

Local Area Energy Plan (LAEP)

Cardiff

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



Abbreviations



| Acronym | Definition or meaning |
|---------|---|
| CCGT | Combined Cycle Gas Turbine |
| CCR | Cardiff Capital Region |
| CCUS | Carbon Capture, Utilisation and Storage |
| DFES | Distribution Future Energy Scenarios |
| DNO | Distribution Network Operator |
| ECOFLEX | Flexible Eligibility Energy Company Obligation |
| EPC | Energy performance certificate |
| ESC | Energy Systems Catapult |
| EV | Electric Vehicle |
| 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 |
| LSOA | Lower super output area, a small area classification in the UK designed to have a comparable population |

| Acronym | Definition or meaning |
|---------|--|
| MSOA | Middle super output area, a medium-sized area classification in the UK designed to have a comparable population. |
| NAEI | National Atmospheric Emissions Inventory |
| NGED | National Grid Electricity Distribution |
| NZ | Net Zero |
| RIIO | Revenue = Incentives + Innovation + Outputs, a regulatory framework used by the UK energy regulator, Ofgem. |
| RTP | Regional Transport Plan. |
| SDP | Strategic Development Plan |
| SLES | Smart Local Energy System |
| SMR | Steam Methane Reformation |
| WWU | Wales and West Utilities |

In addition to the abbreviations, a glossary page is included at the end of the report explaining key words, units and terms used

Contents



| | |
|--|----|
| Abbreviations | |
| Foreword | 2 |
| Local Area Energy Plan outline | 4 |
| Executive summary | 5 |
| 1. Introduction | 6 |
| 2. The current energy system | 12 |
| 3. The future energy system | 19 |
| 4. Action planning | 36 |
| 5. Next steps | 48 |
| Table of figures | 61 |
| Table of tables | 66 |
| Glossary of terms | 69 |
| Units of measure | 70 |
| Bibliography | 78 |
| | 80 |

Navigating this report

Home icon

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

Navigation to sections

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

Navigation within the report

Throughout this document, clicking on underlined text will take the reader to the page referred to.



This Local Area Energy Plan was prepared by Arup, Carbon Trust and Afallen on behalf of Cardiff Council 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.

Foreword

A note from Councillor

I am really pleased to present the finding of the Cardiff Local Area Energy Plan (LAEP).

As with all LAEPs in Wales, its production has been funded by Welsh Government.

Cardiff Council has been working with consultants in a collaborative approach with Cardiff's public, private and voluntary sector and the local energy network operators to produce this Cardiff Local Area Energy Plan. The primary focus is on the area's built-environment (domestic, business and industrial buildings), transportation activities and energy generation and distribution infrastructure. The Cardiff LAEP outlines a vision for what a net-zero carbon energy could look like in 2050 for Cardiff. It outlines the scale and pace of carbon reduction related activities required to meet national net zero targets by assessing what is needed, how much is needed, by when it should happen, and who the key delivery partners may be. It has been developed in wide consultation by bringing local organisations, stakeholders and Council officers together to gather and discuss the evidence and findings.

For the first time this LAEP quantifies the scale of the challenge that we face in decarbonising the city and the shared ownership and partnership work that will be required to achieve this immense shift. We all have a role to play in shaping Cardiff and Wales' transition to net zero, and as the Local Authority for Cardiff, we understand how important it will be for us to do this in a way that maximises our local potential, supports our most vulnerable communities, and delivers additional benefits such as improved health and employment opportunities across the county.

This is a plan for the whole city and all stakeholders will be able to use it as a key evidence base to inform their actions moving forward.

Councillor Dan De'Ath
Cabinet Member for Climate Change and Strategic Planning & Transport



Figure 0.1: Pierhead Building in Cardiff Bay

Local Area Energy Plan outline

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

Overview

What is a LAEP?

- Local Area Energy Planning (LAEP) is a data-driven and whole energy system, evidence-based approach that aims to identify the most effective route for the local area to contribute towards meeting local and national net zero targets.
- It explores a range of different future local energy scenarios with stakeholders across technologies and infrastructure to achieve deep decarbonisation at least cost, setting out a plan for implementation.

Why create a LAEP for Cardiff?

This Local Area Energy Plan (LAEP) outlines a compelling vision for what a net-zero carbon energy system could look like in 2050 for Cardiff. It assesses what is needed, how much is needed and by when it must happen. It then sets out clear actions for the local authority, utilities, key city stakeholders, CCR and the Welsh Government to ensure alignment at both local and regional levels.



Figure 0.2: The LAEP development process

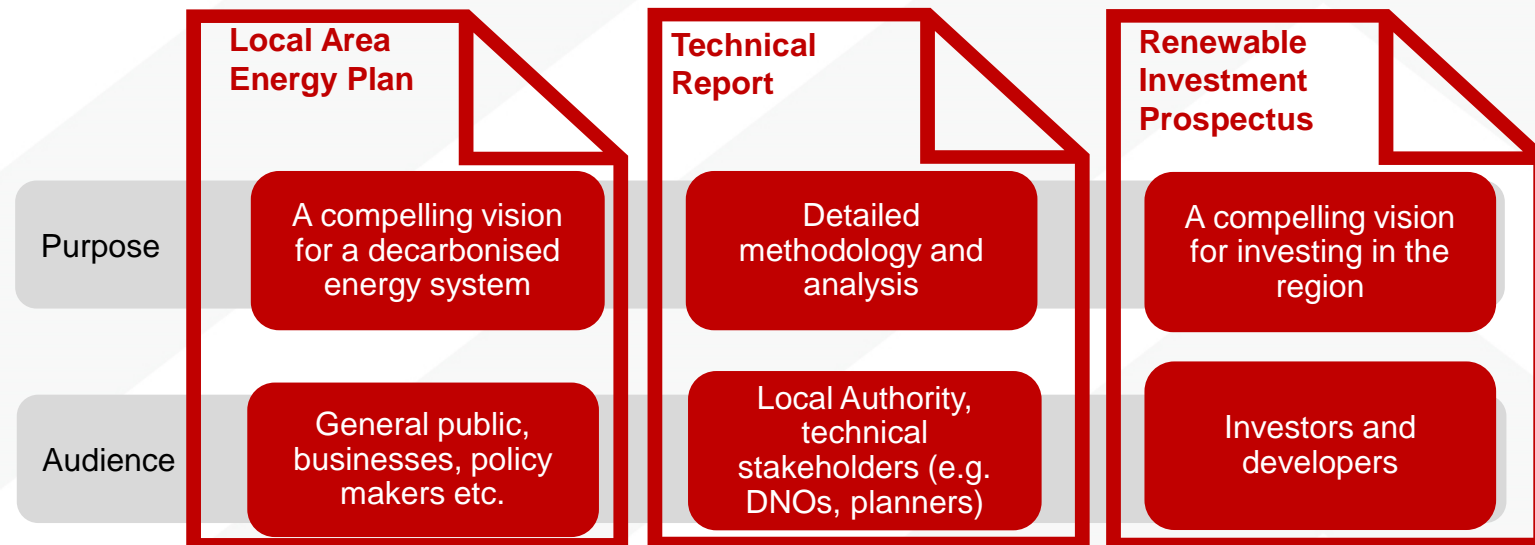


Figure 0.3: LAEP outputs, their purpose and target audience

Executive summary

Our vision for a net zero local energy system

Overview

A local vision for Cardiff

The vision for our future local energy system is:

By pro-actively addressing the factors that contribute to the climate change emergency we can build a cleaner, healthier and more equitable city with a higher quality of life and a thriving, more resilient economy

Central to this vision is ensuring community engagement and ownership, ensuring accessible and affordable energy solutions for all that will lead to a sustainable, inclusive, and prosperous future for residents of Cardiff.

Continued support from a wide range of stakeholders will be required to deliver this plan and implement the change necessary to ensure Cardiff achieves net zero by 2050.

Cardiff's Energy Objectives

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

1. Quantify the scale of the challenge
2. Establish roles and responsibilities for decarbonisation of the energy system
3. Reduce the energy we use and increase energy efficiency in all buildings
4. Increase renewable energy supply
5. Shift to more sustainable and active modes of transport
6. Prioritise actions for best return on investments environmentally, economically and socially

Figure 0.4: Cardiff's energy objectives developed through the LAEP process

Cardiff's Energy Propositions

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

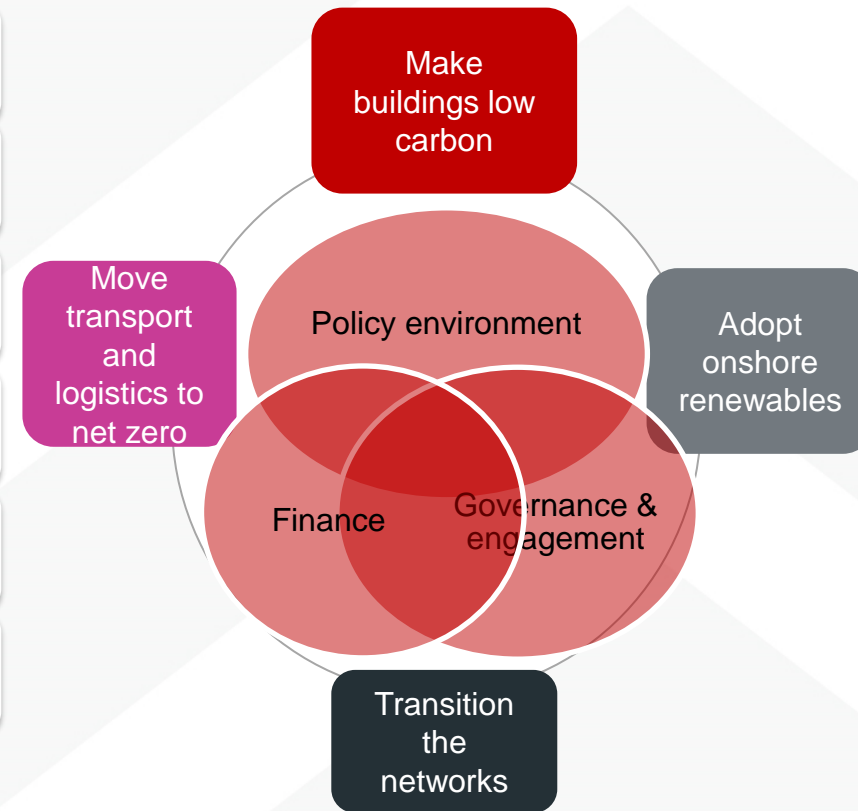


Figure 0.5: Cardiff's energy propositions identified through the LAEP process

Executive summary

Cardiff's net zero future

Overview

Significant changes in the deployment of energy components are needed to achieve a net zero scenario based on National Net Zero targets:

Ground-mounted, rooftop solar PV and onshore wind deployment could be **maximised**.

Heat network adoption and expansion, supported by zoning policy.

The existing energy from waste plant could **continue to operate** and contribute to residual emissions.

Transport emissions could **reduce**, due to uptake of EVs, public transport and active travel.

Heat demand may be met by **large scale adoption of heat pumps**.

Hydrogen demand could **increase** to help transition Cardiff's industrial and transport demands.

Equivalent of 12 Lamby Way Solar Farms

Equivalent of 115,000 domestic roofs with PV

Equivalent of 9 wind turbines

Increase in grid capacity by 2.5 times

Around 26,000 EV chargers

Around 160,000 heat pumps

| | Energy system components | National Net Zero Scenario | |
|------------|--------------------------|----------------------------|-------------|
| | | Baseline | |
| Generation | Ground-mounted PV | 9 GWh | to 118 GWh |
| | Rooftop PV | 14 GWh | to 523 GWh |
| | Onshore wind | 7 GWh | to 63 GWh |
| | Sewage gas | 23 GWh | to 96 GWh |
| | Biomass | 10 GWh | to 0 GWh |
| | Hydrogen import | 0 GWh | to 368 GWh |
| | Electrolyser | 0 GWh | to 15 GWh |
| | Import from Grid* | 1900 GWh | to 4410 GWh |
| | EV chargers | 3 GWh | to 841 GWh |
| | Hydrogen refuellers | 0 GWh | to 112 GWh |
| Conversion | Heat pumps | 4 GWh | to 2960 GWh |
| | Heat networks | 0 GWh | to 747 GWh |
| | Resistance heaters | 280 GWh | to 50 GWh |
| | Biomass boilers | 6 GWh | to 0 GWh |

*Import from Grid is the provision of electricity via distribution and transmission electricity networks from outside the local authority boundary.

Table 0.1: Change in energy components required to achieve National Net Zero targets

Executive summary

Cardiff's local energy system will need to change significantly to achieve net zero by 2050
The rate of change needed

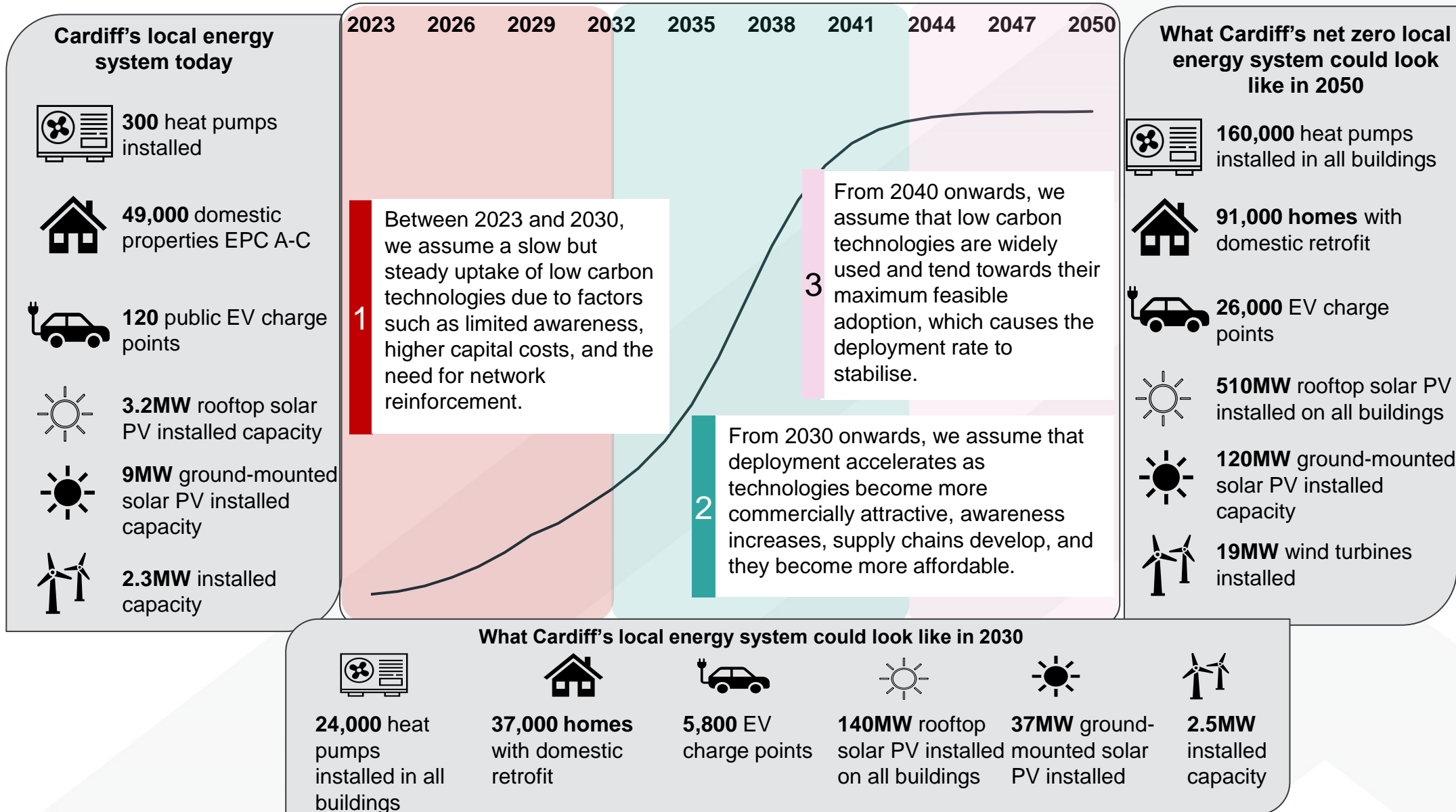


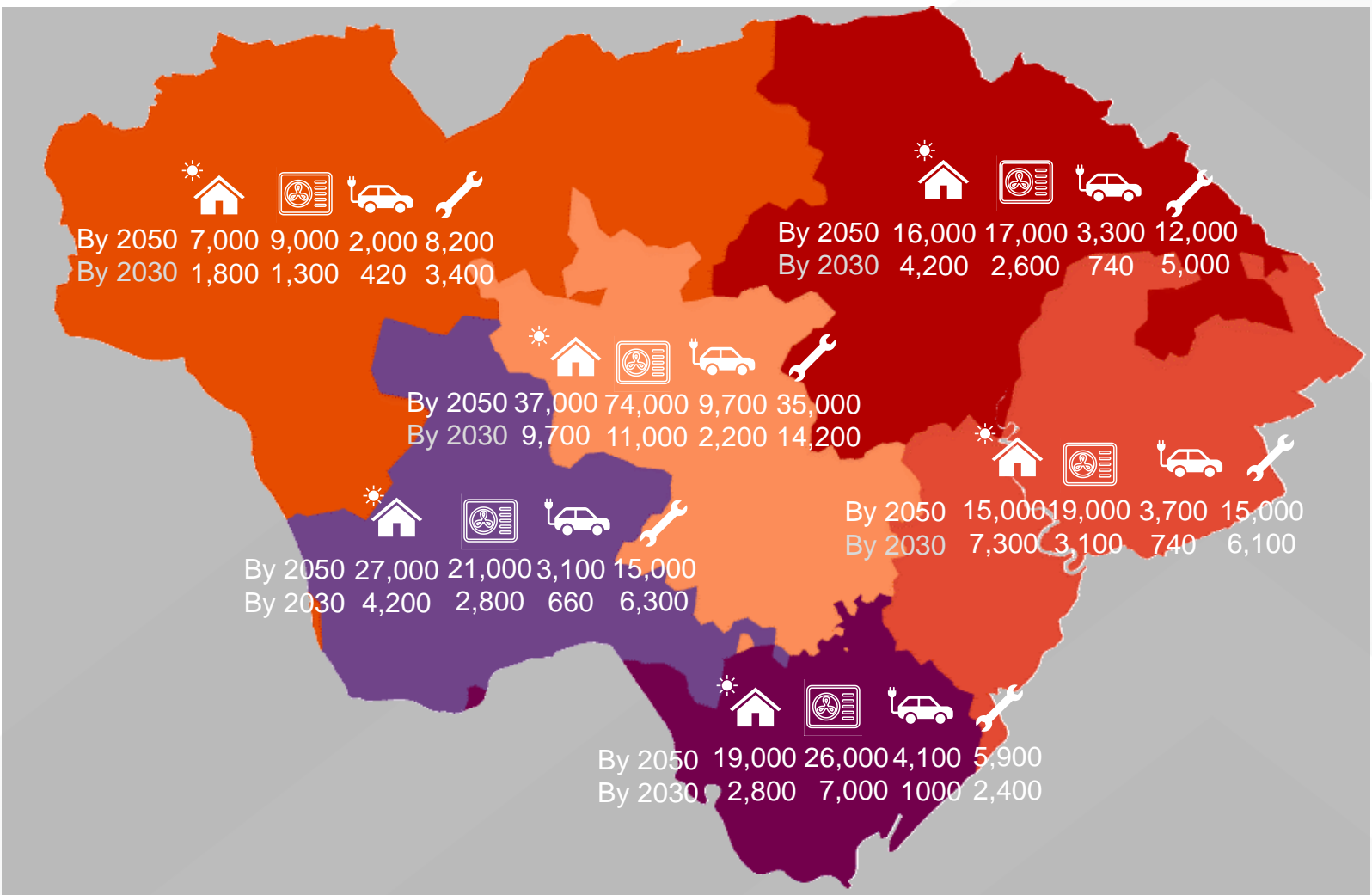
Figure 0.6: Deployment rate for low carbon technologies in Cardiff to 2050

Executive summary

Cardiff's Plan on a page

Overview

This map highlights how much of each intervention is likely to be needed in each area to reach net zero by 2050 on top of what already exists.



- Number of buildings with rooftop solar PV installed
- Number of heat pumps deployed
- Number of EV chargers deployed
- Number of buildings retrofitted with insulation
- Number of onshore wind turbines installed
- Area covered by installed ground mounted solar PV (km²)

Assumptions used:

- 4kW/Roof with PV
- 6kW/Heat pump
- 4.5kW/EV charger
- 53MW/km² Ground PV
- 2MW/Onshore wind turbine

Interventions across Cardiff

| | Wind | Solar |
|---------|------|--------------------|
| By 2050 | 9 | 2.2km ² |
| By 2030 | 1 | 0.7km ² |

(Subject to planning permission)

Figure 0.7: Cardiff's plan on a page

Executive summary

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

| Direct impacts | | Wider impacts | |
|--|--|--|---|
| <p>Emissions reduction</p> <p>Three times less GHG emissions than in 2023</p> | <p>Energy security and reliability</p> <p>Diversified local energy supply improves energy security</p> | <p>Air quality improvements</p> <p>Reduced fossil fuel combustion from transport, heat and power improves air quality</p> | <p>Cumulative savings will reach £500 million by 2050</p> |
| <p>Energy savings</p> <p>By 2050, total emissions will be less than 500ktCO₂e/year</p> | <p>Net job creation</p> <p>Emerging net zero industries attract investment and create high quality local jobs</p> | <p>Affordability</p> <p>Highly insulated homes reduce heat demand, improve affordability and reduce fuel poverty</p> | <p>9,800 jobs created by 2050</p> |
| <p>Emissions from buildings and vehicles will reduce from 81% in 2023 to 7% in 2050</p> | | | <p>Green jobs in 2050 will be more than four times that of 2030</p> |



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

Executive summary



Sponsors:



To deliver the LAEP, we have developed a series of actions and next steps that it is recommended will need to be taken

Action routemap

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

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

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

Next steps

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

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

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

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