified time. By exploring a range of technologies and scenarios through whole energy system modelling and analysis, the most cost-effective preferred pathway to net zero can be identified. The process follows standardised guidance defined by ESC.

Being data-driven and evidence-based, a LAEP uses a whole energy system approach that is led by local government and developed collaboratively with defined stakeholders. It sets out to identify the most effective route for the local area to meet its local net zero target, as well as contributing towards meeting the national net zero target.

A LAEP results in an indicative costed spatial plan that identifies the change needed to the local energy system and built environment, detailing what changes are required, where, when and by whom. The level of detail in a LAEP is equivalent to an outline design or masterplan and is intended to identify core areas that require focus over the next 25 years. It proposes future sector-specific action plans that set out how each part of the area will be designed and built. Additional detailed design work will be required for identified specific actions, projects and programmes to progress to delivery.*

Vision of a LAEP

A LAEP defines a long-term vision for an area but should be updated approximately every 5 years (or when significant technological, policy or local changes occur) to ensure the long-term vision remains relevant. This LAEP sets out the start of Flintshire's net zero energy transition journey.

**For example, a LAEP may identify a zone that is best suited to a district heat network by assessing the types of buildings in the zone, their characteristics, and density; however, to deliver the district heat network it would require a full feasibility assessment by an appropriately qualified installation or design company, along with assessment of commercial viability and delivery mechanisms.*

A note on the use of "we" throughout this report:

Achieving the transformation that is needed for the energy system to reach net zero will not be easy and will need a collaborative approach. In this plan, the term "we" has therefore been used to refer to the range of people and organisations across the Isle of Anglesey who will support the ambition set out and agreed in this plan. The Council and Ambition North Wales have taken facilitating roles in developing this LAEP but cannot deliver the ambition it sets out alone. This Plan has been developed with input from a range of stakeholders, and we all hope that you will be inspired by the actions that stakeholders have committed to, to take action to transform the island's energy system too.

1. Introduction
What is Local Area Energy Planning (LAEP)?

Overview

Scope of a LAEP

The UK government's 2021 Net Zero Strategy[M02] estimates that **82% of the UK's emissions are "within the scope of influence of local authorities."**

The scope of a LAEP covers the current and projected future energy consumption and associated greenhouse gas (GHG) emissions, primarily focusing on an area's built environment (all categories of domestic, non-domestic, and industrial buildings), energy used for road transport (excl. energy used in rail, aviation, and shipping), local renewable generation and the energy networks needed to support this consumption.

Elements included in a LAEP are:

- Electricity, heat and gas networks
- The future potential for hydrogen
- The built environment (industrial, residential, and commercial), its fabric and systems,
- Flexibility (in terms of shifting when demand is placed on the grid), and the storage and generation of energy,
- Providing energy to decarbonised transport (i.e., the electricity required for electric vehicle charging infrastructure).

Some GHG emissions sources are excluded from scope, because they are either not directly associated with the energy system (e.g. emissions from land, land use and forestry) or are produced from assets that are national (e.g. rail, aviation and shipping). More information on the boundary and scope can be found in Chapter 1: Introduction and the Technical Report (*Chapter 1*).

It identifies near-term actions and projects, providing stakeholders with a basis for taking forward activity and prioritising investments and action. Site-specific data is used where available, with remaining areas covered by the national dataset.

Benefits of a LAEP

A LAEP provides a long-term plan to deliver net zero. A benefit of LAEP is the 'whole systems approach', aligned to the Wellbeing of Future Generations Act[M06] "way of working" on integration. This provides consideration to the most cost-effective solutions to future energy system at the right time. For example, deploying different heat decarbonisation technologies to avoid a high-cost upgrade of the electricity network. By working closely with local stakeholders, incorporating their data, knowledge and plans, a LAEP is built on a common evidence base. The outputs can then be used reliably by stakeholders from Flintshire's public service providers to network operators to community groups, knowing they are working towards a common goal built on strong foundations.

1. Introduction
The energy transition across Wales

Overview

The Welsh Government's "Net Zero Wales" plan[M03] establishes an increased level of ambition on decarbonisation, with a legally binding target to reach net zero emissions by 2050. It is the first national government to fund the roll out of LAEP to all its local authorities. The programme is being co-ordinated through a regional approach, where LAEPs are being developed for local authorities in mid Wales, South West Wales and in the North Wales and the Cardiff Capital Region. The rationale for taking this approach was because there are efficiencies on data collection and management, as well as reinforcing the links between the regional and local plans to maximise opportunities across LA areas and between regions. Several suppliers have been selected to produce the LAEPs for each region, as detailed in the map.

To contribute to the Welsh Government's commitment of producing a "National Energy Plan" in 2024, upon completion of the LAEP programme Energy Systems Catapult[M04] will aggregate the LAEPs into a national view. To support this task, they are working with the Welsh Government to create and import standardised LAEP outputs for aggregation into the DataMapWales platform[M05]. Energy Systems Catapult is also providing technical advisory support to the Welsh Government throughout the programme.

The LAEPs will also form the basis of the 'National Energy Plan' Welsh Government has committed to produce in 2024.

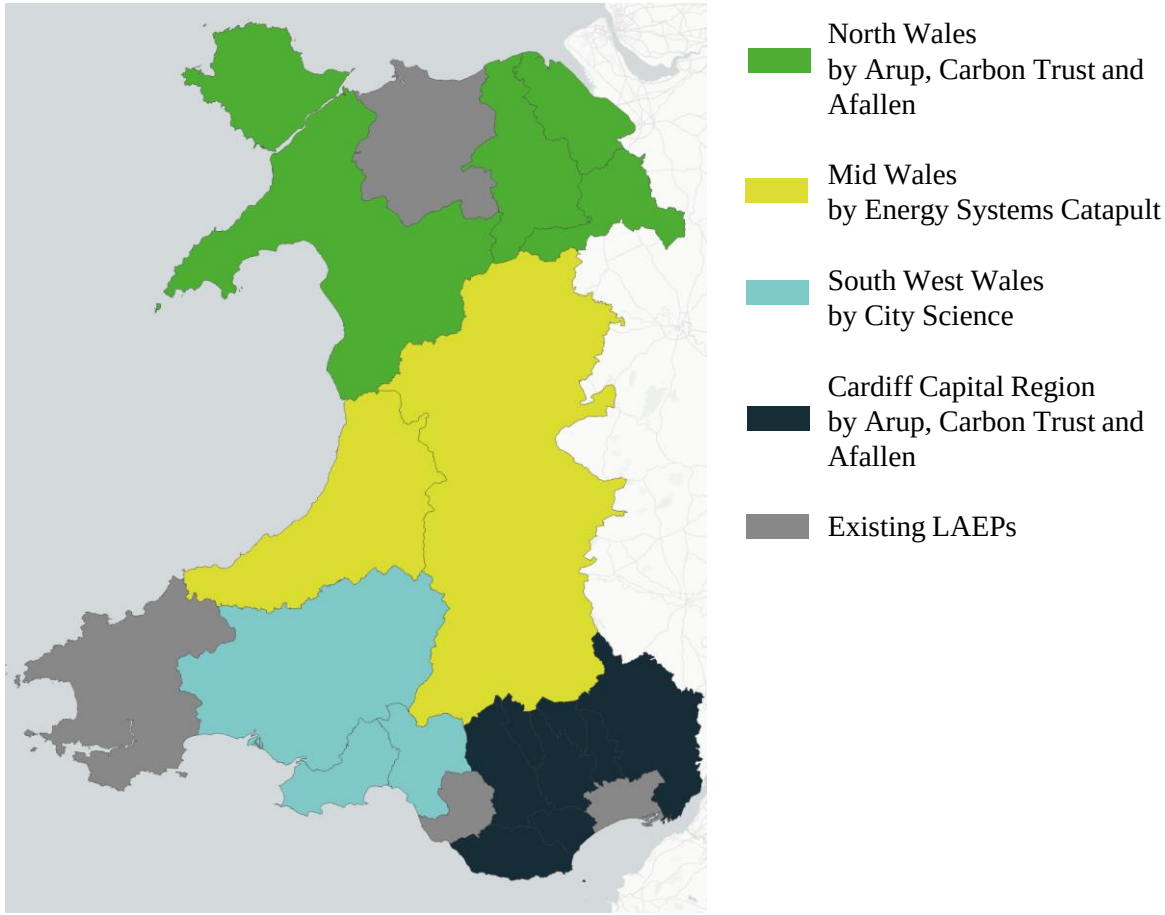


Figure 1.0.1: LAEP landscape across Wales

1. Introduction
Boundary and scope

A LAEP considers energy use, supply and generation within the Flintshire boundary.

There are three core parts to the local energy system:

- **Infrastructure** – The physical assets associated with the energy system such as electricity substations.
- **Supply** – Generation (renewable and non-renewable), storage and distribution of energy to local consumers for use in homes, businesses, industry and transport.
- **Demand** – The use of energy driven by human activity e.g. petrol/diesel used in vehicles, gas burned for heat in homes. required for the energy system to operate.

The whole energy system across all sectors is considered in the planning process to ensure that the interactions and dependencies between generation and use of different energy sources are fully considered. This identifies where different systems can work together to improve the overall resilience and flexibility of the energy system.

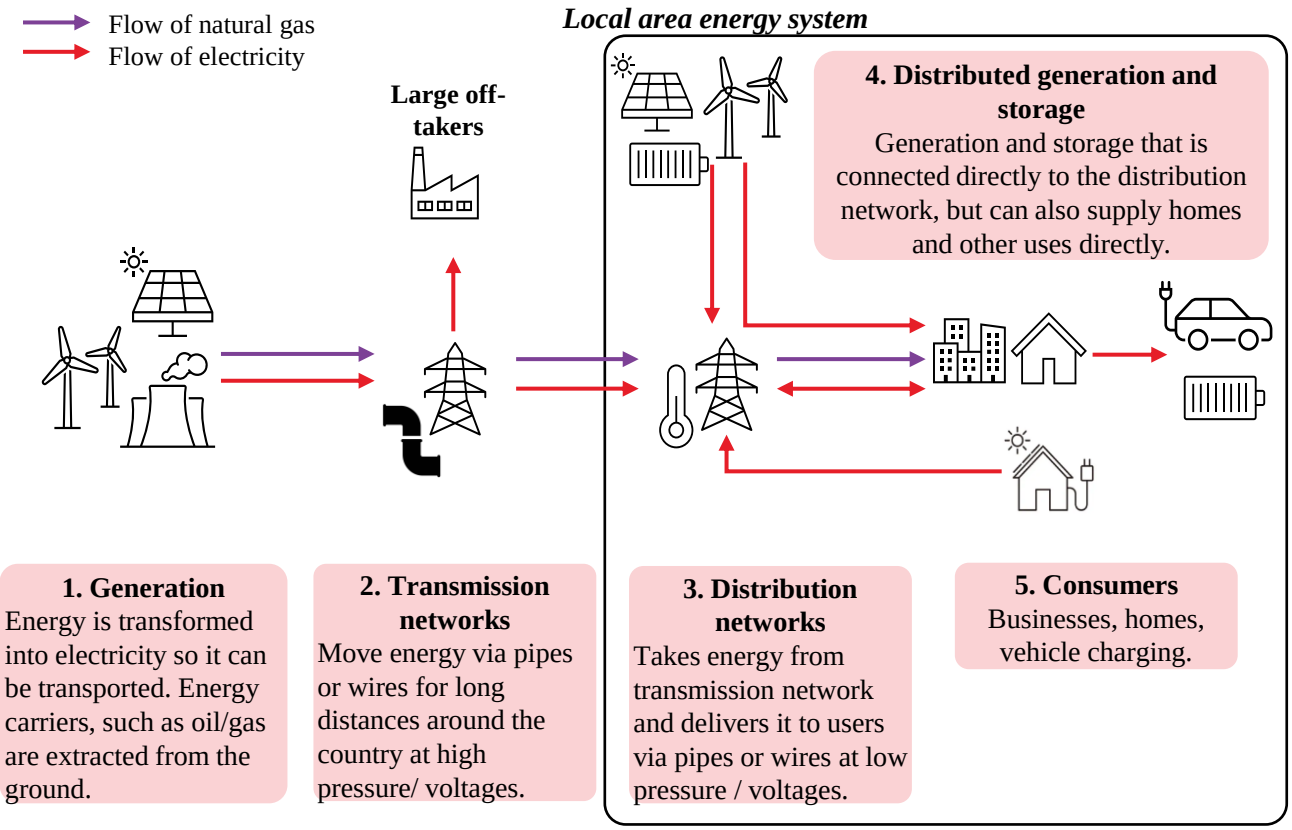


Figure 1.0.2: Schematic of electricity and gas transmission and distribution network and the system boundary for LAEP

1. Introduction
Boundary and scope

Scope for the Welsh LAEPs

The diagram to the right indicate the parts of the local energy system which are in-scope for the LAEPs across Wales. This scope is defined by ESC's LAEP Guidance[M01].

Geographic boundary

We used the geographic boundary for Flintshire to set the boundary for the LAEP, which meant that any energy generating assets, energy use and infrastructure in that boundary were considered for inclusion in the LAEP.

Exclusions from the LAEP

The following parts of the energy system within the Isle of Anglesey are excluded from the LAEP:

- Aspects of the energy system which are expected to be overseen by central government, or any non-energy sources of greenhouse gas (GHG) emissions occurring within the Local Authority's governing boundary (for example, GHG emissions from industrial processes, agricultural land use and livestock are excluded).
- Energy used for shipping, aviation and rail are excluded on the basis that they are not local uses of energy.
- Large electricity generators connected to the transmission network (such as offshore wind, grid scale batteries, hydrogen SMR) are considered national assets and excluded from the modelling, however these are likely to play an important role in Flintshire's decarbonisation journey.

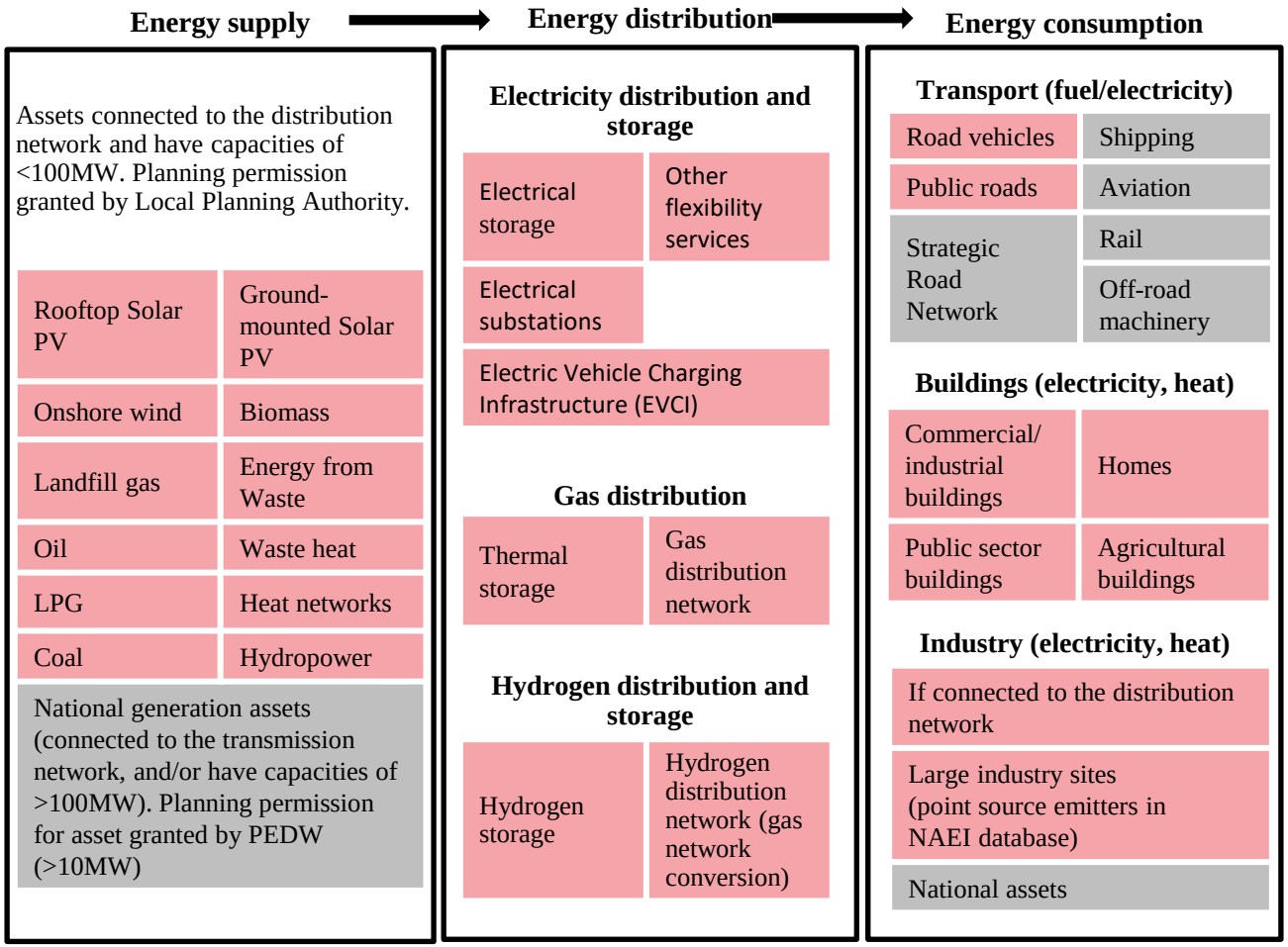


Figure 1.0.3: Schematic of the local system scope for LAEP

1. Introduction
Our vision for Flintshire's future local energy system

Future energy system vision and energy objectives

We have produced the following vision statement that underpins our ambition for the future net zero energy system in Flintshire:

Flintshire's vision

Flintshire County Council envisions a sustainable future with a net zero energy system that is affordable and promotes community health, wellbeing, and economic growth. We commit to a clean energy transition that fosters a resilient, inclusive, and prosperous community, ensuring a harmonious balance between environmental stewardship and social progress.

Finally, in shaping the LAEP for Flintshire, we established the following objectives. These objectives served as foundation elements that were considered when formulating recommended actions:

Energy objectives

1. Support a low-cost and affordable energy system through reducing energy demand and promoting energy efficiency.
2. Optimise the use of local renewable energy sources within Flintshire, encouraging local ownership and community participation.
3. Promote safe, healthy, and sustainable places to live, work and visit – helping to generate connected and resilient communities.
4. Create a resilient energy system capable of meeting future energy demands that reduces carbon emissions and protects and enhances Flintshire's natural assets.
5. Promote a low carbon economy, providing learning and skills for all to create a prosperous, thriving, resilient Flintshire.

1. Introduction
Navigating this report

LAEP contents

This LAEP presents a vision for a net zero local energy system in Flintshire, with a routemap to get there, including a set of recommended actions for Flintshire, whilst recognising the role of other key actors in government, the energy sector and across the community.

Plan structure

This plan is structured into three main topic areas:

Chapter 1 - Introduction – overview of what a LAEP is, and an introduction to Flintshire's vision and objectives for its LAEP.

Chapter 2 - The current energy system - description of Flintshire's existing energy system and relevant policies and objectives.

Chapter 3 - The future energy system - presentation of future scenarios for a net zero local energy system, including risks and "low regrets" measures, which are very likely to be part of the future energy system regardless of uncertainty around certain aspects of the future.

Chapter 4 - Action planning - a routemap and action plan for us to use to drive the local energy system transition in Flintshire, including what needs to happen and what we will do.

Chapter 5 - Next steps - outlines immediate next steps and what is needed to create an enabling environment for the delivery of this plan, and a net zero local energy system.

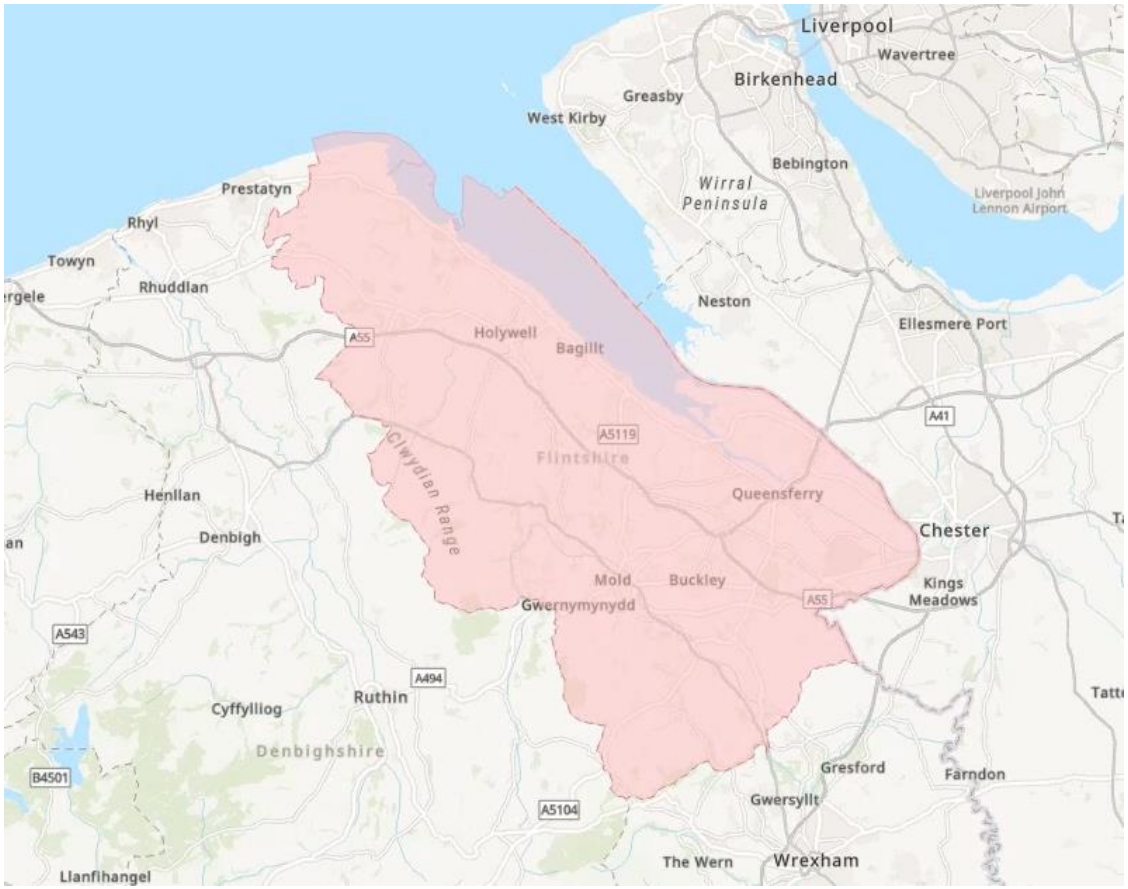


Figure 1.0.4: Geographic boundary for LAEP

Chapter 2: The current energy system

2. The current energy system
Policy and funding context

Net Zero Wales[M03] is the Welsh Government's emissions reduction plan for the current carbon budget period between 2021-2025. This is a statutory document required by the Environment (Wales) Act[M07], which sets out policies and proposals to help Wales meet its carbon budget and be on track to meet its legally binding net zero target for 2050. The Well-Being of Future Generations (Wales) Act[M06] is in place to ensure that this transition fosters greater equality and positive outcomes for all.

There are a range of strategies and policies at Welsh and UK level that will influence how Wales transitions to a net zero energy system in the next 25-30 years. Devolved powers vary across the different parts of the energy system.

Using our own statutory powers, we, as a Local Authority, have also established plans and policies relating to decarbonising energy use across our own operations, and have started to look further to how we influence changes in our local communities through our place-making role.

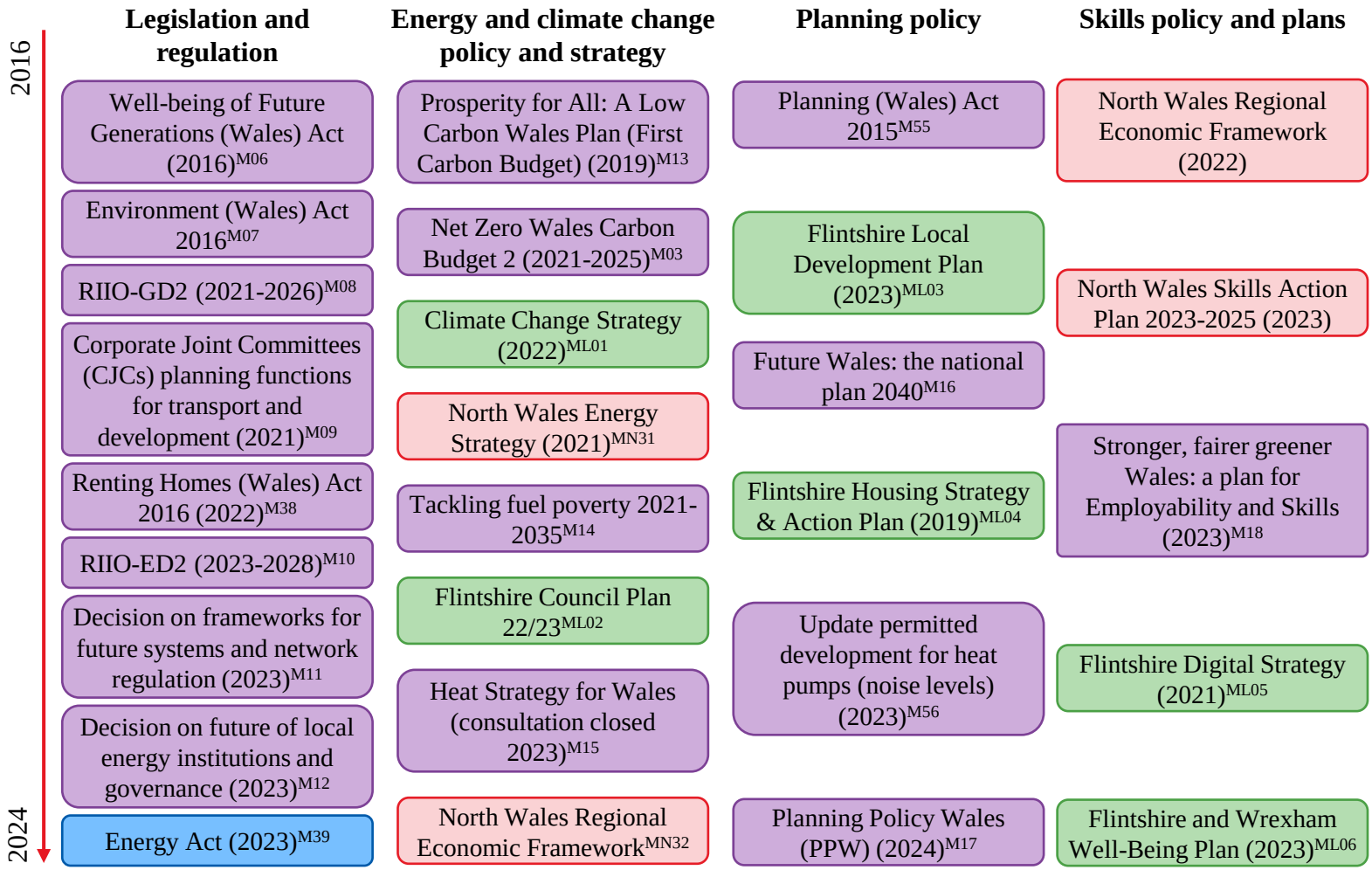


Figure 2.0.1: Summary of cross-cutting regulation / policies at local, regional and national level

2. The current energy system
Policy and funding context

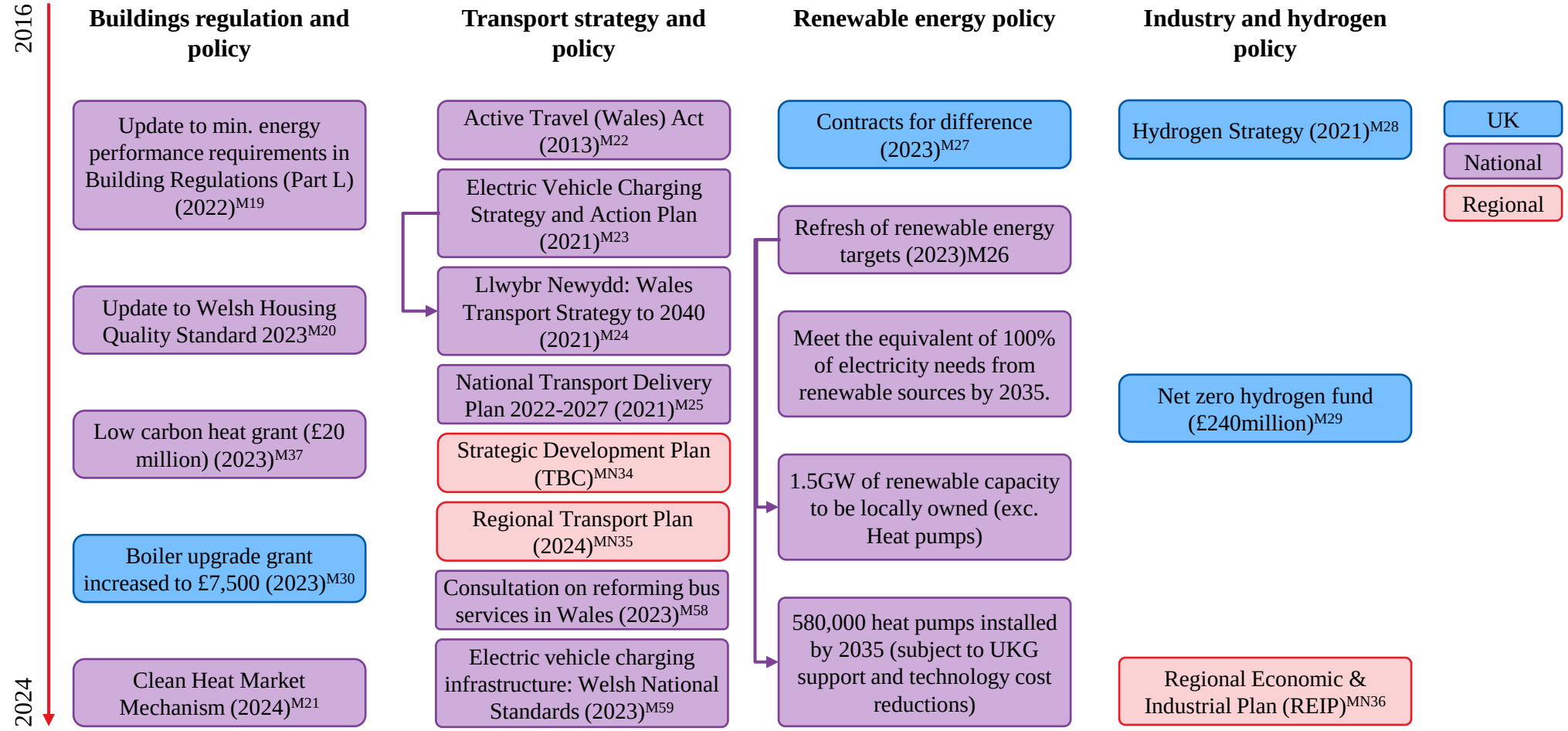


Figure 2.0.2: Summary of sector-specific regulation / policy at local, national and regional level

2. The current energy system

Our collaborative approach to developing and delivering our LAEP

Stakeholder engagement approach

Delivering our LAEP calls for a collective effort from all types of organisations in and beyond the local authority boundary. The local energy system extends beyond Flintshire's influence which is why stakeholder engagement is the foundation for the development of our LAEP.

With the support of our delivery partners, we prioritised stakeholders based on their level of local knowledge of and / or influence over specific elements of the local energy system and their role in the development of the LAEP. The importance of recognising the involvement of regional stakeholders emerged early in the LAEP. They have a unique role, ensuring cohesion of action for specific element(s) of the energy system across neighbouring LAEPs in the same region and offering regional efficiencies where local objectives are aligned.

We engaged stakeholders at different stages of the development process to make sure stakeholders could help shape the plan and key development milestones. Regional steering groups were held for North Wales, attended by the regional and local authority leads, as well as bi-weekly meetings with the local authority leads. Two workshops were held regionally and involved primary stakeholders from across each local authority in North Wales. These workshops were used at stages where it was important to agree a way forwards that was appropriate for the region, as well as each local authority.

As part of the overarching programme, a national forum brought together all suppliers, local authority leads, the regional leads, Welsh Government and the Technical Advisor to share learnings and maintain a consistent approach across Wales. The suppliers and regional leads also had regular catch ups to share assumptions and challenges.

Please refer to the Technical Report (Chapter 2) for more detailed information on the methodology, analysis and engagement of stakeholders throughout the plan's development.

40+ Organisations engaged

90+ Hours of engagement

Sector	Examples of stakeholders engaged
Buildings	Housing developers
Transport	Transport providers
Renewable energy generation	Energy project developers Community energy groups, landowners
Industry and private sector	Local businesses, larger industrial players
Community engagement	Charities, social enterprise,
Networks	Distribution Network Operators, gas distribution networks
Public sector	Public services board, public service providers, Welsh Government, educational institutions

Figure 2.0.3: Summary of stakeholders engaged

2. The current energy system

Flintshire’s energy baseline

2. The current energy system

Overview

This section provides a detailed overview of the local energy system baseline, and describes the methodology and assumptions used to understand current energy infrastructure, what types of energy are used, what technologies are used to convert it from one form to another (e.g. heat) and how much is consumed.

Results presented reflect the energy baseline in Flintshire in 2023, apart from the transport (2019) and industry data (2019). Transport and industry datasets are the least likely to have changed in terms of electrification over the years 2019 to 2023, and transport is the most likely dataset to have changed due to COVID-19 with 2019 being the most representative year.

Some of the data collected that has locational characteristics is reported by "modelling zone". Figure 2.0.4 shows the geographic boundary of Flintshire (black line) which is also the boundary used for Flintshire's LAEP. The primary substation service areas that supply energy within the geographic boundary are shown with coloured blocks. Where primary substation service areas intersected one or more Local Authority boundaries, they were divided into smaller modelling zones. Most of the analysis, results, and maps in this report are presented in terms of these smaller modelling zones, which may also be called "substation zones" or simply "zones."

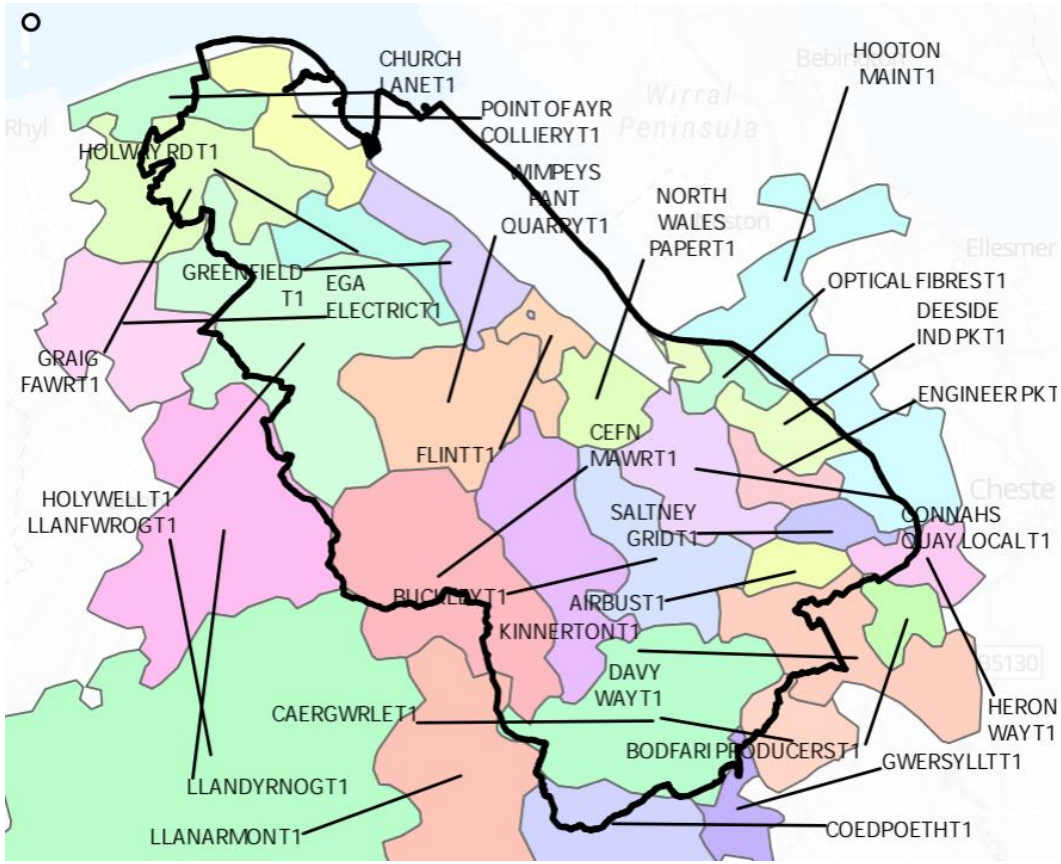


Figure 2.0.4: Geographic boundary of Flintshire used to define the boundary for this LAEP and the associated modelling zones within the LAEP boundary

2. The current energy system

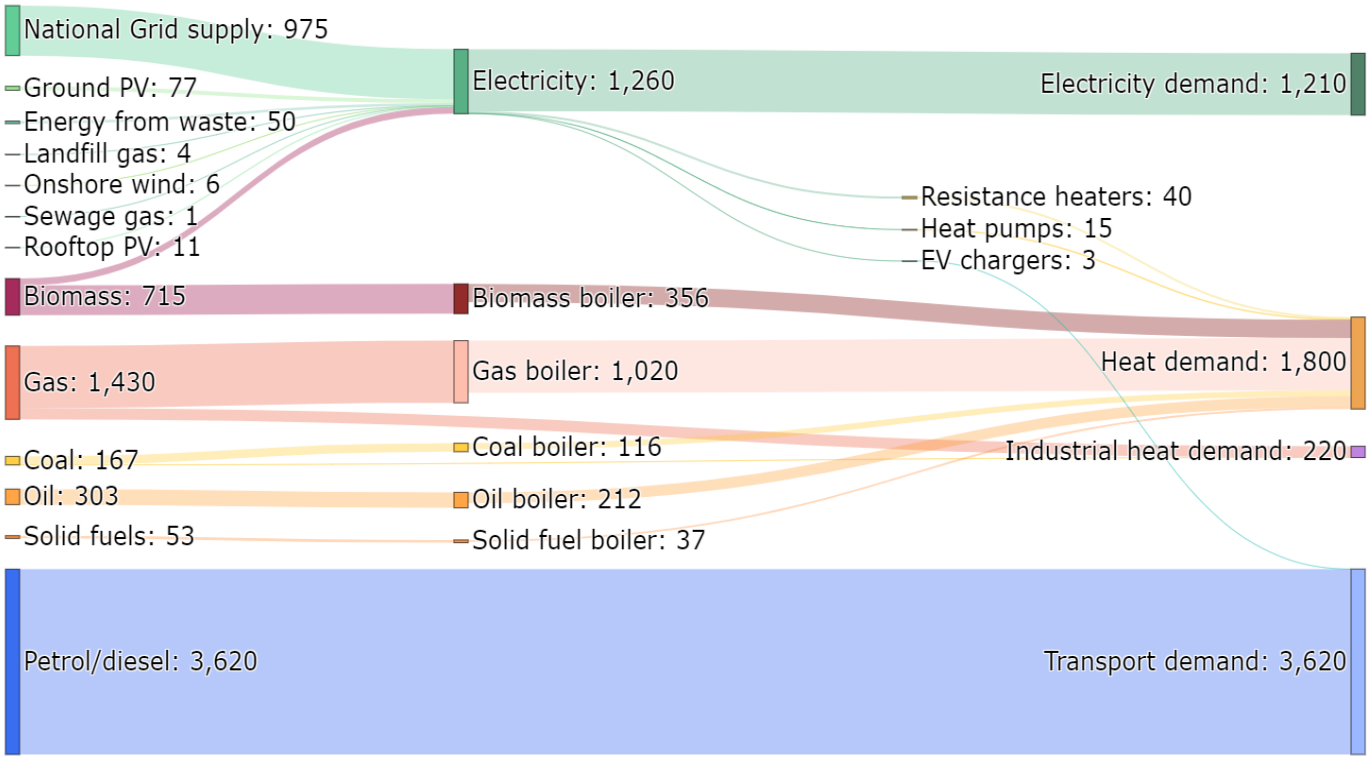
Overview

Sankey diagrams are a way of visualising energy transfer from energy sources to energy demands via energy vectors or conversion technologies.

They are read from left to right and show a snapshot of a scenario in time e.g., 2050

Energy transfers are drawn to scale and so are helpful to identify the size of each transfer and compare different scenarios.

The average Welsh home uses 3,300kWh/year of electricity, which is 0.003GWh for comparison with the scale on the Sankey. In terms of gas, a typical home uses 12,000kWh/year, which is 0.012GWh for comparison with scale on the Sankey[M40].



1. Where the energy comes from
This side represents the different **energy sources**, including generation technologies and imports from the national grid

2. How the energy is being converted

3. Where the energy is being used
This side represents the **final demands** for each energy vector: heat demand, electricity, demand, transport demand.

Figure 2.0.5: How to read a Sankey diagram (units are GWh/year)

2. Current energy system
Flintshire's energy baseline

Energy demand

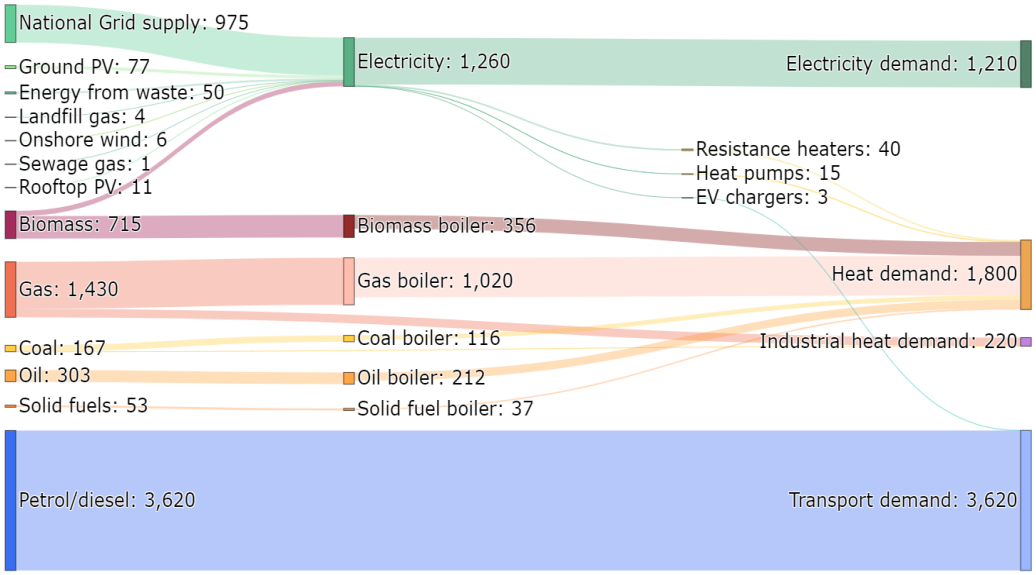


Figure 2.0.6: Sankey diagram showing energy input, conversion and output in Flintshire (GWh/year)

Industry

Around **61%** of total energy consumption in Flintshire is from the industrial and commercial sectors

The industry landscape is varied and expansive but key industries include paper manufacturing, food and drink, and vehicle manufacturing. Many of the largest consumers sit outside of the scope of this plan.

Electricity

18% of total energy demand is electricity

23% generated from renewable sources

The largest renewable source of electricity is ground-mounted **solar PV**, with Shotwick solar park the largest in the country at **72MW**

At the local level **no** electricity is generated through **fossil fuel** means

Transport

53% of total energy demand is from transport

The main source of transport emissions are HGVs, although car travel has the highest mileage

83% of households own a car

M65

67% of fuel consumed is diesel

0.23% of vehicles are electric or plug in hybrid

Heat

26% of total energy demand is from commercial and domestic heating

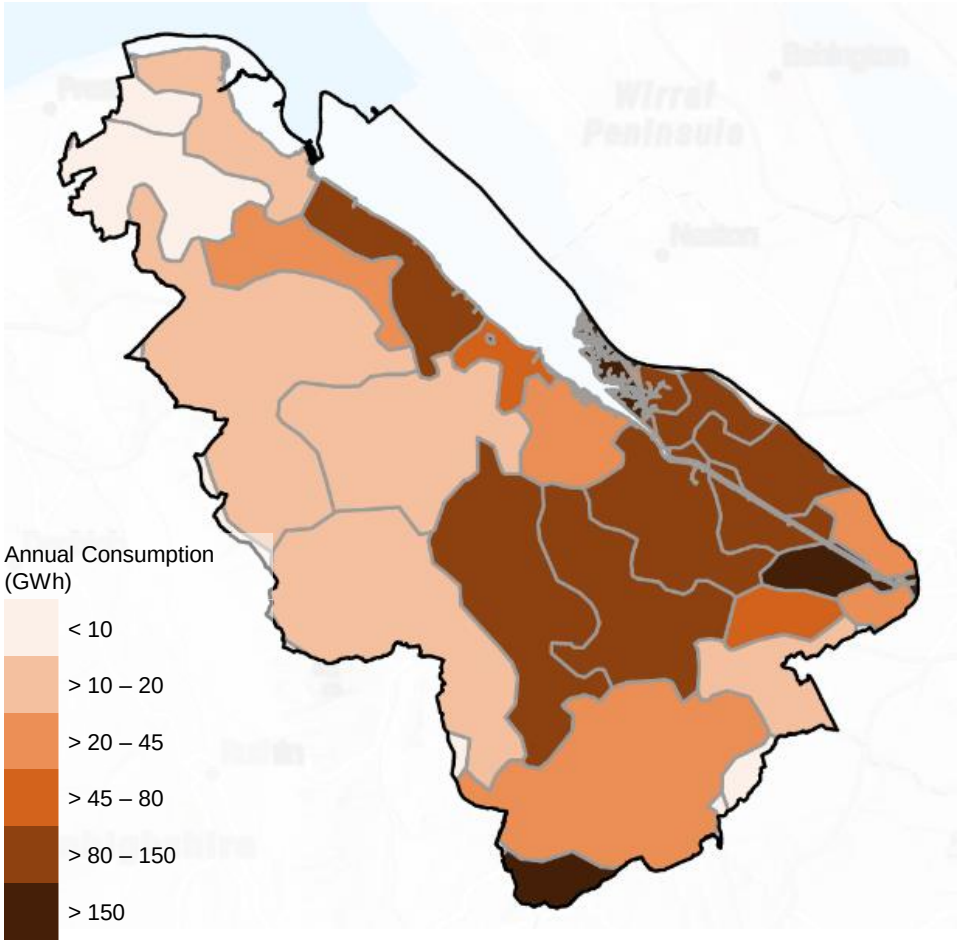
A significant proportion of biomass is used at the Shotton paper mill

The majority of heat demand is met through gas boilers, **82%** of properties have a gas grid connection, equivalent to the national average

42% of properties achieve an A-C EPC rating

2. Current energy system
Flintshire's energy baseline

Electricity demand in buildings (MWh per year)



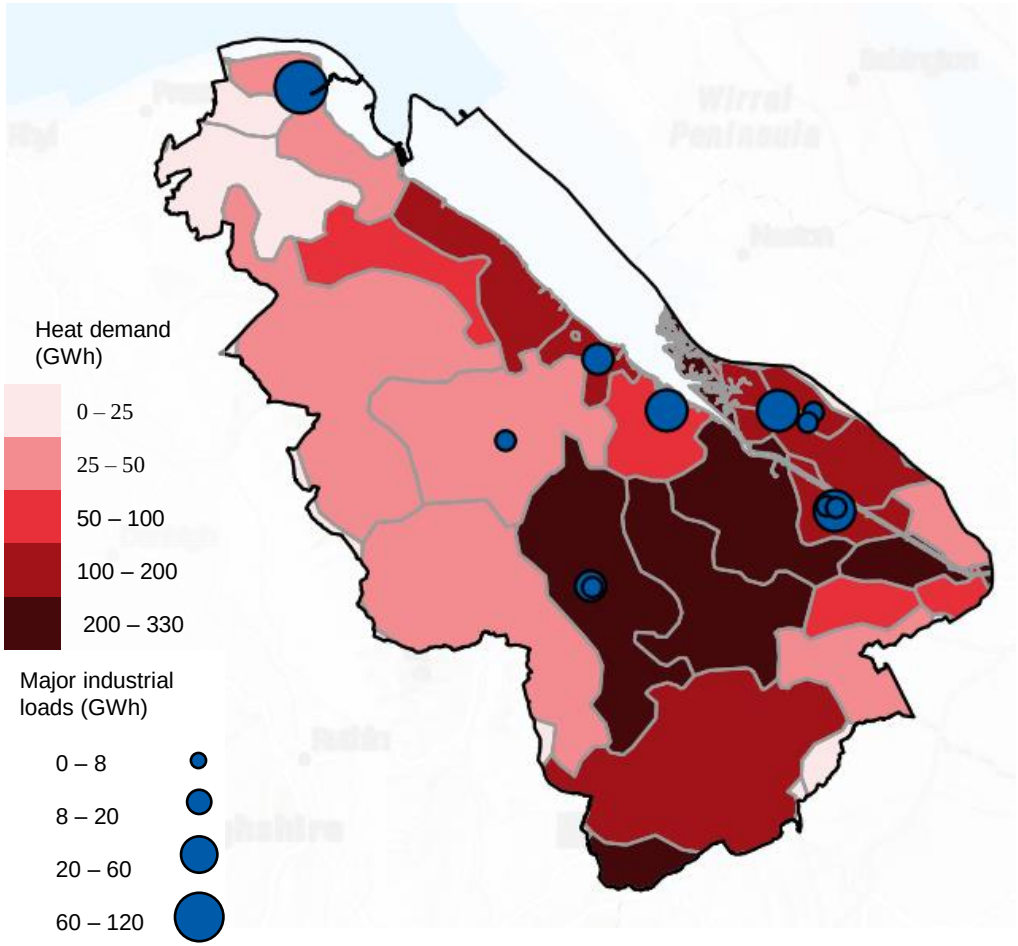
Electricity trends

Electricity consumption across Flintshire varies considerably from sub-station zone to sub-station zone, with some zones having over 100GWh/year difference in electricity consumption. The areas of higher consumption, understandably, correlate with areas of increased commercial, domestic and industrial density.

Figure 2.0.7: Electricity consumption (MWh/year) (domestic and non-domestic properties) by substation zone across Flintshire (2023). Data is based on meter level electricity consumption data

2. Current energy system
Flintshire's energy baseline

Heat demand in buildings and industry (MWh per year)



Building numbers

71,200 domestic buildings

4,000 non-domestic buildings

EPC ratings

On average, properties across Flintshire exhibit below average EPC ratings (35% of properties achieving A-C EPC rating compared with Wales-wide of 40%).

Insulation

26% with <100mm loft insulation, 12% with unfilled cavity walls.

Heating fuels

82% of homes are connected to the gas grid. Most homes that are not connected to the gas network use oil for heating (11% of all homes).

Gas consumption

Areas of high and low gas consumption vary significantly across the local authority. The areas of greatest consumption align with more heavily populated areas in the centre of the county, where off-gas grids are less common and gas boilers are the predominant heating type.

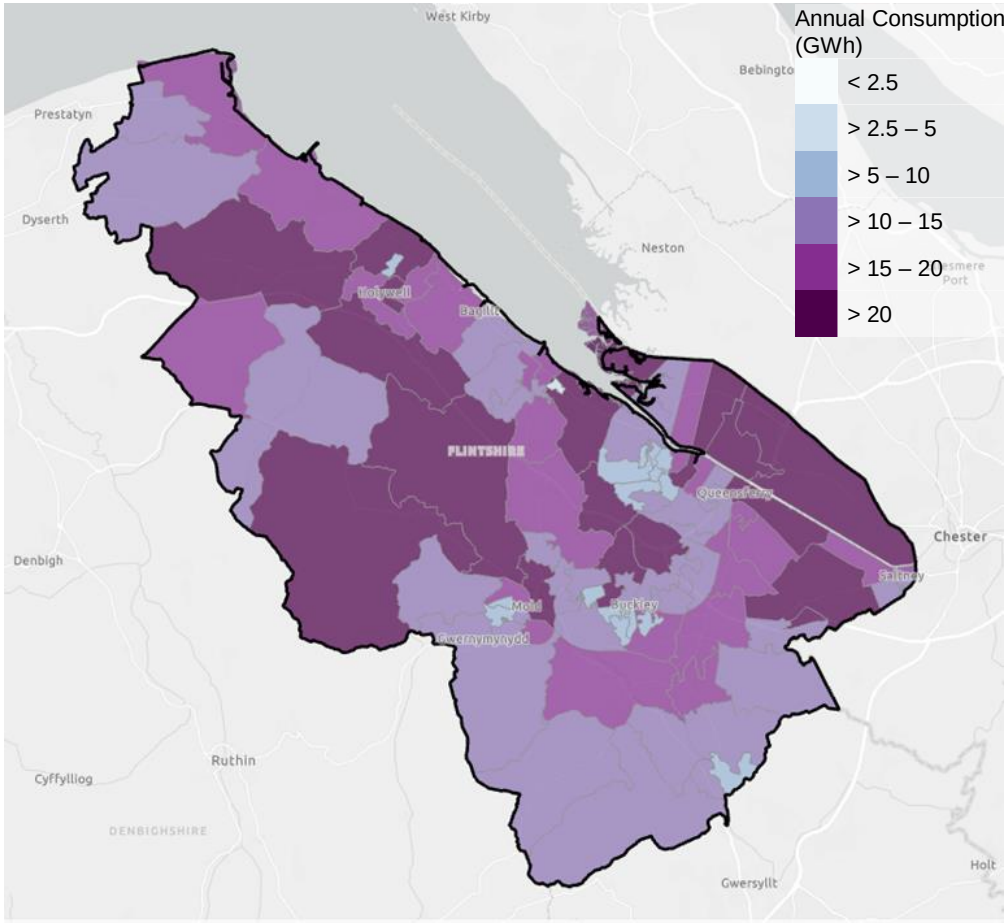
Industry

There are numerous major point demands for gas and other fossil fuels, these are situated in the main industrial areas along the coastal parts of the county in Deeside, Connah's Quay, Flint, Greenfield and Tolacre.

Figure 2.0.8: Major industrial loads (2019) and heat demand (2023) by substation zone across Flintshire. The data is based on meter level gas consumption (MWh/year)

2. Current energy system
Flintshire's energy baseline

Transport energy demand



Transport trends

Transport related energy consumption varies across the local authority. Areas of higher energy consumption tend to align with the main thoroughfares of the A55 and A494 which intersect between Buckley and Deeside, as well as the more rural parts of the county, where car usage is more prevalent. Areas of lowest energy consumption tend to be in and around towns (Mold, Buckley, Deeside, Holywell, and Connah's Quay) where public transport and active travel can be a more viable option.

Number of EV chargers

Currently 53 listed on the National Chargepoint Registry (2023 data). [M43]

Car ownership

83% of households in the area own cars, with an average of 1.3 cars per household, which is above the national average. [M65]

Figure 2.0.9: Transport energy consumption (combined total across cars, light goods vehicles (LGV) and heavy goods vehicles (HGV) by LSOA, in 2019 as a baseline year

2. Current energy system
Flintshire's energy baseline

Energy generation in 2023

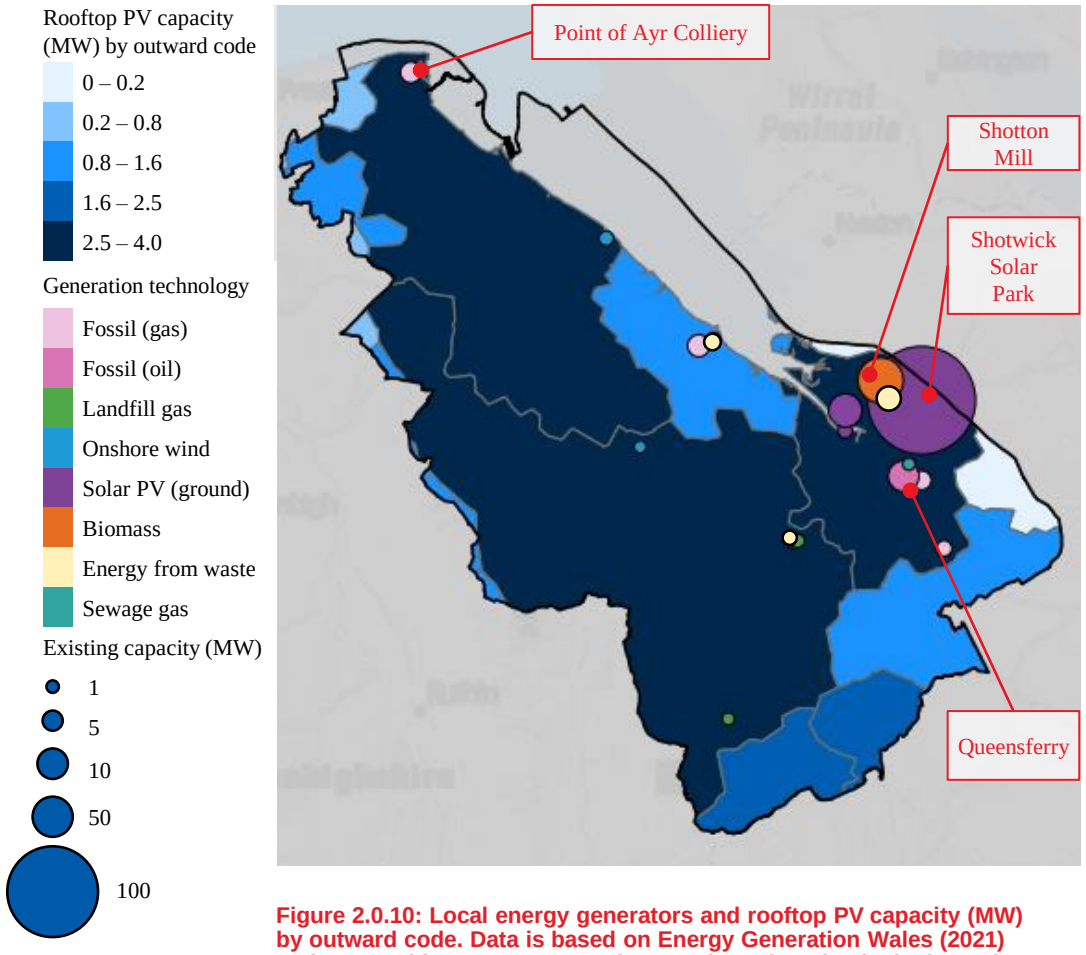


Figure 2.0.10: Local energy generators and rooftop PV capacity (MW) by outward code. Data is based on Energy Generation Wales (2021) and Renewable Energy Generation Database (2023)m (units in MW)

Electricity generation

There is **136MW** of renewable electricity generation capacity, across seven different generating technologies

Ground-mounted solar photovoltaics are the largest source of local electricity generation with a capacity of **80MW**, this includes Shotwick park the **country's largest solar farm**

7% of electricity generation comes from rooftop solar PV across both domestic and non-domestic properties

20% of the electricity generation capacity is from fossil fuel sources (gas and oil), although these may not supply electricity in any given year

Heat generation

The majority of heat is generated through natural gas boilers (62% of heat across all sectors)

Flintshire's large industrial presence provides ample waste heat that could be used for low heat processes or heating.

19% of heat supply comes from low carbon sources (electric or biomass)

2. Current energy system
Flintshire's energy baseline

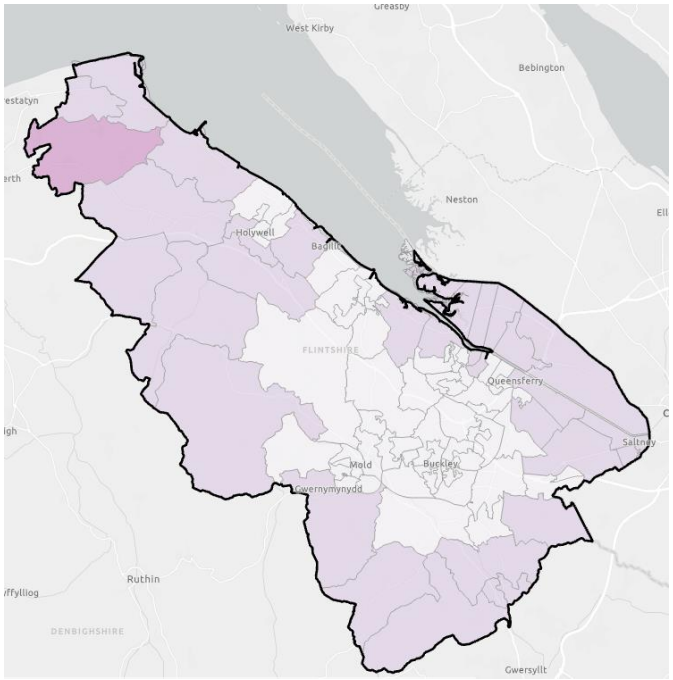
Networks and infrastructure

Figures 2.10 and 2.11 display primary substation's supply and demand headroom across Flintshire, providing an insight to the network capacity in 2019. In this context, headroom is an indicative measure of primary substation's capacity. This metric offers an overview of the electricity network's capacity, highlighting areas where constraints may be present.

Generation headroom is relatively low across the local authority, with very little spare capacity in the largest towns and surrounding areas. There is greater demand headroom in heavily industrialised areas where the grid may be reinforced, and in areas of low population density where demand is low.

Although headroom offers valuable insights into the available 11kV network capacity, it is important to recognise that constraints can occur both upstream and downstream of primary substations. Fig 2.10 and 2.11 may not show the extent of networks constraints in Flintshire.

Generation headroom

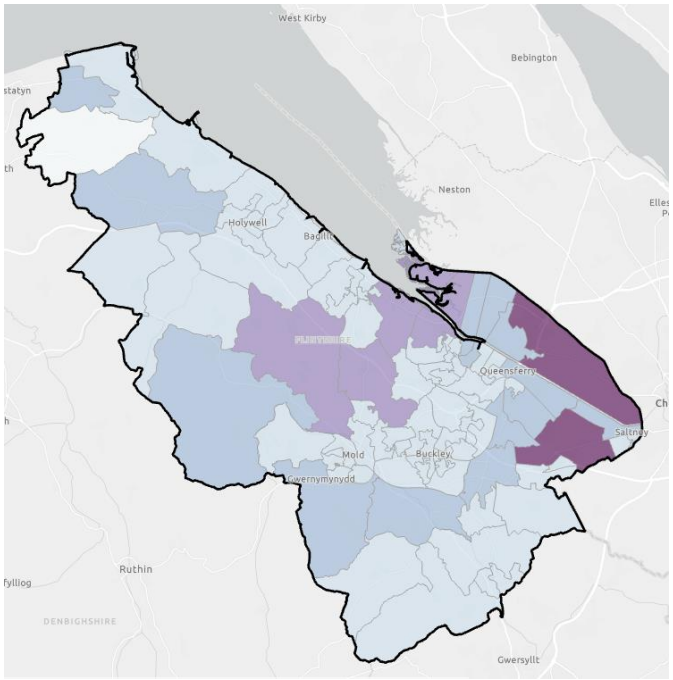


Generation headroom (MW)

0	> 4 – 6
> 0 – 2	> 6 – 8
> 2 – 4	> 8

Figure 2.0.11: Electricity generation headroom

Demand headroom



Demand headroom (MW)

0	> 4 – 6
> 0 – 2	> 6 – 8
> 2 – 4	> 8

Figure 2.0.12: Electricity demand headroom

2. Current energy system
Flintshire's energy baseline

Off gas grid properties

The highest proportion of properties off the gas grid are found in the more rural areas of the local authority, towards the west. In more densely populated areas of the local authority (i.e. where many of the larger towns are located) there is a much higher proportion of properties connected to the gas grid (80%+).

Where properties are not connected to the gas grid, heating oil is used as the primary means of heating and hot water generation. This is the case across the entirety of the local authority.

Off gas grid properties

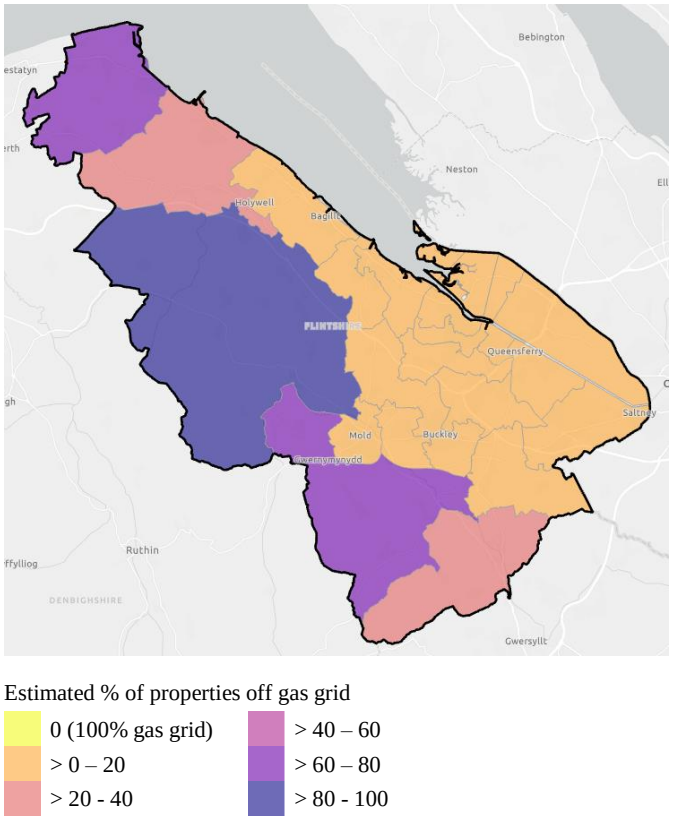


Figure 2.0.13: Percentage of properties that are not connected to the gas distribution network (2023)

Alternative heating

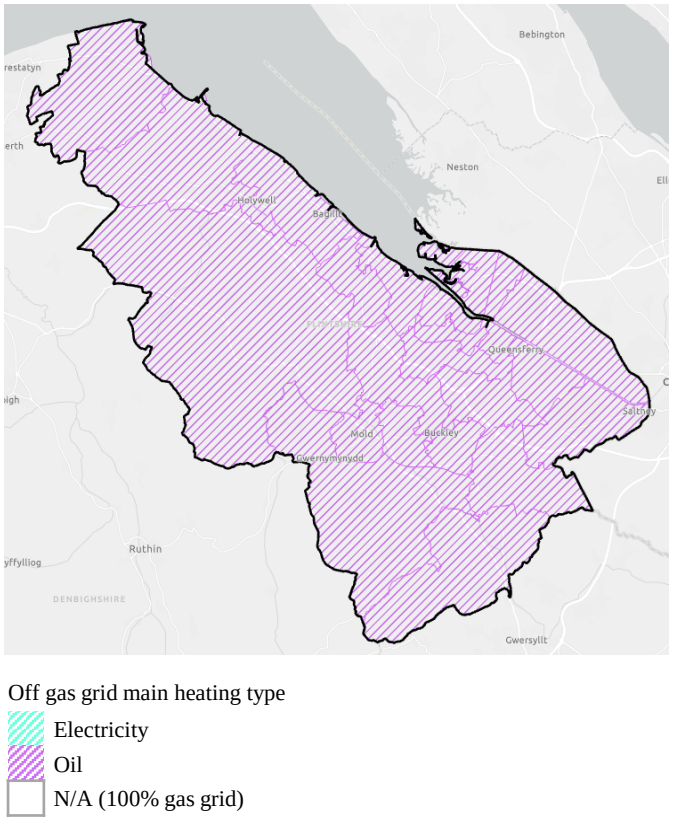


Figure 2.0.14: Main heating type for properties that are not connected to the gas distribution network, using 2019 as a baseline year

2. Current energy system
Flintshire's energy baseline

Local environmental, social and economic factors that influence energy (2019 figures)

Area

Area: Flintshire has a total land area of 438km^2.

Enterprise: Flintshire is home to the Deeside enterprise zone, a 2,000 hectare area with the highest concentration of manufacturing jobs in the UK.

Population density: Around 80% of Flintshire's population inhabits 20% of the county's land.

Designated land: The County hosts over 23 Sites of Special Scientific Interest (SSSIs) and over 300 locally designated wildlife sites.

Demographics

Population: Flintshire has a population of 155,000 and a density of 350 pers/km^2, the eleventh most densely populated local authority (out of twenty-two) in Wales.

Population change: The population has increased by 1.6% between 2011 and 2021 in Flintshire, compared to 1.4% nationally over the same period.

Age: Flintshire has a median age of 44, the proportion of the population over 19 years of age has increased from 76.2% to 78.2% between 2011 and 2021.

Socio-economic

Fuel poverty: 9% of households are regarded as being in fuel poverty, this compares to 12% for the Welsh national average.

Commuting: In general Flintshire sees more people commute out (38,100) of the county for work than commuting in (14,400). 73% of workers (133,000) in Flintshire also live in the county.

Employment: The largest sectors by level of employment in Flintshire are: 'Production', 'Wholesale, retail, transport, hotels and food' and 'Public administration, defence, education and health'.

Industry & commerce: Industries that contribute substantially to the value of goods and services produced within Flintshire and Wrexham include transport manufacturing, health and social work, wholesale and retail trade, food and drink manufacturing.

GHG Emissions

Emissions: Flintshire's baseline year emissions for the region accounted for 7% of the national total and has an average emissions per capita of 10.6 tCO_2e/pers. This is greater than the national average of 7 tCO_2e/pers.

Sectoral emissions: The overwhelming majority of emissions arise from industry (56%), with the transport (23%) and domestic (15%) sectors contributing the next greatest proportion of emissions.

Emissions change: Emissions have decreased on average by just under 2% each year since 2005, this has been driven by decreases in almost all sectors but transport.

2. Current energy system
Flintshire's energy baseline

GHG Emissions

Figures 2.14 and 2.15 display the proportion of GHG emissions by different sectors for both Flintshire as a region (using the boundary considered within this LAEP) and for Flintshire County Council.

The Council's emissions have been taken from their 2018/19 baseline report and equal 46ktCO_2e for that year. Despite the Council's emissions only accounting for a small percentage (~4%) of the region's emissions, they still have a strong influence over emissions outside of their direct control and supply chain. The Council, amongst other local, regional, and national players, has the ability to influence emissions within the domestic, commercial, industrial and transport sectors of Flintshire as a region.

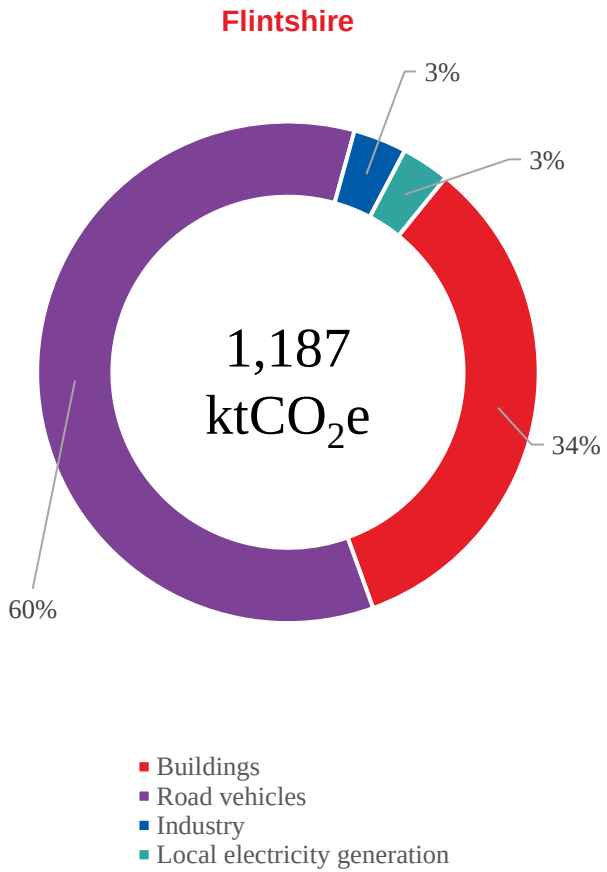


Figure 2.0.15: Doughnut of Flintshire's GHG emissions by sector for baseline years (2019 & 2023)

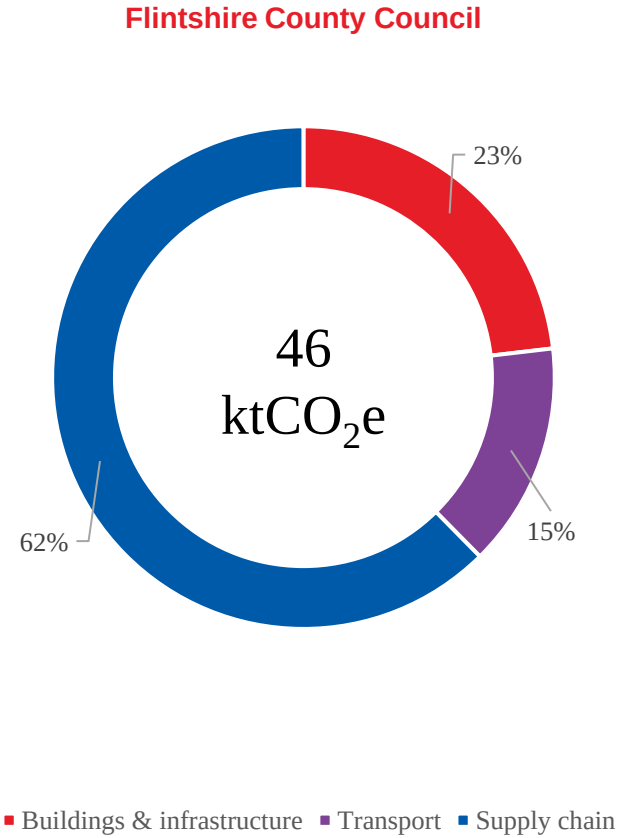


Figure 2.0.16: Doughnut of Flintshire County Council's GHG emissions for baseline financial year 2018/19

2. The current energy system

Progress to date

Since supporting Welsh Government's climate declarations in 2019 and agreeing to develop a climate change strategy, Flintshire has worked to reduce its organisational carbon emissions, and to provide the means for the wider community to do the same, as we transition to a net zero energy system.

Flintshire County Council has made a lot of progress against the four themes of the climate change strategy with a handful of success stories to date listed below:

- Building and renovating fit for future schools through the 21st Century Schools Programme, with new school buildings funded through this programme required to be Net Zero Carbon.
- Replacement of the Council's streetlighting with LED lamps which use significantly less electricity.
- Commitment made by the council for a net zero 2030 ambition, with a strategy and action plan created to deliver against the target.
- Developed and delivered active travel routes across the County.
- Through collaboration with regional partners and Welsh Government, the Council has managed the construction of an energy from waste facility, Parc Adfer, which will create electricity for 30,000 homes from waste that cannot be recycled. It will also help to prevent waste from going to landfill
- The construction of an additional two solar farms, with a combined generation capacity of 3.6MW, amounting in 4.8MW of total generation across four farms.

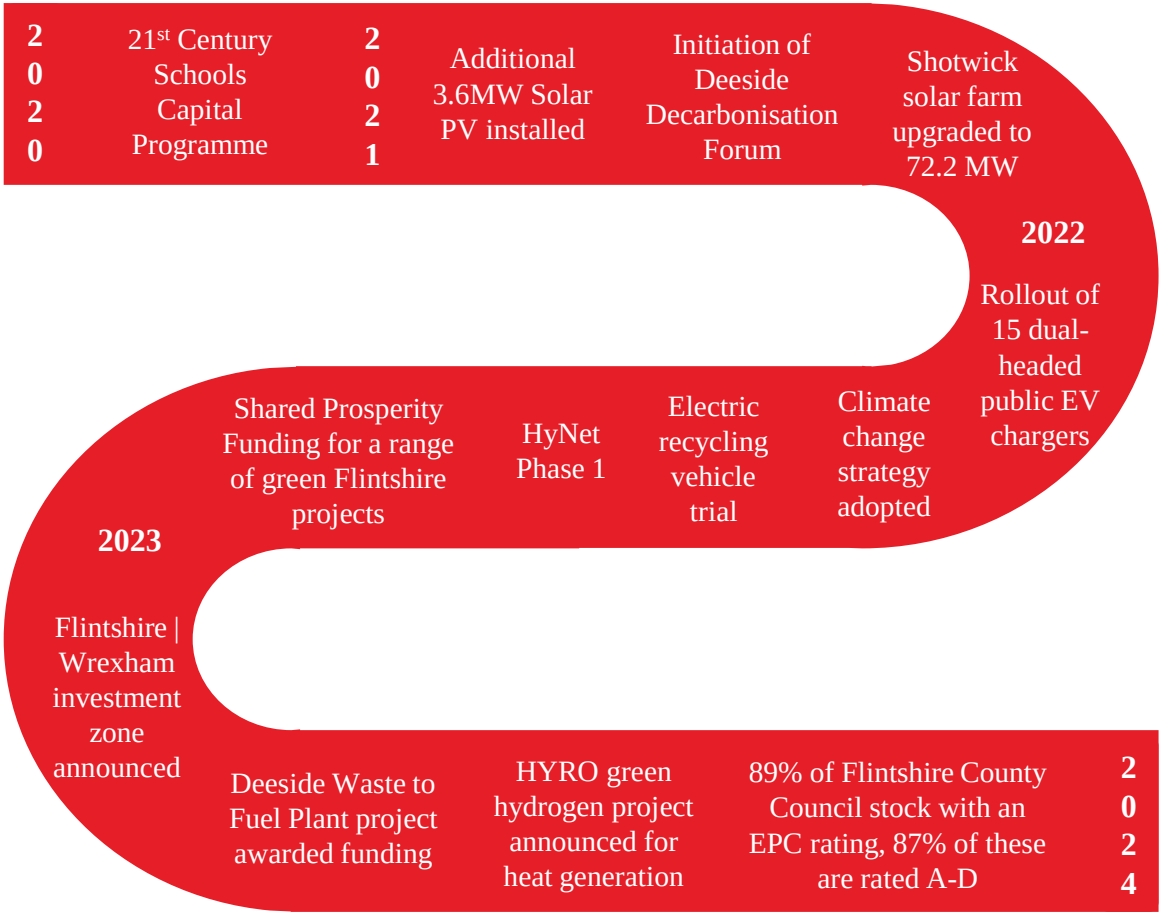


Figure 2.0.17: Summary of activities to date that have contributed to decarbonising the local energy system

2. Current energy system
Flintshire's energy baseline

Plans for the future

Renewable generation

Within the energy baseline, 23% of electricity generated within Flintshire is from renewable sources.

Building on the rollout of solar PV that has already taken place, there are further planning applications for even larger sources of generation, with a 30MW solar PV farm (Bretton Hall – YnNi Newydd) in the pipeline that would be community owned and partially sited in Flintshire.

The Coal Authority released a report in 2024 highlighting the opportunities for mine water heat within Flintshire. This has shown several potential sites that could provide low or zero carbon heat generation. The next step to fully understand the generation potential of these and potential off takers is now required. The timing of this report means it hasn't been included within the future energy system analysis.

Reducing energy demand

There are plans to reduce energy demand across the local authority through retrofit measures available through 21st Century schools and ECO4 programmes.

There are larger scale projects too, such as the combined heat and power (CHP) facility at Shotton paper mill. The CHP facility can reach efficiency ratings in excess of 90%, in comparison of gas power stations, which in the UK range between 49% and 52%. In the future there are possibilities to use Hydrogen gas as a fuel source.

Reducing carbon

Beyond energy generation and demand reduction there are plans to remove or use lower carbon technologies within the energy system. One such example is the planned Carbon Capture and Storage at Padeswood cement site which intends to capture 800,000 tonnes of CO_2 a year, the equivalent of taking 320,000 cars off the road. The scheme will be an integral part of the HyNet industrial cluster, which could save up to 10 million tonnes of CO_2 per year. HyNet is a vast infrastructure project to produce, transport and store low carbon hydrogen across the North West of England and North Wales. Flintshire is likely to have a role to play providing hydrogen off takers in Deeside and helping to support the network of H_2 and CO_2 pipelines.

Another example is the HYRO project which plans to develop hydrogen electrolysers to provide green hydrogen for boilers and plant within the Kimberly-Clark paper manufacturing complex.

Chapter 3: The future energy system

3. The future energy system
Overview

Vision and objectives

Vision

Flintshire County Council envisions a sustainable future with a net-zero energy system that is affordable and promotes community health, well-being, and economic growth. We commit to a clean energy transition that fosters a resilient, inclusive, and prosperous community, ensuring a harmonious balance between environmental stewardship and social progress.

Objectives of the plan

We have worked with stakeholders to define the following objectives for our plan:

1. Support a low-cost and affordable energy system through reducing energy demand and promoting energy efficiency.
2. Optimise the use of local renewable energy sources within Flintshire, encouraging local ownership and community participation.
3. Promote safe, healthy, and sustainable places to live, work and visit – helping to generate connected and resilient communities.
4. Create a resilient energy system capable of meeting future energy demands that reduces carbon emissions and protects and enhances Flintshire's natural assets.
5. Promote a low carbon economy, providing learning and skills for all to create a prosperous, thriving, resilient Flintshire.

Understanding the future energy system

We know that we need to transition our energy system in Flintshire to net zero by 2050.

We also know that there are multiple plausible and attractive future energy systems for Flintshire, depending on a range of factors. This includes how the cost of technologies might change over time, as well as wider policy decisions that will be made by Welsh and UK Governments. These factors will influence the uptake of hydrogen, for example.

Scenario analysis

To inform our plan, we used scenario analysis to explore what a net zero future energy system could look like under different future outcomes, including considering the potential for reduction measures and potential energy sources. We modelled four future energy scenarios and modelled the most cost- and carbon-effective way to meet demand in each one. Through doing this, we were able to identify technologies that played a significant role in all the future scenarios modelled. These technologies represent low- and no-regrets options (meaning that they are likely to be most cost-effective and provide relatively large benefits) which are very likely to be important parts of the future energy system, regardless of the uncertainty of the future.

Deployment modelling

We looked at how aspects of each energy proposition might be deployed between now and 2050, creating deployment pathways. Deployment pathways indicate:

- the scale of change required over time,
- the sequencing of activity that needs to happen to achieve a net zero energy system.

Deployment pathways for different components were informed by broader plan objectives, local and regional strategic priorities, policies and national targets and using this context, helped us to define a suitable level of ambition, and bring all this evidence together into an action plan.

3. The future energy system
Overview

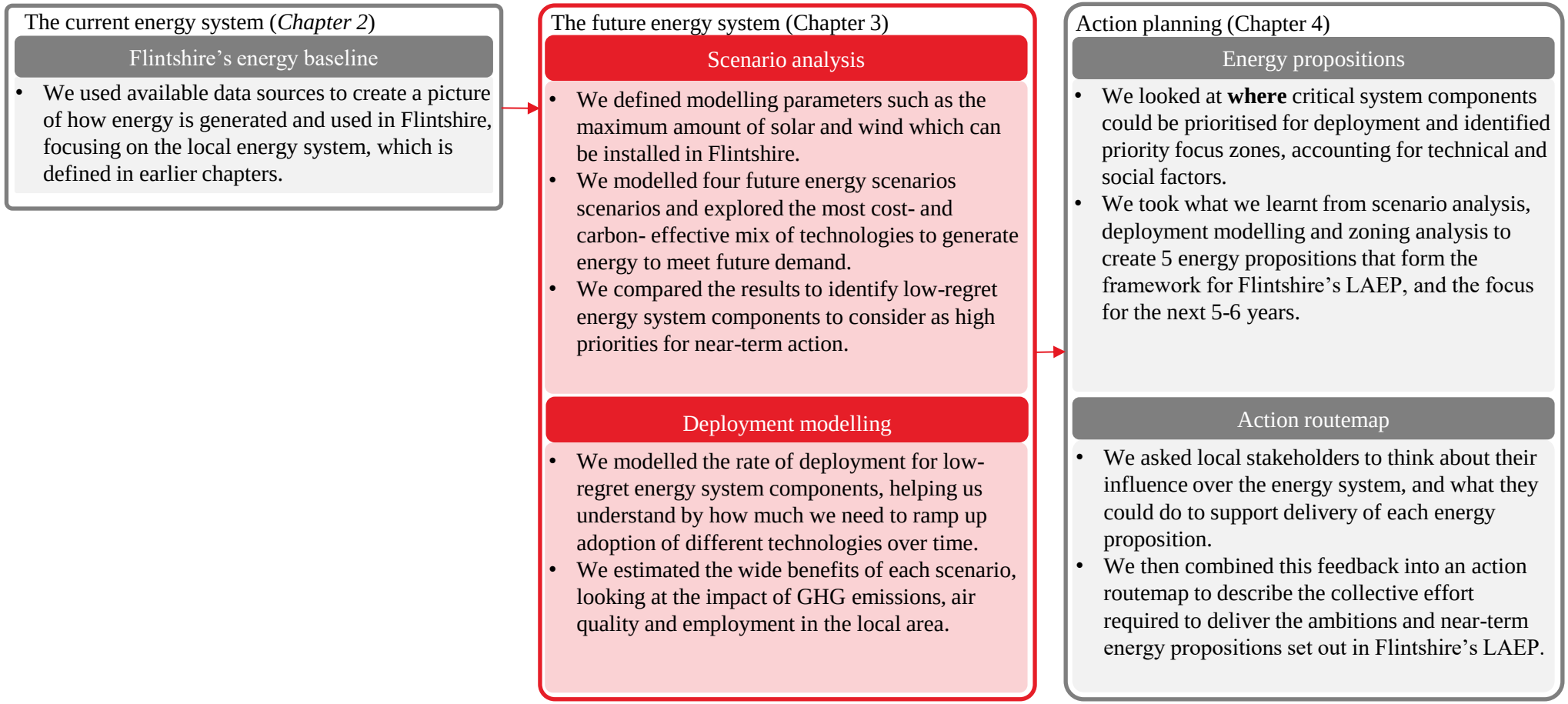


Figure 3.0.1: Summary of steps taken to produce the LAEP

3. The future energy system
Future energy scenarios and pathways

Summary of future energy scenarios

Do Nothing	• A scenario for comparison which considers committed activities and assumes that current and consulted upon policy goes forward and remains consistent. • This scenario provides a cost counterfactual. • There is no decarbonisation target for this scenario, and we do no use it in optimisation modelling.
National Net Zero	• Uses the lowest cost and carbon combination of technologies to meet Wales' 2050 net zero target. • Assumes a moderate level of energy demand reduction across the system. • Model is allowed to import and export to the electricity grid, this assumes that the electricity grid is decarbonised and reinforced to allow for the demands, likely to be a combination of offshore wind, hydrogen CCGT, grid level battery storage, nuclear (these are considered national assets and outside the scope of the LAEP)
Low Demand	• Considers the lowest future energy demand across different sectors. • Explores the impact of energy-reducing initiatives (home fabric improvements) and uptake of active travel and public transport use. • Model finds the lowest cost and carbon combination of technologies to meet predicted future energy demand. • Import and export of electricity as National Net Zero
High Demand	• Considers the highest future energy demand across sectors. • Model finds the lowest cost and carbon combination of technologies to meet predicted future energy demand. • Import and export of electricity as National Net Zero
High Hydrogen	• Considers the highest plausible future energy demand across different sectors. • Uses a cost- and carbon-optimal range of technologies to meet predicted future energy demand. • Considers hydrogen for heavy goods vehicles and industry. • The optimisation model was not forced to use hydrogen for undertaking any heating. Hydrogen was separately explored through hydrogen network modelling.

Figure 3.0.2: Summary of future energy scenarios

3. The future energy system
Scenario analysis

National Net Zero scenario

Figure 3.3 shows a potential future energy system for Flintshire. This system results from modelling to create the most cost and carbon optimal system. We have run a number of scenarios to support us in making decisions. The optimisation modelling informs the deployment modelling and the actions that go into the plans, but is not the "final plan" for the local authority area.

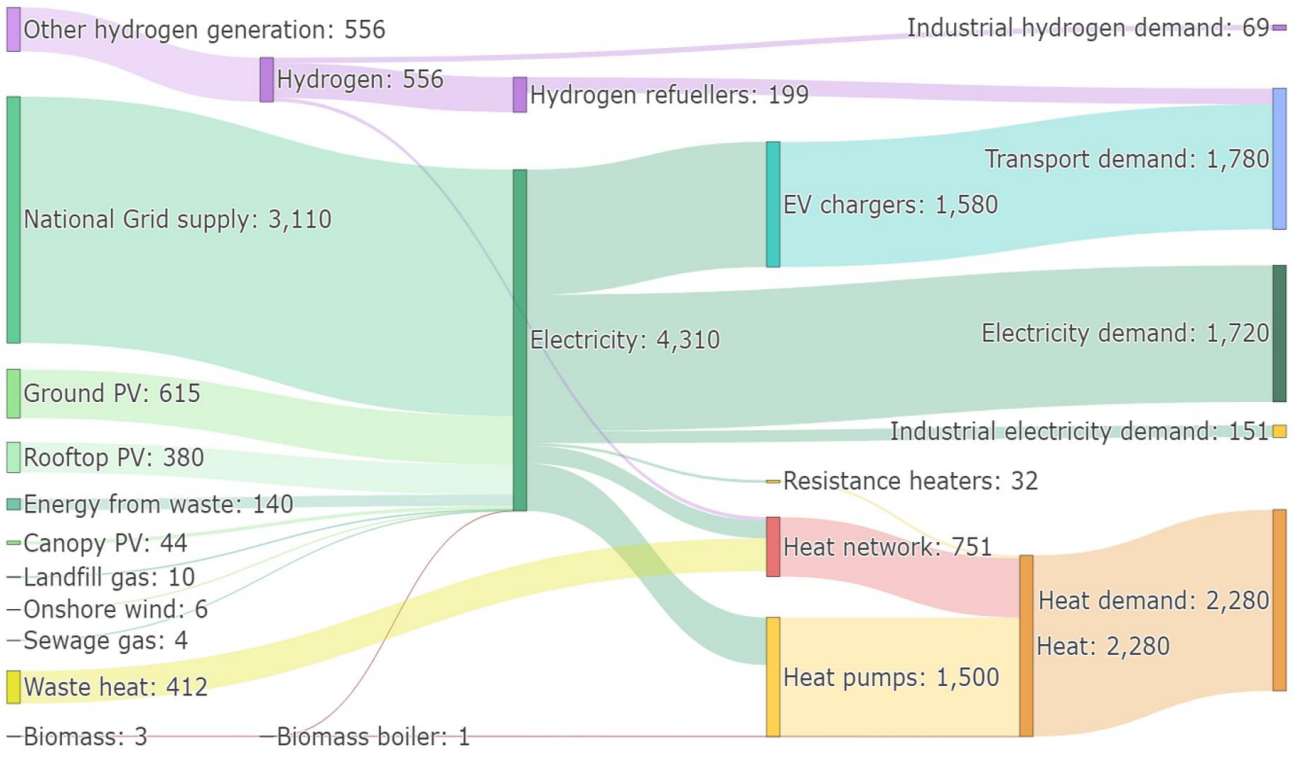
Hydrogen supply required for heavy transport and heavy transport

Electricity supply could be almost four times as great

Local renewables could provide 28% of electricity supply, compared to 23% in the baseline

Waste heat sources could supply a lot of heat in a future energy system via heat networks

Biomass supply reduces substantially as industrial processes switch to hydrogen or electricity for heat processes



Majority of transport demand could be met through electric vehicles (89%) and some hydrogen refuellers (11%) for heavier vehicles

Electricity demand could increase by over 40% by 2050

Heat demand could grow by almost 30% and be met by a predominant mix of heat pumps (66%) and waste heat (33%). This will all be met by 70% of the energy supply required for heat in 2019

Figure 3.0.3: A Sankey diagram for a potential future 2050 energy system (energy flows in GWh/year)

3. The future energy system
Scenario analysis

Energy system components

Figure 3.4 provides an overview of the variations in energy components observed in the optimisation modelling results across future energy scenarios, benchmarked against the baseline results.

Optimisation modelling shows ground-mounted and rooftop solar consistently increasing across all scenarios; contributing to meeting both Flintshire's energy demand but also exporting in times of surplus to the National Grid, and serving broader energy needs. In contrast, biomass generation sees a decline across all scenarios, likely due to a reduced dependency resulting from the enhanced output of solar and wind farms. Hydrogen is incorporated into the energy mix in all scenarios, sustaining Flintshire's industrial and transport demands.

Transport demand decarbonises, primarily due to the supply of electricity through EV charge points. Hydrogen also contributes to this demand, albeit to a lesser extent.

Heat demand is predominantly catered for by heat pumps, a trend that is consistent across all scenarios. While heat networks and other technologies contribute to this demand, their usage is comparatively less.

Energy system components	Baseline (GWh)	National Net Zero (GWh)	High Demand (GWh)	Low Demand (GWh)	High Hydrogen (GWh)
Ground-mounted PV	77	615 ↑			
Rooftop PV	11	380 ↑			
Onshore wind	6	6 →			
Sewage gas	1	4 ↑			
Biomass	715	3 ↓		2 ↓	3 ↓
Hydrogen import	0	556 ↑	553 ↑	555 ↑	1,850 ↑
Import from Grid	975	3,110 ↑	3,130 ↑	1,940 ↑	2,350 ↑
EV chargers	3	1,580 ↑	1,600 ↑	1,580 ↑	972 ↑
Hydrogen Refuellers	0	199 ↑	198 ↑	199 ↑	712 ↑
Heat pumps	15	1,500 ↑		507 ↑	1,500 ↑
Heat networks	0	751 ↑		747 ↑	751 ↑
Resistance heaters	40	32 ↓		13 ↓	32 ↓
Biomass boilers	356	1 ↓			

Figure 3.0.4: Comparison across the scenarios

3. The future energy system
Scenario analysis

Energy system components

Energy system components	Baseline (GWh)	National Net Zero (GWh)	High Demand (GWh)	Low Demand (GWh)	High Hydrogen (GWh)
Petrol/diesel	3,620	0 ↓			
Oil	303	0 ↓			
Coal	167	0 ↓			
Natural gas	1,430	0 ↓			
Solid fuels	53	0 ↓			
Energy from waste	50	140 ↑			
Export to National Grid	0	0 →	0 →	2 ↑	0 →

Figure 3.0.4 (continued): Comparison across the scenarios

3. The future energy system
Deployment modelling

Impact on energy demand

Figure 3.0.5 shows how the energy demand could change for each optimised scenario between 2023 and 2050.

All scenarios show a potential for an increase in total energy demand between 2023 and 2030 and then a reduction by 2050 (against both 2023 and 2030). Energy demand increases initially as a result of growth in housing and commercial property, before efficiency measures, and electrification of heat and transport take over and result in a peak in demand in the mid-2030s. Ultimately energy demand is only slightly lower in three of four scenarios by 2050.

The greatest reduction in total energy demand is understandably seen in the Low Demand scenario, primarily driven by improving building energy efficiency to achieve heat demands that are associated with homes with EPC A ratings.

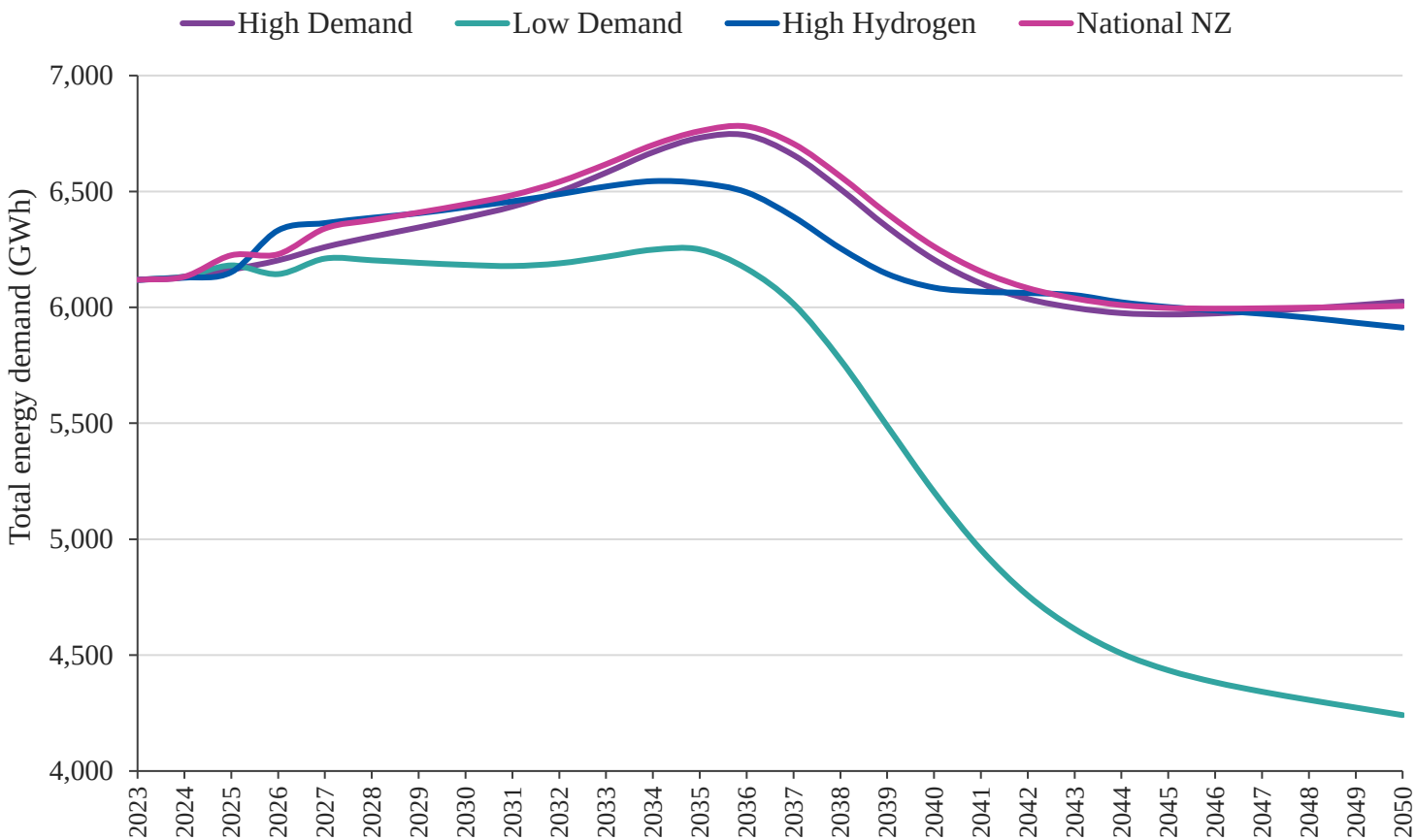


Figure 3.0.5: Change in total energy demand by scenario between 2023 and 2050 (GWh)

3. The future energy system
Deployment modelling

Impact on GHG emissions

Deployment modelling sets out the rate at which each energy component could be deployed in each optimisation scenario and the Do Nothing scenario. The Do Nothing scenario is based on current deployment rates and policy levers, whereas the other scenarios show trajectories that meet the optimisation models.

Figure 3.6 shows the gap in the carbon emissions between the Do Nothing scenario and the optimised scenarios. The optimised scenarios achieve a reduction in GHG emissions of at least 92% against 2023, while the Do Nothing achieves a 4% reduction.

Our deployment modelling provides additional evidence on the realism of delivering the changes suggested by the optimisation modelling. It helps us to determine the actions needed in the next five years to set us on the pathway to net zero in 2050. There are also bigger systemic changes that will be needed to achieve the scale of change set out in this plan.

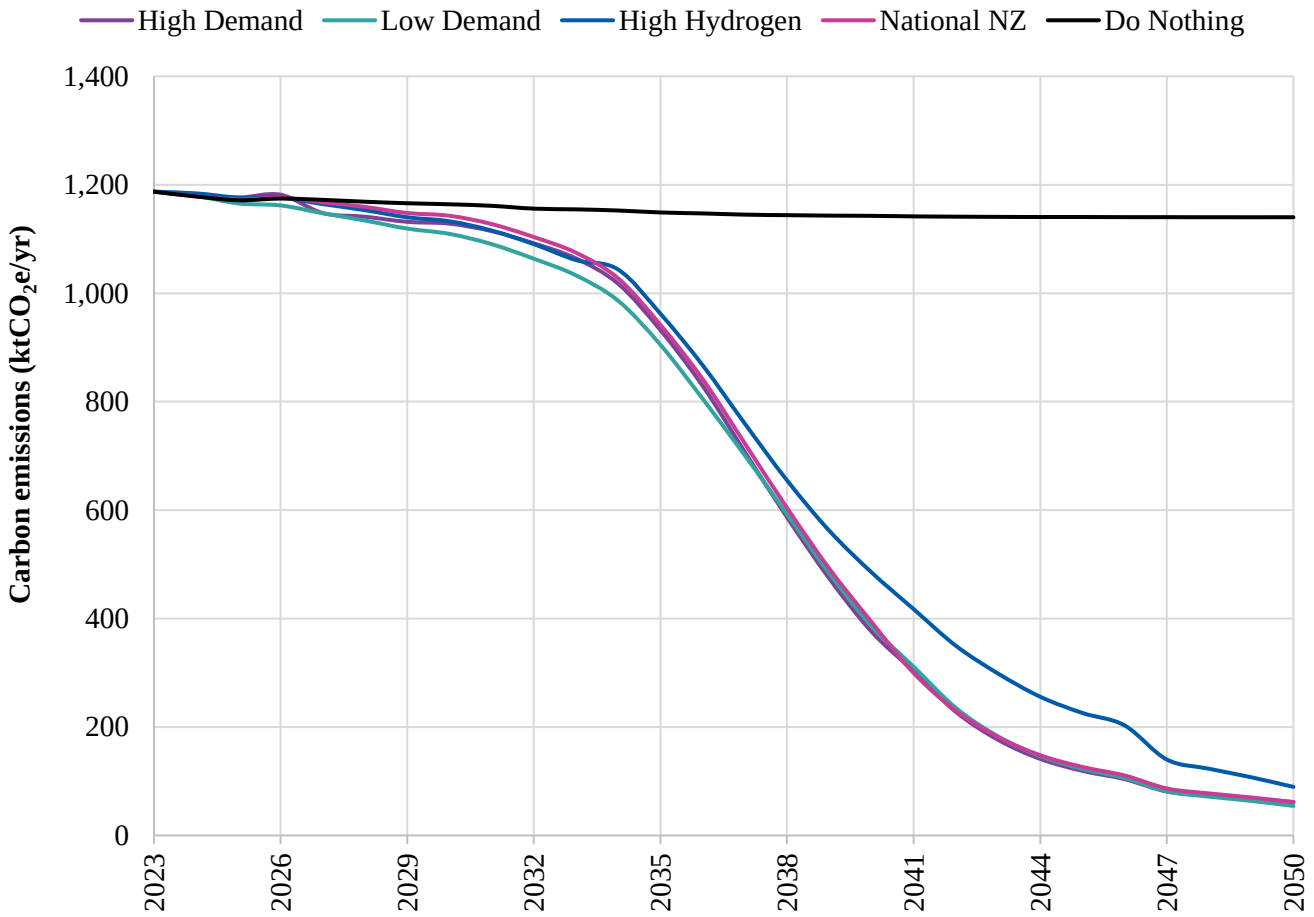


Figure 3.0.6: Carbon emissions (ktCO$_2$e/year) over time for each scenario

3. The future energy system
Deployment modelling

Impact on GHG emissions

The deployment modelling also shows how these pathways contribute to the Welsh Government emissions reduction targets. For Flintshire, Figure 3.7 shows that the 2023 baseline is a 30% reduction on the 1990 levels, all the pathways continue to underperform against the Welsh Government targets. All pathways also miss the net zero target in 2050, this is a result of residual emissions within the energy system. This is likely to always be expected to some extent as there will always like be hard to reduce emissions that arise from areas such as hydrogen production, or non-renewable electricity generation.

Scenario	2023	2030	2040	2050
High Demand	30%	34%	78%	96%
Low Demand	30%	35%	77%	97%
High Hydrogen	30%	34%	72%	95%
National Net Zero	30%	33%	77%	96%
Do Nothing	30%	32%	33%	33%
Welsh Government Targets	53%	63%	89%	100%

Table 3.0.1: GHG emissions from deployment against the Welsh Government emissions reduction targets

3. The future energy system
Deployment modelling

Socio-economic impacts

Reducing the amount of energy we use and using renewable energy sources for power generation can have wider environmental, social and economic benefits so it is important that they are fully understood to support decisions that impact the future of the energy system. For example, for every £1 invested in energy efficiency measures, the NHS can save £0.42 (amounting to annual savings of £1.4 billion in England alone)[M41].

Employment impacts

Investments in local energy systems can be expected to have employment benefits by providing local, skilled jobs. These will include direct jobs from construction and operational phases of the development as well as associated supply chain and multiplier effects[M42].

Impact on air quality

It can also impact the quality of the air which in turn impacts: human health, productivity, wellbeing and the environment, which is why it is so important to understand when planning future policy or programmes of work. Activity costs presented in Figure 3.8 show estimates for the impact of air pollution per unit of fuel consumed in each future energy scenario and estimates for the employment impacts associated with each future energy scenario, compared to the Do Nothing scenario

Metric	Do Nothing	National Net Zero	High Demand	Low Demand	High Hydrogen
Energy change (GWh, relative to 2023)	0	-113 (-2%)	-94 (-2%)	-1,878 (-31%)	-206 (-3%)
Change in GHG emissions ($ktCO_2e$, relative to 2023)	-47	-1,126	-1,125	-1,133	-1,097
Cumulative air quality activity costs between 2023-2050 (£m, *2022 prices*)	£0	£1,200	£1,177	£1,198	£1,170
Employment impacts between 2023-2050 relative to the Do Nothing scenario (net FTE)	0	7,178	7,194	7,325	8,760

Table 3.0.2: Summary of economic impacts for each scenario: employment impacts and air quality activity costs. Figures shown relate to the period 2023 – 2050. Air quality activity costs are presented using 2022 prices and are not discounted

3. The future energy system
Future energy scenarios and pathways

Summary of deployment

Our deployment model helps us to think about where we are now and where we need to get to, providing a starting point to frame the challenge and for more detailed analysis. We have included theoretical pathways which have a high degree of uncertainty as there are many variable factors and unknowns. The deployment modelling can't take into account every factor, some of the things that will impact deployment include:

1) Technological advance and innovation
2) Supply chains and how they develop
3) Large scale activity to decarbonise infrastructure at other levels: regional, UK and beyond.

*According to the National Charge Point Registry[M43] as of May 2023. Refers to individual charge points, and assuming 4kWp per charge point

**Assuming 4kWp per roof

***Renewable generation capacity is shown for technologies where current installed capacity is >5MW

Measure	2023	By 2030	By 2050
Number of homes retrofitted	13,00 homes with EPC A-C (35%)	Up to 25,000 homes retrofitted	Up to 61,100 homes retrofitted
Buildings with heat pumps installed (#)	700	Up to 14,600	Up to 95,300
EV charge points (#)*	220	Up to 8,430	Up to 63,840
Buildings with rooftop solar PV (#)**	2,900 (12 MW)	28,000 (112 MW)	99,700 (399 MW)
Ground-mounted solar PV capacity (MW)	80 MW	228 MW	645 MW
Other renewable capacity (MW)***	44 MW	73 MW	110 MW

Figure 3.0.7: Summary of deployment of various technologies between 2023, 2030 and 2050

4. Action planning

4. Action planning
Energy propositions

We shared what we learnt from exploring different energy futures and deployment pathways with our stakeholders and discussed with them what key drivers will be critical for the transition to net zero. We then considered their feedback, our strategic vision and objectives and agreed energy propositions to act as the framework for Flintshire's LAEP. There are numerous inter-dependencies and interactions between these propositions, as shown here, and this highlights the importance of a whole system approach with a co-ordinated programme of delivery to meet the net zero target by 2050. The following section describes each energy proposition in more detail, drawing together the evidence collected from baselining, scenario analysis and spatial modelling to propose priority areas to test critical, low-regrets system components that make up each energy proposition.

Vision

Flintshire County Council envisions a sustainable future with a net zero energy system that is affordable and promotes community health, well-being, and economic growth. We commit to a clean energy transition that fosters a resilient, inclusive, and prosperous community, ensuring a harmonious balance between environmental stewardship and social progress.

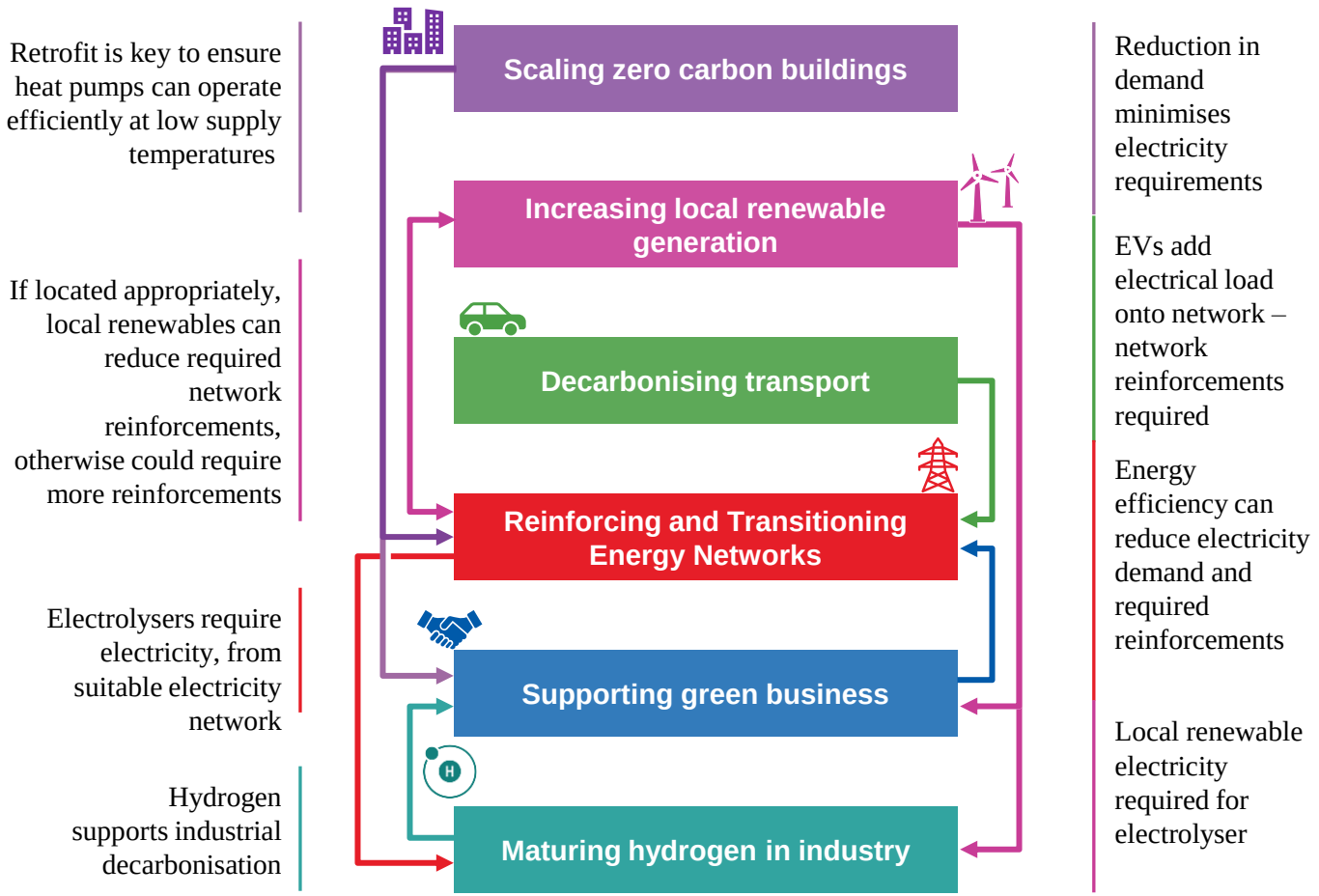


Figure 4.0.1: Summary of energy propositions and their inter-dependencies

4. Action planning
Energy propositions

Energy propositions in more detail

Scaling zero carbon buildings

Supporting and deploying energy efficiency measures across the county to reduce energy demand and costs.

Ensuring buildings are safe, healthy and low carbon in operation and design.

Decarbonising transport

Enabling the rollout of ultra low/zero carbon vehicles across the county and transitioning to a zero carbon council fleet.

Promoting active and sustainable travel within the region.

Increasing local renewable generation

Investigating opportunities for local and community ownership of renewables, providing low cost, clean energy to residents.

Supporting future green business

Encouraging and supporting businesses to adopt low carbon measures and reduce energy costs.

Create an attractive environment for sustainable businesses to make base in Flintshire.

Maturing hydrogen in industry

Exploring the potential for hydrogen within particular sectors and understand the infrastructure requirements for implementation.

Reinforcing and Transitioning Energy Networks

Grid reinforcement will be required to accommodate the shift towards electric vehicles and heating.

Even in a low hydrogen scenario the gas grid will require repurposing for hydrogen within some applications.

Figure 4.0.2: Summary of propositions

4. Action planning
Energy propositions

Identifying priority focus zones and creating an action routemap

Although the exact form of the decarbonised energy system in 2050 is uncertain, there are actions we can take now with relative certainty that will help us maintain the ability to meet our 2050 Net Zero ambition and capitalise on the opportunities that this transition will bring.

Plan on a page

As a starting point, Flintshire's "plan on a page," shown in Figure 4.0.3 on the next page, indicates the location and scale of change that scenario modelling indicates for Flintshire be on a pathway to Net Zero by 2050. The map highlights five modelling zones identified as priority focus zones for the low-regret energy system components included in Flintshire's energy propositions: heat pumps, EV chargers, rooftop solar PV, ground-mounted solar PV, onshore wind, and insulation retrofits. To prioritise where each low-regret energy system component could be deployed, each modelling zone was ranked using two or more of the following considerations:

- **Off-gas homes** – prioritise zones with higher baseline proportion of off-gas housing. These homes will be the most challenging to transition to hydrogen and therefore are the most likely no-regrets targets for conversion to heat pumps.
- **Socioeconomics** - prioritise zones with higher baseline rates of deprivation (lower WIMD score).
- **Property ownership** - prioritise zones with the highest baseline percentage of social housing.
- **Substation generation headroom** – prioritise zones with the most baseline generation headroom available.
- **Listed buildings** – prioritise zones with the least number of currently listed buildings.
- **Domestic energy efficiency** – prioritise zones with the highest baseline percentage of homes with an EPC rating of D or below.
- **Built additional substation capacity** - prioritises zones where the least upgrades are required in the high demand scenario, since heat electrification is typically a major contributor to grid upgrade requirements (which may be back-logged by several years).
- **Built EV charging capacity** – prioritise zones with the most EV charging built in the high demand scenario.
- **Built additional capacity of each local generation technology** (rooftop PV, ground-mounted PV, or onshore wind) – prioritise zones where the most additional new capacity is built between the baseline and 2050 high demand scenario.

For more details on the methodology behind the "plan on a page", please see Chapter 4 of the Technical Report.

In the map (Figure 4.0.3 on the next page), green areas show modelling zones identified as priority focus zones, where the modelling indicates that conditions are most favourable to trial deployment of energy system components at pace and scale. Blue areas show "progress" zones where the conditions are less favourable in the near-term for delivery compared to the green zones, and where only tried and tested delivery models should be deployed. A consistent level of deployment will still be required in these zones to transform the local energy system at the pace indicated by the deployment analysis.

4. Action planning
Energy propositions

Plan on a page

To support transformation of the energy system, pilot projects may be useful. The map below highlights areas that could provide a useful focus for these pilots.

Figure 0.4 identifies zones with particularly favourable conditions for specific energy components, making them ideal locations for pilot studies. The summary boxes detail the location, opportunity type, potential capacity, required investment for each component, and total investment necessary for both energy component installation and electricity network infrastructure in each zone by 2030. Ranges have been calculated by taking the minimum and maximum results from each future energy scenarios modelled.

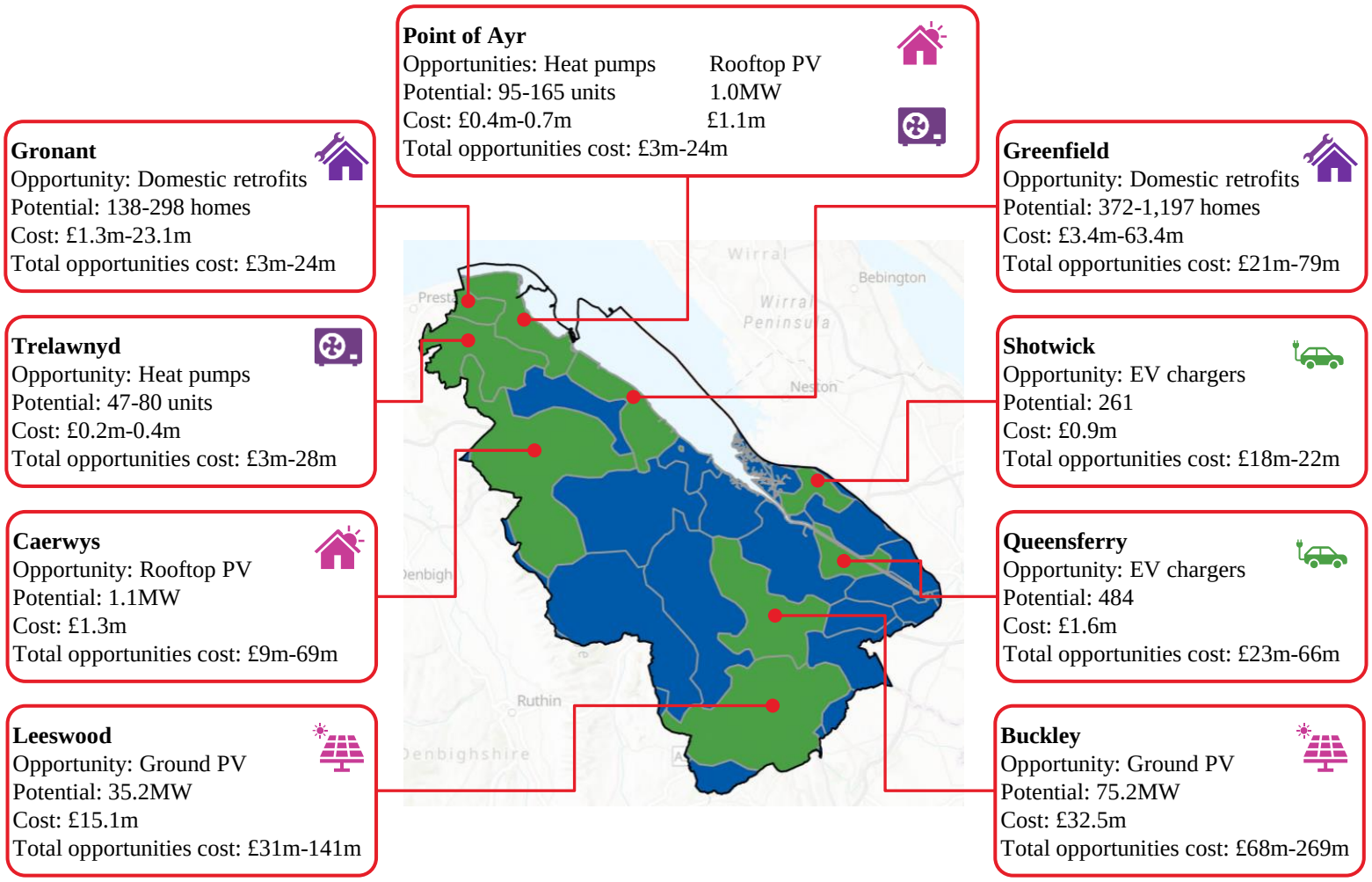


Figure 4.0.3: Flintshire's spatial representation of opportunities, including 2030 ambition and investment (million £) – in High and Low Demand scenarios. Zone boundaries are defined by primary substation service areas

4. Action planning
Energy propositions

Identifying priority focus zones and creating an action routemap

Action routemap

Our energy propositions describe where our priorities lie based on the evidence presented thus far. Our **action routemap** takes each energy proposition and outlines critical, enabling actions that we will take collectively alongside our stakeholders in the coming decade, with a particular focus on what we can achieve in the next 5-7 years. Our action routemap has been developed as a dynamic plan that recognises the influence that wider contextual changes at national and local level will have on the way we choose to transition to a net zero energy system, such as national regulation, policy and strategic plans. As a result, we expect to regularly review and update our routemap based on these dependencies.

Each action will require four key elements to be successful:

- Mobilising finance
- Strong and consistent policy frameworks
- Identifying delivery owners
- Community engagement

As Flintshire County Council, our role in delivering each energy proposition will vary. Some actions call for council action in the material delivery of programmes, whilst others require the council to act as the facilitator for market-driven change.

Through the LAEP process, we also identified that some of the actions are best delivered collaboratively through the regional partnership. This is because there are economies of scale, and it would be more efficient to have joined up and focused public resources. The regional actions will require detailed design work, to create projects and programmes, to progress them to implementation stage - with an initial focus on the tried and tested. The council will take an active role in supporting Ambition North Wales going forward.

Local ownership is a key focus throughout this plan, and where possible the action taken should leverage the progress made through the Welsh Government's recent Co-operation Agreement[M63] with Plaid Cymru, which includes key goals on tackling climate change in a way that maximises local benefits.

The following section provides further detail on each of the actions that we will undertake under each energy proposition, as well as our key asks of others. Due to the relative uncertainty of longer-term actions, we have chosen not to focus on detailed scoping of these in this report and instead, focus on actions we intend to deliver in the short-term, subject to appropriate support. For more details on the action plan, please see the Technical Report for further details.

4. Action planning

Routemap | short term actions

#	Lead	Scaling Zero Carbon Buildings	2024	2025	2026	2027	2028	2029	2030
1.1	FCC	Develop and implement programme of support for off-gas grid homes							
1.2	FCC	Develop programme for retrofit of Council owned buildings							
1.3	FCC	Promote rollout of EPCs to all Flintshire residents							
1.4	FCC	Complete existing ECO4 and ORP 2 and 3 funding programmes							
1.5	FCC	Upskill Council planning and regeneration team staff on retrofit of 'heritage' buildings, and novel technologies (e.g. heat pumps and charging hubs)							
1.6	FCC	Develop emissions standards for operation and construction of Council new builds and retrofits							
1.7	FCC	Explore opportunities to engage with the supply chain to ensure they are adequately aware of the scale of change required for domestic retrofit							
1.8 B.1.8	WG	Apply lessons learnt from Optimised Retrofit Programme to retrofitting the privately rented and owner-occupied sectors through Welsh Zero Carbon Hwb.							
1.9 B.2.1	WG	Using the learning from other information hubs to develop an information service that provides a trusted source of retrofit and energy efficiency information for consumers. Explore the potential of establishing an advice hub to support regional decarbonisation / low carbon energy initiatives.							
1.10 R1.4	Warm Wales	Work with Community Interest Companies (CIC) to provide a regional service of wrap around support for residents covering education, behaviour change, energy advice and support.							
1.11 3A	RSLs	Provide support and incentives for households to install energy efficiency measures and low-carbon heating systems, ensuring such support is targeted at those in fuel poverty and/or in most need.							
1.12 3C	FCC; RSLs	Ensure PAS 2035 surveys and a clear plan for retrofit measures are prepared for individual social homes, in accordance with the Welsh Housing Quality Standard (WHQS)[M20].							

FCC - Flintshire County Council; WG – Welsh Government; RSL – Registered Social Landlords

4. Action planning

Routemap | short term actions

#	Lead	Scaling Zero Carbon Buildings	2024	2025	2026	2027	2028	2029	2030
1.13 3D	WG; LAs	Review current support provision to tenants and landlords in the private-rented sector to ensure minimum energy efficiency standards are met. Review enforcement provisions to ensure minimum statutory standards within the sector are achieved.							
1.14 5C	Business Wales / M-Sparc; North Wales Mersey Dee Business Council	Explore development of support mechanisms for small to medium-sized enterprises (SMEs) to encourage uptake of energy efficiency improvements to commercial buildings.							
1.15 B.1.7	WG	Work with local authorities and regional bodies to determine an approach to coordinated, street-by-street approach to retrofit and the mechanisms for delivery (e.g. governance, resource, finance, policy). Co-ordinate a retrofit plan for all housing tenures which expands on the Optimised Retrofit Programme.							
1.16 B.5.1 3E	WG; LAs	Identify specific local planning constraints (e.g. permitted developments i.e. 3 metre rule for heat pumps, permissive planning for listed buildings, new build regulations) limiting progress to net zero and delivering the LAEPs and work with Welsh Government to resolve these.							
1.17 B.5.2	WG	Consider tighter building regulations to support delivery of net zero ready buildings including a consultation on Part L regulations in 2024							
1.18 B.1.2 3B	WG	Develop and agree an approach and delivery plan for tackling owner-occupied retrofit. Review existing and explore new potential financial mechanisms to support owner-occupiers and building owners seeking to undertake energy efficiency retrofit works.							
1.19 E.4.1	WG	Identify procurement frameworks for renewable technologies which consider local and ethical sourcing of goods and services. Develop national procurement framework, learning from previous ECO 4 roll out and the Optimised Retrofit Programme, to deliver street-by-street retrofit.							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; RSL – Registered Social Landlords

4. Action planning

Routemap | short term actions

#	Lead	Decarbonising Transport	2024	2025	2026	2027	2028	2029	2030
2.1	FCC	Apply pressure to Welsh Government for greater direction for on street EV charging							
2.2	FCC	Explore EV charging technologies for kerbline properties where no off-street options are available							
2.3	FCC	Understand charging facilities potential within town centre regeneration and place making plans, explore SPF and ORCS funding							
2.4	FCC	Ensure commitment to high speed broadband connections for everyone in Flintshire							
2.5	FCC	Lobby for investment in the rail infrastructure to improve service frequency and reduce travel time							
2.6	FCC	Further develop active travel networks and principles, keeping in mind impacts of equalities act							
2.7	FCC	Develop plans for last mile sustainable mobility requirements within the scope of new and improved stations in the North Wales metro programme							
2.8	FCC	Provide public finance options and national standards for EV charging infrastructure.							
2.9	FCC	Release pilot EV charge point locator and costing tool for EV charge points.							
2.10 4C	ANW; WGES	Collaborate on opportunities to decarbonise the public sector fleet, public service vehicles, and commercial and industrial fleets and the co-ordination of associated infrastructure design and development across local authority boundaries.							
2.11 4D	ANW; North Wales Corporate Joint Committee; TfW; SPEN	Work together to deliver the most appropriate electric vehicle public charging infrastructure across the region, aligning with national work being undertaken through Transport for Wales.							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; TfW – Transport for Wales; SPEN – SP Energy Networks; WGES – Welsh Government Energy Service

4. Action planning

Routemap | short term actions

#	Lead	Decarbonising Transport	2024	2025	2026	2027	2028	2029	2030
2.12 4F	ANW	Support greater awareness raising of UK Government funding for development of electric vehicle charging infrastructure such as the on-street residential charging scheme.							
2.13 4G	ANW; WGES	Continue to support organisations such as local community car clubs to deliver community-oriented, low-carbon transport infrastructure and services.							
2.14 R4.1	North Wales Corporate Joint Committee	Establish a Regional Transport Officer's Group that provides a forum for collaboration and alignment between local and national government in addition to Transport for Wales.							
2.15 R4.2	North Wales Corporate Joint Committee	Explore opportunities around bus franchising across the region.							
2.16 R4.3	North Wales Corporate Joint Committee	Produce the first Regional Transport Plan (RTP) in line with that Welsh Government statutory guidance.							
2.17 T.2.4	WG	Develop a national procurement framework for EV infrastructure							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; TfW – Transport for Wales; WGES – Welsh Government Energy Service

4. Action planning

Routemap | short term actions

#	Lead	Increasing Local Renewable Generation	2024	2025	2026	2027	2028	2029	2030
3.1	FCC	Promote community energy schemes							
3.2	FCC	Continue to rollout renewables in line with REAs, land assessments and constraints mapping							
3.3	FCC	Facilitate rooftop solar PV uptake in owner-occupied dwellings through knowledge sharing and signposting							
3.4	FCC	Understand local potential for solar carports							
3.5	FCC	Support SMEs with rooftop solar installation for reducing energy costs by highlighting energy savings, local installers and potential costs							
3.6	FCC	Further explore possibilities for geothermal energy generation within old coal fields, this can build on the work that has been undertaken by the Coal Authority.							
3.7 G	ANW	Explore the development of an investment prospectus for renewable developments currently in the pipeline.							
3.8 2A	Ynni Cymru; ANW	Engage with Welsh Government to identify and build on opportunities that Ynni Cymru could provide to North Wales.							
3.9 2B	ANW	Explore how to improve communication of available funding sources for the development and delivery of a range of low-carbon power generation projects (e.g. onshore and offshore wind, solar PV, nuclear, and tidal and marine energy).							
3.10 2D	Ynni Cymru; ANW	Support workstreams in increasing local ownership of energy projects to be delivered in line with proposed guidance on local and shared ownership in Wales.							
3.11 2E	ANW	Explore the potential of establishing an advice hub to support regional decarbonisation / low carbon energy initiatives.							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales

4. Action planning

Routemap | short term actions

#	Lead	Increasing Local Renewable Generation	2024	2025	2026	2027	2028	2029	2030
3.12 2F	ANW	Maximise opportunities for public procurement to support the acceleration of renewable energy generation and secure local economic and social value. - Ensure that public procurement strengthens local supply chains / local jobs (social value). - Ask the supply chain to deliver against public sector carbon ambitions through procurement frameworks.							
3.13 2G	ANW	Maximise opportunities for community benefits funds from energy infrastructure projects (on the distribution network) to support local and regional decarbonisation initiatives, recognising the need to target those communities and areas most impacted by such developments.							
3.14 R2.1	ANW	Explore the opportunities that Power Purchasing Agreements could provide to energy generation across the region.							
3.15 R2.2	ANW; WGES	Continue to explore the opportunities presented by solar canopies in car parking spaces and the enablers to scale the technology across the region.							
3.16 RN.4.1	WG; Trydan Gwyrdd Cymru	Identify and explore opportunities for the development of renewables on public sector owned land							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; WGES – Welsh Government Energy Service

4. Action planning

Routemap | short term actions

#	Lead	Supporting green business	2024	2025	2026	2027	2028	2029	2030
4.1	FCC	Promote work undertaken by AMRC where appropriate							
4.2	FCC	Continue to support Deeside Decarbonisation Forum and signpost funding opportunities							
4.3	FCC	Understand potential for redevelopment plan of Mostyn dock, undertake opportunities mapping							
4.4	FCC	Understand how sustainability can be worked in to Flintshire's digital strategy and potential for data supported decarbonisation							
4.5	FCC	Look to undertake heat mapping exercise and understand heat network potential							
4.6	FCC	Support SMEs to develop plans to decarbonise and signpost to funding opportunities							
4.7	FCC	Continue to support town centre place making investment and signpost funding opportunities available to businesses and social enterprises							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales

4. Action planning

Routemap | short term actions

#	Lead	Maturing hydrogen in industry	2024	2025	2026	2027	2028	2029	2030
5.1	FCC	Plan for and be aware of upcoming hydrogen project funding opportunities							
5.2	FCC	Develop local strategy to understand local need, requirements, challenges, and opportunities for hydrogen							
5.3	FCC	Look to support research into hydrogen co-challenges for local businesses							
5.4 E	ANW	Support the emerging hydrogen economy, taking account of proposed hydrogen projects across the region.							
5.5 N.4.4	WG; NRW	Publish a Welsh Government carbon intensity standard for hydrogen production based on that of UK Government. This standard can be used as a basis for future permitting by Natural Resources Wales.							
5.6	WWU	Publish findings from North Wales Conceptual Plan for hydrogen infrastructure.							
5.7 N.3.5	WWU	Make the network hydrogen ready. Deliver programme to convert remainder of gas network not covered by the REPEX programme to enable a 100% hydrogen conversion, WWUs sustainability strategy from 2023 identifies a desire to complete this between 2035-2040.							to 2040 >
5.8 N.4.4	WWU	Develop hydrogen and bio-methane projects.							to 2050 >
5.9 N.4.5	WWU	Develop a more detailed understanding of potential hydrogen transport demand and incorporate this demand within existing network demands. This action will be supported by WWU's innovation project HyDrive.							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; NRW - Natural Resources Wales; WWU – Wales and West Utilities

4. Action planning

Routemap | short term actions

#	Lead	Reinforcing and Transitioning Energy Networks	2024	2025	2026	2027	2028	2029	2030
6.1 N.1.2	SPEN; WWU	Hold regular engagement meetings between FCC, SPEN and WWU						Ongoing basis	
6.2 N.2.2 N.3.3	FCC; SPEN	FCC and SPEN to work collaboratively to understand future demands (electricity) and use this to influence ED3 Planning and investment from OFGEM.							
6.3 N.2.1	SPEN	Inform local authorities about available data resources by providing access to the DFES report and the resulting NDP (Network Development Plan) via SPEN's Open Data Portal as well as other datasets such as heat maps, network infrastructure & usage. Requests for additional, bespoke reports can also be made via the portal.							
6.4 N.2.3	SPEN	Use all relevant outputs from the LAEPs to inform SPEN's DFES (Distribution Future Energy Scenario) Report, in turn SPEN will share the trends and highlights from the DFES with individual LAs.							
6.5 N.2.4	SPEN	Provide low carbon technology (LCT) optioneering services to Local Authorities to support them with site optioneering (cost and timescale) for EV charging, heat pump rollout and renewable generation infrastructure planning.							
6.6 N.2.5	SPEN; WWU	Co-ordinate Net Zero clinics for Local Authorities to discuss decarbonisation of heat, transport and renewables strategies, and willingly contribute to workshops organised by the Local Authorities for local small-medium enterprises (SMEs).						Ongoing basis	
6.7 N.2.6	SPEN; WWU	Discuss and agree any strategic optimisation opportunities with each Local Authority to continue progressing decarbonisation and economic growth plans.						Ongoing basis	
6.8 N.1.3	SPEN; WWU	Plan a method to consolidate the pipelines for all energy-related projects across the electricity and gas/hydrogen networks. This will consolidate all actions planned by electricity and gas/hydrogen networks within an area into one common database. As a starting point, set up ongoing engagement meetings with DataMapWales, NGED SPEN, and WWU to coordinate if and how DataMap Wales may be an appropriate platform to consolidate this information.						Ongoing basis	

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; SPEN – SP Energy Networks; WWU – Wales and West Utilities

4. Action planning

Routemap | short term actions

#	Lead	Reinforcing and Transitioning Energy Networks	2024	2025	2026	2027	2028	2029	2030
6.9 N.3.1	WWU	Highlight gas infrastructure opportunities. Support Local Authorities in exploring new opportunities to develop the existing gas networks in advance of 100% transition to existing hydrogen network.						Ongoing basis	
6.10 N.3.2	WWU	Include new projects from the LAEP in strategic planning process.							
6.11 N.3.4	WG	Share LAEP outputs on DataMapWales, plan how to keep this data up to date and relevant							
6.12	SPEN	Raise awareness of SPEN's Flexibility Service procurement to support a smarter system.							
6.13 N.2.7	SPEN	SPEN is already looking at industrial decarbonisation through their partnership in the NEW-ID (North East Wales Industrial Decarbonisation) Project. Any opportunities/benefits identified as part of work on this project will be shared with the affected Local Authorities, including Flintshire .							
6.14	WG; Coal Authority; WWU	Explore opportunities for partnership delivery of district heating and cooling networks, using waste heat sources such as mine water.							
6.15 5B	ANW; DDF	Understand the role that micro-grids and other innovative solutions can play in existing industrial clusters such as those in Deeside and Flintshire.							
6.16 R5.1	North Wales Corporate Joint Committee; DDF	Explore and recognise opportunities that will be made available from the Flintshire/Wrexham investment zone.							

FCC - Flintshire County Council; WG – Welsh Government; ANW – Ambition North Wales; SPEN – SP Energy Networks; WWU – Wales and West Utilities; DDF – Deeside Decarbonisation Forum

4. Action planning

Routemap | short term actions

#	Lead	Enabling actions	2024	2025	2026	2027	2028	2029	2030
7.1 A	ANW	Ensure effective alignment between local, regional and national energy strategies, plans and initiatives.							
7.2 D	ANW	Provide regional support in the delivery of commitments made in the Climate Action Wales public engagement strategy (July 2023) to help citizens take action to reduce demand, improve energy efficiency and use energy in a way which supports our vision							
7.3 I.1.3 F	ANW; Ynni Cymru; WG	Continue to explore and support opportunities for smart local energy systems in the region. Using outputs from the LAEP, map smart local energy system opportunities and identify feasibility/demonstrator projects through engagement with key stakeholders including community energy groups and general public.							
7.4 R1.1	WG; Ofgem; National Grid ESO	Ensure alignment between the scope and function of the new Regional Energy Strategic Planners (RESPs) with Ofgem's policy design. Consultation of the policy design will be published in the summer of 2024 with the RESPs in operation by late 2025/early 2026							
7.5 R1.2	North Wales Corporate Joint Committee	North Wales Corporate Joint Committee to support the Race to Zero campaign and provide oversight on carbon emissions across the region							
7.6 E3.1 C	RSP; WG	Lead on developing the skills requirements identified in the Regional Skills Partnership's (RSP's) Green Skills Report and Welsh Government's Net Zero Skills Action Plan. Map and identify skills and labour needs and gaps up to 2050 for retrofit and low carbon new builds; renewable deployment; decarbonised transport and business / industry decarbonisation.							
7.7 E3.2	WG	Review and develop educational programmes to meet skills needed							
7.8 E3.3	WG	Develop a communication strategy to educate, promote skills, training and the need for a supply chain							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; WGES – Welsh Government Energy Service; RSP – Regional Skills Partnerships

4. Action planning

Routemap | short term actions

#	Lead	Enabling actions	2024	2025	2026	2027	2028	2029	2030
7.9 R1.5	ANW; WGES	Work with Welsh Government to create a governance structure and performance management framework for the LAEPs to facilitate monitoring of progress and performance of the LAEPs across the Region.							
7.10 E2.2	WG	Using the outputs from the LAEPs and REPs, create a national plan which covers the gaps such as national and regional assets.							
7.11 R1.3	North Wales Corporate Joint Committee	Develop the first regional Strategic Development Plan (SDP). Include policies in the plan that support low carbon building practices and low carbon new builds.							
7.12 H	Bangor University / M-Sparc; Wrexham University; ANW	Strengthen the link between research, development and innovation with regards to current and emerging technology and the Energy Strategy priorities.							

FCC - Flintshire County Council; WG – Welsh Government; LA – Local Authority; ANW – Ambition North Wales; WGES – Welsh Government Energy Service

4. Action planning

Routemap | short term

National Targets	2024	2025	2026	2027	2028	2029	2030
Up to 1GW of electrolytic hydrogen secured (2025) [UK][M44]							
Decision on hydrogen to heat buildings (2026) [UK][M45]							
Up to 10GW hydrogen capacity in UK (50% electrolytic) [UK][M44]	Progressing towards 2030						
Up to 50GW of offshore wind capacity including up to 5GW of innovative floating wind (2030) [UK] [M44]	Progressing towards 2030						
Future Homes Standard consultation suggests all space heating and hot water demand be met through low carbon sources in new builds (2025)[M46]							
All new social homes built to Welsh Development Quality Requirements 2021 without fossil fuel heating (from 2025)[M47]							
All existing social homes to have a plan for minimising environmental impact and improving energy performance (2027) [Wales][M48]							
-37% GHG emissions by 2025 (rel. to 1990) [Wales][M49]							
-63% GHG emissions by 2030 (rel. 1990) [Wales][M49]	Progressing towards 2030						
Meet the equivalent of 100% of electricity needs from renewable sources by 2035 [Wales][M26]	Progressing towards 2035						
1.5GW of renewable capacity to be locally owned (exc. Heat pumps) (2035) [Wales][M26]	Progressing towards 2035						
580,000 heat pumps to be installed in Wales by 2035, contingent on scaled up support from the UK Government and reductions in the cost of technology (2035) [Wales][M26]	Progressing towards 2035						
Minimum EPC E to rent out any property (from 2023 onwards) and EPC C from 2030 [UK][M51]							
1 public charge point for every 7 to 11 electric vehicles (2025) [Wales][M52]							
Rapid charging available every 20 miles on the strategic trunk road (2025) [Wales][M52]							
£220 million committed through Active Travel Fund (2022-2025) [Wales]							
-10% car miles travelled/person (2030) [Wales][M03]	Progressing towards 2030						
80% new cars and 70% new vans sold to be zero emissions[x] (2030) (ZEV mandate) [UK][M53]	Progressing towards 2030						
100% new cars and vans sold to be zero emissions (2035) (ZEV mandate) [UK][M53]	Progressing towards 2035						
Net zero public sector by 2030 [Wales][M54]	Progressing towards 2030						

5. Next steps

5. Next steps
Enabling conditions for success

Through the LAEP development process, we identified that broadly, each action requires four key elements to be successful. These are:

- Actions to mobilise finance
- A strong and consistent policy framework
- Accountable delivery owners and
- A community engagement element

Progressing energy propositions

We, as a county want to make sure that there is a well-defined governance structure for managing the delivery of the LAEP. As an area-wide plan it is the responsibility of all who live and operate in the area to support its delivery, and the chosen governance framework will need to reflect this. We, as a Council, will seek to bring the delivery of our LAEP into alignment with our plans for delivering our Climate Change Strategy and other plans where activities are mutually beneficial for addressing the climate emergency and meeting our climate change targets.

The council is currently strengthening its governance arrangements to support delivery of its Action Plan to Net Zero Carbon. Currently the climate change strategy programme is monitored by Climate Change Committee is made up of representatives from each political party. The Committee is supported by Officer Groups for each theme with representation from each of the stakeholder portfolios. Progress reports will be received by the Environment & Economy Scrutiny Committee to deliver further development of the plan. Scrutiny of the programme is also available from Internal Audit as appropriate.

Roles and responsibilities

The Council's role in each action will vary. Some actions call for Council action in the delivery of programmes, whilst other actions involve the Council as a convener, or co-ordinator between multiple organisations.

As a Council, we will decarbonise assets within our direct control, such as council buildings and the council transport fleet. Further, we will drive and influence the decarbonisation of the wider area through our role as:

Planning Authority:

- Preparing planning policies and allocating land in our Local Development Plan
- Development management – taking decisions on planning applications submitted to the local planning authority for development; as well as preparing Local Impact Assessments for schemes which are determined by the Infrastructure Planning Commission

Place-maker:

- Acting at a council wide level to achieve a low carbon economy.
- Taking forward wider community action and communicating the need to increase the uptake of renewable energy.

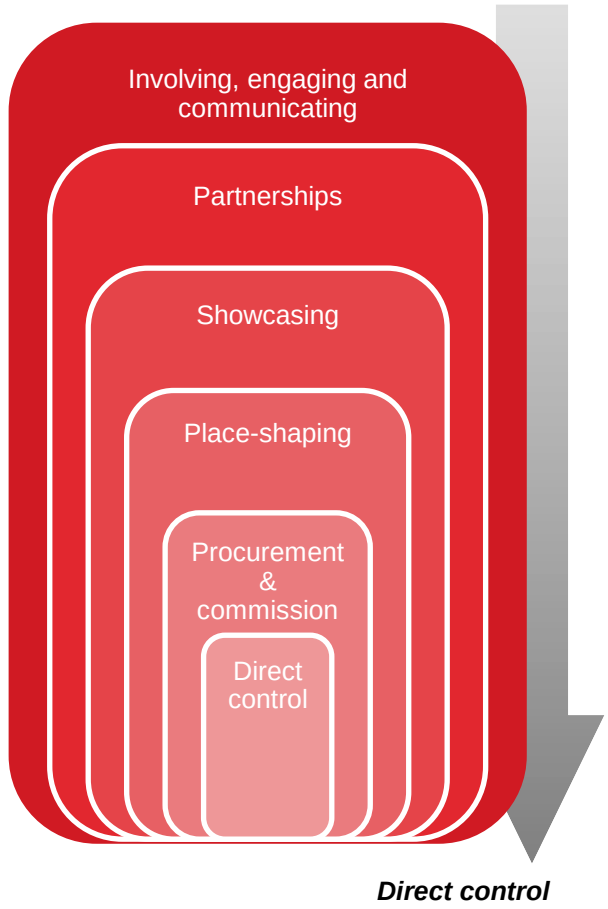


Figure 5.0.1: A local Council's roles and level of influence

5. Next steps
Enabling conditions for success

For this delivery of the LAEP and our own Climate Change Strategy to be successful, we will require a collective, co-ordinated effort from many different stakeholders, which means closer collaboration between the Council and our partners, and building relationships with key stakeholders that hold influence over different parts of the energy system. We will leverage our existing partnerships to do this, such as the Public Sector Board (PSB), Public Sector Decarbonisation Group and others.

Regional perspective

Developing this LAEP in close collaboration with other local authorities in Wales recognises that a consistent, co-ordinated plan for creating a net zero energy system in North Wales can bring wider economic and social benefits and capitalise on the unique potential in each local area. This regional approach to energy planning recognises the environmental, economic and social dependencies between different local areas and energy systems. Ambition North Wales, a regional representative in national discussions on energy, as well as responsible for co-ordinating North Wales' Energy Action Plan and managing the North Wales Growth Deal, recognises its critical role in endorsing this way of working, and how it might support this approach where it is most effective. Ambition North Wales plans to:

- Act as a regional resource to support local authorities to deliver their LAEPs.
- Ensure effective alignment between each LAEP, North Wales Regional Energy Strategy and the emerging National Energy Plan.
- Develop the skills requirements identified in the Regional Skills Partnership's Green Skills Report and Welsh Government's Net Zero Skills Action Plan.
- Encourage, facilitate and support a joined-up approach to delivering local actions that are common across the region to be efficient, effective and consistent (e.g. cross-border collaboration on funding applications).
- Facilitate engagement between local authorities and regional stakeholders e.g. continue to facilitate forums like the Regional Steering Group, where updates and support can be shared regionally between local authorities, networks and other local and regional stakeholders.
- Provide regional support in the delivery of commitments made in the Climate Action Wales public engagement strategy (published July 2023) to help citizens take action to reduce demand, improve energy efficiency and use energy in a way which supports our vision.

5. Next steps
Enabling conditions for success

National perspective

Welsh Government has committed to achieving net zero emissions in Wales by 2050 and recognises that a significant part of this will depend on transforming the energy system to enable the reduction and decarbonisation of energy generation and use in Wales. As such, it committed to providing the resource and funding for each Local Authority to develop a Local Area Energy Plan (LAEP). Having Local Area Energy Plans (LAEP) for every Local Authority in Wales provides an opportunity for Welsh Government to aggregate the findings into a national energy plan that is coherent with local energy priorities and needs and identifies large-scale opportunities to accelerate the transition at pace and scale. Welsh Government is well-placed to:

- Develop a national energy plan using the outputs of the LAEPs and four Regional Energy Strategies which covers aspects of the energy system that Welsh Government could influence (e.g. national assets, rebalancing energy costs etc.) [E2.2]
- Utilise the findings from LAEP to influence national energy infrastructure planning to support local energy ambitions
- Understand what policy and/or institutional support might be needed to empower Local Authorities and regional public bodies to drive energy innovation at a local level.
- Work with local and regional bodies to establish an effective local-national governance framework to enable co-ordinated decision-making and monitoring.
- Scale-up local energy plans to identify gaps to enable us to plan for a system that is flexible and smart – matching local renewable energy generation with energy demand

5. Next steps
Enabling conditions for success

Finance

For those actions that relate directly to our statutory duties as a local council and align with our immediate priorities, we will develop an investment plan to support the delivery of a Local Authority programme of works to enable the delivery of the LAEP. This may be from usual capital markets or through more innovative financing mechanisms such as community municipal investments, Pay as you Save or net-metering. Innovative finance options to be explored for individual energy consumers such as green mortgages.

For actions that are best delivered by other local, regional or national organisations, partnering and engaging with these organisations will be critical for discussing Flintshire's ambitions and how to make them investable.

Monitoring and review

This plan sets out key actions that will be taken by various stakeholders across Flintshire for the first five years to set the local area on a journey to achieve a net zero energy system. The plan needs to be flexible to adapt to changes in the future.

We will work with regional and national partners to develop a monitoring framework which builds on existing data and processes and helps us understand the progress Flintshire is making towards its committed actions and ambitions set out in this plan.

We will make use of publicly available datasets such as the Energy Performance Certificate Register[ML19], the Micro Generation Certification Scheme[ML20], the Renewable Energy Planning Database[M62] and publications such as Renewable Generation in Wales report[M61].

We will also track GHG emissions reduction, building on our existing submissions to Welsh Government for Public Sector Reporting as a starting point. We recognise that available data will lag a few years behind.

Our action routemap has been developed as a dynamic plan that recognises the influence that wider contextual changes at national and local level will have on the way we choose to transition to a net zero energy system, such as national regulation, policy and strategic plans. As a result, we expect to regularly review and update our routemap based on these dependencies.

The whole plan will be updated at least every five years to take account of key factors, including policy changes at a UK and Welsh Government level, changes in costs and the effectiveness of technologies.

Appendices

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Glossary of terms

Term	Definition or meaning
Action	The process of doing something – a specific action assigned to a responsible person preferably with a date to be completed.
Anaerobic Digestion	Processes biomass (plant material) into biogas (methane) that can be used for heating and generating electricity.
Baseline	The baseline is the data showing the current energy system, containing the 2019 data sets provided by the LA and publicly available data.
Batteries	Devices that store electrical energy to be used at a later time.
Biomass boiler	A boiler which burns wood-based fuel (e.g. logs, pellets, chippings) to generate heat and electricity.
Carbon Capture and Storage (CCS)	The process of capturing and then storing carbon emissions before they enter the atmosphere.
Certainties	A fact that is definitely true or an event that is definitely going to take place. In terms of a local energy system, certainties include funded projects, etc.
Demand	Local energy demand that the local energy system needs to meet.
Demand headroom	The difference between the electrical capacity of a substation, and the electricity demand at the substation at the time of peak demand.
Deployment modelling	A model investigating rates by which to deploy specific technologies between the baseline year and 2050 to achieve the end state developed by the optimisation model for each scenario. The model considers broader plan objectives and local, regional, and national strategic priorities, policies, and targets to help us to define a suitable level of ambition and inform an action plan.
Dispatchable energy generation	Energy generation that can turn on and off (i.e. isn't controlled by the weather) – this is likely to be gas turbines of some sort.

Glossary of terms

Term	Definition or meaning
Distribution network	Takes energy from transmission network and delivers it to users via pipes or wires at low pressure / voltages.
Electricity network	Interconnected infrastructure which consists of power stations, electrical substations, distribution lines and transmission lines. The network delivers electricity from the producers to consumers.
Electrolyser	A piece of equipment that uses electricity to split water into hydrogen and oxygen.
Energy Proposition	A proposition is an energy component with a scale and a timescale. For instance, X MW of wind turbine to be built in 5 years, 10,000 buildings to retrofit with XX by 2030, or a pilot project such as hydrogen storage innovation. These are typically near term, low regrets energy components that are needed in future energy systems (it is likely that these appear in all scenarios).
Energy System Component	A term used to describe anything that can have a direct impact on energy demand and/or the way energy is supplied. E.g. installing retrofit measures can reduce overall heating demand, increasing solar PV capacity can change the supply mix and the way that the energy system operates.
Focus zone	A modelling zone which has been identified as an area in which to target near-term installation, upgrade, retrofit, or other activities related to a specific energy system component.
Generation	Local generation – size below 100MW.
Generation headroom	Generation headroom in a local authority's electricity distribution network refers to the remaining primary substation capacity at the time of peak generation, crucial for maintaining a stable and reliable power supply to meet the community's needs
Grid electricity	Electricity that is supplied by the electricity network.
Grid substation	The physical equipment comprising a substation with a 132kV-33kV transformer(s) connecting the grid-level, extra high voltage electricity lines to the primary-level, high voltage electricity lines. The grid substation facilitates connection with the national grid.
Heat network	A distribution system of insulated pipes that takes heat from a central source and delivers it to a number of domestic or non-domestic buildings.
Heat pump	A piece of equipment that uses a heat exchange system to take heat from air, ground or water and increases the temperature to heat buildings.

Glossary of terms

Term	Definition or meaning
Hydrogen	A flammable gas that can be burned, like natural gas, to generate heat or power vehicles. The by-product is water only, no carbon.
Infrastructure	Local energy distribution infrastructure, includes storage assets if these are at grid level.
Landfill gas	Gases such as methane that are produced by micro-organisms in a landfill site that can be used as a source of energy.
Lever	We use the term policy levers to refer to the 'governing instruments' (Kooiman, 2003) which the state has at its disposal to direct, manage and shape change in public services.
Local energy system	The distribution level energy system, excludes the transmission and national assets.
Longer-term options	The likely outcome of these is less certain and dependent upon actions and decisions being made that are not under our control, e.g. a national policy or the capability / availability of a technology.
Major industrial load	The power demand of industrial sites in the 2019 NAEI Point Sources data are large enough to be classified as major industrial loads. Sites that aren't included in this database are likely too small to have a significant impact on the energy system singlehandedly.
Methane reformation	Process of producing hydrogen by heating methane from natural gas and steam, usually with a catalyst. Produces carbon dioxide as a by product.
Modelling zone	A specified area in our modelling which is the smallest level of granularity for analysis. The zones are used through energy modelling, deployment modelling, and mapping. Zones were created by intersecting the Local Authority boundary with the primary substation service area boundary, as described in the "Methodology - electricity and gas network infrastructure" section of the Technical Report. *May also be called "zone" or "substation zone" in the reports.*
National Asset	National infrastructure (can be supply or demand and the accompanying transmission / distribution infrastructure) – defined as over 100MW, unless it produces heat which can only be used locally this is generally excluded from LAEP particularly the modelling.

Glossary of terms

Term	Definition or meaning
National grid	A generic term used in the reports referring to the electricity network serving Wales, including both the transmission and distribution networks and facilitating the flow of electricity between neighbouring areas or regions. *May also be called generically "grid" in the reports.*
National Net Zero	The National Net Zero modelled in the LAEP. Details of assumptions are in the methodology section.
Natural Heritage	This includes features which are of ecological, geological, geomorphological, hydrological or visual amenity importance within the landscape, and which form an essential part of the functioning of the natural environment and natural assets.
Net Zero	Net zero when used in this LAEP is the energy net zero as it does not include all emissions, only energy emissions.
No regrets/ low regrets	Options which are common to all scenarios, cost-effective, provide relatively large benefits, and are very likely to be important parts of the future energy system, regardless of future uncertainty.
Optimisation modelling	Modelling to create the most cost and carbon optimal system.
Option	A term used to describe ways that a particular objective can be achieved. In the context of this LAEP, an option could be deploying a particular energy system component
Outward code	The first part of a postcode i.e. BS1.
Pathway	A pathway is how we get from the current energy system, to the most likely net zero end point. The pathway will consider what is needed from across the scenarios, the supply chain, number of installers etc. The propositions will make up the more certain part of the pathway, whereas the longer-term energy components will need further definition in the future.
Primary substation	The physical equipment comprising a substation with a 33kV-11kV transformer(s) connecting the primary-level, high voltage electricity lines to the consumer-level, low voltage electricity lines.
Primary substation service area	The area bounding the buildings or other electricity demands which are served by a primary substation (or, in ANW, a group of primary substations acting together to serve one area).

Glossary of terms

Term	Definition or meaning
Programme	A series of projects, usually with a theme, that is run collectively.
Project	Strategic scale projects being implemented or planned for implementation in the local energy system that will significantly affect local demand or local supply.
Resistance heating/ heater	Generate heat by passing electrical currents through wires.
Scenario	A scenario is a set of assumptions for a particular end point (usually 2050) which are modelled in our optimisation model. We modelled 5 different scenarios to see what was common across the scenarios and therefore is a "no regrets" measure, and what changed between the modelled scenarios.
Solar PV	Convert solar radiation into electricity using photovoltaic (PV) cells.
Strategic objective	Strategic objectives are purpose statements that help create an overall vision and set goals and measurable steps to achieve the desired outcome. A strategic objective is most effective when it is quantifiable either by statistical results or observable data. Strategic objectives further the vision, align goals and drive decisions that impact change.
Strategic options	Strategic options are longer-term changes to demand, generation and infrastructure that will lead onto decarbonisation of the local energy system - and the key variables that determine scenarios.
Substation upgrades	Interventions at an existing primary substation designed to increase the capacity of the substation, such as upgrading an existing primary substation or installing a new primary substation. *May also be called 'substation interventions' in the reports.*
Supply	Energy supply options – this is how energy is delivered from the point of source – so a supply option would be solar PV.
Supply/generation headroom	The difference between the electrical capacity of a substation, and the power being supplied to the substation at a given time.
Transmission network	Move energy via pipes or wires for long distances around the country at high pressure/ voltages.
Uncertainties	Uncertainty results from lack of information or from disagreement about what is known or even knowable.
Wind power	Harnessing the kinetic energy of wind to turn a turbine to generate electricity.

Units of measure

Unit	Definition or meaning
°C	Degree(s) Celsius – a unit of temperature on the Celsius scale.
GWh	Gigawatt hour(s) – a unit of energy representing 1 billion watt-hours.
$kgCO_2e$	Kilogram(s) of carbon dioxide equivalents – a unit of measurement for greenhouse gas warming potential, expressing the equivalent weight of carbon dioxide with the same global warming potential.
$ktCO_2e$	Kilotonne(s) of carbon dioxide equivalents - a unit of measurement for greenhouse gas warming potential, expressing the equivalent weight of carbon dioxide with the same global warming potential. Represents 1 million kgCO2e.
kV	Kilovolt(s) – a unit of potential energy of a unit charge in a point of a circuit relative to a reference (ground) representing 1000 volts.
kW	Kilowatt(s) – a metric unit of power measuring rate of energy consumption or production representing 1000 watts.
kWh	Kilowatt hour(s) - a unit of energy representing 1000 watt-hours.
kWp	Peak kilowatt(s) – the maximum power rating possible produced by an energy generation source (i.e., amount of power produced in ideal generation conditions).
MW	Megawatt(s) – a metric unit of power measuring rate of energy consumption or production representing 1 million watts.
MWe	Megawatt(s) electric – a unit of electric power output from a generation source representing 1 million watts electric.
MWth	Megawatt(s) thermal – a unit of thermal power output from a generation source representing 1 million watts thermal.
MWh	Megawatt hour(s) - a unit of energy representing 1 million watt-hours.
tCO_2 per capita	Tonne(s) of carbon dioxide per capita – a unit of mass of carbon dioxide emitted per member of a population per year. Represents 1000 $kgCO_2$ per capita.