

Main Report

# Local Area Energy Plan (LAEP)

Caerphilly County Borough



# Abbreviations



Sponsors:



Delivery partners:



| Acronym | Definition or meaning                                |
|---------|------------------------------------------------------|
| CAPEX   | Capital Expenditure                                  |
| CCGT    | Combined Cycle Gas Turbine                           |
| CCR     | Cardiff Capital Region                               |
| DESNZ   | Department for Energy Security and Net Zero          |
| DFES    | Distribution Future Energy Scenarios                 |
| ECOFLEX | Flexible Eligibility Energy Company Obligation       |
| EPC     | Energy performance certificate                       |
| EV      | Electric Vehicle                                     |
| FES     | Future Energy Scenarios                              |
| GHG     | Greenhouse Gas                                       |
| HGV     | Heavy Goods Vehicles                                 |
| LAEP    | Local area energy planning or Local area energy plan |
| LDP     | Local Development Plan                               |
| LGV     | Light Goods Vehicles                                 |

| Acronym | Definition or meaning                                                                                            |
|---------|------------------------------------------------------------------------------------------------------------------|
| LSOA    | Lower super output area, a small area classification in the UK designed to have a comparable population.         |
| 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.                                                                          |
| RIIO    | Revenue = Incentives + Innovation + Outputs, a regulatory framework used by the UK energy regulator, Ofgem.      |
| RLDP    | Replacement Local Development Plan                                                                               |
| SDP     | Strategic Development Plan.                                                                                      |
| SLES    | Smart Local Energy System.                                                                                       |
| SMR     | Steam Methane Reformation.                                                                                       |
| TfW     | Transport for Wales.                                                                                             |
| WWU     | Wales and West Utilities.                                                                                        |

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## Navigating this report

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### Navigation to Sections

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Llywodraeth Cymru  
Welsh Government



This Local Area Energy Plan was prepared by Arup, Carbon Trust and Afallen on behalf of Caerphilly County Borough and co-ordinated across the region by the Cardiff Capital Region. 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 the County Borough to reach a net zero energy system

## Overview

As part of this project, three 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 three documents are the:

1. **Local Area Energy Plan** (*this document*) contains the overarching plan, focusing on the Caerphilly County Borough'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 taken to modelling and scenario analysis. This report is available upon request.
3. **Renewable Investment Prospectus** highlights short-term, regional and local renewable energy opportunities that have the greatest potential for delivery across the Cardiff Capital Region (CCR).

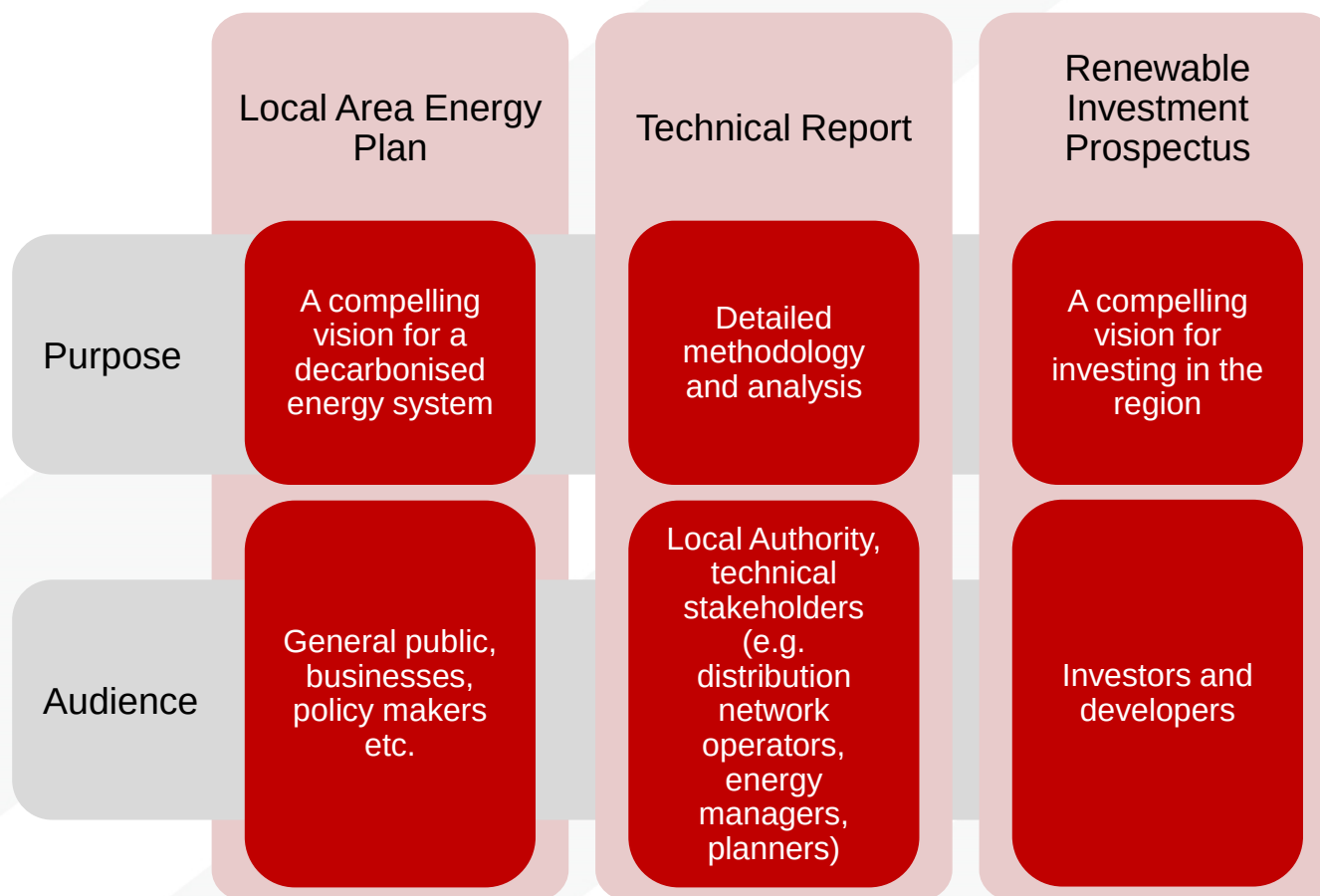


Figure 0.0.1: LAEP support documents purpose and audience summary



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# Executive summary

Caerphilly County Borough has a vision to transition the local energy system to net zero



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The **vision** for Caerphilly County Borough's future local energy system is:

To develop a net zero energy system for Caerphilly County Borough that harnesses local renewable resources, providing equitable, affordable, resilient, and sustainable energy to enable our residents and businesses to thrive.

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

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

1. To work collaboratively with national and regional partners, building partnerships to share best practice and learning, ensuring cohesive action to develop a net zero carbon energy system.

2. To work with businesses, schools, colleges and universities, nationally and regionally, to develop training opportunities to reduce demand, empower sustainable choices and support a just transition.

3. To generate clean, low carbon energy solutions that promote a healthier and more sustainable living environment.

4. To work with businesses to support the growth of clean energy industries and to encourage the creation of a low carbon green economy.

5. To encourage and enable residents to make more sustainable transport choices, promoting active travel, public transport and electric vehicles.

Increasing renewable generation

Getting buildings zero carbon ready

Making journeys more sustainable

Decarbonising energy networks

Supporting net zero businesses

# Executive summary

## Caerphilly County Borough's energy propositions



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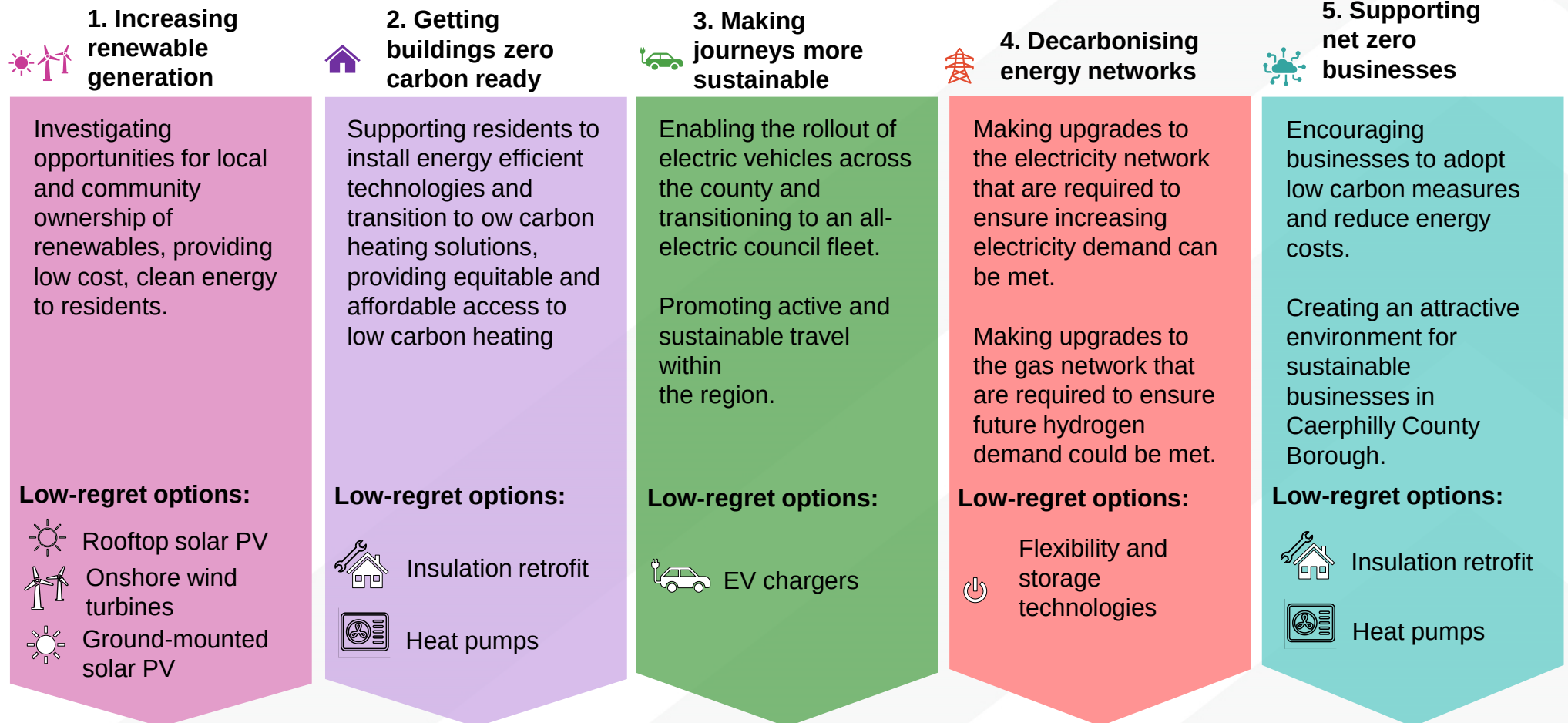


Figure 0.0.2: Summary of energy propositions

# Executive summary

Caerphilly County Borough's local energy system will need to change significantly to achieve net zero by 2050



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## Caerphilly County Borough's local energy system today



**200** heat pumps installed



**38%** domestic properties EPC A-C



**460** public EV charge points



**7.7 MW<sub>p</sub>** rooftop solar PV installed capacity



**44 MW<sub>p</sub>** ground-mounted solar PV installed capacity



**10 MW<sub>p</sub>** installed capacity

## The rate of change required

2023 2026 2029 2032 2035 2038 2041 2044 2047 2050

1

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

2

From 2030 onwards, it is assumed that deployment accelerates as technologies become more commercially attractive, awareness increases, supply chains develop, and they become more affordable.

3

From 2040 onwards, it is assumed that low-carbon technologies are widely used and tend towards their maximum feasible adoption, which causes the deployment rate to stabilise.

## What Caerphilly County Borough's net zero local energy system could look like in 2050, across the range of scenarios



**45,000 – 72,000** heat pumps installed



**100%** domestic properties EPC A-C



**16,000 – 18,000** public EV charge points



**68 - 100 MW<sub>p</sub>** rooftop solar PV installed capacity



**700 – 2,100 MW<sub>p</sub>** ground-mounted solar PV installed capacity



**~140 MW<sub>p</sub>** installed capacity

# Executive summary

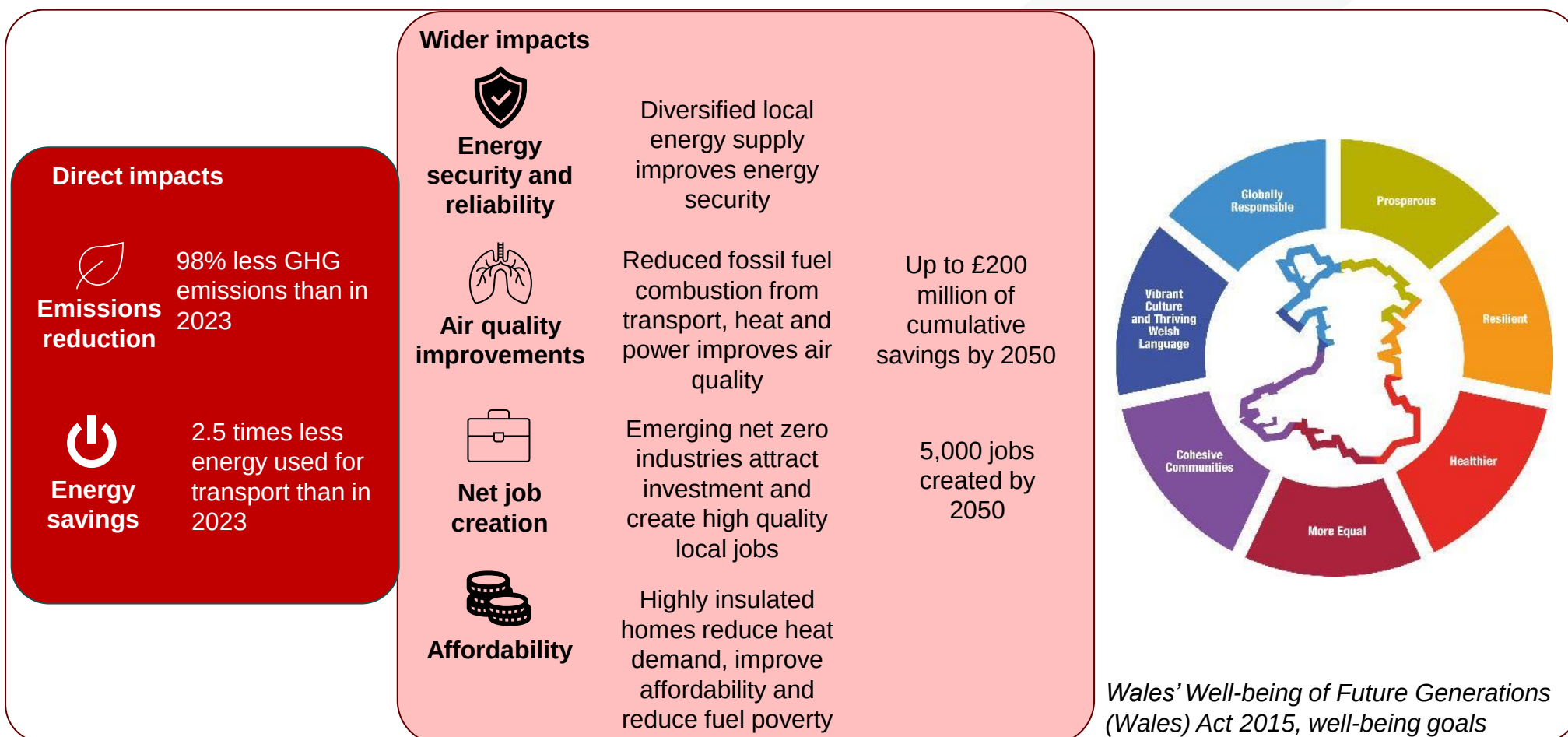
Achieving a net zero local energy system in 2050 aligns with the Well-being of Future Generations (Wales) Act 2015 and could lead to the following



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Delivery partners:



# Executive summary

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 0.0.3 identifies zones with particularly favourable conditions for specific energy components, making them ideal locations for pilot studies. The summary tables detail key figures for each zone by 2030: (i) pilot ambition, (ii) required investment for each pilot and (iii) total investment for all deployment in the zone, including all energy components and electricity network infrastructure interventions. Ranges show the minimum and maximum results from each future energy scenario modelled (see [Chapter 3](#) for more detail). Note: intervention should still be carried out in 'Progress' zones to transition the local area to net zero.

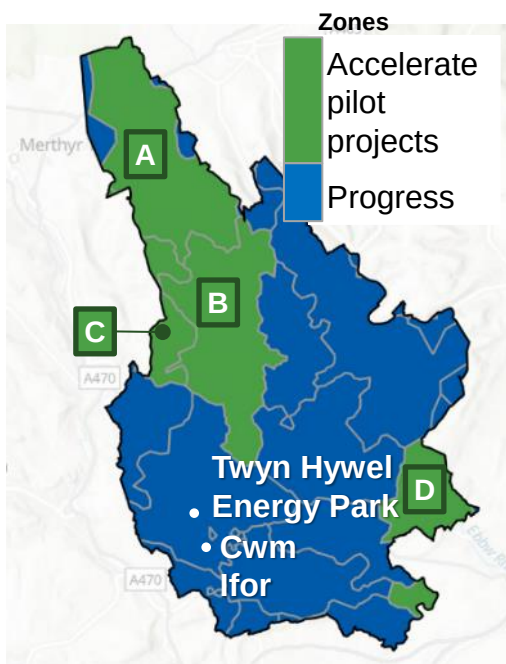


**Figure 0.0.3: Caerphilly County Borough's spatial representation of opportunities, including 2030 ambition and investment (million £). Zone boundaries are the modelling zone boundaries.**

|               | (i)                  | (ii)          | (iii)                                          |
|---------------|----------------------|---------------|------------------------------------------------|
| <b>Zone A</b> | <b>Abertysswg</b>    |               |                                                |
|               | 126 – 136 chargers   | £0.42 – 0.45m | <b>Zone A total</b><br><br><b>£49 – £159 m</b> |
|               | 67 MW                | £29m          |                                                |
|               | 0.7 MW               | £0.75m        |                                                |
|               | 500 – 900 heat pumps | £2.3 - £3.9m  |                                                |
|               | 1,600 – 2,600 homes  | £8.2 - £120m  |                                                |

|               |                     |              |                                           |
|---------------|---------------------|--------------|-------------------------------------------|
| <b>Zone B</b> | <b>Pengam Grid</b>  |              | <b>Zone B total</b><br><b>£67 - £386m</b> |
|               | 2 - 6 MW            | £2.3 – £6.5m |                                           |
|               | 3,400 - 7,000 homes | £21 - £340m  |                                           |
|               | 22 - 57 MW          | £10 – £25m   |                                           |

|               | (i)               | (ii)           | (iii)                                  |
|---------------|-------------------|----------------|----------------------------------------|
| <b>Zone C</b> | <b>Nantwen</b>    |                | <b>Zone C total</b><br><b>£4 - £6m</b> |
|               | 4 – 6 heat pumps  | £0.02 – £0.03m |                                        |
|               | 21 – 23 chargers  | £0.07 - £0.08m |                                        |
| <b>Zone D</b> | <b>Rogerstone</b> |                | <b>Zone D total</b><br><b>£16-£96m</b> |
|               | 1.5 MW            | £1.7m          |                                        |
|               | 0.05 MW           | £0.05m         |                                        |

## Suggested energy components to pilot in each zone

|  |            |  |                   |  |                     |
|--|------------|--|-------------------|--|---------------------|
|  | Heat pumps |  | Ground-mounted PV |  | Rooftop PV          |
|  | EV charger |  | Onshore wind      |  | Insulation measures |



Sponsors:



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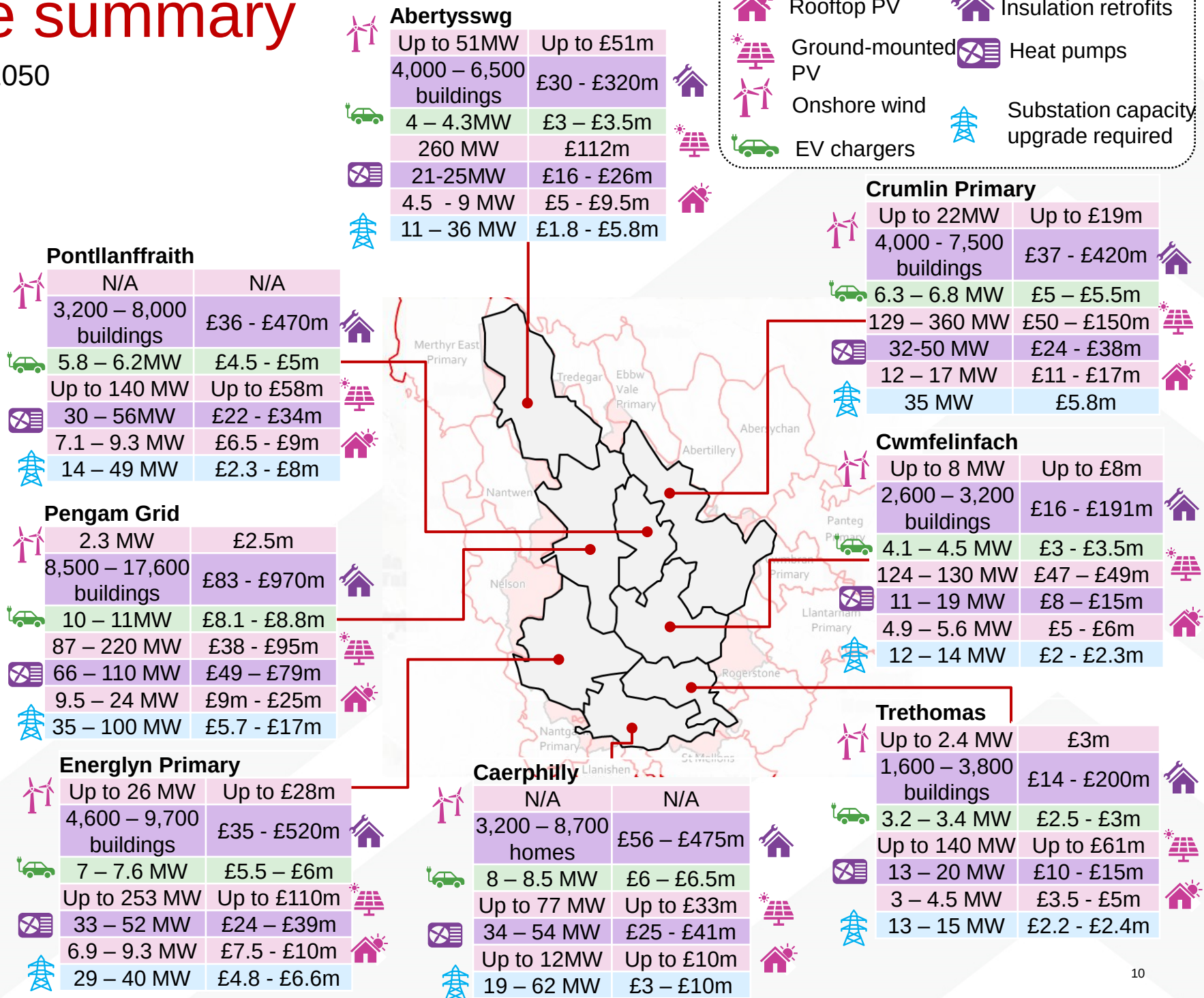
# Executive summary

## Plan on a page for 2050

This graphic highlights the potential location, scale of rollout and cost of some key measures that are expected to be required within Caerphilly County Borough's 2050 energy system. This system results from modelling to create the most cost and carbon optimal system. The scenarios produced are intended to provide models of a range of possible future Net Zero energy systems to help inform decision making, they are not intended as recommendations or targets for what should definitely happen.

\*Costs quoted using 2022 prices

**Figure 0.0.4: Caerphilly County Borough's spatial representation of opportunities, including 2050 ambition and investment (million £)**



# Executive summary

To deliver the LAEP, a series of actions and next steps have been developed for delivery



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## Action routemap

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

The action routemap takes each energy proposition and outlines critical, enabling actions that will be taken collectively alongside stakeholders in the coming decade, with a particular focus on what can be achieved in the next 5-7 years.

The sequencing of activities in the routemap is highly dependent on the political, regulatory, and strategic context within which it has been created. Therefore, it is expected to evolve over time and be regularly updated to ensure it remains relevant. Caerphilly County Borough's routemap can be found in Chapter 4: Action Planning.

## Next steps

**Progressing energy propositions:** A series of development activities will be undertaken for each prioritised proposition to advance towards delivery, including feasibility studies, detailed technical and commercial development, business case formulation, commercialisation, and procurement.

**Governance:** Integration of oversight of LAEP delivery with existing governance structures will be pursued where feasible.

**Monitoring:** Collaboration with regional and national partners will be established to develop a monitoring framework that builds on existing processes and facilitates an understanding of the progress Caerphilly County Borough is making towards its committed actions and ambitions as outlined in this plan.

**Engagement & collaboration:** The collaboration of various stakeholders with interests and influence over the local energy system has been instrumental in shaping this LAEP, and this collaboration must continue during the plan's implementation. The development of this LAEP has brought together stakeholders with shared interests and influence.

Caerphilly County Borough

# 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<sup>M01</sup>. 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<sup>M01</sup>.

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 implementation<sup>a</sup>.

#### Vision of a LAEP

A LAEP defines a long-term vision for an area but should be updated approximately every 3–5 years (or when significant technological, policy or local changes occur) to ensure the long-term vision remains relevant.

<sup>a</sup> 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.



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# 1. Introduction

## What is Local Area Energy Planning (LAEP)?

### Overview

#### Scope of a LAEP

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

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).

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 nationally available datasets.

#### 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 "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 Caerphilly County Borough planners to network operators to community groups, knowing they are working towards a common goal built on strong foundations.



Sponsors:



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# 1. Introduction

## The energy transition across Wales

### Overview

The Welsh Government's Net Zero Wales plan<sup>M03</sup> 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, 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<sup>M04</sup> 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<sup>M05</sup>. The 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.



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Delivery partners:

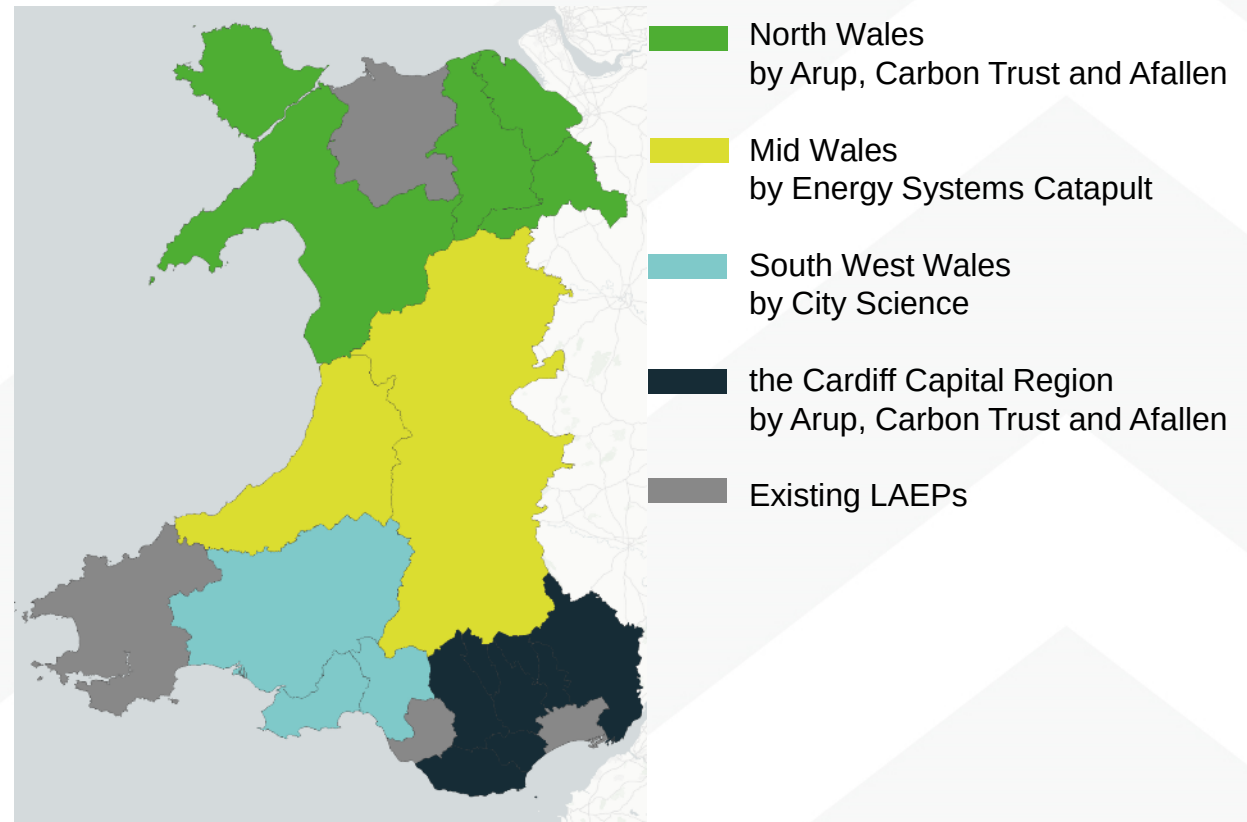


**Figure 1.0.1: Progress made in the development of LAEPs across Wales**

# 1. Introduction

## Boundary and scope

### Parts of the energy system analysed in a LAEP

A LAEP considers energy use, supply and generation within the Caerphilly County Borough 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.

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.

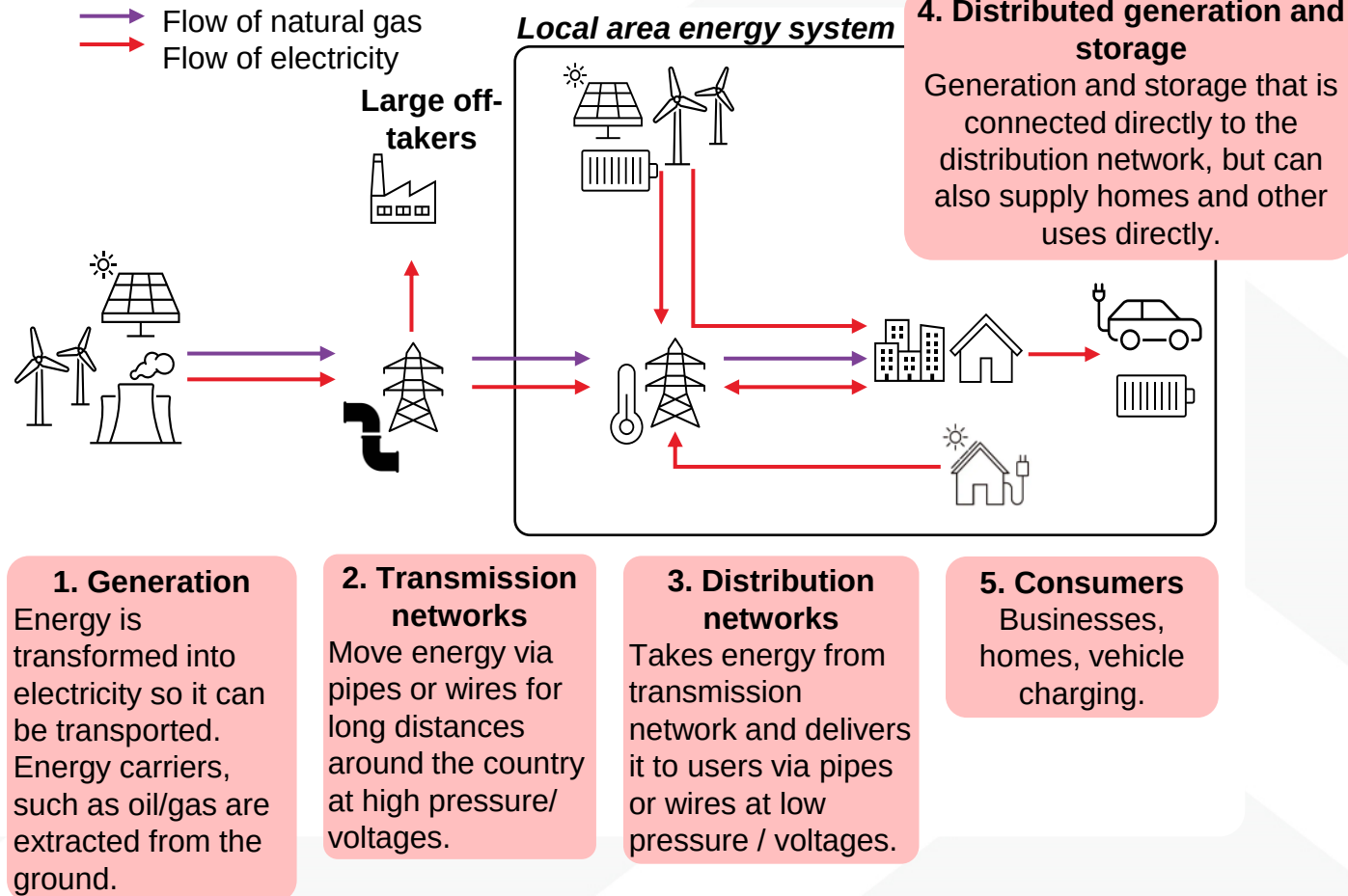


**Figure 1.0.2: Schematic of electricity and gas transmission and distribution network and the system boundary for LAEP**



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# 1. Introduction

## Boundary and scope - Definitions

### 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<sup>M01</sup>.

### Geographic boundary

The geographic boundary was used for Caerphilly County Borough 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

LAEP does not consider 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, 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 Caerphilly County Borough's decarbonisation journey.

- In scope of LAEP
- Out of scope of LAEP

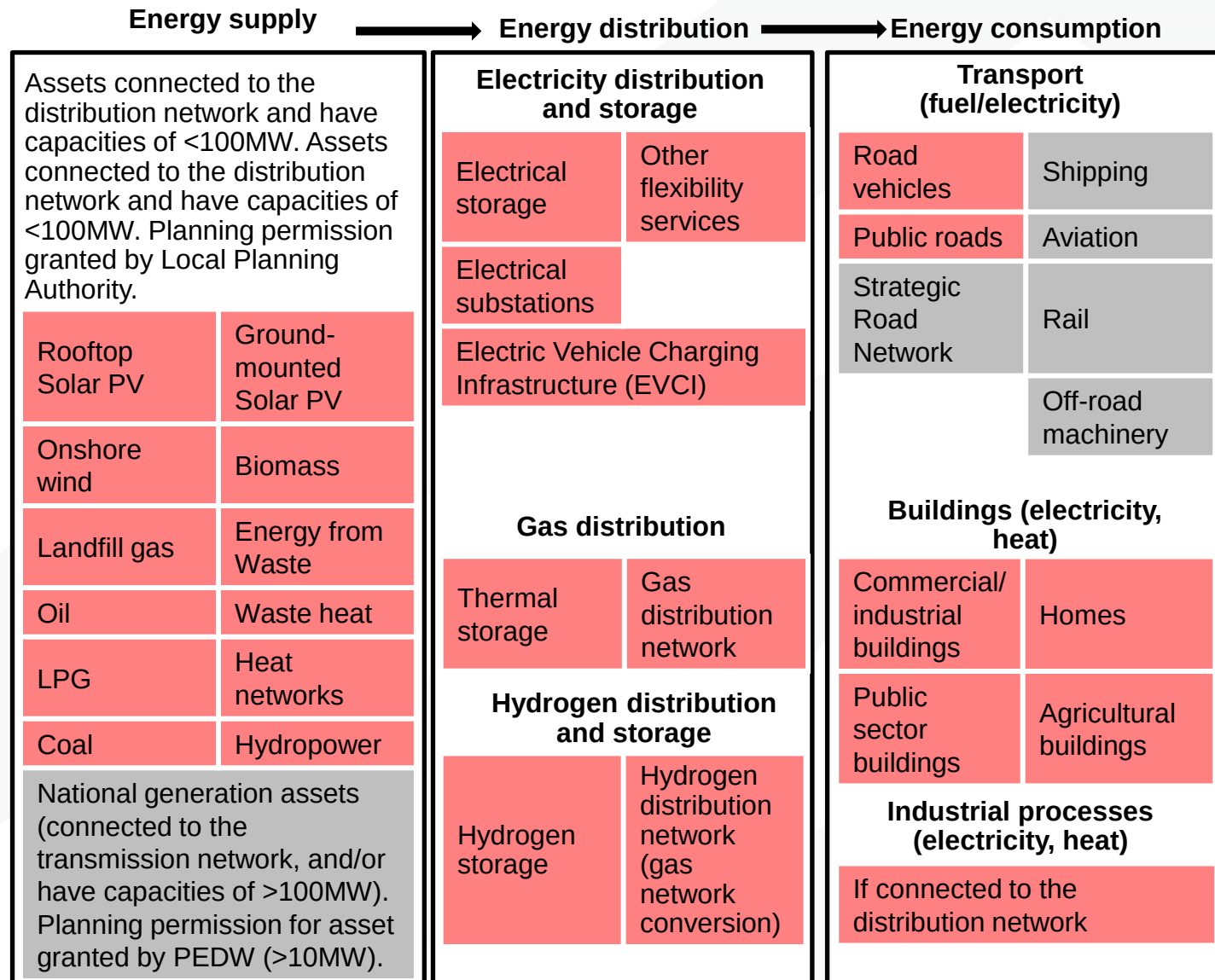


Figure 1.0.3: Schematic of the local system scope for LAEP



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# 1. Introduction

Our vision for their future local energy system

**Future energy system vision, objectives and principles**

The following vision statement underpins the ambition for a future net zero energy system in Caerphilly County Borough. Accompanying this statement, specific energy system objectives for the LAEP have been developed. The proposed actions outlined in Section 4 of this plan are designed to implement changes that will facilitate in achieving these objectives.

## **Caerphilly County Borough's LAEP vision:**

*To develop a **net zero energy system** for Caerphilly County Borough that **harnesses local renewable resources**, providing **equitable, affordable, resilient, and sustainable energy** to enable our residents and businesses to **thrive**.*

## **LAEP energy objectives**

- i. To work collaboratively with national and regional partners, building partnerships to share best practice and learning, ensuring cohesive action to develop a net zero carbon energy system.
- ii. To strengthen the local energy infrastructure to ensure a consistent, resilient, and secure energy supply capable of meeting future energy demand.
- iii. To work with businesses, schools, colleges and universities, nationally and regionally, to develop training opportunities to reduce demand, empower sustainable choices and support a just transition.
- iv. To generate clean, low carbon energy solutions that promote a healthier and more sustainable living environment.
- v. To work with businesses to support the growth of clean energy industries and to encourage the creation of a low carbon green economy.
- vi. To encourage and enable residents to make more sustainable transport choices, promoting active travel, public transport and electric vehicles.



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# 1. Introduction

## LAEP contents

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

### Plan structure

This plan is structured into four main topic areas:

1. **The current energy system** - description of Caerphilly County Borough's existing energy system and relevant policies and objectives.
2. **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.
3. **Action planning**- a routemap and action plan to drive the local energy system transition in Caerphilly County Borough, including what needs to happen and what the council and others will do.
4. **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.



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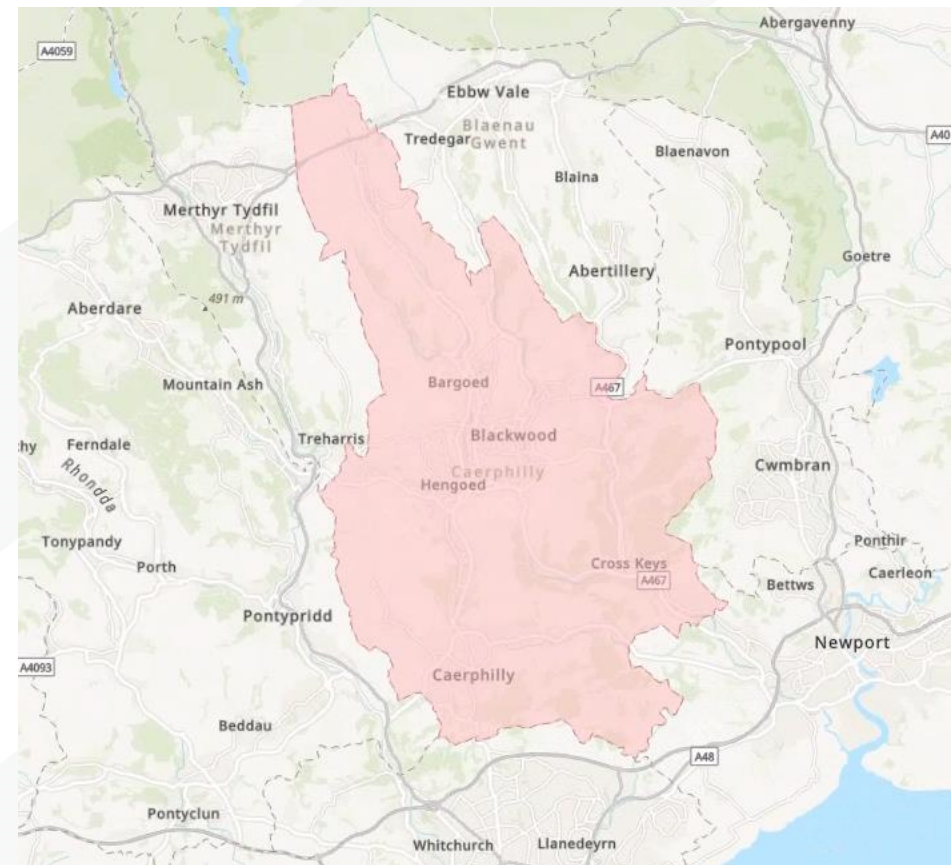


Figure 1.0.4: Geographic boundary for LAEP

Caerphilly County Borough

## Chapter 2: The current energy system



## 2. The current energy system

### Policy and funding context

Net Zero Wales 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, 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 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 Government 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 existing statutory powers as a Local Authority, the Council have established plans and policies relating to decarbonising energy use across their own operations and have begun to look further at how to influence changes within the borough through local place-making.

The figure summarise some key local, regional and national policies and strategies that will influence this LAEP.

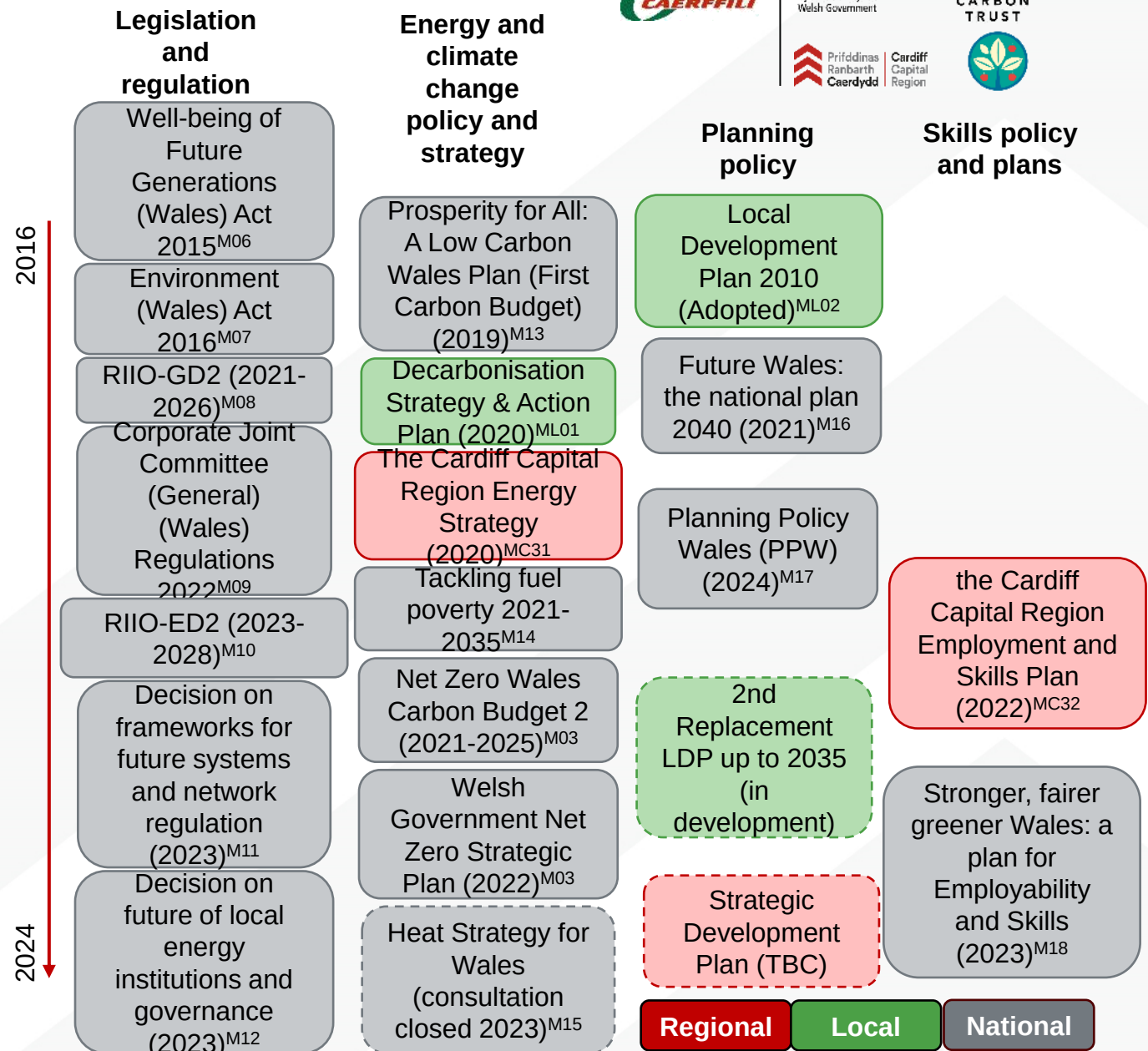
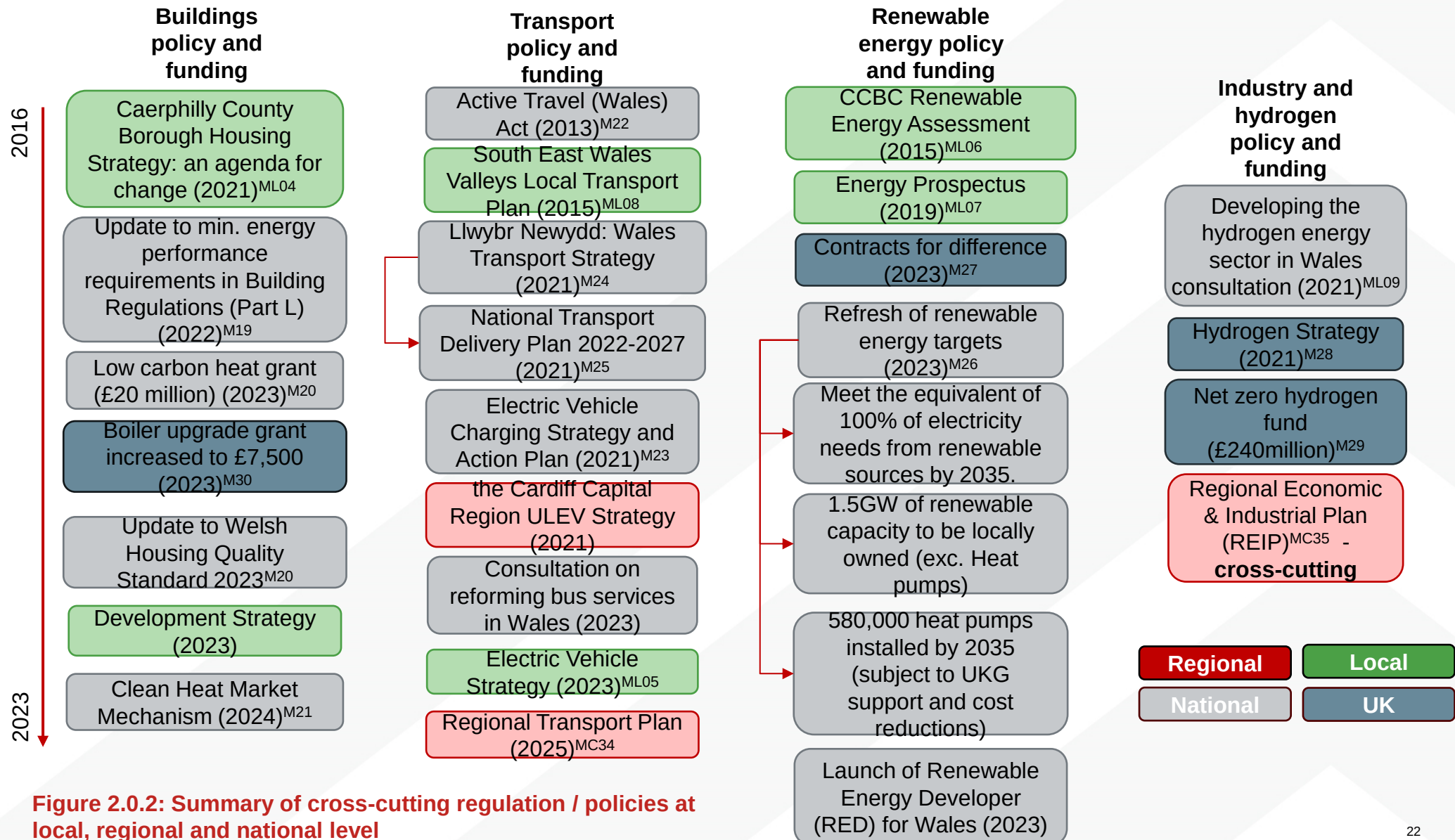


Figure 2.0.1: Summary of cross-cutting regulation / policies at local, regional and national level. Dashed border indicates in development

# 2. The current energy system

## Policy and funding context



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Industry and hydrogen policy and funding

Developing the hydrogen energy sector in Wales consultation (2021)<sup>ML09</sup>

Hydrogen Strategy (2021)<sup>M28</sup>

Net zero hydrogen fund (£240million)<sup>M29</sup>

Regional Economic & Industrial Plan (REIP)<sup>MC35</sup> - cross-cutting



Figure 2.0.2: Summary of cross-cutting regulation / policies at local, regional and national level

## 2. The current energy system

Our collaborative approach to developing and delivering the LAEP

### Stakeholder engagement approach

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

Stakeholders were prioritised based on their level of local influence and/or knowledge of 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.

Stakeholders were engaged at different stages of the development process to make sure stakeholders could help shape the plan and key development milestones. Regional steering groups for the Cardiff Capital Region were

attended by the regional and local authority leads, as well as bi-weekly meetings with the local authority leads. Three workshops were held regionally and involved primary stakeholders from across each local authority in the Cardiff Capital Region. These workshops were used at stages where it was important to agree on 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, 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.

*This report is accompanied by a **Technical Report** which includes more detailed information on the analysis methodology and engagement of*

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

**Table 2.0.1: Summary of stakeholders engaged through the LAEP development**



Sponsors:



Delivery partners:



## 2. The current energy system

### Caerphilly County Borough's energy baseline

#### How to read a Sankey diagram

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.

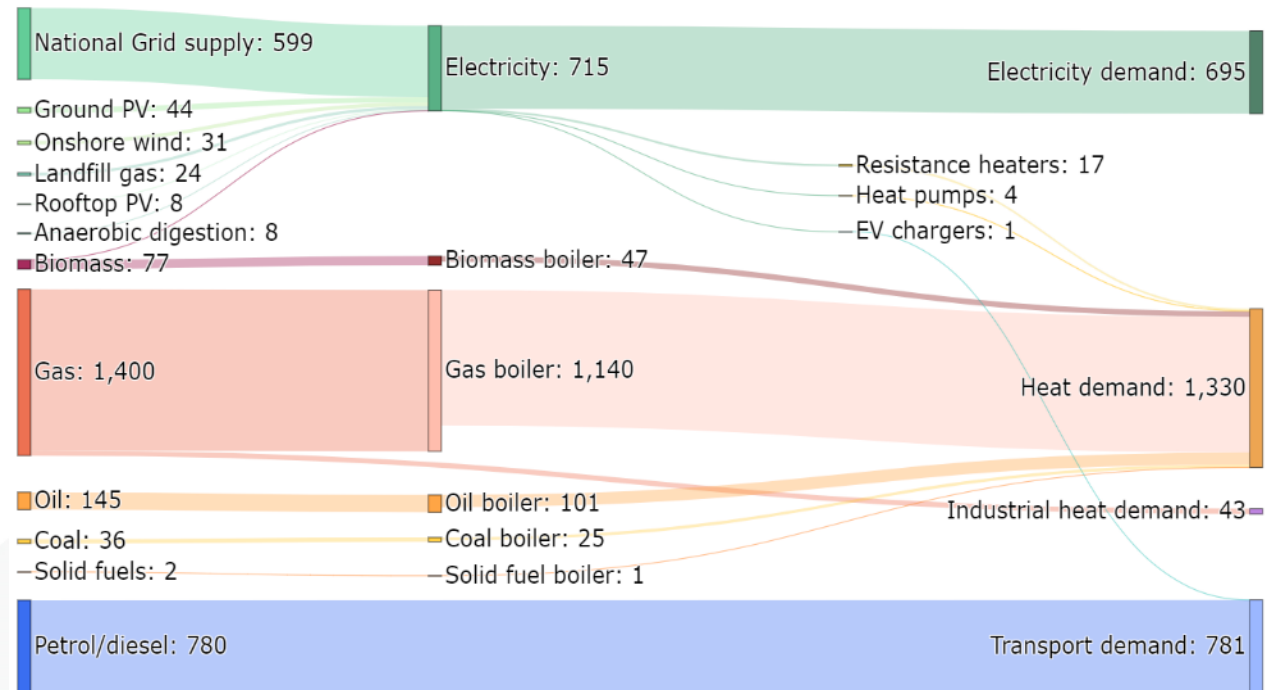
Results presented in this section reflect Caerphilly County Borough's energy baseline in 2023, apart from the transport (2015) and industry data (2019). Transport and industry datasets are the least likely to have changed in terms of electrification over the years 2019 to 2023, and transport is the most likely dataset to have changed due to COVID-19.

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 3.325MWh/year of electricity, which is 0.003GWh for comparison with the scale on the Sankey. In terms of gas, a typical home uses 12MWh/year, which is 0.012GWh for comparison with scale on the Sankey<sup>M40</sup>.



#### 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 2.0.3: How to read a Sankey diagram (units: GWh/yr)



Sponsors:



Delivery partners:



# 2. The current energy system

## Caerphilly County Borough's energy baseline

### Energy demand in 2023

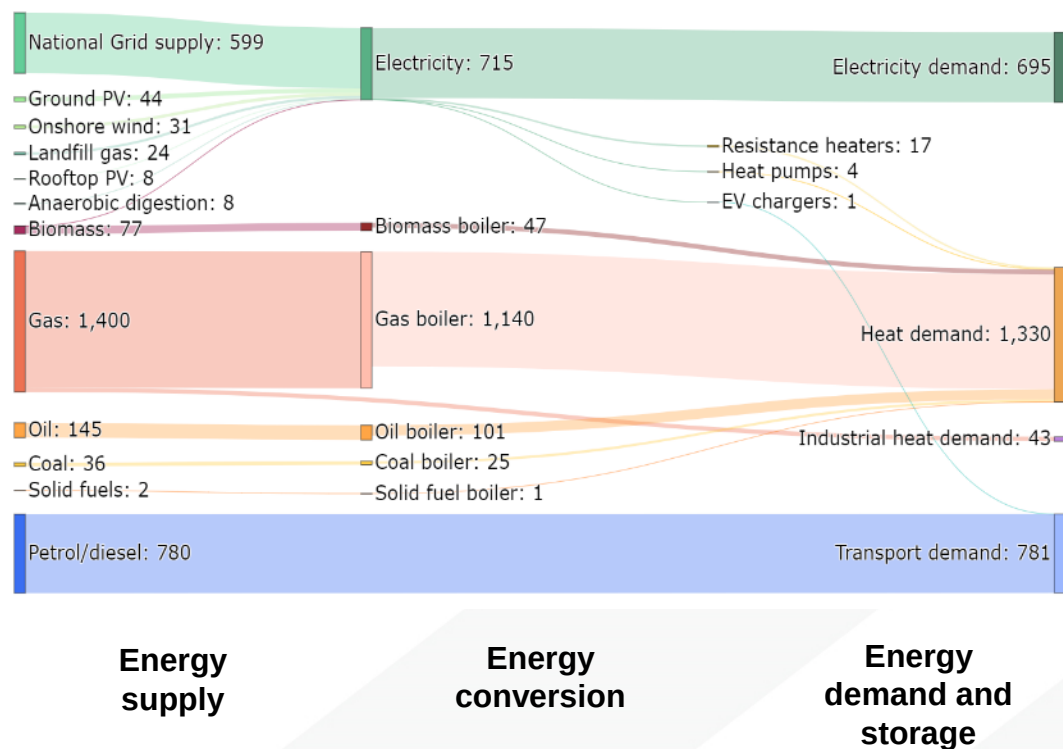


**Figure 2.0.4: Sankey diagram showing energy input, conversion and output in Caerphilly County Borough (units: GWh/yr)**



Sponsors:



Delivery partners:



Electricity

### Total energy demand

~24% of total energy demand

### Local generation

16% of electricity is generated locally, with 91 MW of local generation installed, 71 MW of this is renewable

Ground PV was the largest renewable energy source across the County

Industry

### Total energy demand

~1% of total energy demand

### Key industries

Caerphilly County Borough is not heavily industrialised. Activity mainly related to food and drinks manufacturing, medical products and technologies and aggregate manufacturing

Transport

### Total energy demand

~27% of total energy demand

### Car ownership

Cars account for 51% of transport emissions, with 1.16 cars per household. 0.17% of cars were electric or hybrid

### Electric Vehicles

75 charge points were listed on the National Chargepoint Registry (2023 data)

Heat

### Total energy demand

~48% of total energy demand

### Main source of demand

More than 98% of buildings are connected to the gas grid

### Domestic archetype

57% of homes are detached or semi-detached, homes have below-average levels of loft insulation

## 2. The current energy system

### Caerphilly County Borough's energy baseline

#### Buildings energy demand

#### Buildings and industry - Figure 2.0.5, left

Gas consumption totals 1,400 GWh across the County Borough. Heat demand was highest in substation zones with the highest levels of population, primarily because industrial activity in the County Borough is relatively low. Major industrial heating loads are associated with Convatec (medical devices), RF Brookes (food manufacturing), Hafod Asphalt Plant (aggregates) and Machen Quarry (aggregates)

#### Electricity demand - Figure 2.0.6, right

Electricity demand totals 715GWh across the County Borough. Electricity demand was highest in substation zones (Pengam Grid) with the highest population levels. Similarly to gas consumption, this is driven by the relatively low levels of industrial activity in the County Borough.

#### Buildings and industry

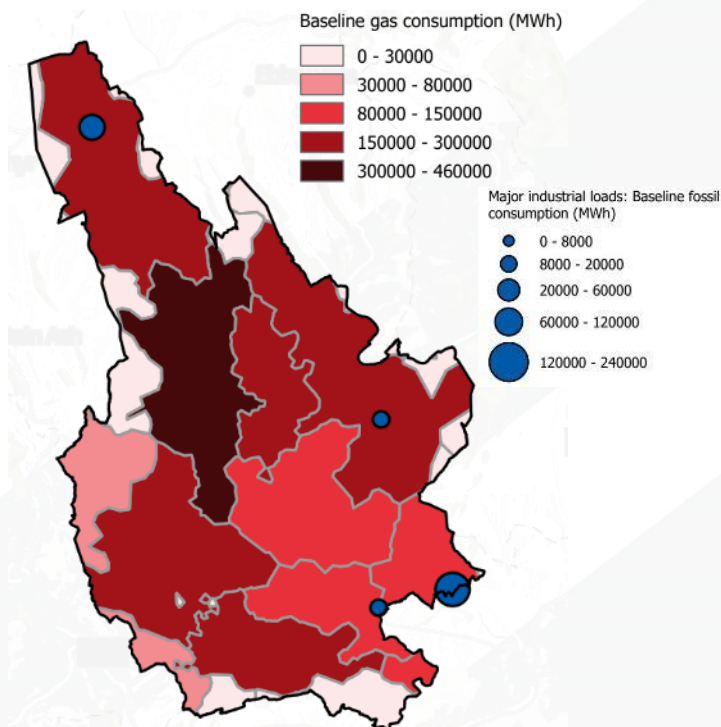


**Figure 2.0.5: Major industrial loads (2015) and gas consumption (2023) by substation zone across Caerphilly County Borough. The data is based on meter level gas consumption. (units: MWh)**

#### Electricity demand

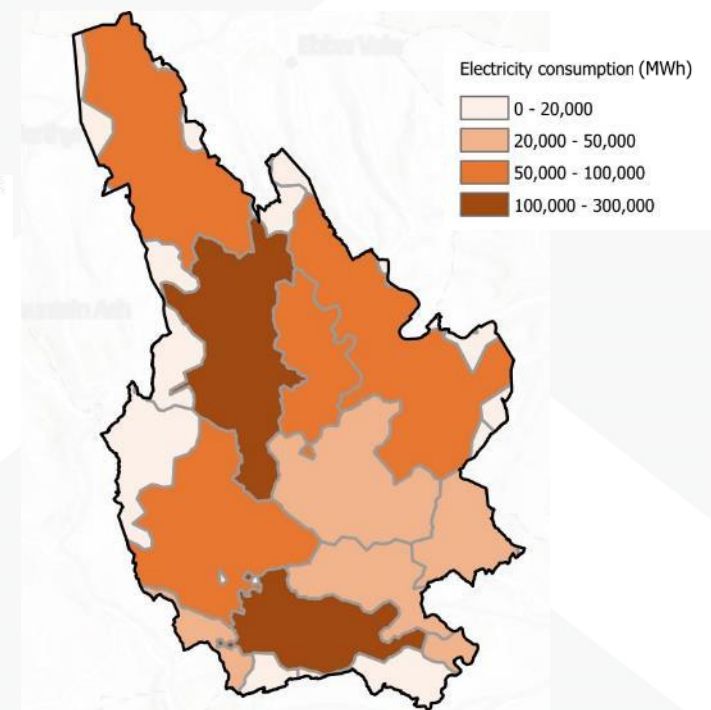


**Figure 2.0.6: Electricity consumption (combined total of domestic and non-domestic consumption) by substation zone across Caerphilly County Borough, using 2019 as a baseline year. (units: MWh)**



Sponsors:



Delivery partners:



## 2. The current energy system

### Caerphilly County Borough's energy baseline

#### Transport energy demand

#### Transport

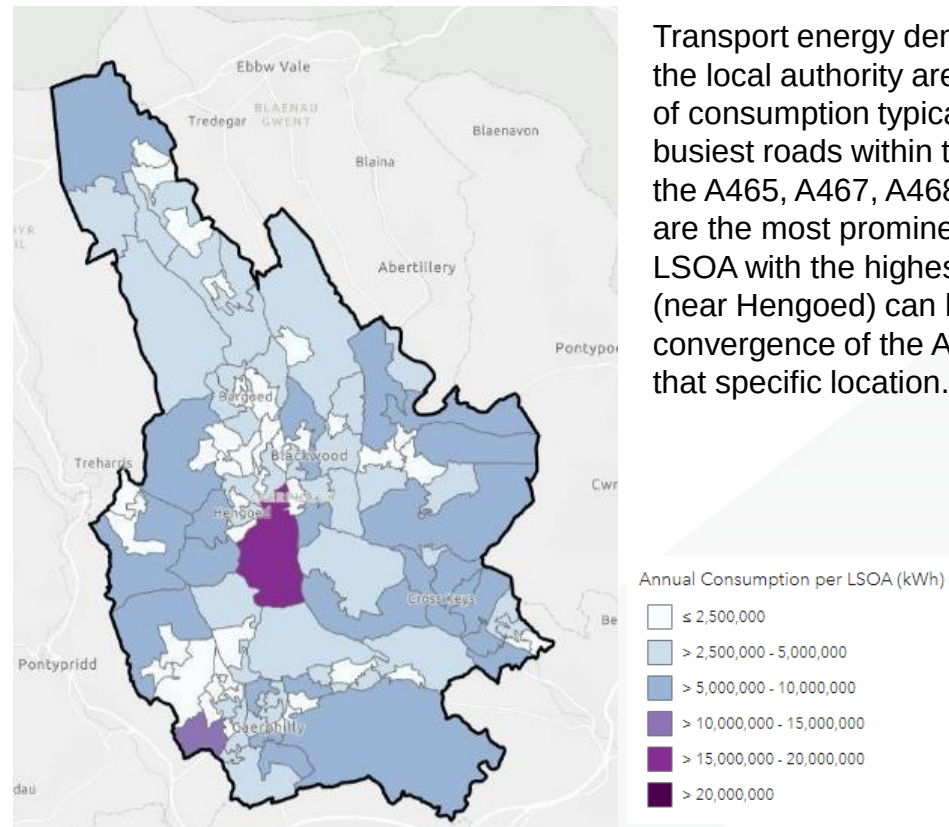


**Figure 2.0.7 : Transport energy consumption (combined total across cars, light goods vehicles (LGV) and heavy goods vehicles (HGV) by LSOA (2015)**



Sponsors:



Delivery partners:



# 2. The current energy system

## Caerphilly County Borough's energy baseline

### Transport energy baseline

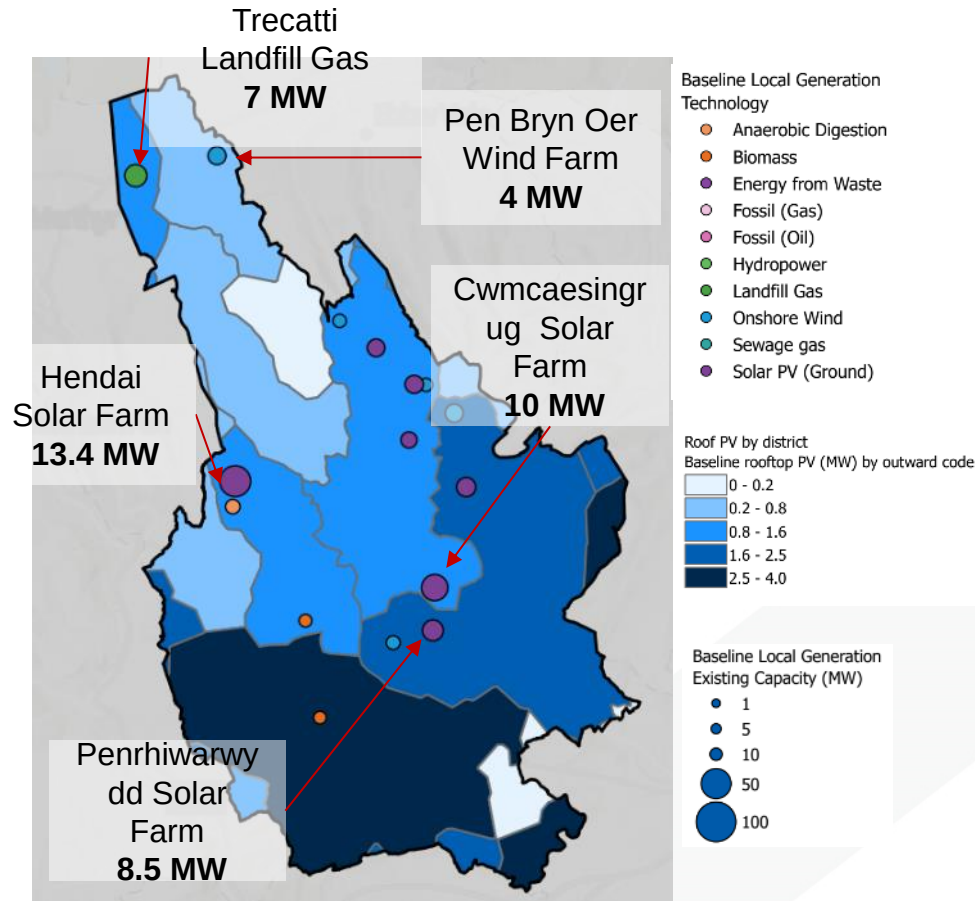


**Figure 2.0.8: Local energy generators. Data is based on Energy Generation Wales (2019) and Renewable Energy Generation Database (2019)**

\* Total may not equal 100% due to rounding



Sponsors:



Delivery partners:



Electricity generation

**91 MW** of local generation installed, **71 MW** of renewable generation

**20MWp** total fossil fuel powered generation capacity, from one oil fuelled power plant, Pentref Y Groes – this operates on a short-term basis to balance the grid

**53MWp** solar photovoltaic capacity from ground-mounted (45MW<sub>p</sub>) and rooftop installations (8MW<sub>p</sub>), top three sites:

- Hendai Solar Farm -13.4MW<sub>p</sub>
- Cwmcaesingrug Solar Farm - 10MW<sub>p</sub>
- Penrhiwarwydd Solar Farm - 8.5MW<sub>p</sub>

**10MWp** onshore wind generation capacity

**7MWp** landfill gas capacity from Trecatti landfill

Heat generation

Majority of heat was generated through gas boilers - **86%** of all heat within the County Borough.

The remainder of heat is delivered by oil (8%), biomass (3%), coal (2%), electricity (2%) and solid fuels (<0.1%)\*

Caerphilly County Borough has **no active district heating networks**

# 2. The current energy system

## Caerphilly County Borough's energy baseline

### Networks and infrastructure



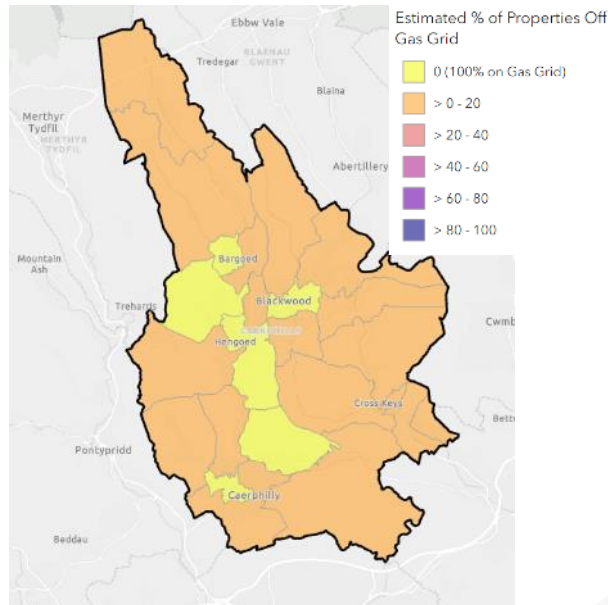
Sponsors:



Delivery partners:



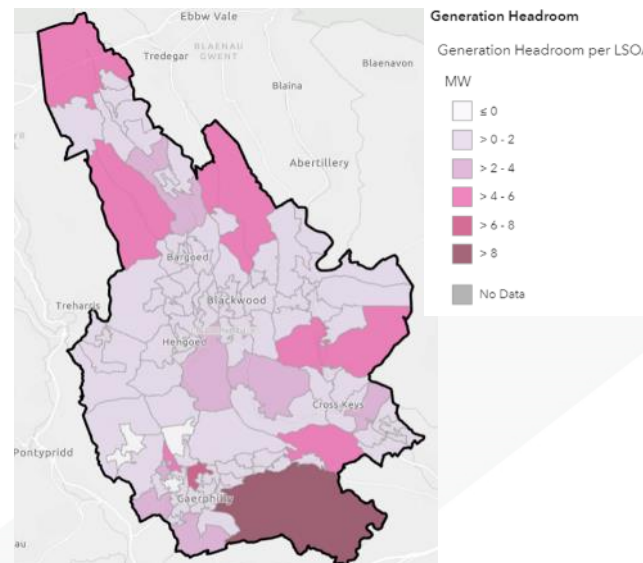
### Off-gas buildings



There are very few buildings that are not connected to the gas grid with some areas showing 100% connection, 98% of homes are connected to the gas grid, surpassing the average for Wales at 79%.

**Figure 2.0.9: % of properties that are not connected to the gas distribution network, using 2019 as a baseline year (MSOA)**

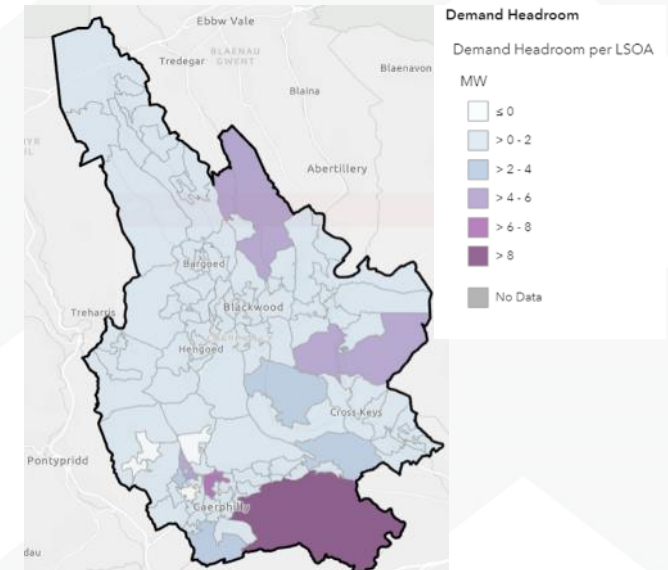
### Generation headroom



In Caerphilly County Borough, the generation headroom exhibited significant variation, ranging from 0 to 8 MW per LSOA with a median of 0 to 2 MW. This variability in generation headroom highlights various opportunities for increased electricity generation; most notably in areas such as Twyn Carno and Darran Valley, Machen and Rudry, Argoed, and Pwllypant.

**Figure 2.0.10: Electricity generation headroom by LSOA**

### Demand headroom



In Caerphilly County Borough, the demand headroom exhibited significant variation, ranging from 0 to 8 MW per LSOA with a median of 0 to 2 MW. This diversity in demand headroom highlights various opportunities for potential growth in electricity demand; most notably in areas such as Machen and Rudry, Argoed, and Pwllypant.

**Figure 2.0.11: Electricity demand headroom by LSOA**

# 2. The current energy system

## Caerphilly County Borough's energy baseline

### Local environmental, social and economic factors that influence energy



Sponsors:



Delivery partners:



#### Land

Total land area of 277 km<sup>2</sup>.

Over 75% of the county is covered in woods, farmland, commons and green spaces.

Caerphilly County Borough has 16 conservation areas, 13 Sites of Special Scientific Interest (SSSIs) and borders the Brecon Beacons National Park.

The north of the County Boroughs is located near the Ebbw Vale enterprise zone, the zone is located in Blaenau Gwent County Borough and consists of 8 key sites and over 40 acres of land.

#### Demographics

The County Borough has a population of 176,000 and a density of 634/km<sup>2</sup>, the fourth most densely populated local authority in Wales. The population has fallen by 1.6% between 2011 and 2021.

There are five principal centres within Caerphilly County Borough: Caerphilly, Blackwood, Risca, Bargoed and Ystrad Mynach – Caerphilly being the largest with a population of 41,000

In general Caerphilly County Borough sees more people commute out (31,800) of the area for work than commuting in (18,600). 61% of workers in Caerphilly also live there.

10.5% of the population can speak Welsh.

#### Socio-economics

8% of households are regarded as being in fuel poverty, this compares to 12% for the Welsh national average.

Around 26,000 people or 23.3% of the population aged 16 to 64 years were "economically inactive", this is slightly higher than the Wales average.

20% of those in employment work within the 'Manufacturing' sector; other large employing sectors are 'Wholesale And Retail Trade; Repair Of Motor Vehicles And Motorcycles' - 13% and 'Health And Social Work Activities' – 13%.

#### Emissions

In 2023, Caerphilly County Borough's total emissions were 477 ktCO<sub>2</sub>e, or 2.65 tCO<sub>2</sub>e per capita, the lowest per capita emissions of any local authority in Wales.

Buildings contributed 313 ktCO<sub>2</sub>e to the total emissions, accounting for 65% of the overall emissions. Transport contributed 156 ktCO<sub>2</sub>e, accounting for 33% of overall emissions.

Emissions have steadily been decreasing with an average decrease of 3% per year since 2005, with the domestic sector seeing the greatest absolute reduction in emissions.

## 2. The current energy system

Caerphilly County Borough Council, progress to date

Since declaring a climate emergency in 2019, the council has worked to reduce its organisational carbon emissions, and has begun to support the wider community to do the same.

Caerphilly County Borough Council has developed a *Decarbonisation Strategy* that aligns with its overarching objective of becoming a "Net carbon neutral authority" by 2030. Working groups have been established to drive forward the work on each of the four pillars. This commitment is further supported by a detailed *Action Plan* and *Energy Prospectus* detailing potential commercial projects aimed at achieving decarbonisation.

The council has a housing stock 10,700 homes and has made positive steps to improve energy efficiency through the *Welsh Housing Quality Standard* whilst also securing funding to construct 18 *Passivhaus* apartments. The council has made a commitment to build a further 10,000 new affordable homes by 2033, following a fabric first approach.

With the creation of a dedicated decarbonisation team in 2022, more resource has been available to support a range of decarbonisation initiatives such as development of the Penyrheol Solar Farm, reforestation and hydrogen feasibility studies.

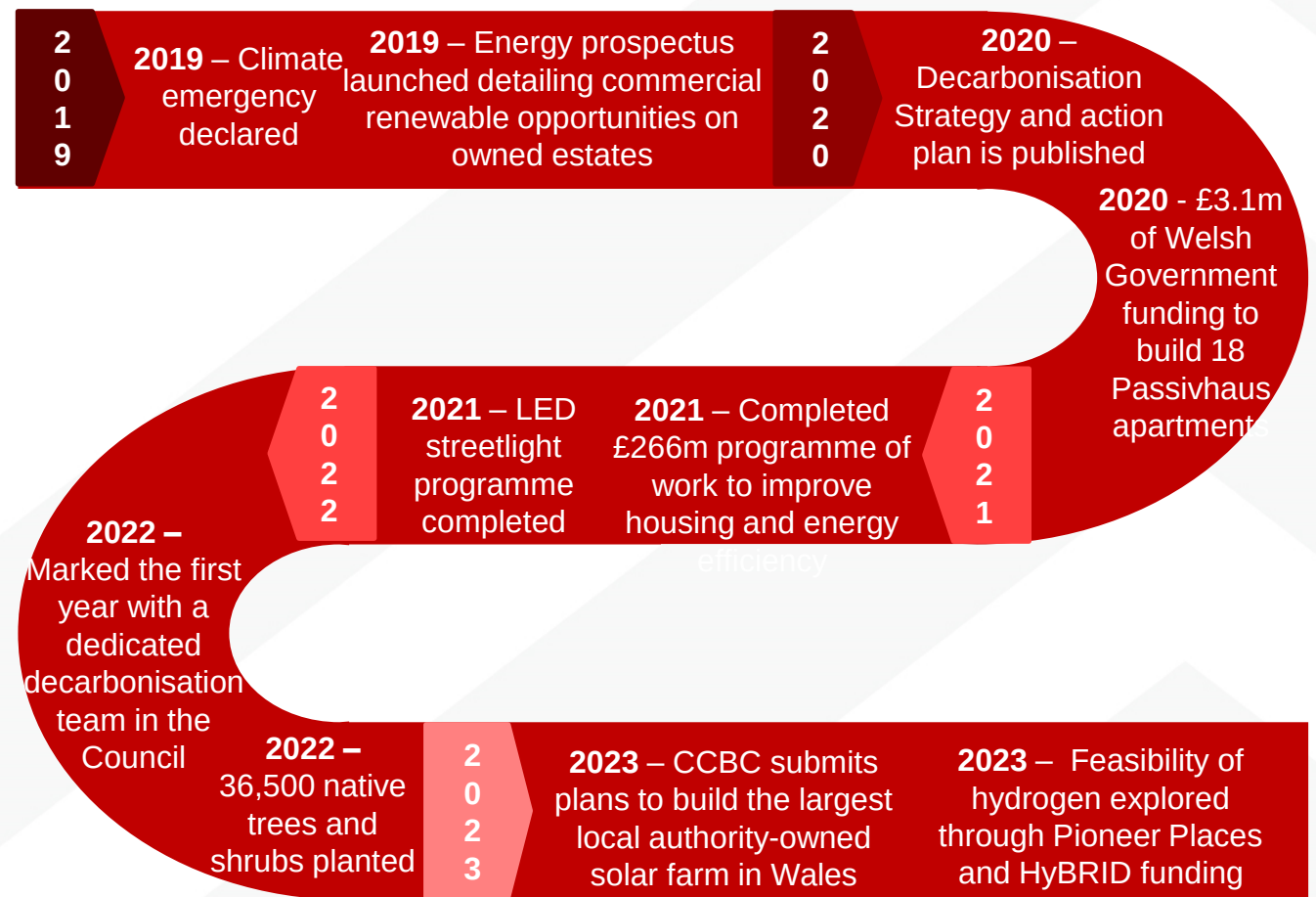


**Figure 2.0.12: Summary of council activities to date that have contributed to decarbonising the local energy system**



Sponsors:



Delivery partners:



## 2. The current energy system

### Progress to date, from other organisations

Fostering collaboration between public and private sector entities is imperative for the successful delivery of comprehensive decarbonisation efforts within Caerphilly County Borough. The examples from Aneurin Health University Board and Natural Resources Wales here provide a snapshots of progress within the public sector, it is important to acknowledge that these are just a few highlights amidst a landscape of diverse and dynamic initiatives. Numerous other public and private sector stakeholders are actively engaged in decarbonisation efforts, each contributing in their own unique way to mitigating climate change impacts. From local businesses implementing energy-efficient practices, community groups advocating for sustainable development; the breadth and depth of activity across the region underscores the shared commitment towards building our future energy system.



Natural Resources Wales (NRW) is actively engaged in efforts to reduce carbon emissions and promote sustainability. Over the past five years, NRW has made substantial strides to reduce their operational greenhouse gas emissions, with a 34% reduction in emissions between 2018/19 and 2021/22<sup>ML03</sup>.

Within the energy realm, NRW has contributed towards the delivery of Welsh Government's energy and low carbon aspirations. Managing 7% of Wales' land area through the Welsh Government Woodland Estate (WGWE) NRW are a key stakeholder in the deployment of renewable energy production with a growing track record of delivering wind farms, ground-mounted solar and hydropower projects across Wales.



Sponsors:



Delivery partners:



In the last decade, the Aneurin Bevan University Health Board has made consistent progress with reducing both energy consumption and carbon emissions. Since the original baseline in 2009/10 the Health Board has cut carbon emissions by 17,418 tonnes CO<sub>2</sub>, equating to a 45% reduction<sup>ML04</sup>

The Decarbonisation Framework, forms the basis for the Health Board's response to commitments and objectives set out in the national NHS Wales Decarbonisation Strategic Delivery Plan. This outlines the main areas of focus for a net zero trajectory; the goals and objectives required to meet performance targets and provide a time-scale and action plan.

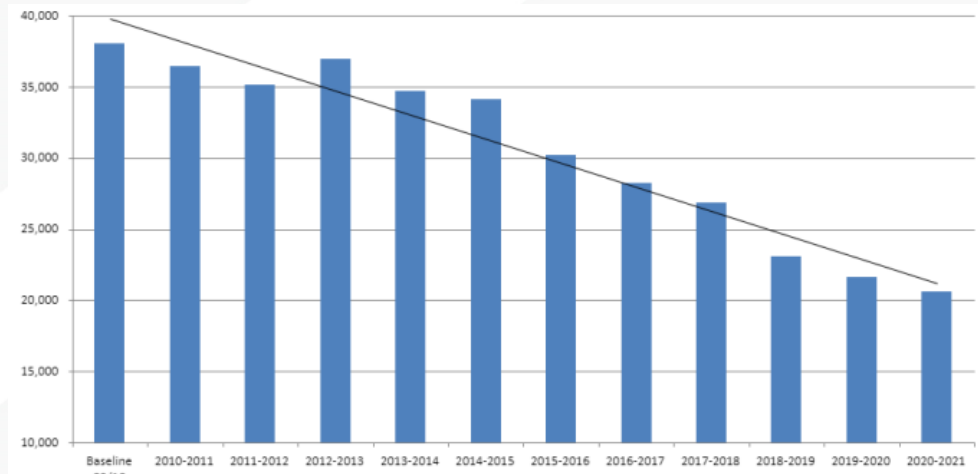


**Figure 2.0.13: Summary of emissions reduction (tCO<sub>2</sub>e) achieved by Aneurin Bevan University Health Board to date**  
(Source: Aneurin Bevan University Health Board, Decarbonisation Framework)

Caerphilly County Borough

## Chapter 3: The future energy system



# 3. The future energy system

## Overview

### Vision and objectives

#### Our vision

*To develop a net zero energy system for Caerphilly County Borough that harnesses local renewable resources, providing equitable, affordable, resilient, and sustainable energy to enable our residents and businesses to thrive.*

#### Objectives of the plan

Working with stakeholders, the following objectives for the plan have been defined:

1. To work collaboratively with national and regional partners, building partnerships to share best practice and learning, ensuring cohesive action to develop a net zero carbon energy system.
2. To strengthen the local energy infrastructure to ensure a consistent, resilient, and secure energy supply capable of meeting future energy demand.
3. To work with businesses, schools, colleges and universities, nationally and regionally, to develop training opportunities to reduce demand, empower sustainable choices and support a just transition.
4. To generate clean, low carbon energy solutions that promote a healthier and more sustainable living environment.
5. To work with businesses to support the growth of clean energy industries and to encourage the creation of a low carbon green economy.
6. To encourage and enable residents to make more sustainable transport choices, promoting active travel, public transport and electric vehicles.



Sponsors:



Delivery partners:



# 3. The future energy system

## Overview

### Vision and objectives



Sponsors:



Delivery partners:



### Understanding the future energy system

There is a need to transition the energy system in Caerphilly County Borough to net zero by 2050.

However, it is recognised that there are multiple plausible and attractive future energy systems for the County Borough, contingent upon various factors. This encompasses potential shifts in technology costs over time, alongside broader policy determinations to be made by Welsh and UK Governments. Such factors will shape the adoption of hydrogen, for instance.

### Scenario analysis

The plan was informed by employing scenario analysis to explore potential outcomes of a net zero future energy system under various scenarios, including considerations of reduction measures and potential energy sources. Four future energy scenarios were modelled, and the most cost- and carbon-effective approach to meeting demand in each was determined. Through this process, technologies that played significant roles in all modelled scenarios were identified. These technologies represent low- and no-regrets options, likely to be cost-effective and provide substantial benefits, irrespective of future uncertainties.

### Deployment modelling

This involved examining aspects of each energy proposition to determine how they might be deployed between now and 2050, creating deployment pathways. These pathways indicate the scale of change required over time and the sequencing of activities necessary 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. Utilising this context helped define a suitable level of ambition and consolidate all evidence into an action plan.

# 3. The future energy system

## Overview



Sponsors:



Delivery partners:

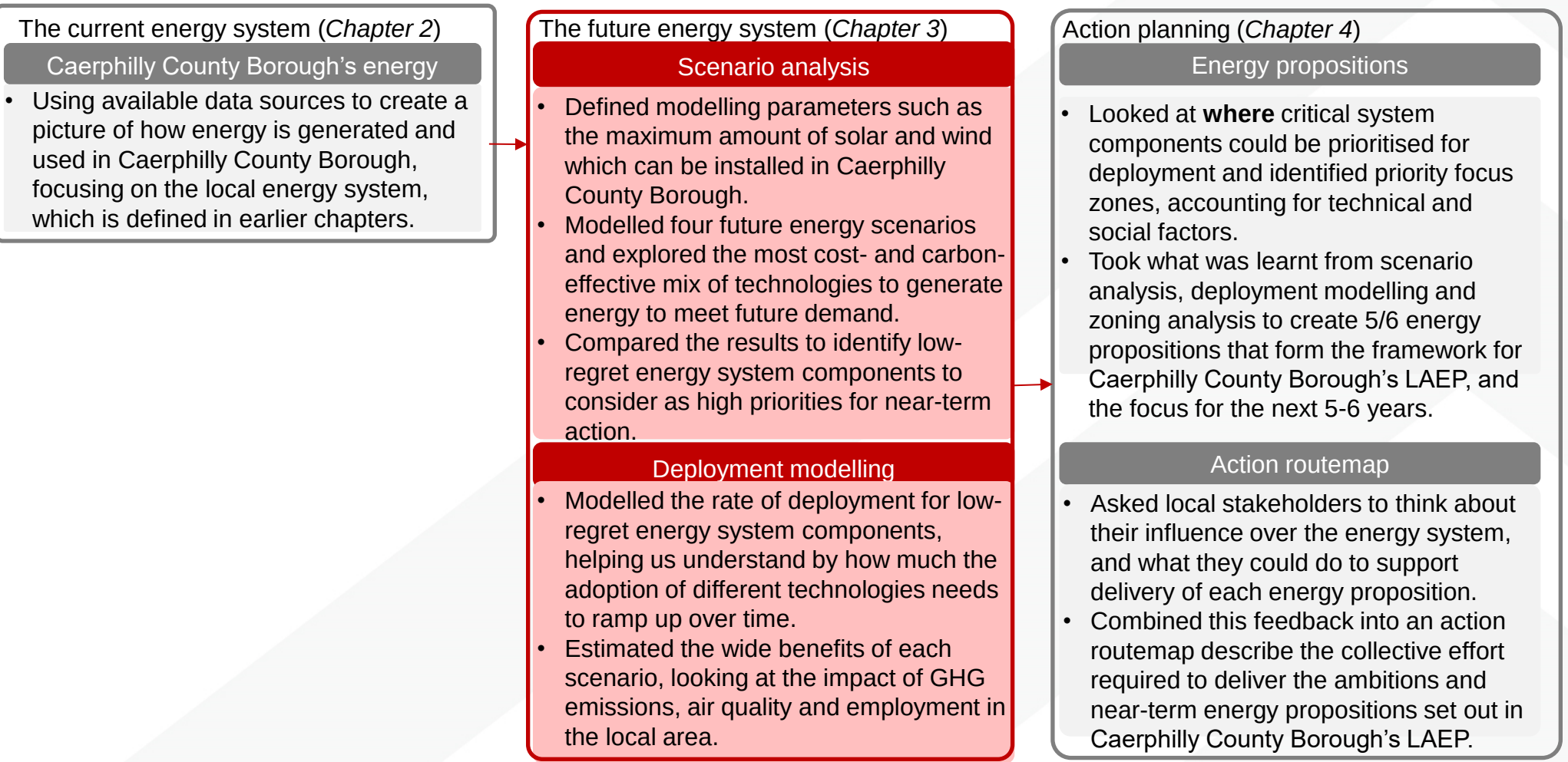


Figure 3.0.1: Summary of steps taken to produce the LAEP

# 3. The future energy system

## Scenario analysis

### Summary of future energy scenarios



Sponsors:



Delivery partners:



|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Do Nothing</b>        | <ul style="list-style-type: none"><li>• A scenario for comparison which considers committed activities and assumes that current and consulted upon policy goes forward and remains consistent.</li><li>• This scenario provides a cost counterfactual.</li><li>• There is no decarbonisation target for this scenario and it has not been derived from optimisation modelling.</li></ul>                                                                                                                                                                                                  |
| <b>National Net Zero</b> | <ul style="list-style-type: none"><li>• Uses the lowest cost and carbon combination of technologies to meet Wales' 2050 net zero target.</li><li>• Assumes a moderate level of energy demand reduction across the system.</li><li>• 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 as national assets and outside the scope of the LAEP).</li></ul> |
| <b>Low Demand</b>        | <ul style="list-style-type: none"><li>• Considers the lowest future energy demand across different sectors.</li><li>• Explores the impact of energy-reducing initiatives (home fabric improvements) and uptake of active travel and public transport use.</li><li>• Model finds the lowest cost and carbon combination of technologies to meet predicted future energy demand.</li><li>• Import and export of electricity as National Net Zero</li></ul>                                                                                                                                  |
| <b>High Demand</b>       | <ul style="list-style-type: none"><li>• Considers the highest future energy demand across sectors.</li><li>• Model finds the lowest cost and carbon combination of technologies to meet predicted future energy demand.</li><li>• Import and export of electricity as National Net Zero</li></ul>                                                                                                                                                                                                                                                                                         |
| <b>Energy Island</b>     | <ul style="list-style-type: none"><li>• Considers the highest plausible future energy demand across sectors.</li><li>• Explores impact of restricting electricity imports and increasing reliance on local renewable generation.</li></ul>                                                                                                                                                                                                                                                                                                                                                |

Figure 3.0.2: Summary of future energy scenarios

# 3. The future energy system

## Scenario analysis

### National Net Zero scenario

Figure 3.0.3 depicts a potential future energy system for Caerphilly County Borough, developed through modelling to achieve the most cost-effective and carbon-efficient system. A variety of scenarios have been created to inform local decision-making processes. It's important to note that while the optimisation modelling informs deployment strategies, this is an indicative pathway and does not represent the final pathway and vision for the local area.



Sponsors:



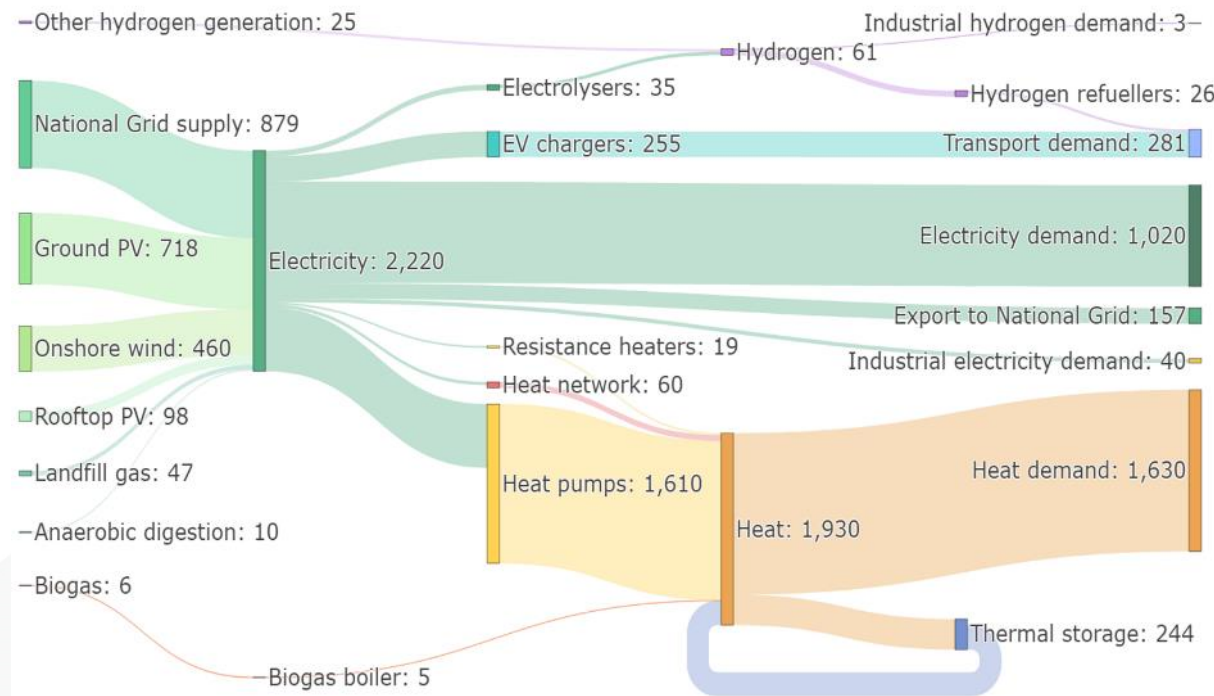
Delivery partners:



Electricity demand could increase threefold as it becomes the primary vector for heat and transport demand

Onshore wind, ground-mounted and rooftop solar PV could provide 57% of the local electricity supply

Landfill gas capacity increases, alternatively this could be provided by an increase in grid imports



The transport sector could be almost fully electrified, with some contribution from hydrogen refuellers.

Heat demand could grow 22% and be met entirely through heat pumps and waste heat delivered through heat networks. 50% less input energy is required (compared to 2019) to provide the increased 2050 baseline demand.

Thermal storage could be the primary means of storing energy due to the relative low cost to deploy

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

# 3. The future energy system

## Scenario analysis

### Energy system components

Table 3.0.1 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, rooftop solar and onshore wind generation consistently increasing across all scenarios. Energy storage plays a crucial role with varying proportions in all scenarios. The Energy Island scenario represents a significant deviation from all other scenarios, with increased deployment of ground-mounted PV and energy storage.

Import from grid increases in all scenarios except for low demand due to improved energy efficiency and lower total energy demand in this scenario.

Hydrogen is incorporated into the energy mix in all scenarios, primarily used to support heavy transport demands. Transport demand decarbonises almost primarily due to the supply of electricity, through the deployment of EV charge points.

Heat pumps emerge as the dominant solution for meeting heat demand across all scenarios. While heat networks and other technologies contribute, their impact remains comparatively minor.

| Energy system components                     | Baseline (GWh) | National net zero (GWh) | High demand (GWh) | Low demand (GWh) | Energy Island (GWh) |
|----------------------------------------------|----------------|-------------------------|-------------------|------------------|---------------------|
| Ground-mounted PV                            | 44             |                         | ↑ 718             |                  | ↑ 1,980             |
| Rooftop PV                                   | 8              |                         | ↑ 98              |                  | ↑ 62                |
| Onshore wind                                 | 31             |                         | ↑ 460             |                  | ↑ 414               |
| Biomass                                      | 77             |                         | ↓ 6               |                  | ↓ 4                 |
| Hydrogen import                              | 0              | ↑ 25                    | ↑ 24              | ↑ 17             | ↑ 16                |
| Electrolyser                                 | 0              | ↑ 35                    | ↑ 33              | ↑ 44             | ↑ 41                |
| Import from grid                             | 599            | ↑ 879                   | ↑ 891             | ↓ 474            | ↓ 0                 |
| EV chargers                                  | 1              | ↑ 255                   | ↑ 275             | ↑ 255            | ↑ 275               |
| Refuellers                                   | 0              | ↑ 26                    | ↑ 24              | ↑ 26             | ↑ 24                |
| Heat pumps                                   | 4              | ↑ 1610                  | ↑ 1610            | ↑ 984            | ↑ 1650              |
| Heat networks                                | 0              |                         | ↑ 60              |                  |                     |
| Resistance heaters                           | 17             | ↑ 19                    | ↑ 19              | ↓ 8              | ↑ 24                |
| Biomass boilers                              | 47             | ↓ 5                     | ↓ 5               | ↓ 5              | ↓ 3                 |
| Energy storage (thermal, battery and pumped) | N/A            | ↑ 244                   | ↑ 243             | ↑ 196            | ↑ 1,132             |

**Table 3.0.1: Annual energy demand comparison across the scenarios**



Sponsors:



Delivery partners:



# 3. The future energy system

## Deployment modelling

### Impact on energy demand

Deployment modelling sets out how quickly each energy component could be deployed in each optimisation scenario and the Do Nothing scenario. The rate of change in the Do Nothing scenario is based on current deployment rates and policy levers, whereas the other scenarios show trajectories that meet the optimisation models, taking into account the need for growth in the supply chain.

Figure 3.0.4 shows how the energy demand could change over time in the different sectors for the baseline, 2030 and 2050.

The energy demand has then converted into carbon emissions, numbers of jobs and air quality, on the following pages.

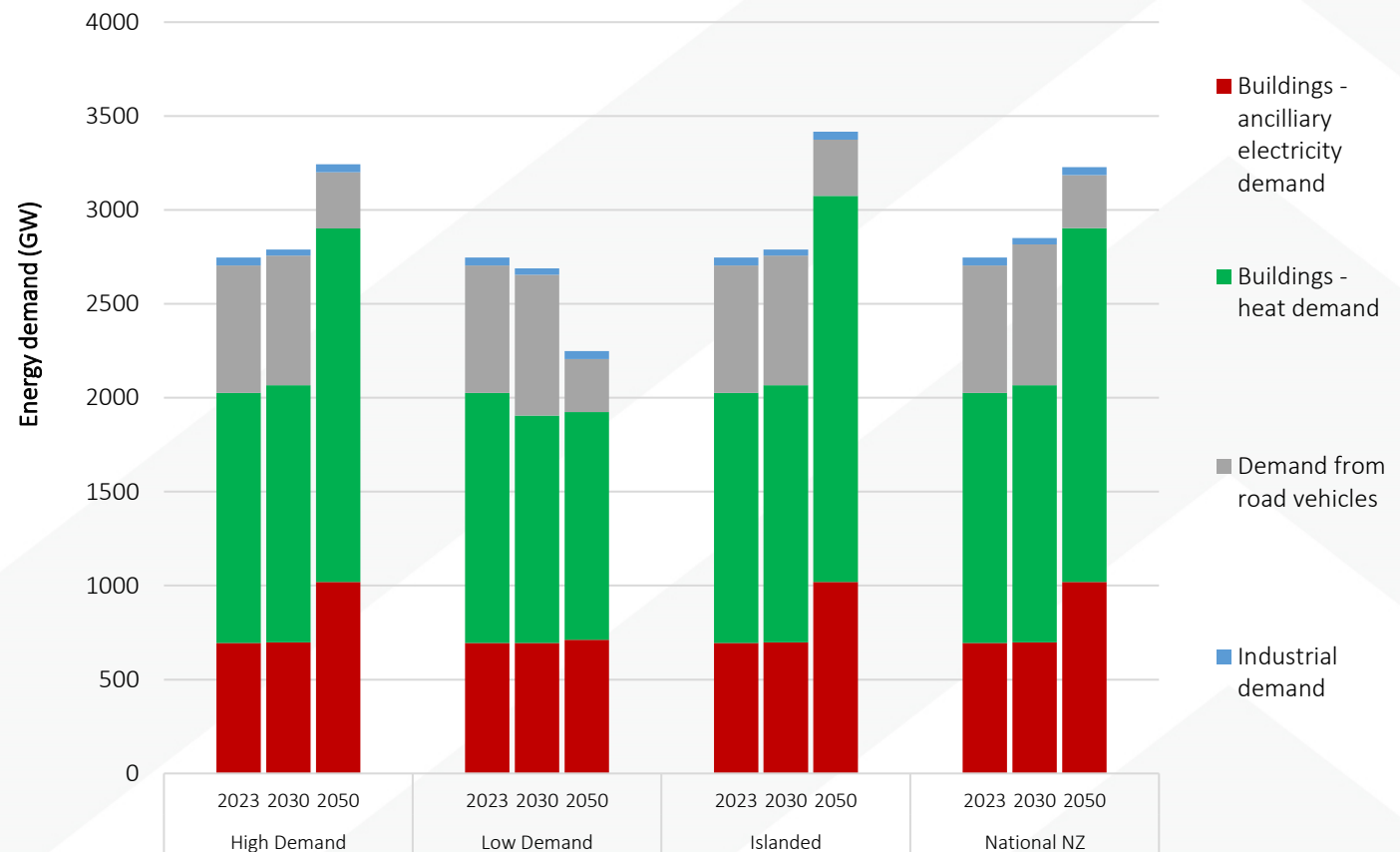


Figure 3.0.4: Energy demand over time for each scenario



Sponsors:



Delivery partners:



# 3. The future energy system

## Deployment modelling

### Impact on GHG emissions

Figure 3.0.5 shows the gap in the GHG emissions between the Do Nothing scenario and the optimised scenarios. The deployment modelling provides additional evidence on the realism of delivering the changes suggested by the optimisation modelling. It helps to determine the actions needed in the next five years to achieve 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.

The deployment modelling shows how these pathways contribute to the Welsh Government emissions reduction targets. For Caerphilly County Borough, the 2023 baseline is a 59% reduction on the 1990 levels.

By 2040, all pathways exceed the 89% emissions target outlined by Welsh Government. An absolute zero target in 2050 is slightly missed, due to residual electricity in the network with an average reduction of 99% against the 1990 levels.

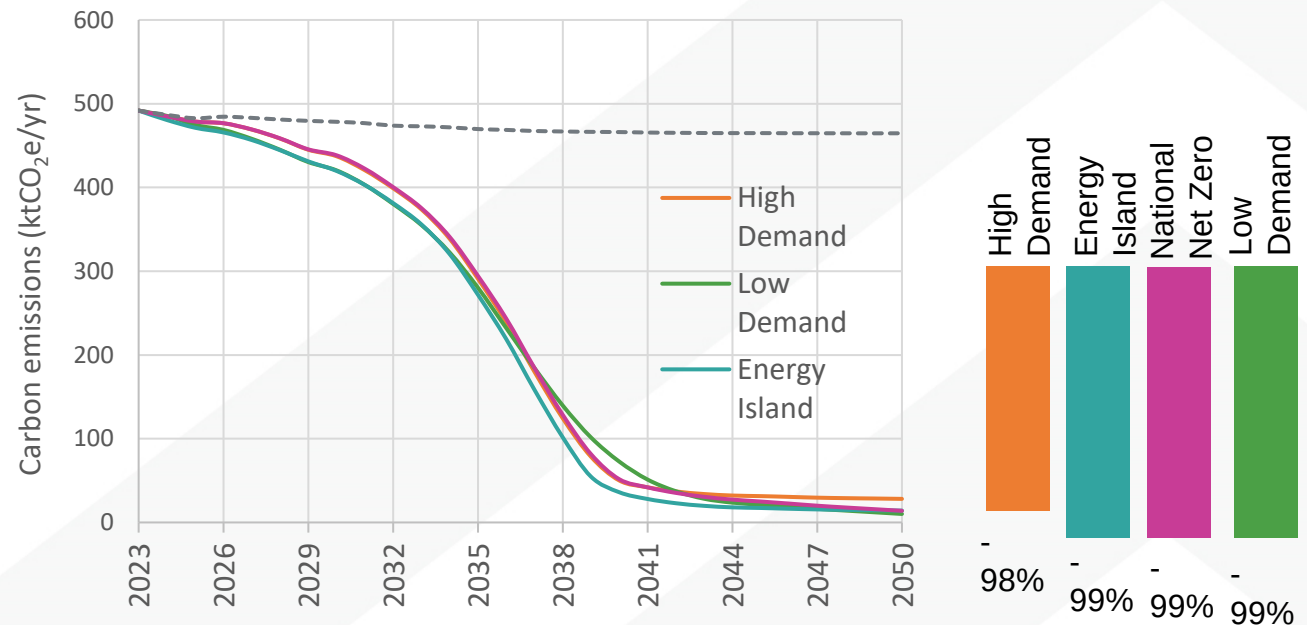
The Energy Island scenario deploys at the fastest rate due to the higher rate of renewable deployment in the County Borough.



Sponsors:



Delivery partners:



| Scenario          | 2030 | 2040 | 2050  |
|-------------------|------|------|-------|
| Welsh Gov targets | -63% | -89% | -100% |
| National Net Zero | -64% | -96% | -99%  |
| High Demand       | -64% | -96% | -98%  |
| Energy Island     | -65% | -97% | -99%  |
| Low Demand        | -65% | -94% | -99%  |
| Do Nothing        | -60% | -61% | -61%  |

**Figure 3.0.5: GHG emissions (ktCO<sub>2</sub>e) across energy use for each scenario over time, compared to the Do Nothing scenario (bottom) % GHG emissions reduction for each scenario compared to the Welsh Government emissions reduction targets**

# 3. The future energy system

## Deployment modelling

### Socio-economic impacts

Reducing the amount of energy used 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)<sup>M41</sup>.

### 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<sup>M42</sup>. The table to the right shows estimates for the employment impacts associated with each future energy scenario, compared to the Do Nothing scenario.

### Impact on air quality

Reducing energy demand and increasing use of renewables can also impact the quality of the air which in turn impacts: human health, productivity, wellbeing and the environment, which is why it is important to understand when planning future policy or programmes of work.



Sponsors:



Delivery partners:



| Metric                                                                | Do Nothing | National Net Zero | High Demand | Low Demand  | Islanded   |
|-----------------------------------------------------------------------|------------|-------------------|-------------|-------------|------------|
| Energy change (GWh, relative to 2023)                                 | ~0         | 481 (+18%)        | 498 (+18%)  | -498 (-18%) | 670 (+24%) |
| Employment impacts between 2023-2050 (FTE)                            | N/A        | 4,400             | 4,400       | 5,300       | 4,600      |
| Cumulative air quality activity costs between 2023-2050 (2022 prices) | £374m      | £179m             | £162m       | £185m       | £170m      |

**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

## Deployment modelling

### Summary of deployment

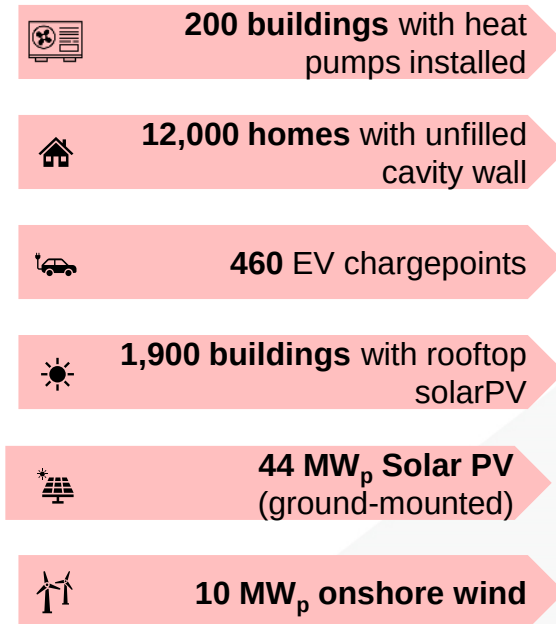
The deployment model helps to consider the current state of the County Borough and the desired future state, providing a starting point to frame the challenge and for more detailed analysis. Theoretical pathways were included which have a high degree of uncertainty as

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:

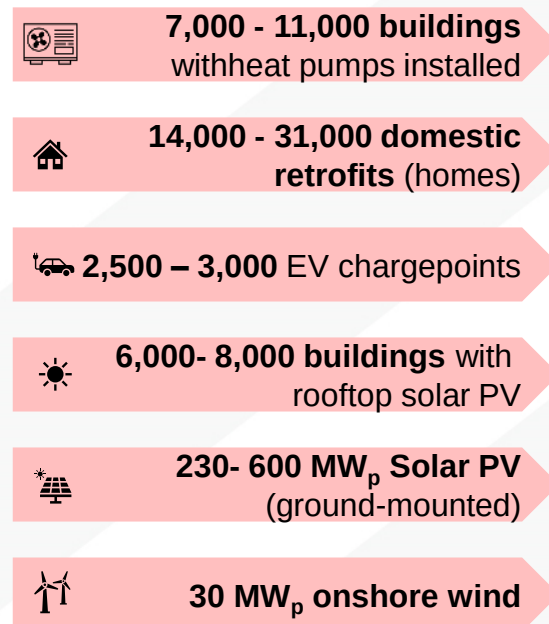
1) Technological advance and innovation

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

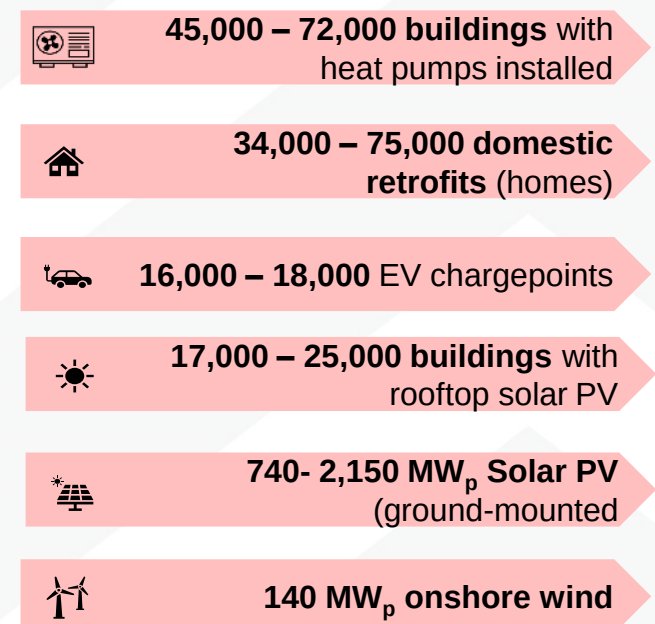
#### Now (2023):



#### By 2030:



#### By 2050:



This is the minimum average annual rate of change required, considering the different scenarios set out in Chapter 3: The future energy system.

A) According to the National Charge Point Registry as of May 2023<sup>M43</sup>. Refers to individual charge points

B) Assuming 4.5kWp per charge point

C) Assuming 4kWp per roof

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



Sponsors:



Delivery partners:



Caerphilly County Borough

## Chapter 4: Action planning



# 4. Action planning

## Energy propositions

The insights gained from examining various energy futures and deployment pathways were communicated to stakeholders, and discussions were held with them regarding the key drivers essential for achieving the transition to net zero. Subsequently, their feedback was taken into account alongside the strategic vision and objectives. As a result, energy propositions were agreed as the framework for delivery of the County Borough's LAEP. The diagram illustrates numerous interdependencies and interactions among these propositions, emphasising the necessity of a comprehensive system approach with a coordinated delivery programme to attain the net zero target by 2050.

### The Vision

*To develop a net zero energy system for Caerphilly County Borough that harnesses local renewable resources, providing equitable, affordable, resilient, and sustainable energy to enable our residents and businesses to thrive.*

Retrofit is key to ensure heat pumps can operate more efficiently, adding less load to the grid

If located appropriately, local renewables can reduce required network reinforcements, otherwise could require more reinforcements

Electrolysers require electricity, from suitable electricity network

Hydrogen supports industrial decarbonisation with the potential to support balancing the grid

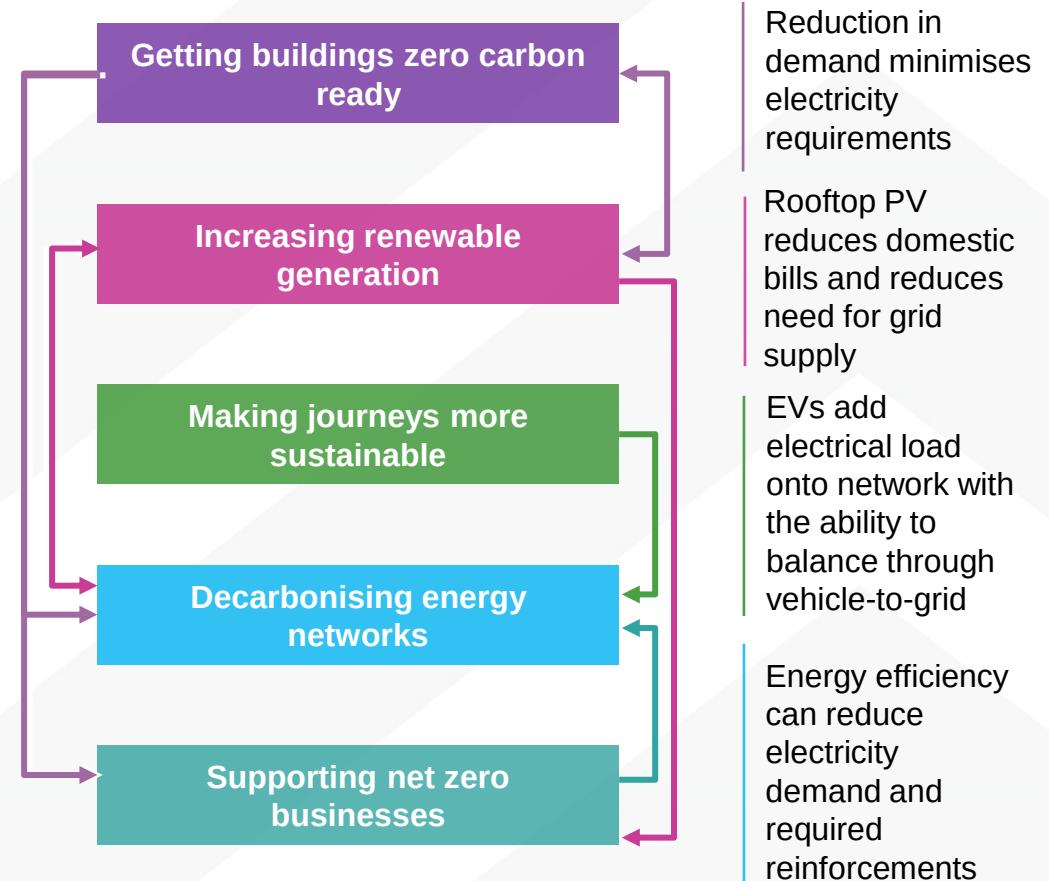


Figure 4.0.1: Summary of energy propositions and their inter-dependencies



Sponsors:



Delivery partners:



# 4. Action planning

## Energy propositions

### Energy propositions in more detail



Sponsors:



Delivery partners:



#### 1. Getting buildings zero carbon ready

**Ambition:** Supporting residents to install energy-efficient technologies and transition to low-carbon heating solutions, providing equitable and affordable access to low-carbon heating.

CAPEX: £600 - 4,500m



#### 2. Making journeys more sustainable

**Ambition:** Enabling the rollout of electric vehicles across the county and transitioning to an all-electric council fleet. Promoting active and sustainable travel within the region.

CAPEX: £50- 60m



#### 3. Increasing renewable generation

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

CAPEX: £500 - £1,100m



#### 4. Supporting net zero businesses

**Ambition:** Encouraging businesses to adopt low carbon measures and reduce energy costs.

Creating an attractive environment for sustainable businesses to make a base in Caerphilly County Borough.

CAPEX: key uncertainty



#### 5. Decarbonising energy networks

**Ambition:** Making upgrades to the electricity network that are required to ensure increasing electricity demand can be met.

Making upgrades to the gas network that are required to ensure future hydrogen demand could be met.

CAPEX: key uncertainty



\*This CAPEX figure only includes the cost to install EV chargepoints. It does not include investment required to improve active travel routes and public transport networks.

**Note:** CAPEX required to deliver has not been calculated for proposals 4 and 5 due to the high uncertainty associated with these proposals.

# 4. Action planning

## Energy propositions

### Identifying priority focus zones and action routemap

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

#### Plan on a page

As a starting point, the “plan on a page,” shown in Figure 4.0.2 (overleaf), indicates the location and scale of recommended near-term changes required across Caerphilly County Borough. The map highlights 1-4 modelling zones identified as priority focus zones for the low-regret energy system components for the energy propositions: heat pumps, EV chargers, rooftop PV, ground-mounted PV, onshore wind, and insulation retrofits. To prioritise where each low-regret energy system component should be deployed, each modelling zone underwent ranking based on various technical and social factors, such as the available capacity at each substation and the Welsh Index of Multiple Deprivation.

#### Action routemap

The action routemap outlines critical enabling actions corresponding to each energy proposition, which will be collectively undertaken alongside stakeholders in the coming decade, with a particular focus on what can be achieved in the next 5-7 years. Developed as a dynamic plan, it recognises the influence of wider contextual changes at national and local levels on the transition to a net-zero energy system, including national regulation, policy, and strategic plans. Consequently, regular reviews and updates to the routemap are anticipated 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

The council's role in delivering each energy proposition will vary, with some actions requiring council intervention in material programme delivery and others involving the council as a facilitator for market-driven change.

Through the LAEP process, it was identified that some actions are best delivered collaboratively through regional partnerships, leveraging economies of scale and focusing public resources efficiently. Regional actions will necessitate detailed design work to progress projects and programmes to the implementation stage. The council will play an active role in supporting the Cardiff Capital Region going forward.

Local ownership is a key focus throughout the plan, and where possible, actions should leverage progress made through the Welsh Government's recent Co-operation Agreement with Plaid Cymru, which includes key goals on tackling climate change to maximise local benefits.

The subsequent section provides further detail on each of the actions to be undertaken under each energy proposition, as well as key requests of others. Due to the relative uncertainty surrounding longer-term actions, detailed scoping of these actions is not the primary focus of this report. Instead, the focus lies on actions intended for short-term delivery, subject to appropriate support. For additional details on the action plan, please see page 106 in the Technical Report.



Sponsors:



Delivery partners:



# 4. Action planning

## Energy propositions

Plan on a page



Sponsors:



Delivery partners:



Figure 4.0.2 identifies zones with particularly favourable conditions for specific energy components, making them ideal locations for pilot studies. The summary tables detail key figures for each zone by 2030: (i) pilot ambition, (ii) required investment for each pilot and (iii) total investment for all deployment in the zone, including all energy components and electricity network infrastructure interventions. Ranges have been calculated by taking the minimum and maximum results from each future energy scenarios modelled (see [Chapter 3](#) for more detail). Note: intervention should still be carried out in 'progress' zones to transition the local area to net zero.

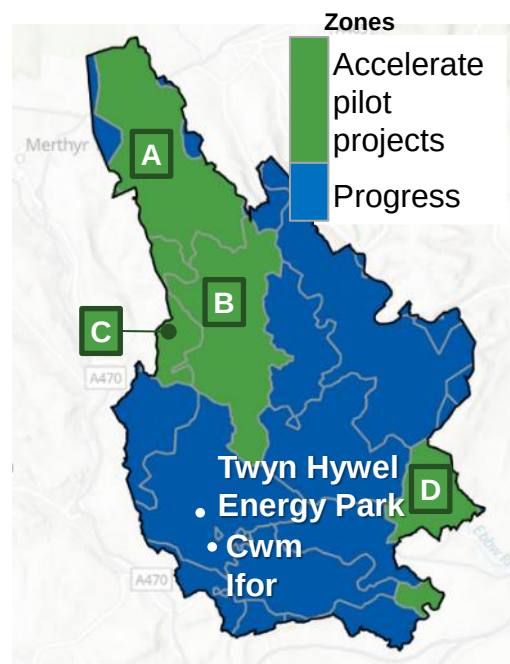


**Figure 4.0.2: Caerphilly County Borough's spatial representation of opportunities, including 2030 ambition and investment (million £). Zone boundaries are the modelling zone boundaries.**

|               | (i)                  | (ii)          | (iii)                                          |
|---------------|----------------------|---------------|------------------------------------------------|
| <b>Zone A</b> | <b>Abertysswg</b>    |               |                                                |
|               | 126 – 136 chargers   | £0.42 – 0.45m | <b>Zone A total</b><br><br><b>£49 – £159 m</b> |
|               | 67 MW                | £29m          |                                                |
|               | 0.7 MW               | £0.75m        |                                                |
|               | 500 – 900 heat pumps | £2.3 - £3.9m  |                                                |
|               | 1,600 – 2,600 homes  | £8.2 - £120m  |                                                |

|               |                     |              |                                               |
|---------------|---------------------|--------------|-----------------------------------------------|
| <b>Zone B</b> | <b>Pengam Grid</b>  |              | <b>Zone B total</b><br><br><b>£67 - £386m</b> |
|               | 2 - 6 MW            | £2.3 – £6.5m |                                               |
|               | 3,400 - 7,000 homes | £21 - £340m  |                                               |
|               | 22 - 57 MW          | £10 – £25m   |                                               |

|               | (i)               | (ii)           | (iii)                                       |
|---------------|-------------------|----------------|---------------------------------------------|
| <b>Zone C</b> | <b>Nantwen</b>    |                |                                             |
|               | 4 – 6 heat pumps  | £0.02 – £0.03m | <b>Zone C total</b><br><br><b>£4 - £6m</b>  |
|               | 21 – 23 chargers  | £0.07 - £0.08m |                                             |
| <b>Zone D</b> | <b>Rogerstone</b> |                |                                             |
|               | 1.5 MW            | £1.7m          | <b>Zone D total</b><br><br><b>£16- £96m</b> |
|               | 0.05 MW           | £0.05m         |                                             |

### Suggested energy components to pilot in each zone

|  |            |  |                   |  |                     |
|--|------------|--|-------------------|--|---------------------|
|  | Heat pumps |  | Ground-mounted PV |  | Rooftop PV          |
|  | EV charger |  | Onshore wind      |  | Insulation measures |

# 4. Action planning

## Action routemap

### National policies and targets



Sponsors:



Delivery partners:



2024 2025 2026 2027 2028 2029 2030

#### Action

- Up to 1GW of electrolytic hydrogen secured (2025) [UK]<sup>M40</sup>
- Decision on hydrogen to heat buildings (2026) [UK]<sup>M41</sup>
- Up to 10GW hydrogen capacity (50% electrolytic) [UK]<sup>M40</sup>
- Up to 50GW of offshore wind capacity including up to 5GW of innovative floating wind (2030) [UK]<sup>M40</sup>
- Replace with: Future Homes Standard consultation suggests all space heating and hot water demand be met through low carbon sources in new builds (2025)<sup>M42</sup>
- All new social homes built to Welsh Development Quality Requirements 2021 without fossil fuel heating (from 2025)<sup>M43</sup>
- All existing social homes to have a plan for minimising environmental impact and improving energy performance (2027) [Wales]<sup>M44</sup>
- 37% GHG emissions by 2025 (rel. to 1990) [Wales]<sup>M45</sup>
- 63% GHG emissions by 2030 (rel. to 1990) [Wales]<sup>M45</sup>
- Meet the equivalent of 100% of electricity needs from renewable sources by 2035 [Wales]<sup>M46</sup>
- 1.5GW of renewable capacity to be locally owned (exc. Heat pumps) (2035) [Wales]<sup>M46</sup>
- 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<sup>x</sup> (2035) [Wales]<sup>M46</sup>
- Minimum EPC E to rent out any property (from 2020 onwards) and EPC C from 2030 [UK]<sup>M47</sup>
- 1 public charge point for every 7 to 11 electric vehicles (2025) [Wales]<sup>M48</sup>
- Rapid charging available every 20 miles on the strategic trunk road (2025) [Wales]<sup>M48</sup>
- 10% car miles travelled/person (2030) [Wales]<sup>M03</sup>
- 80% new cars and 70% new vans sold to be 0 emissions (2030) (ZEV mandate) [UK]<sup>M48</sup>
- 100% new cars and vans sold to be 0 emissions (2035) (ZEV mandate) [UK]<sup>M48</sup>
- Net zero public sector by 2030 [Wales]<sup>M26</sup>

National targets

Progressing towards 2030

Progressing towards 2030

Progressing towards 2030

Progressing towards 2035

Progressing towards 2030

Progressing towards 2030

Progressing towards 2035

Progressing towards 2030

# 4. Action planning

## Enabling actions

### Routemap – short-term

- N** Action will be implemented at a national scale, across all of Wales
- R** Action will be implemented at a regional scale, across CCR local authorities
- L** Action will be implemented at a local scale, across Caerphilly County Borough
- Timescale for the action is ongoing



Sponsors:



Delivery partners:



| Action                                                                                                | 2024                                                                       | 2025 | 2026 | 2027 | 2028 | 2029 | 2030                 | Proposed lead(s) |
|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------|------|------|------|------|----------------------|------------------|
|                                                                                                       |                                                                            |      |      |      |      |      |                      |                  |
| <br>Enabling actions | E.1.1: Develop a governance structure and performance management framework |      |      |      |      |      |                      | R                |
|                                                                                                       | E.1.2: Facilitate monitoring of the LAEP across the Region                 |      |      |      |      |      |                      | R                |
|                                                                                                       | E.1.3: Develop a business plan for delivery of the LAEPs across the region |      |      |      |      |      |                      | R                |
|                                                                                                       | E.2.1: Develop a regional Strategic Development Plan (SDP)                 |      |      |      |      |      |                      | R                |
|                                                                                                       | E2.2: Develop a national energy plan                                       |      |      |      |      |      |                      | N                |
|                                                                                                       | E.3.1: Map and identify skills and labour needs                            |      |      |      |      |      | Review               | R N              |
|                                                                                                       | E.3.2: Review and develop educational programmes to meet skills needed     |      |      |      |      |      | Review               | R N              |
|                                                                                                       | E.3.3: Develop a communication strategy to promote jobs                    |      |      |      |      |      | Review every 5 years | R N              |
|                                                                                                       | E.3.4: Identify supply chain needs                                         |      |      |      |      |      | Review every 5 years | R                |

# 4. Action planning

## Action routemap

### Getting buildings zero carbon ready

- N** Action will be implemented at a national scale, across all of Wales
- L** Action will be implemented at a local scale, across Caerphilly County Borough
- R** Action will be implemented at a regional scale, across CCR local authorities
-  Timescale for the action is ongoing



Sponsors:



Delivery partners:



| Action                                                                                                                       |                                                                                                                                                                                     | 2024                                                                                  | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | Proposed lead(s) |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|------|------|------|------|------------------|
| <br><br>Getting buildings zero carbon ready | B.1.1: Develop a retrofit prioritisation plan                                                                                                                                       | Reviewed annually                                                                     |      |      |      |      |      |      | <b>R</b>         |
|                                                                                                                              | B.1.2: Develop a delivery plan for owner-occupied retrofit                                                                                                                          | Review                                                                                |      |      |      |      |      |      | <b>R N</b>       |
|                                                                                                                              | B.1.3: Review current ECOFLEX programme                                                                                                                                             |                                                                                       |      |      |      |      |      |      | <b>R</b>         |
|                                                                                                                              | B.1.4: Continue to develop a programme of council housing retrofit, prioritising fabric first in line with PAS2035 to reduce total energy demand and prepare for low-carbon heating |                                                                                       |      |      |      |      |      |      | <b>L</b>         |
|                                                                                                                              | B.1.5: Continue to deliver LA ECO4 Flex to fund works and improvements to existing private sector households                                                                        |  |      |      |      |      |      |      | <b>L</b>         |
|                                                                                                                              | B.1.6: Continue to work with third-party funders such as Warm Homes Scheme, currently NEST.                                                                                         |  |      |      |      |      |      |      | <b>L</b>         |
|                                                                                                                              | B.1.7: Consider mechanisms for encouraging greater uptake of retrofit                                                                                                               |  |      |      |      |      |      |      | <b>N</b>         |
|                                                                                                                              | B.1.8: Apply lessons learnt from ORP through the Welsh Zero Carbon Hwb                                                                                                              |  |      |      |      |      |      |      | <b>N</b>         |
|                                                                                                                              | B.2.1: Co-ordinate a network for supporting local new build and retrofit businesses                                                                                                 | Quarterly meetings                                                                    |      |      |      |      |      |      | <b>R</b>         |
|                                                                                                                              | B.2.2: Identify and develop procurement frameworks for larger projects of scale                                                                                                     |                                                                                       |      |      |      |      |      |      | <b>R N</b>       |

# 4. Action planning

## Action routemap

### Getting buildings zero carbon ready

- N** Action will be implemented at a national scale, across all of Wales
- R** Action will be implemented at a regional scale, across CCR local authorities

- L** Action will be implemented at a local scale, across Caerphilly County Borough

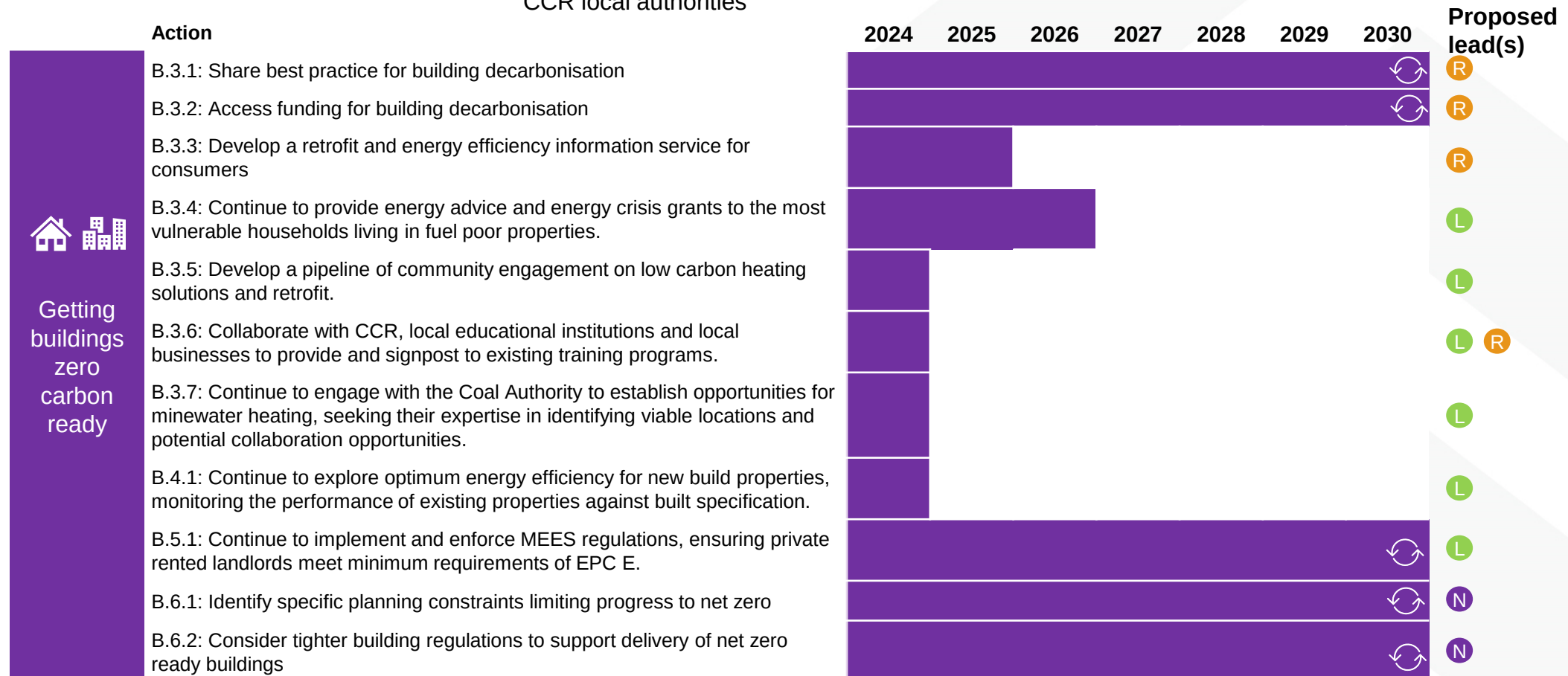
↻ Timescale for the action is ongoing



Sponsors:



Delivery partners:



Getting buildings zero carbon ready

# 4. Action planning

## Action routemap

### Making journeys more sustainable



Action will be implemented at a national scale, across all of Wales



Action will be implemented at a local scale, across Caerphilly County Borough



Action will be implemented at a regional scale, across CCR local authorities



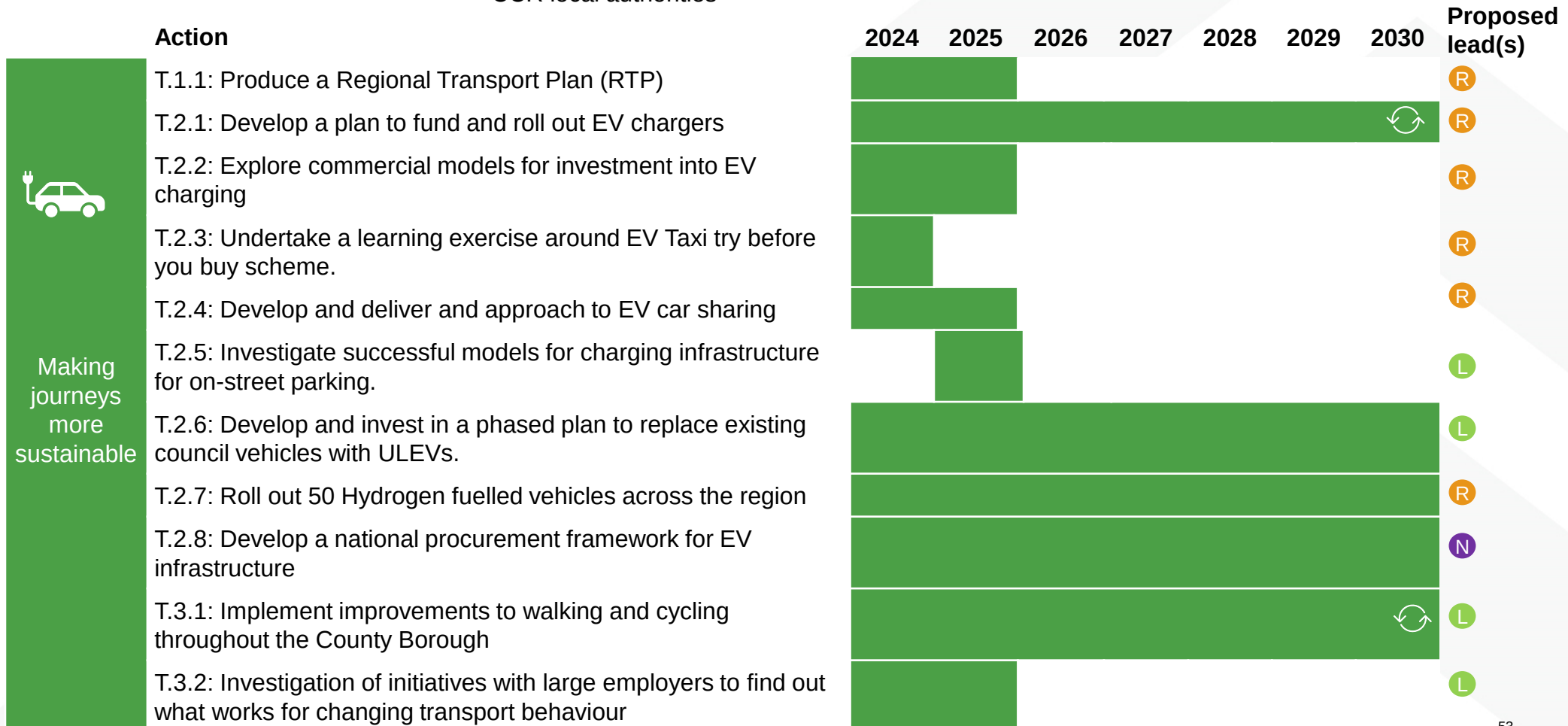
Timescale for the action is ongoing



Sponsors:



Delivery partners:



# 4. Action planning

## Action routemap

### Increasing renewable generation

N

Action will be implemented at a national scale, across all of Wales

L

Action will be implemented at a local scale, across Caerphilly County Borough

R

Action will be implemented at a regional scale, across CCR local authorities



Timescale for the action is ongoing



Sponsors:



Delivery partners:



#### Action

2024 2025 2026 2027 2028 2029 2030 Proposed lead(s)



Increasing renewable generation

R.1.1: Create a regional renewable energy investment prospectus

R.1.2: Attract investment in renewable energy

R.1.3: Seek out crowdfunding or community investment opportunities to fund rooftop solar installations.

R.2.1: Collaborate with local businesses, research institutions, and other stakeholders to identify feasible opportunities for green hydrogen production.

R.2.2: Continue to collaborate in seeking funding and the development projects exploring green hydrogen feasibility within the Borough.

R.2.3: Explore partnerships with private sector companies interested in investing in green hydrogen technology.

R.3.1: Develop a renewable energy communication campaign

R.3.2: Explore partnerships with local businesses or community groups interested in supporting rooftop solar initiatives (e.g. Engi Coop)

R.4.1: Conduct an updated survey of council-owned land to identify areas suitable for renewable projects, focussing on new opportunities such as canopy solar installations.

R.4.2: Identify public sector land suitable for renewables

R

R

L



L

L



L

R

N

L

L

N

# 4. Action planning

## Action routemap

### Supporting net zero businesses

- N** Action will be implemented at a national scale, across all of Wales
- L** Action will be implemented at a local scale, across Caerphilly County Borough
- R** Action will be implemented at a regional scale, across CCR local authorities
-  Timescale for the action is ongoing



Sponsors:



Delivery partners:



| Action                                                                                                              |                                                                                                                                                                                                                                                                                              | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | Proposed lead(s)                                                                        |
|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|-----------------------------------------------------------------------------------------|
| <br>Supporting net zero businesses | C.1.1: Co-ordinate a network to decarbonise local businesses                                                                                                                                                                                                                                 |      |      |      |      |      |      |      | R                                                                                       |
|                                                                                                                     | C.1.2: Develop an industrial engagement programme to decarbonise industry                                                                                                                                                                                                                    |      |      |      |      |      |      |      | R                                                                                       |
|                                                                                                                     | C.1.3: Creation of Net Zero Clusters (Partnerships) across the region in key Net Zero areas as identified in the LAEPs                                                                                                                                                                       |      |      |      |      |      |      |      | R                                                                                       |
|                                                                                                                     | C.1.4: Identify opportunities for smart local energy systems                                                                                                                                                                                                                                 |      |      |      |      |      |      |      | R L                                                                                     |
|                                                                                                                     | C.2.1: Undertake feasibility studies for potential novel technology partnerships                                                                                                                                                                                                             |      |      |      |      |      |      |      | R  |
|                                                                                                                     | C.2.2: Assessment of district heating opportunities and a review of zoning policy to promote their development                                                                                                                                                                               |      |      |      |      |      |      |      | L                                                                                       |
|                                                                                                                     | C.3.1: Provide support and advice for local businesses to help them understand their carbon footprint, how they can reduce their emissions and signpost to programmes, networks or campaigns encouraging the uptake of energy efficiency measures, waste reduction and the circular economy. |      |      |      |      |      |      |      | L                                                                                       |
|                                                                                                                     | C.3.2: Develop an approach to assess the carbon impacts associated with procurement and investments. Integrate these assessments into decision-making processes to ensure a holistic consideration of environmental impact.                                                                  |      |      |      |      |      |      |      | L                                                                                       |

# 4. Action planning

## Action routemap

### Decarbonising energy networks



Sponsors:



Delivery partners:



| Action                            |                                                                                                 | 2024      | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | Proposed lead(s) |
|-----------------------------------|-------------------------------------------------------------------------------------------------|-----------|------|------|------|------|------|------|------------------|
| Decarbonising energy networks<br> | N.1.1: Provide data for forecasting to NGED and WWU                                             | Annually  |      |      |      |      |      |      | R                |
|                                   | N.1.2: Hold regular engagement meetings between Caerphilly County Borough Council, NGED and WWU | Quarterly |      |      |      |      |      |      | L                |
|                                   | N.1.3: Consolidate project pipelines across electricity and gas networks                        |           |      |      |      |      |      |      | nationalgrid     |
|                                   | N.2.1: Inform local authorities about our available data resources                              |           |      |      |      |      |      |      | nationalgrid     |
|                                   | N.2.2: Respond to consultations in support of required investment                               |           |      |      |      |      |      |      | L                |
|                                   | N.2.3: Include new projects from the LAEP in strategic planning process                         |           |      |      |      |      |      |      | nationalgrid     |
|                                   | N.3.1: Highlight gas infrastructure opportunities                                               |           |      |      |      |      |      |      | nationalgrid     |
|                                   | N.3.2: Include new projects from the LAEP in strategic planning process                         |           |      |      |      |      |      |      |                  |

**N** Action will be implemented at a national scale, across all of Wales

**L** Action will be implemented at a local scale, across Caerphilly County Borough

**R** Action will be implemented at a regional scale, across CCR local authorities

Timescale for the action is ongoing

nationalgrid

Action will be implemented by Wales and West Utilities (WWU)

Action will be implemented by National Grid Distribution Network (NGED)

# 4. Action planning

## Action routemap

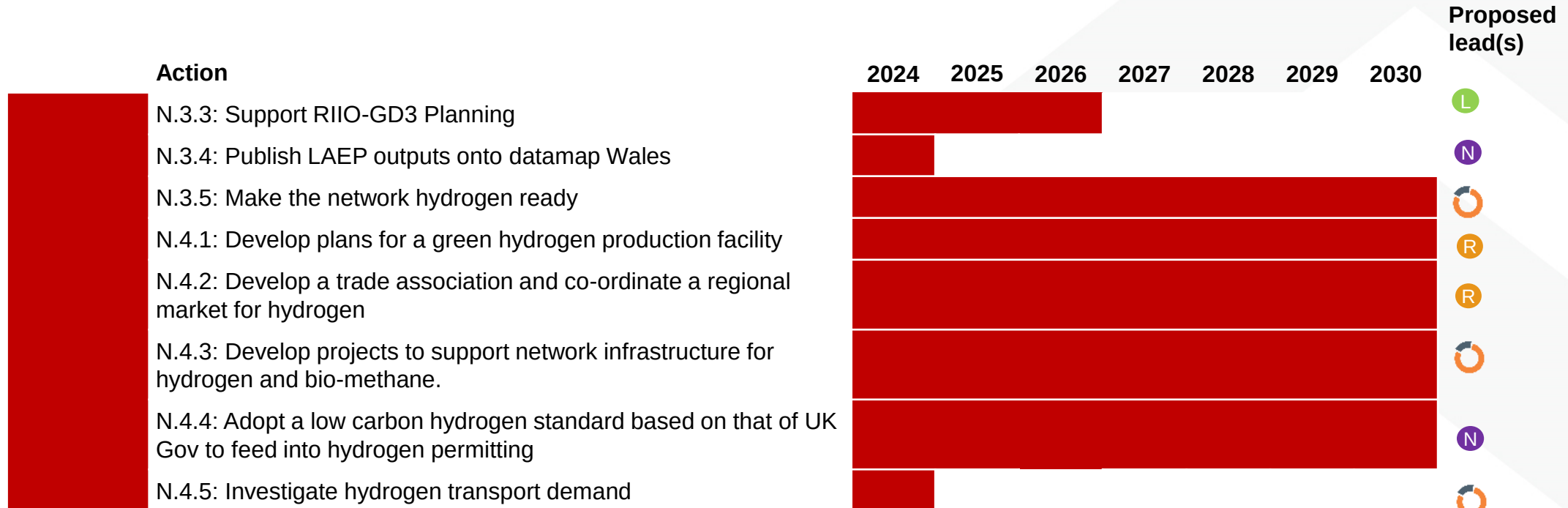
### Decarbonising energy networks



Sponsors:



Delivery partners:



**N** Action will be implemented at a national scale, across all of Wales

**L** Action will be implemented at a local scale, across Caerphilly County Borough

**R** Action will be implemented at a regional scale, across CCR local authorities

Timescale for the action is ongoing



Action will be implemented by Wales and West Utilities (WWU)

nationalgrid

Action will be implemented by National Grid Distribution Network (NGED)

Caerphilly County Borough

## Chapter 5: Next steps



# 5. Next steps

## Our LAEP in the context of programmes and projects

The LAEP provides a good understanding of the current state of the local energy system, and what it will take to decarbonise it. A plan of action for the next 6 years has been created, with its delivery subject to sufficient political, and financial support.

Each proposition has been assessed against the diagram to the right in terms of which stage of the development journey it is at. To take each proposition to delivery, programmes and projects will need to go through the entire journey.

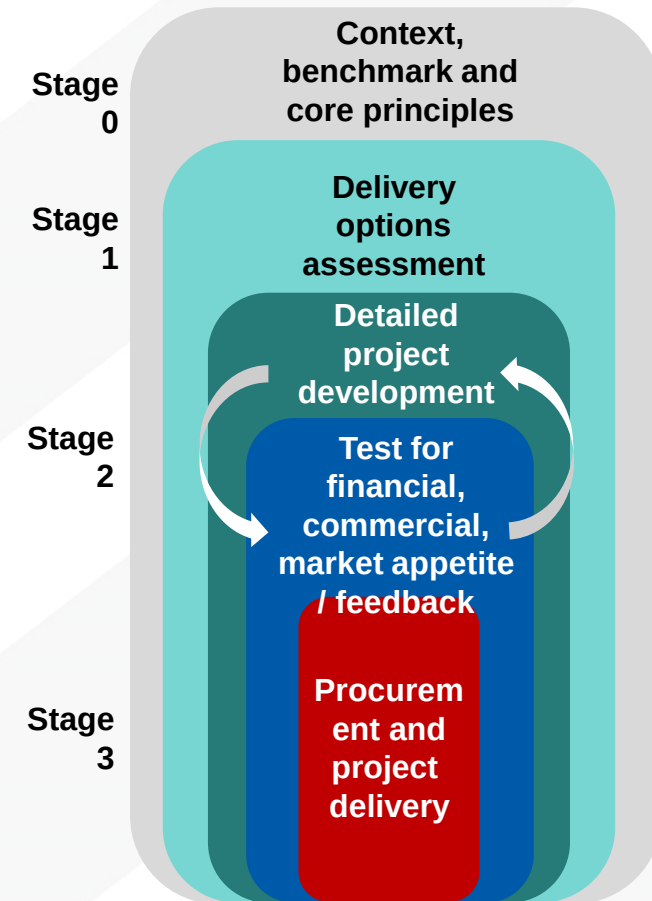
Figure 5.0.1 shows how projects move from context and vision setting, to procurement and project delivery.

**Stage 0 Context setting:** This stage involves understanding the context, key challenges, strategic objectives as well as roles to support delivery.

**Stage 1 Delivery option assessment:** This stage involves the initial options exploration with the defining of potential long list commercial options, an appropriate evaluation framework and initial market testing.

**Stage 2 Detailed project development (including market testing):** Following the initial long listing exercise, detailed development of a shortlist of potential commercial options will be developed and tested with the market. This process will be iterative, as options will be refined based on feedback from the market as well as commercial and technical limitations.

**Stage 3 Procurement and project delivery:** Stage will include selection of the commercial delivery option which best delivers the objectives and is commercially deliverable. This will be taken forward to procurement (if required) and subsequent delivery.



Sponsors:



Cardiff Capital Region

Delivery partners:



Figure 5.0.1: How programmes and projects develop

# 5. Next steps

## Enabling conditions for success

### Governance

Delivery of the LAEP will be overseen by Caerphilly County Borough and the Cardiff Capital Region.

Acknowledging the diverse stakeholders crucial for effecting the necessary changes to achieve the plan's objectives and actions, collaboration with the Cardiff Capital Region and partners from various sectors will establish a governance framework to facilitate broader engagement to support delivery.

To deliver this, Caerphilly County Borough Council will decarbonise assets within their direct control, such as council buildings and the council transport fleet. Additionally, efforts will be made to drive and influence wider decarbonisation within the area through community engagement, collaboration, and showcasing.

The sphere of influence for CCBC might include:

- **Budget and finance**
- **Defining and helping to achieve the project outcomes**
- **Identifying the priorities**
- **Identifying potential risks and monitoring risks**
- **Monitoring timelines**
- **Monitoring the quality of the project as it develops**

Engagement spans across a spectrum of projects, initiatives, and partnerships, each with varying levels of control. Within the Cardiff Capital Region (CCR), synergies are identified in the selected propositions. There will be efficiencies in undertaking many of the programmes and projects forward regionally and/or nationally.



Sponsors:



Delivery partners:

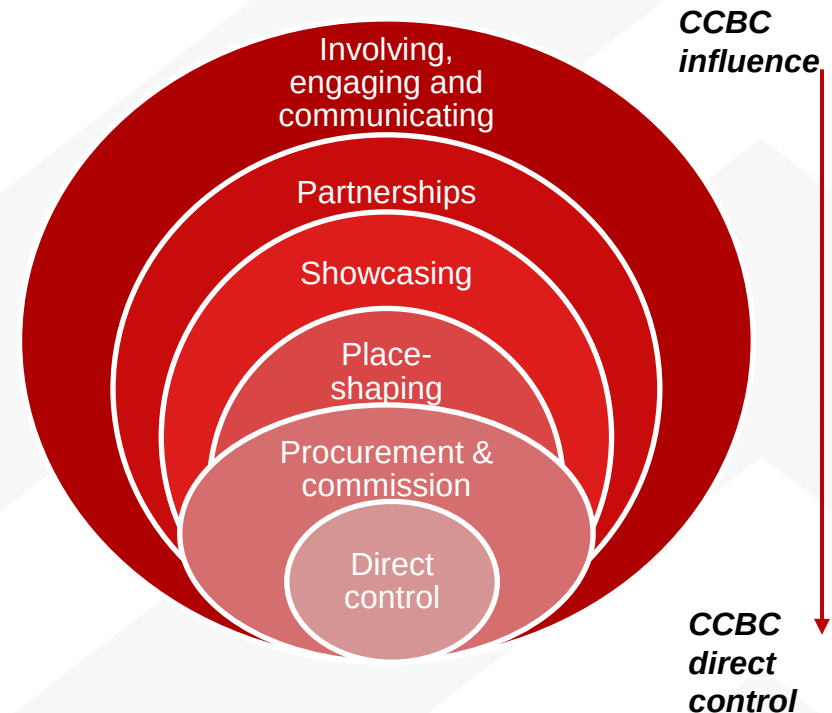


Figure 5.0.2: Local Authority roles and level of influence

# 5. Next steps

## Enabling conditions for success

### Monitoring and reporting

The key actions for the first five years outlined in this plan will set the organisation on the right journey to achieve the ambitions in the longer-term routemap. The plan requires flexibility to adapt to future changes.

Across the region, a consistent performance management framework will be developed by the Cardiff Capital Region, facilitating the monitoring and review of the LAEPs throughout the area (refer to action E.1.2). An annual monitoring report will be produced, building on the Welsh Government's Energy Generation in Wales reports, which will describe progress against the actions set out in this plan and also against key output metrics as follows:

- Number of homes retrofitted
- Number of non-domestic buildings retrofitted
- Number of EV charging points installed
- Total installed capacity of renewables such as solar PV and onshore wind
- Heat pumps installed
- Hydrogen electrolyzers
- Battery installations
- Number of low carbon energy innovations.

To monitor these metrics, publicly available datasets such as the DFES reports

conducted by NGED, the Energy Performance Certificate Register, the Micro Generation Certification Scheme, and the Renewable Energy Planning Database will be utilised.

A baseline comprehension of these metrics will be developed using existing data, with annual monitoring of changes.

Additionally, tracking of GHG emissions reduction will be conducted, building upon current submissions to the Welsh Government for Public Sector Reporting as a foundational reference point. It is acknowledged that available data will typically lag behind by a few years.

The entire plan will undergo updates at least every five years to accommodate significant factors, including policy alterations at both UK and Welsh Government levels, shifts in costs, and the efficacy of technologies.



Sponsors:



Delivery partners:



Caerphilly County Borough

# Appendices

Appendix A – Table of figures and tables



# Table of figures



Sponsors:



Delivery partners:



| Reference    | Description                                                                                                                                                                        | Page number |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Figure 0.0.1 | LAEP support documents purpose and audience summary                                                                                                                                | 4           |
| Figure 0.0.2 | Summary of energy propositions                                                                                                                                                     | 6           |
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# Appendices

Appendix B – Glossary of Terms



# Glossary of terms



Sponsors:



Delivery partners:



| 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.                                                                                                                                             |
| Cardiff Capital Region           | The Cardiff Capital Region, that covers the 10 local authority areas covering South East Wales -Blaenau Gwent; Bridgend; Caerphilly; Cardiff; Merthyr Tydfil; Monmouthshire; Newport; Rhondda Cynon Taf; Torfaen; and Vale of Glamorgan. |
| Certainties                      | A fact that is definitely true or an event that is definitely going to take place. In terms of a local energy system, uncertainties include funded projects, etc.                                                                        |
| Demand                           | Local energy demand that the local energy system needs to meet.                                                                                                                                                                          |

# Glossary of terms



Sponsors:



Delivery partners:



| Term                           | Definition or meaning                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                                                                                                                                                            |
| 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).   |
| 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.                                                                                                                                                                                                                                                                                                                                                           |

# Glossary of terms

| Term                | Definition or meaning                                                                                                                                                                                                                                                    |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                            |
| 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.                                                                 |



Sponsors:



Delivery partners:



# Glossary of terms

| Term                  | Definition or meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                                                                                                                                                                                                                                      |
| Microgeneration       | Small-scale generation of heat and electricity by individuals, households, communities or small businesses for their own use.                                                                                                                                                                                                                                                                                                                                                       |
| 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. <i>May also be called "zone" or "substation zone" in the reports.</i> |
| 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.                                                                                                                                                                                                                  |
| National Net Zero     | The National Net Zero modelled in the LAEP. Details of assumptions are in the methodology section.                                                                                                                                                                                                                                                                                                                                                                                  |
| National 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 of RCT.                                                                                                                                                                                                                             |

# Glossary of terms

| Term                            | Definition or meaning                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                                                                                                                                                                                                             |
| 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. |
| Power factor                    | The ratio between useful power (kW) and apparent power (kVA) consumed or transformed by electrical equipment.                                                                                                                                                                                                                                                            |
| Power Purchase Agreement (PPA)  | A contract between two parties where one produces and sells electricity and the other purchases electricity.                                                                                                                                                                                                                                                             |
| 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).                                                                                                                                                                                    |
| Programme                       | A series of projects, usually with a theme, that is run collectively.                                                                                                                                                                                                                                                                                                    |



Sponsors:



Delivery partners:



# Glossary of terms

| Term                                                   | Definition or meaning                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Project                                                | Strategic scale projects being implemented or planned for implementation in the local energy system that will significantly affect local demand or local supply.                                                                                                                                                                                                 |
| Quick win projects                                     | Very short-term actions, certain as no major blockers.                                                                                                                                                                                                                                                                                                           |
| Renewable Energy Guarantees of Origin (REGO) Agreement | A scheme that tells consumers what proportion of their electricity comes from renewable sources.                                                                                                                                                                                                                                                                 |
| 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.                                                               |
| Sensitivities                                          | Sensitivities of a specific scenario can be tested – for instance to test the impact of increasing electricity/hydrogen prices on the scenario. Testing a sensitivity is when you change one thing multiple times to assess the impact on the cost/carbon.                                                                                                       |
| Sewage gas                                             | A mixture of gases generated in sewer systems, used in a reciprocating gas engine to produce heat and electricity.                                                                                                                                                                                                                                               |
| 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. |



Sponsors:



Delivery partners:



# Glossary of terms

| Term                        | Definition or meaning                                                                                                                                                                                                                                              |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. <i>May also be called 'substation interventions' in the reports.</i> |
| 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.                                                                                                                                    |
| TfW zone                    | An area used by the Transport for Wales (TfW) as a point of origin or departure for vehicle trips. <i>May also be called "transport zone" within the reports.</i>                                                                                                  |
| 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.                                                                                                                                                            |
| We                          | The range of people and organisations in Caerphilly County Borough who will support the ambition and take action.                                                                                                                                                  |
| Wind power                  | Harnessing the kinetic energy of wind to turn a turbine to generate electricity.                                                                                                                                                                                   |

Caerphilly County Borough

# Appendices

Appendix C – Units of measure



# Units of measure

| Unit                | Definition or meaning                                                                                                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GWh                 | Gigawatt hour(s) – a unit of energy representing 1 billion watt-hours.                                                                                                                                                                                              |
| kgCO <sub>2</sub> e | 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 <sub>2</sub> e | 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 kgCO <sub>2</sub> e.                       |
| 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).                                                                                                       |
| MVA                 | Mega volt amp(s) – a metric unit of apparent power measuring rate of energy consumption or production and considering the efficiency by which electrical power is converted into useful output. It is related to MW by the power factor of the system or equipment. |



Sponsors:



Delivery partners:



# Units of measure

| Unit                        | Definition or meaning                                                                                                                                               |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 <sub>2</sub> 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 <sub>2</sub> per capita. |

Caerphilly County Borough

# Appendices

Appendix D – Bibliography



# Bibliography



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Sponsors:



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