

ARUP



Perth and Kinross Council

Local Area Energy Plan

RP-SS-PKC-LAEP-240130 FINAL ISSUE

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Executive summary

Overview

This Local Area Energy Plan (LAEP) sets out a vision of what a net-zero carbon energy system could look like for Perth and Kinross and describes priority interventions and recommendations for actions that will support Perth and Kinross Council (the Council) in delivering their 2045 net zero target.

The vision for Perth and Kinross’s future energy system is:

Perth and Kinross will become a model for affordable, equitable access to sustainable energy for all residents, businesses and organisations through an integrated, net-zero local energy system.

Modelling conducted for this plan illustrates the radical transformation necessary to fully decarbonise the local energy system. Numerous possible pathways were analysed to identify opportunities and constraints. While the results shouldn’t be considered to be an exact prediction for the future of the area, it has supported the identification of priority interventions and actions focused on both system-led change, and incentivising consumers to decarbonise. This plan sets out key recommended actions for the initial phases of implementation. Continued multi-sector support will be vital to deliver this ambitious plan and align top-down and bottom-up efforts toward decarbonisation.

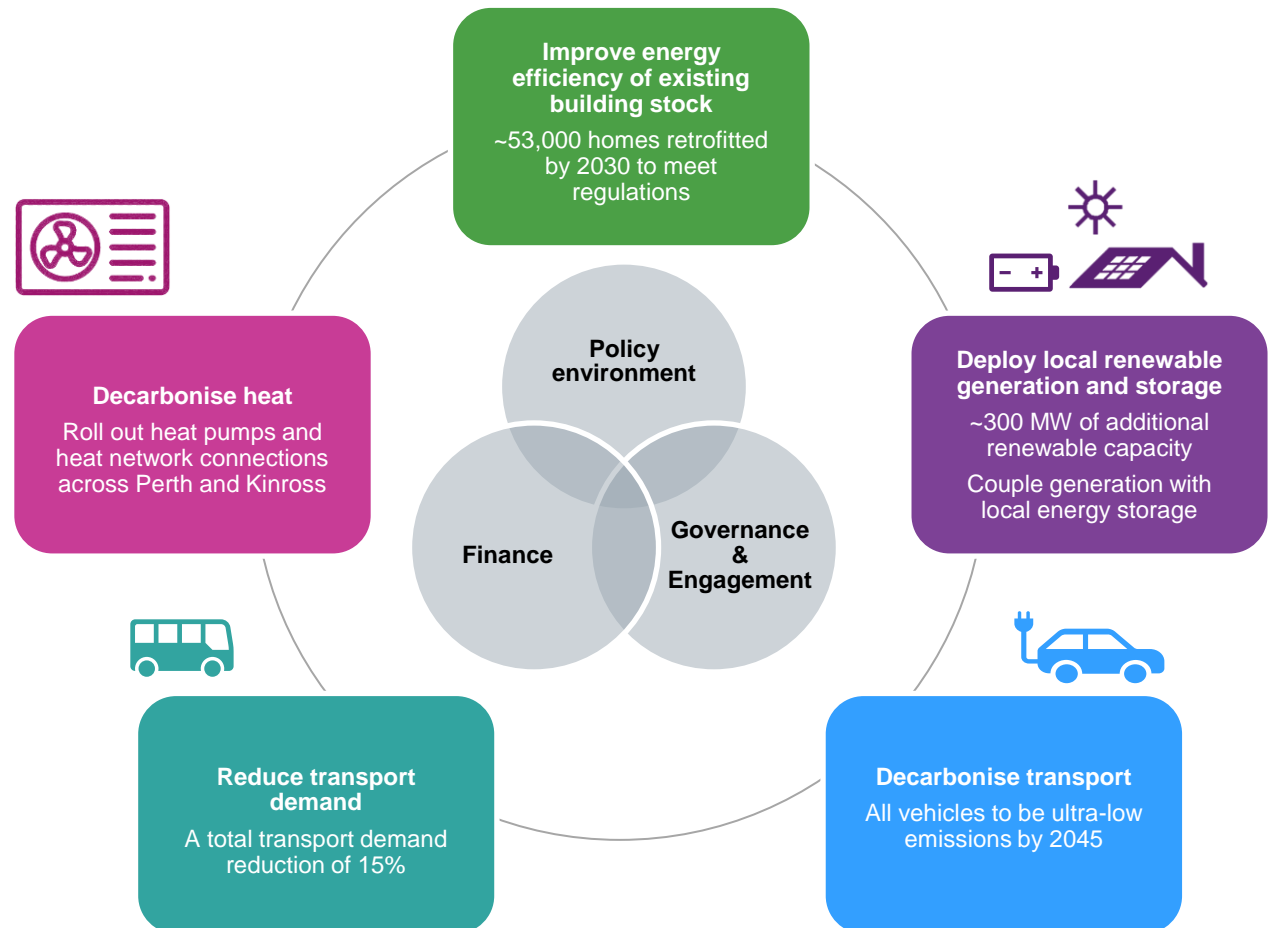


Figure 0.1: LAEP Priority intervention areas

Executive summary

Pathways to net zero

Perth and Kinross is unique in many ways, with a largely rural area with many off-gas properties, and a high dependence on private vehicles to move around, dominating the area’s current energy usage. The area presents distinct opportunities, challenges, and uncertainties.

The LAEP attempts to consider these factors through the exploration of a series of potential pathways for the area’s energy transition, examining how the LAEP area’s energy system and emissions could change between 2022 and 2045. The pathways are presented in Figure 0.2. The emissions performance, social impact, affordability and deliverability of these were reviewed with stakeholders, and a recommended pathway for the energy system transition has been identified.

This process has determined that the current, ‘Business as Usual’ pathway is not an acceptable option for Perth and Kinross, given its significant impact on cumulative and residual emissions. The analysis also shows that existing legislation is not sufficient to drive change. Even if the public sector leads by example and decarbonises its own assets, the area still depends heavily on private sector initiatives and investments to truly deliver noticeable change.

The LAEP suggests a pathway which leverages the area’s unique opportunities for decarbonisation. This includes whole building retrofits to minimise energy use; heat networks to supply low carbon heat to developments where it is most cost-effective; and decentralised heat pumps in more rural areas. Drastic reductions in transport emissions will be enabled

through smart spatial planning to reduce travel distances, plus an uptake in EVs and active travel modes.

Finally, the local energy system will see a further shift towards local renewable generation operating at a local scale to balance local supply and demand. This reduces dependence on the wider grid, making the whole system more resilient to change while aligning with net zero.

It is important to note that the full decarbonisation of Perth and Kinross’s energy system however also relies on the net zero transition of the wider electricity grid, and the delivery of the priorities set out in this LAEP should be coupled with supporting the wider decarbonisation of Scotland’s electricity supply.

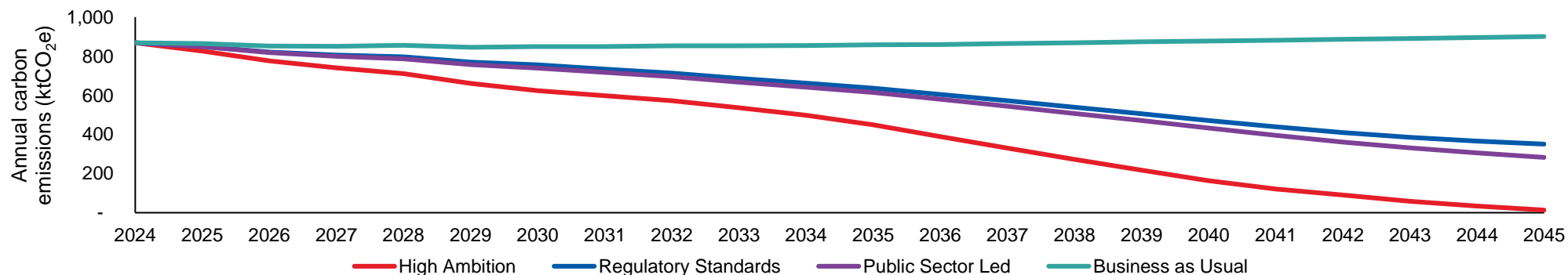


Figure 0.2: Carbon emission pathways

Glossary of terms and acronyms

Table 0.1: Table of terms and acronyms

Term or acronym	Definition or meaning	Term or acronym	Definition or meaning
BaU	Business as Usual	LAEP	Local Area Energy Plan
BECCS	Bioenergy with Carbon Capture and Storage	LHEES	Local Heat and Energy Efficiency Strategy
CO ₂	Carbon dioxide	LPD	Local Development Plan
The Council	Perth and Kinross Council	LPG	Liquefied Petroleum Gas
DNO	Distribution Network Operator	MaaS	Mobility as a Service
EfW	Energy from Waste	OSS	One Stop Shop
EPC	Energy Performance Certificate	PCDB	Perth City Development Board
EST	Energy Saving Trust	PSL	Public Sector Led
EV	Electric Vehicle	PV	Photovoltaics
GSP	Grid Supply Points	RESOP	Regional Energy System Optimisation and Planning
HA	High Ambition	RS	Regulatory Standards
HES	Home Energy Scotland	SGN	Scottish Gas Networks
HGV	Heavy Goods Vehicle	SSEN	Scottish and Southern Electricity Networks
HiB	Heat in Buildings Strategy	UK	United Kingdom
HNA	Heat Networks Act	ULEV	Ultra Low Emission Vehicle
ICE	Internal Combustion Engines		

Chapter 1: Introduction

1. Introduction

Overview

Overview

Introduction

In March 2019, Perth and Kinross Council (the Council) declared its support for the Scottish and United Kingdom (UK) Parliaments' declaration of a climate emergency. In 2021, the Council published their Climate Change Strategy and Action Plan, which sets out how Perth and Kinross will transition to net-zero carbon emissions by 2045, or sooner. The strategy outlines the Council's goals and commitments to tackling the climate emergency while also ensuring a resilient and just transition.

The Council recognises the necessity to take an interdisciplinary approach to support the energy transition in the context of global, national and local climate trends, and are taking measured action now through the development of a Local Area Energy Plan (LAEP) for Perth and Kinross. The large and rural nature of the area poses a significant challenge for the supply of decarbonised energy for heating, electricity and transport in a manner which aligns with the Council's climate ambitions, as set out in Chapter 2.

This plan not only contributes to the decarbonisation of Perth and Kinross, but also provides an evidence base for other local net zero energy planning projects for local authorities across Scotland and the UK. Note that this work feeds into a wider programme of coordinated decarbonisation planning projects for

Perth and Kinross, including the preparation of a Local Heat and Energy Efficiency Strategy (LHEES) for Perth and Kinross, and Project RESOP (Regional Energy System Optimisation and Planning) which aims to consolidate data about energy systems components into a single tool to facilitate collaboration between Distribution Network Operators (DNOs), local actors and other stakeholders to take targeted and considered action.

What is a LAEP?

A LAEP provides an understanding of the nature, scale, rate, and timings of changes needed for the transition to a net zero energy system within Perth and Kinross.

The LAEP process takes a whole energy systems approach, considering the complex interdependencies of different energy vectors from generation through to demand.

Following Ofgem's methodology, the LAEP process combines robust technical analysis with comprehensive stakeholder engagement to create a routemap for delivering decarbonisation as effectively as possible, identifying actions required by groups including local and national government, energy providers, regulators, and residents.

This process aims to account for the local and national wider conditions to achieve net zero, considering how co-operation with adjacent areas can help to bring success to decarbonising the wider area. The LAEP will form part of Perth and Kinross Council's overarching decarbonisation strategy.

This plan also aims to facilitate increased local stakeholder awareness in Perth and Kinross, resulting in more widespread and meaningful consent for the changes required and credible commitments to deliver the plan.

Stakeholder engagement

This plan has been developed through active involvement with various stakeholders in the local energy system. These include Distribution Network Operators (DNOs), regional transport authorities, housing providers, public services, local energy charities, and neighboring local authorities. Engaging with stakeholders is crucial to secure support from diverse perspectives and foster collaboration as we progress towards a more localised and interconnected energy system, where energy generation, storage and distribution happens closer to the end-user and more flexibly matches local supply and demand conditions.

1. Introduction

LHEES and LAEP

A joined-up approach

This LAEP has been produced in alignment with the LHEES for Perth and Kinross. As a statutory requirement for all local authorities in Scotland, the LHEES and supporting delivery plan must set out a strategy and delivery plan for reducing building emissions and addressing fuel poverty. The LHEES will be published by 2024 and targets are to be met by 2045.

The LHEES identifies opportunities for energy efficiency improvements, heat decarbonisation and priority areas suited for heat network development across Perth and Kinross. Data collection and analysis is conducted at building level, providing granular insights to enable targeted interventions on a hyper-local basis.

The relationship between the LHEES and LAEP is integral, as shown in Figure 1.1. This LAEP has directly incorporated LHEES outputs into whole systems energy modelling, capturing wider components like power and transport, transmission systems and storage. This allows an understanding of how the granular LHEES impacts the broader energy system and its transition to net zero. The linkage enables optimised, integrated planning and decisions across the patchwork of systems that must evolve in coordination on the pathway to decarbonisation.

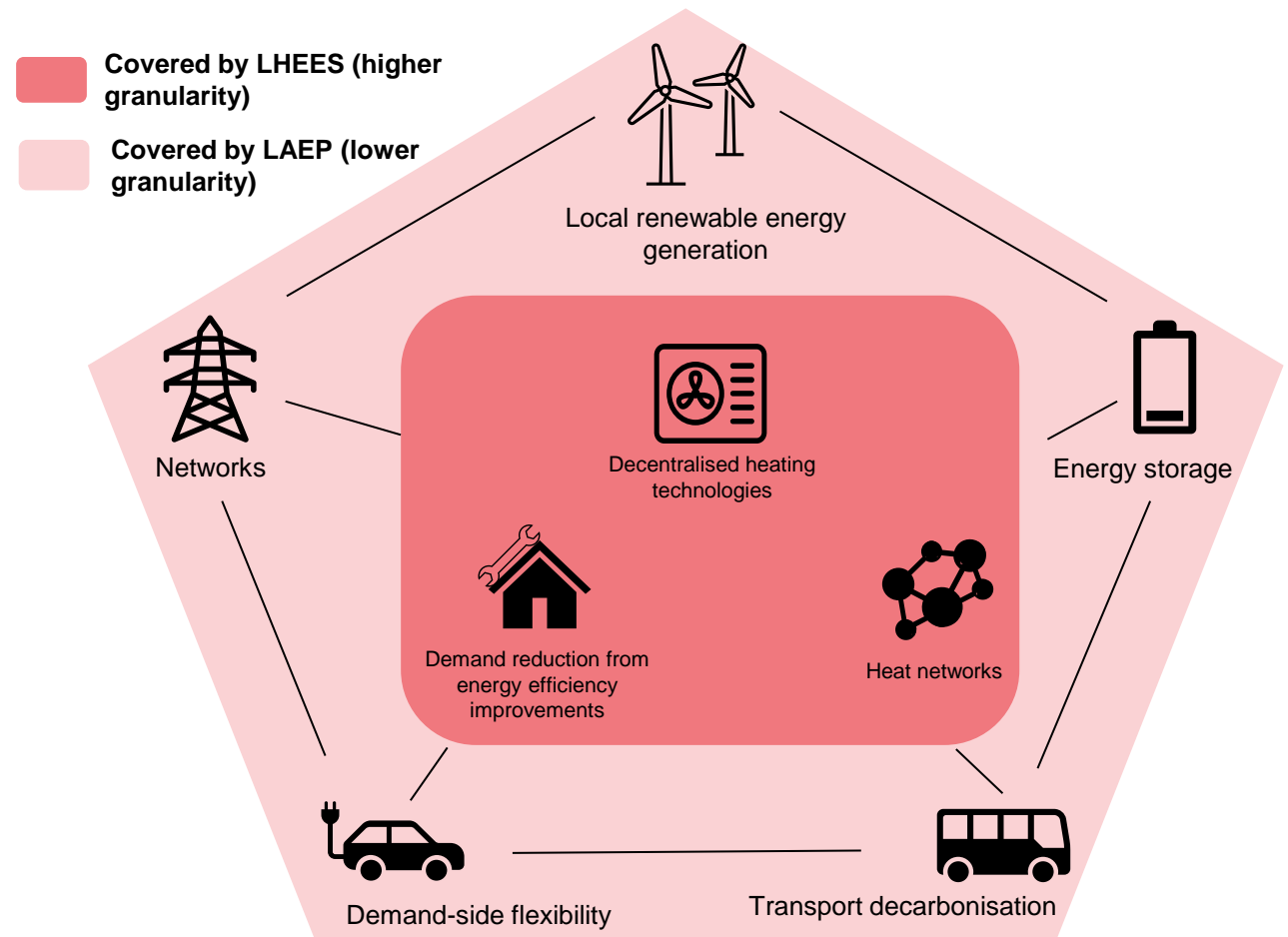


Figure 1.1: Relationship between the LHEES and LAEP.

1. Introduction

Approach and zoning

Data aggregation and analysis

For this LAEP, Perth and Kinross's energy system was analysed from a bottom-up approach. Data has been collected on individual asset basis across various energy domains.

To facilitate the LAEP analysis, Perth and Kinross was divided into distinct zones based on SSEN's primary substation supply areas. These zones represent core areas of demand, supply and transmission in the energy system. Data on future demand and supply options was aggregated at the zone level.

Optimisation modelling determined the optimal energy mix for each zone. The modelling considered zone-specific constraints and opportunities, and interactions between zones. Key factors and dynamics considered were renewable energy resource availability, existing energy infrastructure, and projected demand changes. The optimisation modelling provides a high time resolution view into Perth and Kinross's energy system, simulating hourly energy flows over a full year to maintain balance across electricity, heat, and transport demand.

While the core results and priority interventions identified in this LAEP are summarised at a regional level, the evidence base was developed at a more granular level. The modelling outputs can be used for additional analysis to inform strategic decisions and investment planning within the region.

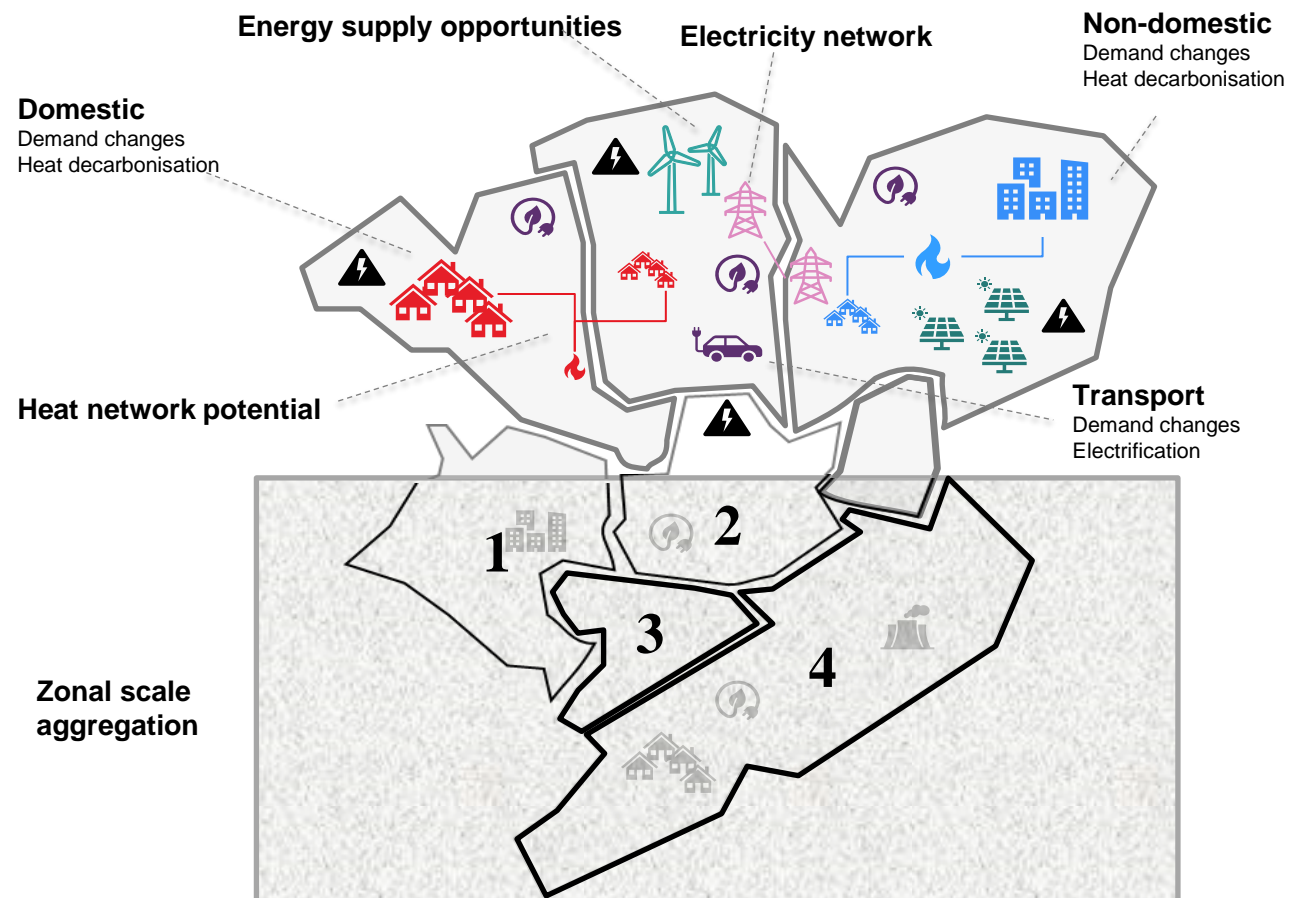


Figure 1.2: Data aggregation and zoning process

1. Introduction

Contents

Plan contents

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

Plan structure

This plan is structured in three main topic areas:

- 1. Context and baseline** – Description of Perth and Kinross’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, and the pathways to get there.
- 3. Priority intervention areas** – Presenting the key future energy system intervention areas, including “low regrets” measures, which are very likely to be part of the future energy system regardless of uncertainty around certain aspects of the future.
- 4. Actions and recommendations** – A routemap and action plan to drive the local energy system transition in the area, including what needs to happen and what Perth and Kinross Council would need to do.



Rooftop PV installation on Perth and Kinross Council's offices in Perth

Chapter 2: Context and baseline

2. Context and baseline

The local area

Socio-economic context of LAEP area

Perth and Kinross is located in central Scotland, covering an area of 5,286km². Perth and Kinross is spread over a mix of rural and urban areas, with the largest urban area being the City of Perth. Key industries include farming, forestry, tourism, manufacturing and services.

Demographics

Population: The estimated population in 2021 was 153,810¹ which accounts for almost 3% of the population of Scotland. Perth and Kinross had the 12th highest population in 2021, out of all 32 council areas in Scotland. The population density is 29 people per km², significantly lower than Scotland overall, which has a population density of 70 people per km².

Ethnicity: At the time of the 2011 census, the largest ethnic group in Perth and Kinross was White Scottish (81.8%), followed by White Other British (11.3%), White Polish (1.7%) and Asian (1.3%). Other ethnic groups make up 0.8% of the population.²

Deprivation: Based on the Scottish Indices of Multiple Deprivation (SIMD) 2020, a measure of the relative level of deprivation in an area, there is some variation in deprivation levels across Perth and Kinross. There is a total of 186 data zones in Perth and Kinross, of which 11 are in the 20% most deprived and 44 within the 20% least deprived.³

As of 2019, the Scottish House Condition Survey shows the percentage of households in fuel poverty (28%) and extreme fuel poverty (18%) in Perth and Kinross is higher than the national average (24% and 12% respectively).⁴

Building Stock

Perth and Kinross's domestic building stock is made up of 77,485 properties. These properties are a varied mix of ages and property types. Most buildings are detached or semi-detached and are owner-occupied. The highest proportion of properties are late 20th century (33%), followed by pre-1919 (24%). Perth and Kinross has a higher proportion of domestic properties in conservation areas than the national average. A significant proportion (58%) of domestic properties across Perth and Kinross have Energy Performance Certificate (EPC) ratings of D-G and there is a large percentage of off-gas buildings (36%).

Transport

Transport amounts to just over half of the total carbon dioxide emissions across Perth and Kinross.⁵ Cars provide roughly 45% of the emissions, light and heavy goods vehicles both around 23% each, with trains providing the remaining 9%. The large rural population poses challenges for efficient transport emissions reduction.



Figure 2.1: Perth and Kinross location in Scotland

Description	Information
Area	5,286km ²
Population (2021)	153,810
Population density	Low
Character	Rural and urban mix
Fuel poverty (2019)	28% of households
Off-gas properties	36% of properties

Table 2.1: Perth and Kinross key area statistics

2. Context and baseline

Policy and context

Local policy

Key local policies and strategies related to LAEP include:

- **Climate Change Strategy and Action Plan⁶** - Sets out the Council's next steps in relation to climate change, outlining the initial route map to support the journey to a net zero carbon and climate resilient Perth and Kinross. It aims to achieve net zero aligned with or sooner than the Paris Agreement and Scottish Government targets.
- **Perth 2040: Our Agenda for Change⁷** - Sets out an agenda for action through to 2040, produced by the Perth City Development Board (PCDB). This advocates to make Perth Scotland's first net-zero carbon city by 2040, promoting energy efficient new and existing residential and commercial properties, facilitating clean energy district heating systems and promoting zero-emission vehicles.
- **Council's Corporate Plan 2022-2028⁸** - The Plan sets out a vision for a Perth and Kinross, where everyone can live life well, free from poverty and inequality. Priorities include tackling climate change and developing a resilient, stronger and greener local economy. It includes targets around greener transport, improving energy efficiency of council buildings and generation of renewable energy across the Council estate, incorporating SMART energy solutions.
- **Community Plan (Local Outcomes Improvement Plan)⁹** - Strategic objectives include reducing poverty, including fuel poverty, through a suite of actions and targets including researching community renewable energy co-operative schemes and assessing the feasibility of implementing these in Perth and Kinross. The Community Planning Partnership has established a Climate Change Working Group, whose remit is to address the specific inequalities which climate change brings and provide a forum for partners to collaborate on climate action.
- **Local Development Plan 2 (LPD)¹⁰** - There are four main categories in the LDP: to create a successful, sustainable place; a low-carbon place; a natural, resilient place; and a connected place.
- **Smart Perth and Kinross Strategy¹¹** - The Strategy sets out the key areas that the Council wishes to progress as a smart city and county and is part of Perth's participation in the Smart Cities Scotland initiative. Perth is also participating in the European Regional Development Fund 8th City Initiative which is providing funding to support projects including an Open Data Platform; Innovation Lab; City Operations Centre; Intelligent Street Lighting; Smart Waste and Mobile Working.
- **Local Housing Strategy 2022-2027¹²** - Priorities include delivering quality homes with affordable warmth, zero emissions and smart technology.
- **Council Energy Strategy & Policy (Non Domestic)** - Strategy developed by Council's Property services to map out energy efficiency measures to be delivered within the Council's building estate.
- **TACTRAN Regional Transport Strategy 2024-2034¹³** - The Regional Transport Strategy sets out a vision to reduce emissions from transport in the region, including supporting low carbon vehicles and reducing car miles.
- **EV Strategy¹⁴** - An Electric Vehicle (EV) Strategy has been produced with TACTRAN partners and Urban Foresight which sets out a baseline to enable the transition to EV vehicles. Targets include a transition for fleet vehicles by 2025 and public vehicles by 2030.
- **Draft Mobility Strategy (2023)¹⁵** - The Mobility Strategy will set out Perth and Kinross Council's vision for managing and developing the transport and active travel network over a minimum of 10 years. The Strategy will respond to the climate change agenda and changes in how people travel following the COVID-19 global pandemic.

2. Context and baseline

Policy and context

National policy

Key national policies and strategies relating to the LAEP include:

- The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019¹⁶**– In direct response to the international Paris Agreement, the Climate Change (Scotland) Act 2009 was amended, increasing the ambition of Scotland’s emissions reduction targets to net zero by 2045.
- Update to Climate Change Plan 2018-2032¹⁷** - This update sets out the Scottish Government's path to achieve the targets set by the Climate Change Act 2019. The strategy advocates for an electricity system powered by a high penetration of renewables, aided by a range of flexible and responsive technologies. By 2030 at least 50% of Scotland’s building stock will be heated using zero emissions systems and the need for new petrol and diesel cars will be phased out.
- The Scottish Energy Strategy 2017¹⁸** - The Scottish Energy Strategy 2017 sets out the 2050 vision for energy in Scotland. It aims for the equivalent of 50% of the energy for Scotland’s heat transport and electricity consumption to be supplied from renewable sources by 2030.
- Draft Energy Strategy and Just Transition Plan¹⁹** - The draft ESJTP was published by Scottish Government January 2023. The strategy sets out the Scottish Government’s plan to transform the way Scotland generates, transports and uses energy. Three overarching aims of the strategy are to scale up renewable energy production; secure continued and increased investment in the Net Zero energy economy; and deliver a fairer, more secure energy system.
- Heat in Buildings Strategy (HiB)²⁰** - The Heat in Buildings Strategy sets out the Scottish Governments vision for the future of heat in buildings, and the actions they are taking in the buildings sector to deliver climate change commitments, maximise economic opportunities, and ensure a just transition. This includes a target for 68% reduction in emissions from heat in buildings by 2030 (relative to 2020 levels).
- Heat Networks (Scotland) Act 2021²¹**- The Heat Networks Act (HNA) aims to accelerate the deployment of heat networks in Scotland through the introduction of a regulatory system aimed at boosting consumer confidence and providing greater certainty for investors. Targets include 2.6TWh of heat to be supplied by heat networks by 2027 and 6TWh by 2030.
- Hydrogen Policy Statement²²** - Published in December 2020, the Hydrogen Policy Statement sets out a vision for Scotland to become a leading hydrogen nation in the production of reliable, competitive, sustainable hydrogen. Key targets include 5GW of renewable and low-carbon hydrogen production by 2030 and 25GW by 2045.
- Fuel Poverty (Targets, Definition and Strategy) (Scotland) Act 2019²³** - The Act sets out a new target relating to the eradication of fuel poverty. By 2040, no more than 5% of households in Scotland are in fuel poverty and no more than 1% of households in Scotland are in extreme fuel poverty.
- National Transport Strategy²⁴** - Launched in 2020, the strategy sets out the vision for Scotland’s transport system for the next 20 years. Aims to provide a sustainable transport system that contributes to net zero and creates better connectivity with sustainable, smart, cleaner transport options. Includes commitments to reduce car kilometres by 20% by 2030, decarbonise passenger rail services by 2035, and fully decarbonise scheduled flights in Scotland by 2040. Also includes phasing out the need for new petrol and diesel cars and light vans as well as vehicles of all types in public sector fleets by 2030.

2. Context and baseline

The current energy system

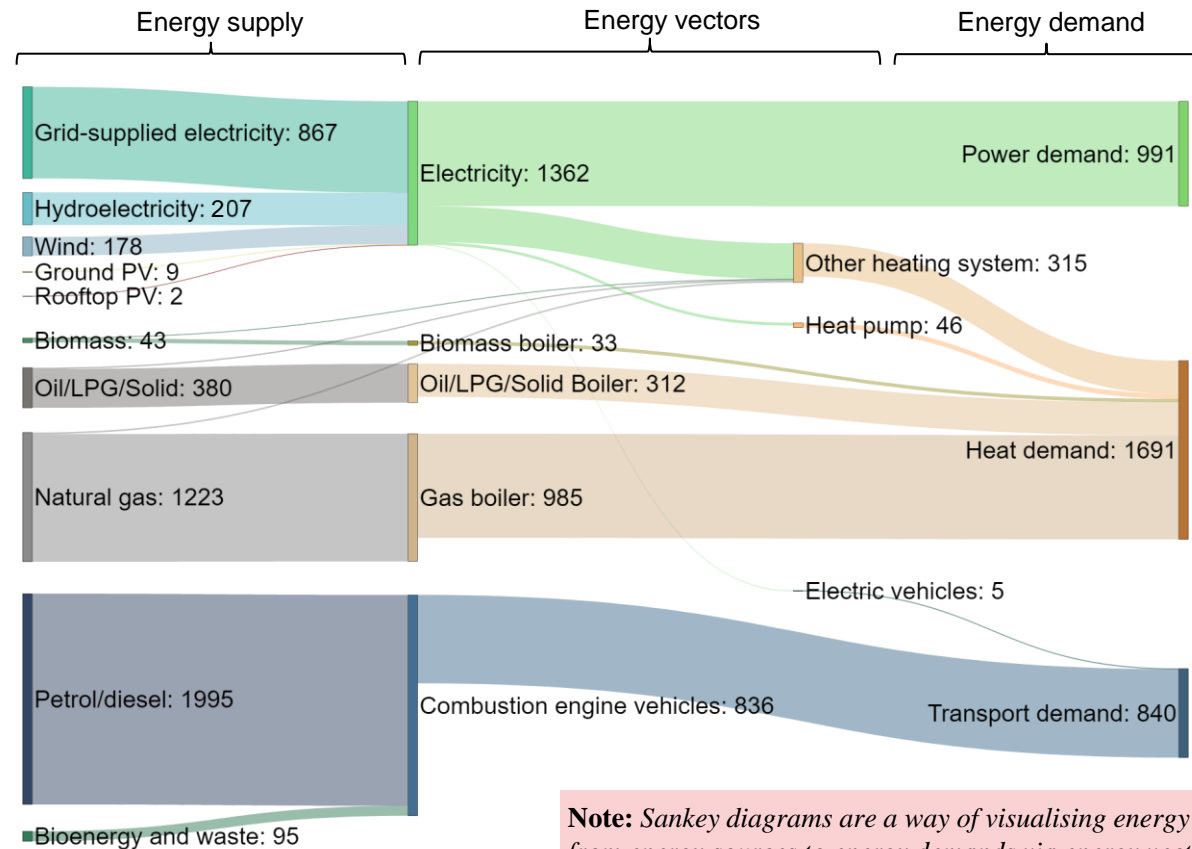
Understanding energy system now

The current energy system in Perth and Kinross consists of three largely isolated energy systems: power, heating, and transportation. Figure 2.2 presents a Sankey diagram showing how different energy sources flow through energy vectors or converting technologies to meet various end-use demands in the energy system. The baseline Sankey diagram represents the energy system in 2021.

Most electricity in the system is imported from outside of the local area via the National Grid’s transmission system and Scottish and Southern Electricity Network’s (SSEN’s) distribution network. The remaining electricity is generated locally by hydroelectric plants, ground-mount solar photovoltaics (PV), onshore and offshore wind sites. Note that larger renewable generation sites exist within Perth and Kinross boundary. However, it is assumed that the energy generated from these sites is supplied to the grid.

Heating demand is primarily met by natural gas through individual boilers. There is also a notable contribution from oil, liquefied petroleum gas (LPG), and solid fuel boilers. This indicates a significant number of properties in Perth and Kinross are not connected to the gas network.

Currently, almost all road transport demand is met by petrol and diesel, with only a small demand from EVs.



Note: 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.

Figure 2.2: 2021 Baseline Sankey diagram for Perth (GWh/year)

2. Context and baseline

The current energy system

Historic greenhouse gas emissions

Carbon dioxide equivalent (CO₂e) emissions in Perth and Kinross have been decreasing across most sectors over the past 15 years, following the trend of the wider UK emissions. Figure 2.3 shows the Perth and Kinross’s historic greenhouse gas emissions from 2005, based on sub-national territorial emissions estimate published by the UK Government. Note that the figure excludes large industrial sites, railways, motorways, land-use, livestock and agriculture, as these are not considered within the Council’s scope of influence.

The transport sector contributes to the largest proportion of carbon emissions and has remained broadly consistent over time. This large transport demand can be attributed to Perth and Kinross’s largely rural landscape with settlements dispersed across the region, where car dependence is high, and distances travelled are long.

Other sectors have seen a steadier decrease in emissions, which can primarily be attributed to the decarbonisation of the electricity grid.

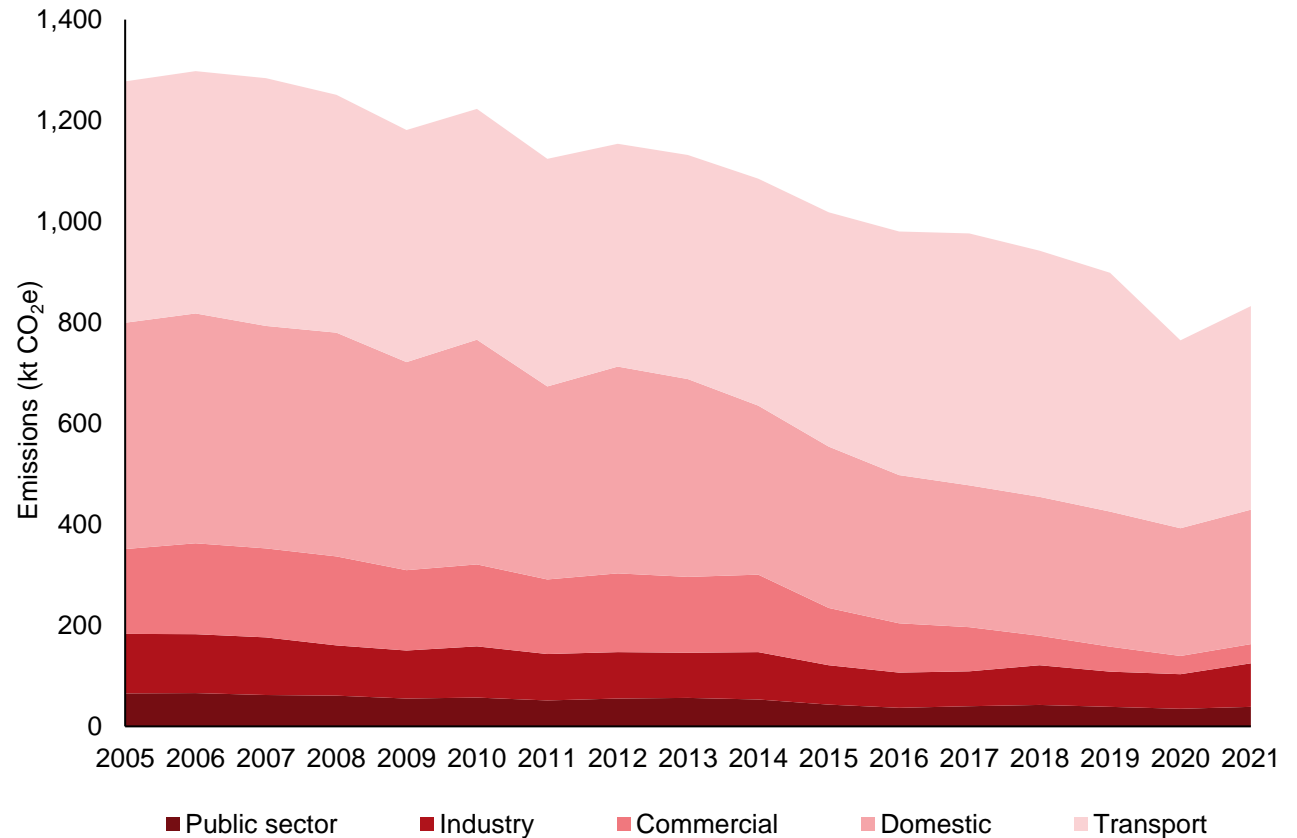


Figure 2.3: Perth and Kinross’ greenhouse gas emissions 2005-2019 by sector (Source: DESNZ UK local authority and regional carbon dioxide emissions national statistics 2005-2021).²⁵

2. Context and baseline

The current energy system

Perth and Kinross' current energy infrastructure

Electricity network

Electricity is supplied to homes and businesses in Perth and Kinross by a distribution network run by Scottish and Southern Electricity Networks (SSEN). The network takes electricity from the National Grid at 17 Grid-Supply Points (GSPs) and lowers the voltage at 51 primary substations before feeding into buildings. Note that some substations supply only small areas within Perth and Kinross. Certain SSEN substations are generation-only, connecting generation assets to the transmission grid without supplying energy to customers.

Existing heat networks

There are currently no existing heat networks within Perth and Kinross. However, a feasibility study for a Perth City Centre heat network has recently been completed in March 2023, which considers a range of low carbon heat sources including river and ground source heat pumps.²⁶

Gas network and hydrogen

Scottish Gas Networks (SGN) operate the gas network in the area, which currently supplies 63% of homes in Perth and Kinross. This proportion of gas heated homes is below the Scottish average, most likely due to the number of rural properties in the LAEP area.

Currently, there are no major hydrogen projects in the area, however there are plans in place for an electrolyser installation at Binn Eco Park. When fully operational, onsite electrolysis will have the potential to produce c. 1 million kg of hydrogen per year.²⁷

GSP Key:

■	Abernethy
■	Boat of Garten
■	Braco
■	Burghmuir
■	Charleston
■	Coupar Angus
■	Dyce
■	Inverness
■	Killin
■	Kinlochleven
■	Lunanhead
■	Rannoch
■	Redmoss
■	St Fillans
■	Tarland
■	Tummel Bridge
■	Woodhill

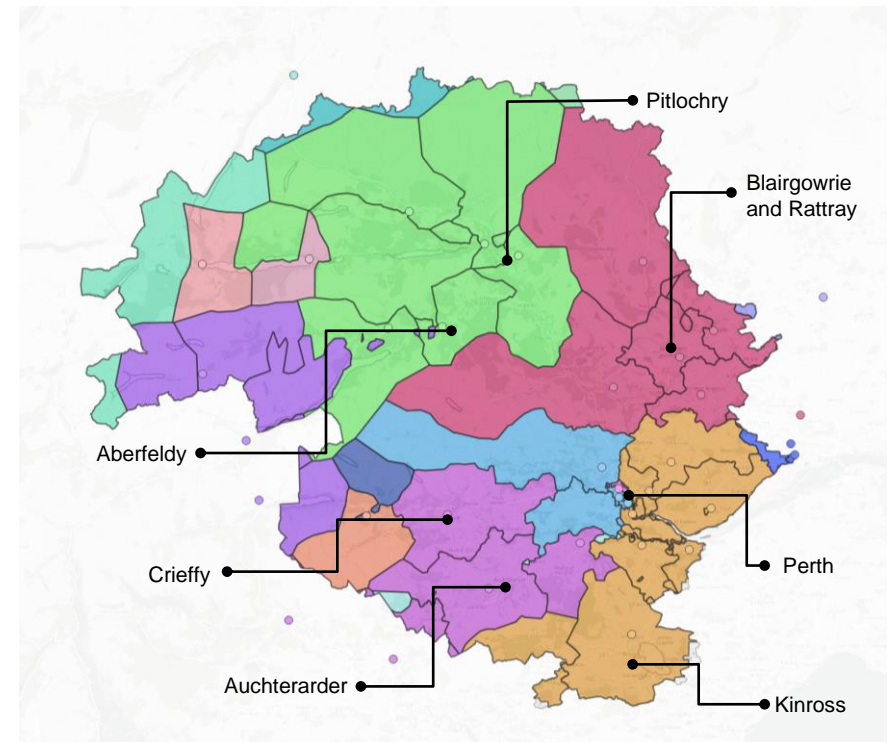


Figure 2.4: Map of grid supply point distribution areas and primary substation locations in Perth and Kinross

2. Context and baseline

The current energy system

Current power demand

The total 2022 baseline annual power demand for buildings in Perth and Kinross is estimated to be 991 GWh.

This captures all end-use electricity use, such as powering lighting and appliances, and excludes heat and transport demands as, given they can be met by multiple different energy carriers (e.g. gas, electricity and hydrogen), these demands are reported on separately.

Figure 2.5 shows that homes contribute to approximately 60% of the total domestic sector exhibits the highest power demand in Perth and Kinross, amounting to 575 GWh annually. This can be attributed to the predominant residential nature of the building stock in Perth and Kinross.

Industry constitutes the highest power demand within the non-domestic sector. Sites contributing to this demand include the Highland Spring water bottling factory and the Internal Procurement and Logistics Inchtute packaging facility.

Note: Data zones are a geography commonly used for the dissemination of small area statistics in Scotland. These zones are nested within Local Authority boundaries and contain standard populations ranging from 500-1,000 household residents.

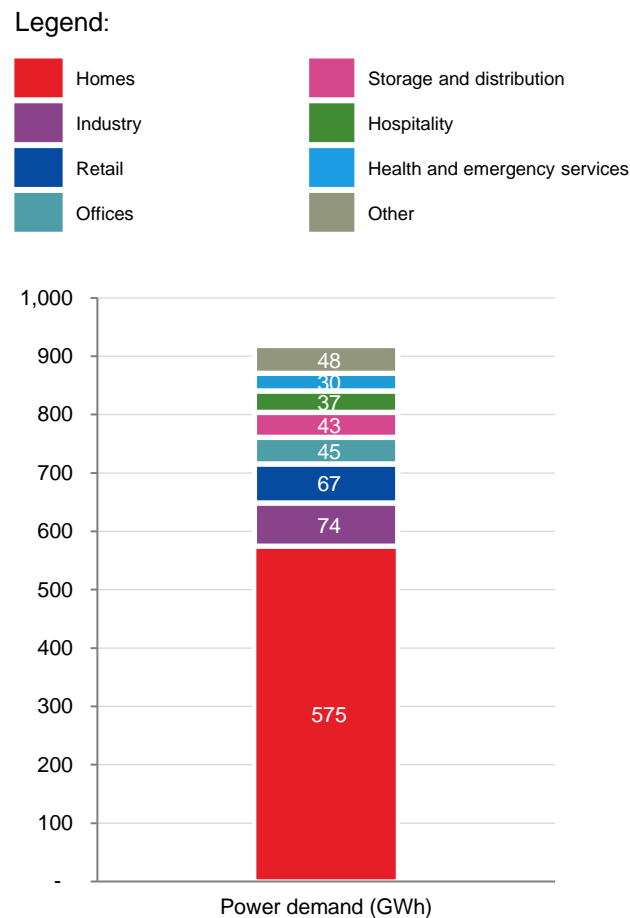


Figure 2.5: Electricity demand (GWh/year) by sector

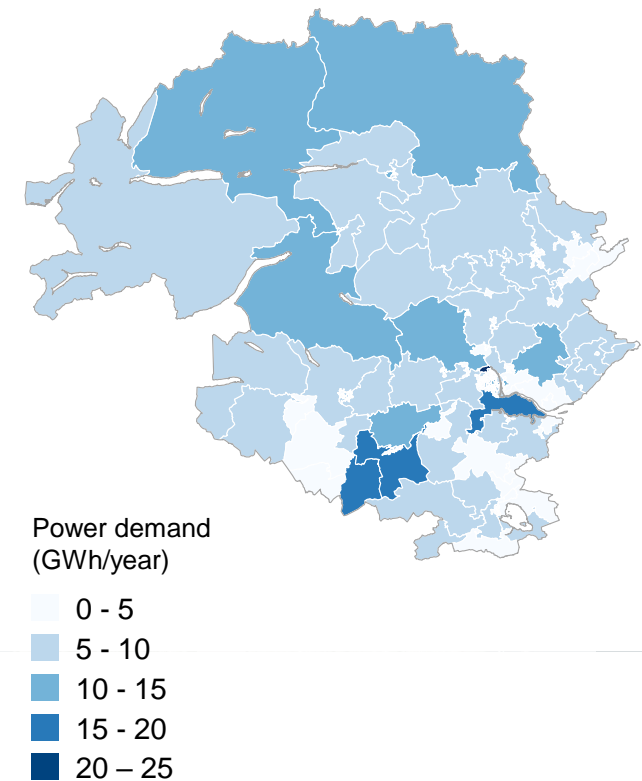


Figure 2.6: Total power demand (GWh/year) by data zone

2. Context and baseline

The current energy system

Current heat demand

Annual heat demand for Perth and Kinross in 2023 is approximately 1,691 GWh. This refers to both domestic and non-domestic demand for space heating and hot water. This demand is primarily met by mains gas; however, large rural areas of Perth and Kinross are off the gas grid and are using electricity, oil, LPG or solid fuel for heating.

Figure 2.7 shows that domestic properties (homes) exhibits the highest heating demand in Perth and Kinross, amounting to 931 GWh annually, or 64% of the heating demand. Just as with power demand, this is primarily due to the predominant residential nature of the building stock in Perth and Kinross.

Figure 2.8 shows the distribution of domestic heating demand by data zone in Perth and Kinross. Rural data zones have greater total heat demands, likely caused by larger and older properties in these areas. Demand density however is concentrated around urban areas such as Perth City, as shown in Figure 2.9.

Heating demand within the non-domestic sector is evenly split across industry, retail, offices, storage and distribution, hospitality and health.

Legend:

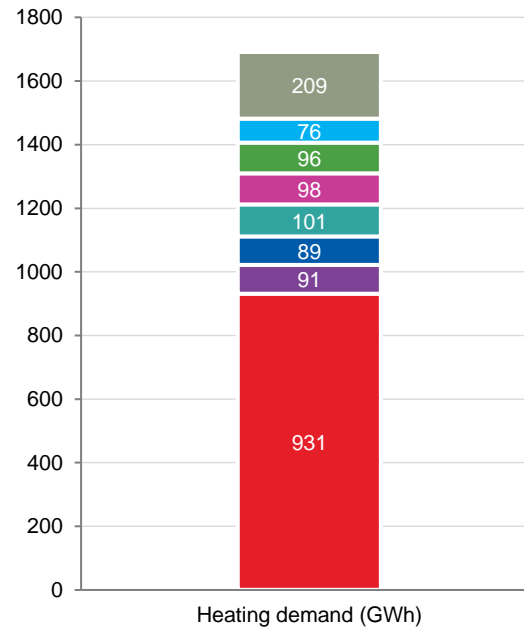
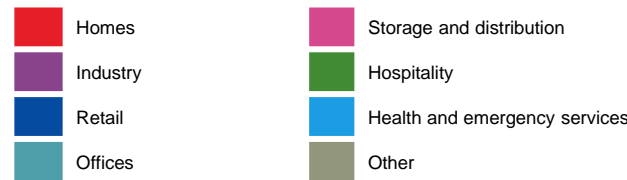


Figure 2.7: Heat demand (GWh/year) by sector

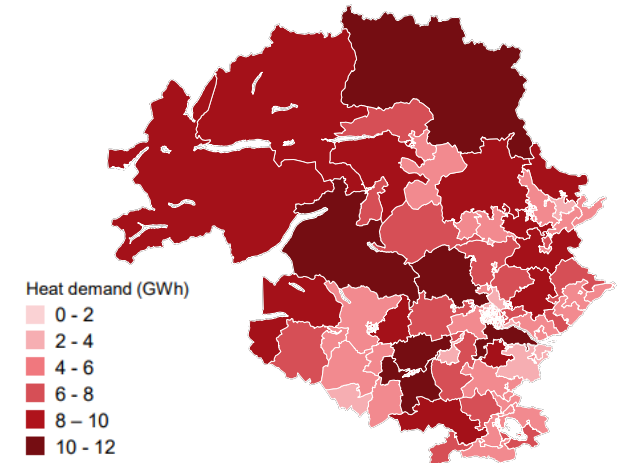


Figure 2.8: Domestic heat demand (GWh/year) by data zone

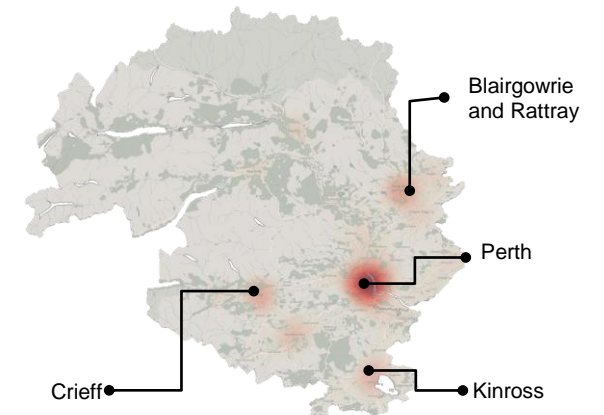


Figure 2.9: Domestic heat demand density

2. Context and baseline

The current energy system

Current transport demand

Annual transport demand in Perth and Kinross is 841 GWh. Currently these demands are met almost entirely by petrol and diesel.

Currently, approximately 1,359 million miles are driven by vehicles in Perth and Kinross each year. Cars comprise the majority of this mileage (71% of miles), followed by vans (21% of miles). While Heavy Goods Vehicles (HGVs) drive relatively few miles (8% of miles), they require significantly more energy per mile than cars or vans. Figure 2.10 shows the transport miles across Perth and Kinross. There are several major roads that run through Perth and Kinross, including the M90 to Edinburgh, A9 from Stirling to Thurso, and the A90 to Fraserburgh.

There are currently c.861 electric private vehicles, which make up <1% of total private vehicle ownership.²⁸ There are public EV charging points across Perth and Kinross, primarily in towns and Perth City ranging from 7kW to 50kW.²⁹

Public transport includes privately operated local buses and national rail, which operates out of Perth and provide routes to the north towards Inverness, northeast towards Dundee and Aberdeen, and south towards Stirling, Edinburgh and Glasgow. Due to the rural nature of the LAEP area, public transport makes a relatively small contribution to overall mileage and transport emissions.

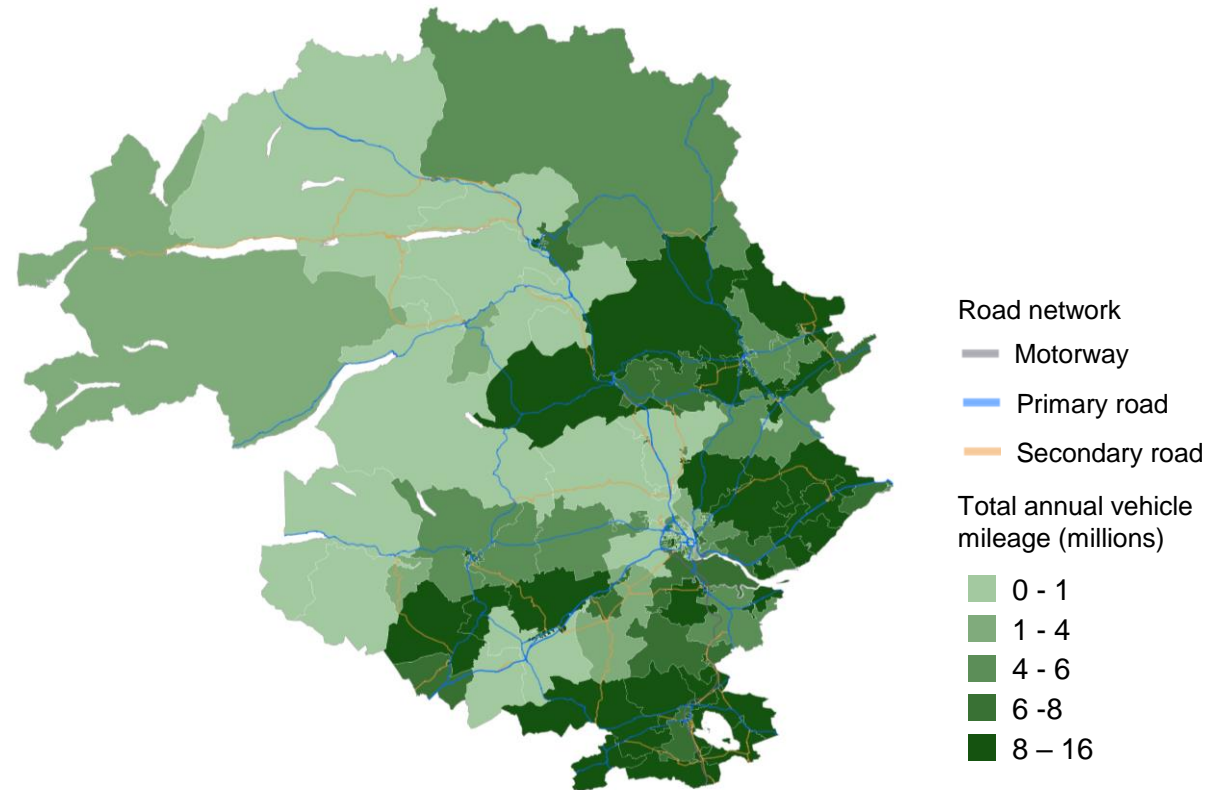


Figure 2.10: Annual transport mileage by data zone and road network in Perth and Kinross

2. Context and baseline

The current energy system

Existing renewable generation assets

Due to the large rural area and natural resources available in Perth and Kinross, there are several existing and proposed renewable generation assets that are feeding into the local energy system. The impact of growth in renewables on local grid constraints will be a key consideration in future energy system planning.

Renewable energy assets in Perth and Kinross had a total installed capacity of 639 MW in 2022. Figure 2.11 shows Perth and Kinross's current renewable energy generation assets. Large scale assets, such as Griffin Wind Farm (204 MW), which is operated by SSE Renewables, that are directly connected to the transmission network have been excluded from this baseline characterisation as they are deemed to serve the national energy system.

Perth and Kinross' renewable energy asset mix is primarily hydroelectric plants, onshore wind sites and solar PV. Local Hydroelectric schemes include Rannoch (44 MW), and Pitlochry (15 MW). Local wind installations include Tullymurdoch (14.4MW), and Lochelbank (9.6 MW). Most solar PV in the LAEP area are small rooftop installations, however there is a 13 MW ground mounted solar PV farm located in Errol, which was Scotland's largest solar farm at time of construction.

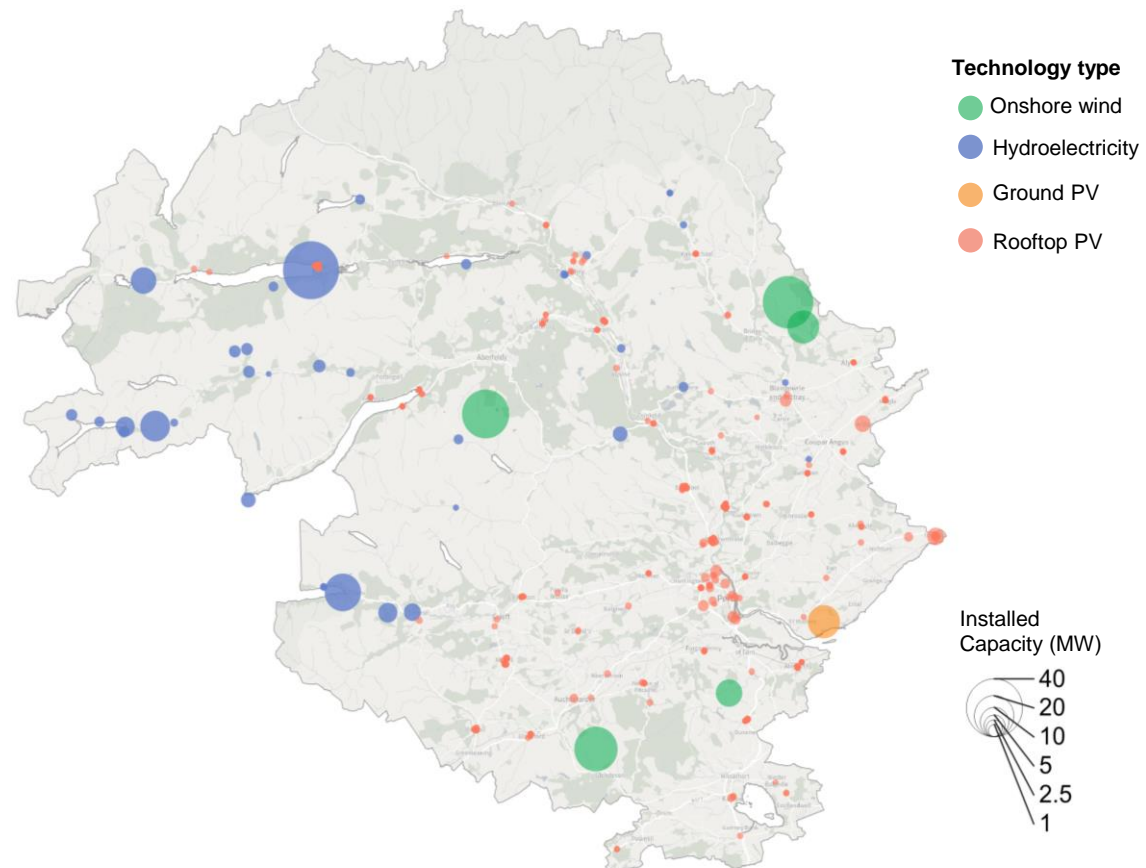


Figure 2.11: Renewable energy assets in Perth and Kinross. Source: Community Owned Energy Survey (provided by PKC), the Renewable Energy Planning Database 2023 (provided by PKC), and the DUKES 5.11 dataset (from DESNZ).

Chapter 3: The future energy system

3. Future energy system

Understanding and objectives

Future energy system vision

Perth and Kinross will become a model for affordable, equitable access to sustainable energy for all residents through an integrated, net-zero local energy system.

Objectives of the plan:

1. To set a well-defined pathway to a resilient, net-zero local energy system that meets future demand across all energy vectors.
2. To engage with and empower the local community to deliver the energy transition, supporting the creation of local jobs
3. To increase local ownership and participation in the net-zero energy system
4. To develop the evidence base to coordinate energy planning and investment across electricity, heat, and transport to maximise efficiencies and recognises the linkages between energy vectors.
5. Ensuring a just transition that makes the benefits of the new energy system affordable and accessible for all, reducing fuel poverty and supporting rural energy consumers

Developing the vision and objectives

This vision and plan objectives have been developed in collaboration with a range of stakeholders in Perth and Kinross's energy system.

Understanding the future energy system

Perth and Kinross's energy system needs to transition to net zero by 2045, while also ensuring that the system is equitable and resilient to future shifts in demand. However, there are a significant number of uncertainties about how Perth and Kinross, as well as the wider energy systems of Scotland and the UK, will transition to enable to a net zero future. These uncertainties include how the cost of technologies might change over time, wider future policy decisions that will be made by the Scottish and UK Governments, and the level of engagement and ambition from the public and private sectors to enable the transition.

Two types of energy system modelling approaches were undertaken to inform the plan:

2045 Optimisation modelling: examining options for the area's energy system in the target year 2045 based on uncertainties on future changes in energy demand;

hourly modelling was performed over the year to optimise each scenario against cost and carbon. A final 2045 optimised energy system was taken forward as the 'preferred' vision of Perth and Kinross's future energy system.

Deployment modelling: examining how to reach the 2045 preferred energy system and exploring the rate and scale of change required between now and 2045. This was compared against a number of alternative pathway scenarios that the local energy system could take out to 2045.

The details and results of these modelling approaches are presented across the following pages.

Through analysis and comparison of modelling scenarios with stakeholders, a recommended pathway for Perth and Kinross's whole systems energy transition was identified to best meet the plan's objectives. Key actions have been identified across Perth and Kinross's energy system to support and enable this vision, while mitigating the risk of uncertainty to certain aspects of the future.

These actions can – and should – be taken now to set Perth and Kinross on track to deliver a net-zero carbon energy system and to ensure the plan's objectives and vision are met.

3. Future energy system

Future energy system vision

An optimised system for 2045

The future optimised energy system Sankey diagram, for 2045 is shown on page 26, overleaf. This sets out a high ambition, net-zero energy system for Perth and Kinross, which is centred around demand reduction, electrification of heat and transport, and smart local energy generation.

Demand reduction

The 2045 optimised energy system sees a significant reduction in demand across heat, transport and electricity. This is driven by a significant uptake in domestic retrofits, with homes being upgraded beyond just a regulatory target efficiency score and all possible cost-effective measures being applied. In non-domestic properties, energy efficiency measures are also optimised to minimise energy use. This includes significant electricity demand savings for lighting, cooling and appliances in non-domestic buildings.

Transport demand also reduces significantly, in line with the reduction necessary to meet a full decarbonisation of transport across Scotland. This involves reductions due to journey shortening and avoidance, modal shifts, and more efficient journey planning.

The 2045 system sees a total heat demand reduction of 30% for domestic properties and 40% for non-domestic properties, a total electricity demand reduction of 20% and a total transport demand reduction of 15%.

Decarbonisation

Coupled with demand reduction, the optimised system sees a shift of meeting demand from carbon-intensive, inefficient technologies, to low carbon technologies.

These include a shift from fossil fuelled heating systems to low carbon heating systems. Heat pumps are the most widely considered technology for decarbonised heating. Heat demand is also met through centralised heat networks, and a smaller proportion of demand is met through direct resistive electric heating.

In order to meet its net-zero targets, by 2045, Perth and Kinross's transport demand needs to be fully shifted away from internal combustion engine (ICE) vehicles. Transport demand is largely expected to be met through electrified forms of transport in 2045, with electric cars and vans already being widely available on the market, and an assumption that electric powertrain technology for heavier vehicles

will have matured significantly by 2045. It is likely that a proportion of heavier, long-haul vehicle demand is met through hydrogen powered vehicles, and the optimised system makes use of locally produced green hydrogen in order to meet this demand.

Local generation and storage

Finally, the optimised system sees an increase in renewable electricity generation, with PV, hydro, and wind being deployed at a local scale and combined with storage solutions to reduce the reliance on the transmission and distribution network. Overall, the cost optimised system sees a 65% increase in local renewable energy generation to benefit the local area, but it is important to note that in the future Perth and Kinross may also be home to larger renewable generation sites that directly feeds into a centralised decarbonised electricity grid.

Note: *The 2045 system scenario should not be considered as an exact prediction for the future of the area but should rather be used as a strategic low-regrets vision of a zero-carbon energy system in the face of significant uncertainty*

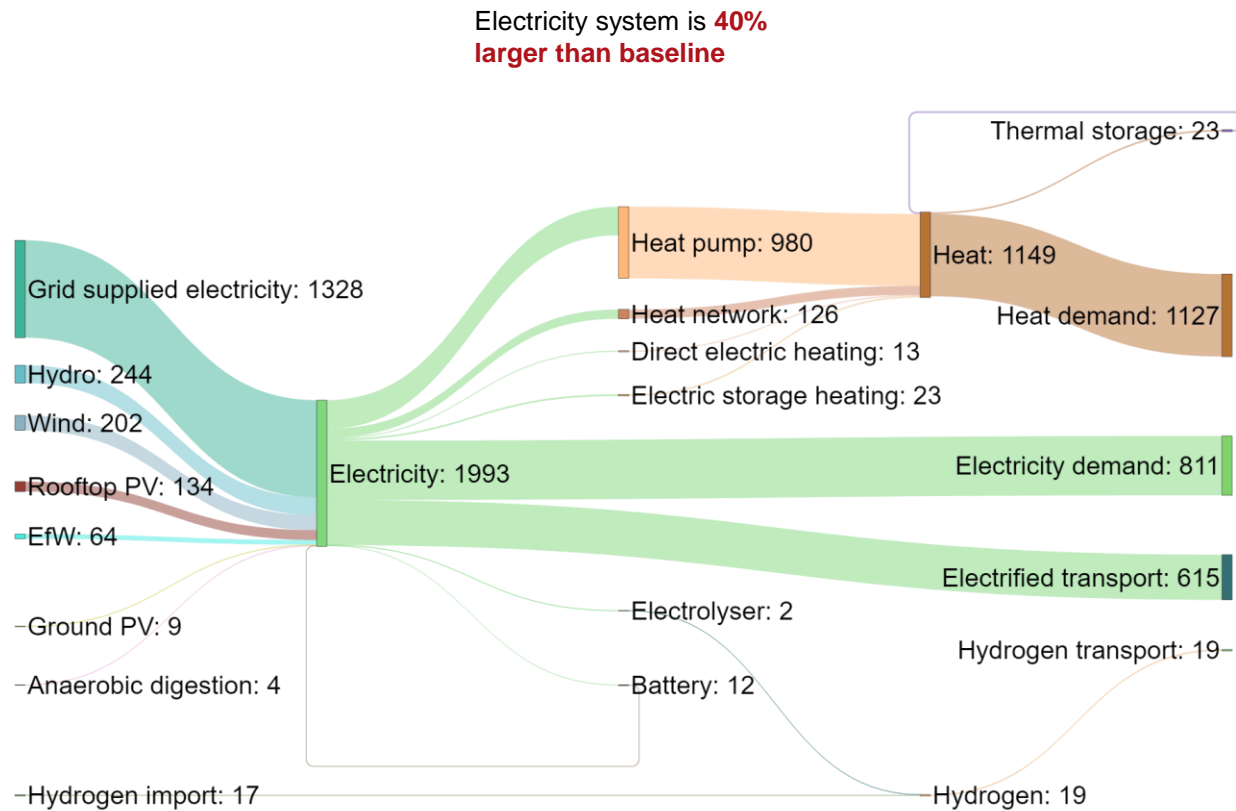
3. Future energy system A 2045 optimised system

Significant build out of **Rooftop PV** capacity

Small increase from baseline **in local wind and hydroelectricity** capacity

Local renewables supplying ~30% of electricity used.

Local electricity production directly feeding into local **green hydrogen production** with electrolyser



Almost all heat demand is met by **heat pumps with built-in flexibility** to reduce peak loads

~10% of heat demand is met by heat networks

~40% reduction in heat demand

~20% reduction in electricity demand

~15% reduction in total transport demand

Electrolyser at Binn Ecopark able to supply 10% of **HGV hydrogen** requirements

Figure 3.1: Energy flows in Perth and Kinross's optimised 2045 energy system (GWh/year). Note that there are losses associated with storage technologies.

3. Future energy system

Future energy system vision

Energy dispatch

The optimised generation and supply of electricity to meet the energy demand in Perth and Kinross over the year 2045 is depicted in Figure 3.2. Electricity use for transport, lighting, appliances, and cooling remains fairly steady throughout the year, while electricity for heating spikes during the winter months when heating needs are higher.

Rooftop PV systems emerge from the modelling as a low carbon, local generation option with a low levelised cost that is especially productive in meeting summer electricity and EV charging demands when solar output is high. This is coupled with smart local battery storage systems which can manage shorter temporal imbalances in supply and demand. Local onshore wind generation is also deployed, with output maximised in winter to meet greater space heating requirements. The optimised system additionally utilises significant hydroelectric resources to generate electricity locally. However, the optimised energy system does maintain a level of dependence on non-local electricity supply out to 2045.

The technology mix is optimised to balance seasonal variations in demand and supply, ensuring system resilience across the year. The interplay of local renewable generation and grid electricity aims to provide consistent, sustainable energy to meet Perth and Kinross's needs in 2045.

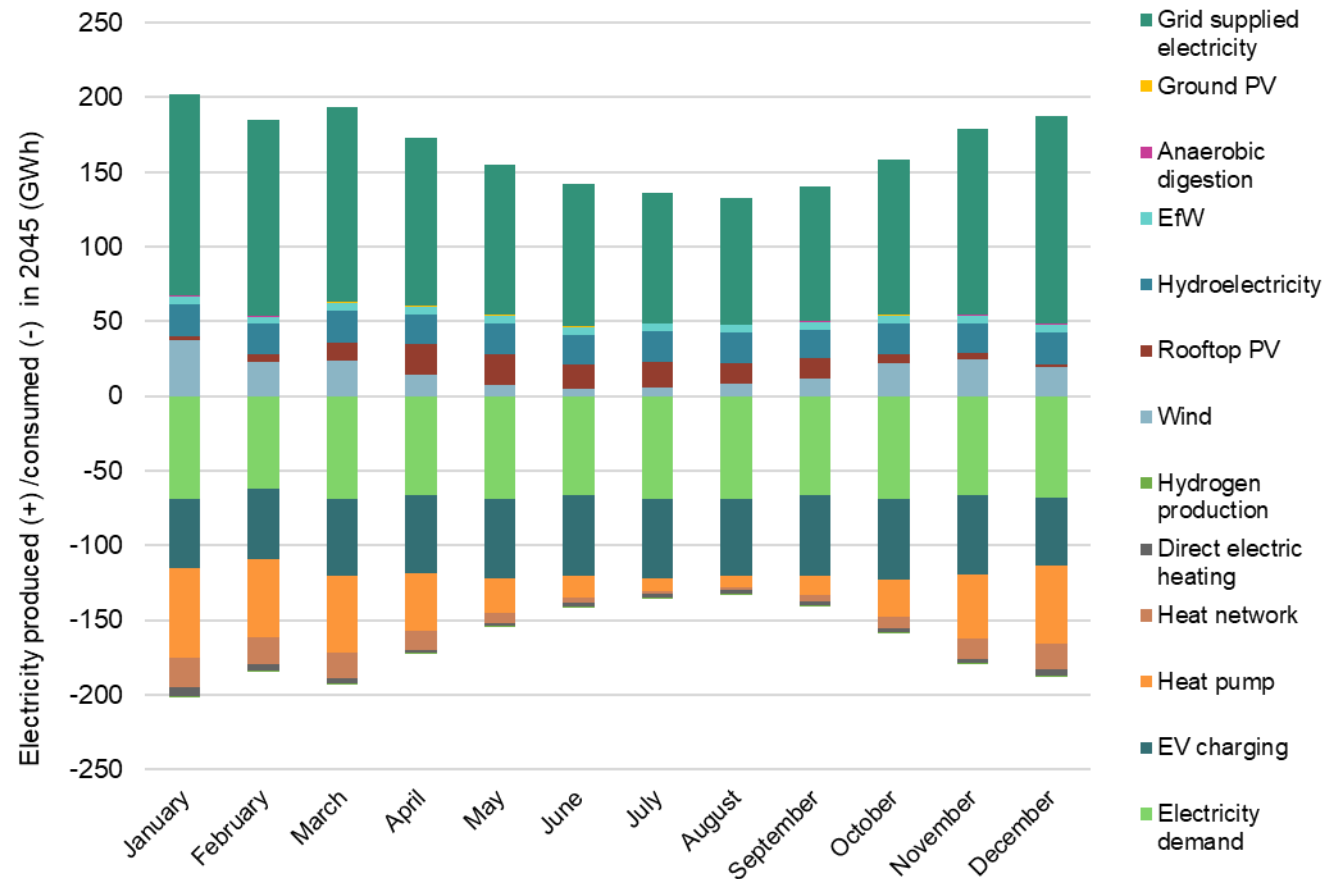


Figure 3.2: Energy flows in Perth and Kinross's optimised 2045 energy system

3. Future energy system Transition pathways

Pathways overview

Deployment modelling has been carried out to identify the impact the rate of change of the energy system has on emissions and energy consumption. The pathways have been developed with input from the Council to explore where current forecasts put Perth and Kinross in 2045 and whether it is on track to meet net zero targets.

The **Business as Usual (BaU)** pathway has been used to indicate what the energy system in Perth and Kinross would look like if there was no further action taken by residents, local businesses, or the Council. As a result, this pathway assumes that all existing technologies remain at a constant capacity. Heating and cooling are assumed to remain constant, however transport demand is forecast to increase based on current trends. This tests the worst-case scenario for 2045.

Regulatory Standards (RS) goes one step further than BaU and assumes that all existing or planned legislation and policies are implemented. National, regional and local plans have all been incorporated, prioritising the most local level of legislation available. However, this only considers actions rather than targets. For example, Scotland's national net zero target for 2045 is not assumed to be met within this scenario, but any existing policies related to achieving this target have been implemented. This scenario

therefore shows the gap between national targets and projections based on existing legislation.

The **Public Sector Led (PSL)** scenario tests how far action from the Council and other public sector organisations can contribute to net zero targets. In this pathway, it is assumed that all public sector assets and activities are decarbonised and reach their optimised capacities by 2045. The residual emissions in the local energy system are those that must be addressed by the private sector.

High Ambition (HA) is based entirely on the optimisation modelling carried out as part of this LAEP. This pathway reaches the optimised energy system in 2045 with deployment based on current trends and forecasts, while also meeting regulatory standards.

The assumptions for each scenario are explored in more detailed overleaf in Table 3.1.

The following pages present and discuss the results of the deployment modelling, starting with the associated energy consumption of each pathway followed by the associated carbon emissions, and a breakdown of residual emissions in 2045. The High Ambition pathway is then explored in further detail to identify the key areas of action for Perth and Kinross.



High Ambition (HA):
Involving the build-out to the modelled optimised system.



Public Sector Led (PSL):
Only publicly owned energy system components achieve optimised targets (e.g., publicly owned buildings, Council vehicle fleet).



Regulatory Standards (RS):
All energy system components meet statutory requirements (e.g., Heat in Buildings Strategy).



Business as Usual (BaU):
Assuming a BAU build-out rate and demand change

Figure 3.3: Overview of deployment pathways

3. Future energy system Transition pathways

Pathways assumptions

Table 3.1: Deployment assumptions for pathways tested.

Technology	Sector	Assumed increase from baseline				Explanation			
		Business as Usual	Regulatory Standards	Public Sector Led	High Ambition	Business as Usual	Regulatory Standards	Public Sector Led	High Ambition
Onshore wind capacity	Generation	No change	Low	Low	Low	No new generation capacity installed	Following current build out rates to meet optimised capacity	Following current build out rates to meet optimised capacity	Build out to optimised capacity
Hydroelectricity capacity	Generation	No change	Low	Low	Low	No new generation capacity installed	Following current build out rates to meet optimised capacity	Following current build out rates to meet optimised capacity	Build out to optimised capacity
Rooftop PV capacity	Generation	No change	Low	Medium	High	No new generation capacity installed	Assumed to follow existing installation rates in Scotland	Maximised build out on council owned buildings	Maximised build out on all buildings
Ground PV capacity	Generation	No change	No change	No change	No change	No new generation capacity installed	Current build out rates reach optimised capacity	Current build out rates reach optimised capacity	Build out to optimised capacity
Anaerobic digestion capacity	Generation	No change	Low	Low	Low	No new generation capacity installed	Binn Ecopark fully operational by 2026	Binn Ecopark fully operational by 2026	Binn Ecopark fully operational by 2026
Energy from waste capacity	Generation	No change	Low	Low	Low	No new generation capacity installed	Binn Ecopark operational by 2026	Binn Ecopark operational by 2026	Binn Ecopark operational by 2026
Domestic retrofit rollout	Heat	No change	Low	Low	High	No retrofit	Meeting 2030 EPC targets ²⁰	Public sector buildings retrofitted to optimised demand savings	Meeting 2030 EPC targets and remaining retrofit to optimised demand savings
Non-domestic retrofit rollout	Heat	No change	No change	Low	High	No retrofit	No regulation on non-domestic retrofit	Public sector buildings retrofitted	Optimised retrofit to maximise demand savings
Domestic heat pump installation	Heat	No change	Low	Medium	High	No new heat technologies installed	Current installation rates	Heat decarbonised in public sector buildings by 2038	All heat electrified by 2045, rollout in line with retrofit
Non-domestic heat pump installation	Heat	No change	No change	Low	High	No new heat technologies installed	No regulation on non-domestic properties	Heat decarbonised in public buildings by 2038 ³⁰	All heat electrified by 2045, rollout in line with retrofit
Heat network installation	Heat	No change	No change	Low	High	No new heat technologies installed	In line to meet Scotland Targets set out in the Heat Networks Act (2027 and 2030) ²¹	Heat networks connections in public sector buildings where suitable	Connections in line with optimised capacity, and meeting HNA targets
Hydrogen import	Transport	No change	No change	No change	High	No future hydrogen demand	Hydrogen demand does not exceed production so no import	Hydrogen demand does not exceed production so no import	Hydrogen import to meet hydrogen HGV demand
Electrolysis	Transport	No change	Low	Low	Low	No future hydrogen demand	Binn Ecopark electrolyser operational by 2026	Binn Ecopark electrolyser operational by 2026	Binn Ecopark electrolyser operational by 2026
EV uptake	Transport	No change	Low	Low	High	No EV uptake	No new ICEs by 2035	Public sector owned transport electrified	100% of transport demand met by EVs or hydrogen HGVs by 2045, roll out inline with FES leading the way
Hydrogen HGV uptake	Transport	No change	Low	Low	Medium	No future hydrogen demand	Hydrogen demand assumed to meet production	Hydrogen demand assumed to meet production	Hydrogen demand assumed to meet production
Transport demand*	Transport	High increase	High increase	Medium increase	High decrease	Growth in transport demand projected by Transport Scotland ³¹	Growth in transport demand projected by Transport Scotland ³¹	Growth as BAU, offset by small reduction in public sector fleet demands	Demand reduction necessary to meet Transport Scotland net zero target ³¹

* An increase in transport demand is forecast for the BaU, RS and PSL pathways which has a negative impact in overall emissions, hence it is highlighted in red here. The rest of the table measures the increase in technologies.

3. Future energy system

Transition pathways

Energy consumption pathways

Figures 3.5 to 3.8 overleaf show the split of energy consumption within Perth and Kinross from 2023 to 2045 across all four pathways. These energy consumption pathways show the direct impact of actions on consumption within Perth and Kinross. The carbon emission pathways (see Figure 3.9) are then created by applying the respective emission factors to show the impact these changes have in meeting Perth and Kinross's net zero target, and the influence of the emissions factor of the fuels used.

The consumption pathways only show imported energy, excluding local electricity generation via renewables, Energy-from-Waste (EfW) and anaerobic digestion, and local hydrogen production via electrolysis.

Figure 3.5 shows that petrol and diesel consumption increase in the Business as Usual (BaU) pathway, leading to an overall increase in energy consumption each year out to 2045 and potentially beyond. This is due to the forecast increased transport demand, with total mileage expected to increase by 28% from the baseline, without any further switch to electric vehicles. As the BaU pathway assumes no further actions, annual consumption of grid import and fossil fuel heating fuels remain constant.

The Regulatory Standards and Public Sector Led pathways (shown in Figures 3.6 and 3.7 respectively) show similar trends in consumption. The change in consumption is primarily driven by a reduction in petrol and diesel due to drivers switching to electric vehicles. This accelerates after the 2035 ban of the sale of internal combustion engines (ICEs) in the UK. It has been assumed for these scenarios that no extra hydrogen refuellers are installed so hydrogen demand is only as large as that produced at Binn Ecopark. As fossil fuel boilers and heating is being switched out for electric alternatives, there is a decrease in fossil fuel heating fuels. This, and the uptake of EVs, does however lead to increase in grid imported electricity.

Within the High Ambition pathway, the optimised system eliminates the consumption of petrol and diesel and fossil fuel heating fuels as transport and heating demand is electrified or met with hydrogen. This leads to an increase in grid electricity imported. This increase is minimised by energy efficiency improvement measures which, along with the improved efficiency of heat pumps, leads to a 70% reduction of overall energy consumption.

As shown in Figure 3.4, in the high ambition scenario in 2045, 68% of total demand is met by grid electricity, 26% by local renewable generation, and

2% by production from EfW and anaerobic digestion facilities. The remaining demand is met by hydrogen import (4%) or production via electrolysis produced at Binn Ecopark (0.1%). By 2031, hydrogen demand exceeds production within Perth and Kinross so import is needed, as shown on Figure 3.7 overleaf.

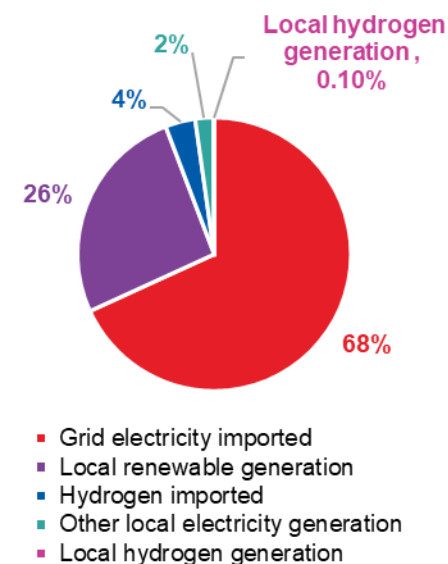


Figure 3.4: Split of import and generation to meet demand in 2045 for the High Ambition pathway.

3. Future energy system Transition pathways

Energy consumption pathways

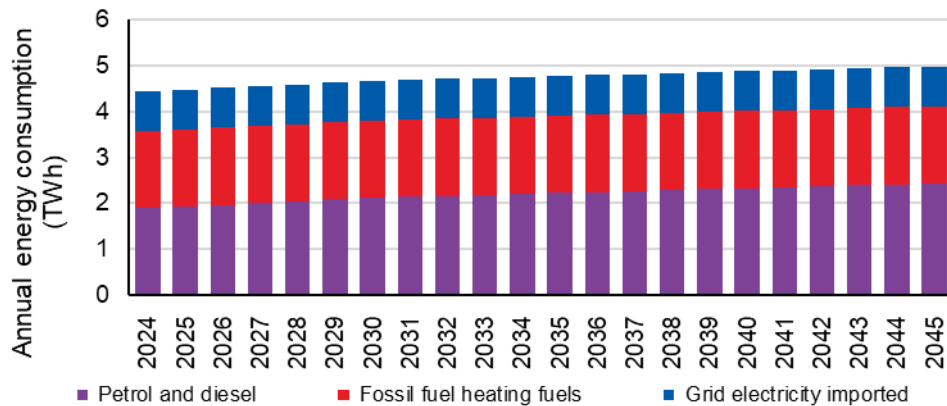


Figure 3.5: Energy consumption by fuel type for Business as Usual

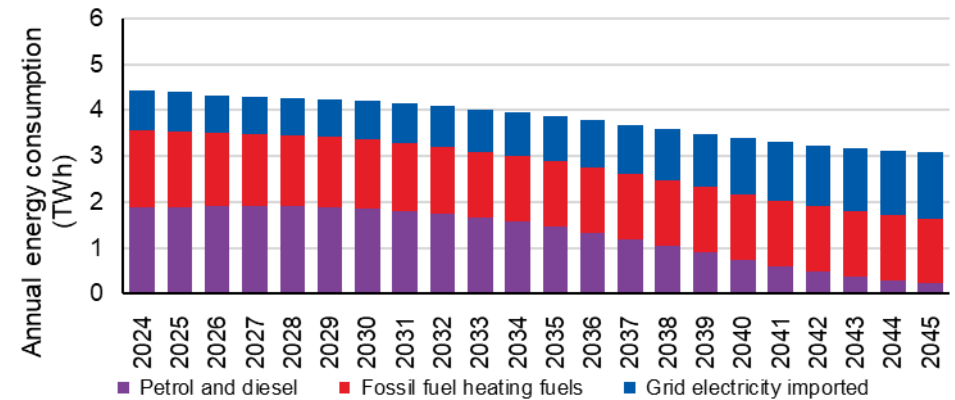


Figure 3.5: Energy consumption by fuel type for Regulatory Standards

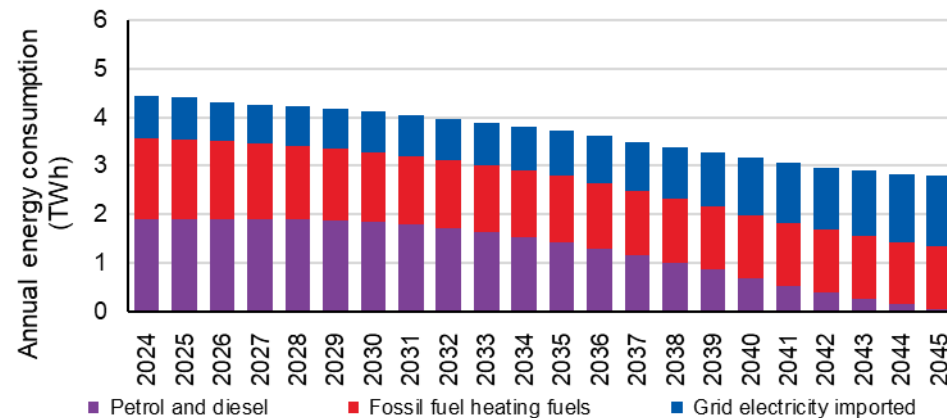


Figure 3.7: Energy consumption by fuel type for Public Sector Led

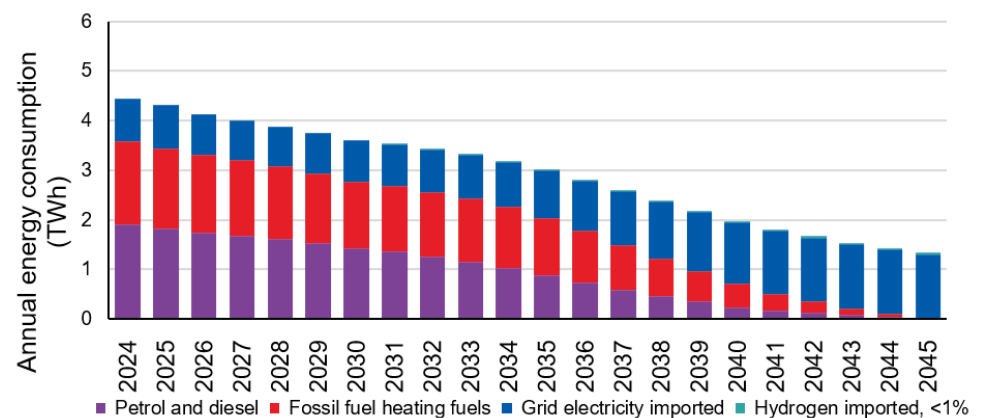


Figure 3.8: Energy consumption by fuel type for High Ambition

3. Future energy system

Transition pathways

Carbon emissions pathways

Carbon emission pathways have been developed to show how energy emissions could change between 2022 and 2045 within Perth and Kinross for each of the four pathways. These are shown on the next page in Figure 3.10 with key targets annotated on the figure. Across all pathways, the same grid emissions factors were assumed based on the Future Energy Scenario 2022: Leading the way electricity CO₂ intensity (excluding negative emissions from bioenergy with carbon capture and storage (BECCS)) by National Grid.³²

The baseline emissions were estimated to be around 870 ktCO₂e. Within the Business as Usual (BaU) scenario, this is forecast to increase by 2045 by 4% to 900 ktCO₂e despite a decrease in the grid emissions factor, driven by the increase in ICE transport demand (as shown in Figure 3.4) and the associated increase in petrol and diesel.

Regulatory Standards (RS) presents the potential annual carbon emissions reduction to 2045 if all current local and national policy and legislation is met. Within this pathway, transport demand is still expected to grow but the switch to EVs and heating decarbonisation and efficiency measures lead to an overall decrease by 2045 of 60% when compared to the baseline.

The Public Sector Led (PSL) pathway then tests how far action from the Council can contribute to meeting net zero. Both the PSL and RS pathways rely heavily on the decarbonisation of the grid to reduce emissions without the intervention of energy efficiency measures in private sector domestic and non-domestic buildings to reduce heating demand. Both scenarios also assume there is no action to reduce transport and power demand in the private sector. This leads to higher cumulative emissions and higher fuel costs for consumers.

Figure 3.10 shows that the HA pathway achieves a 98% reduction from baseline levels. This pathway and the residual emissions in 2045 are explored in more detail on pages 35 and 36. It should be noted that this is not an exact prediction of the future energy system but instead one potential pathway to achieving net zero.

The overarching statutory target for greenhouse gas emissions, as set by Scottish government, is to reach net zero by 2045. Only the High Ambition scenario will likely reach the net zero target once residual emissions have been offset.

That no other pathway reaches net zero implies that current legislation and targets will not be enough to

reach Perth and Kinross's 2045 net zero target, even with additional action from the Council as shown in the PSL pathway.

This highlights the importance of buy in and action from industry and the private sector to meet the overall 2045 target.

The impact of this is highlighted by the shaded areas of Figure 3.9 below which show the emissions gap and therefore the emission reduction opportunities that can be met by public sector action (blue) and private sector action (light red). The scale to which this gap is closed and potential emissions are avoided, by improving on the current RS trajectory, will be dependent on the implementation of the delivery actions detailed in Chapter 5.

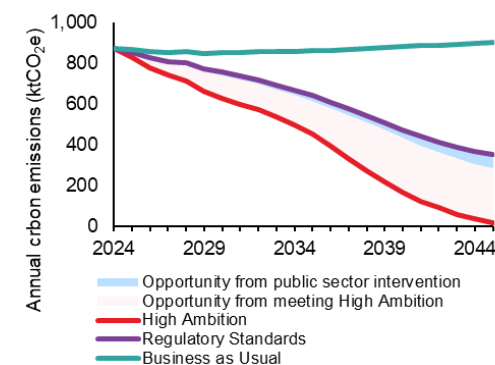


Figure 3.9 Emission reduction opportunity

3. Future energy system Transition pathways

Annual carbon emissions

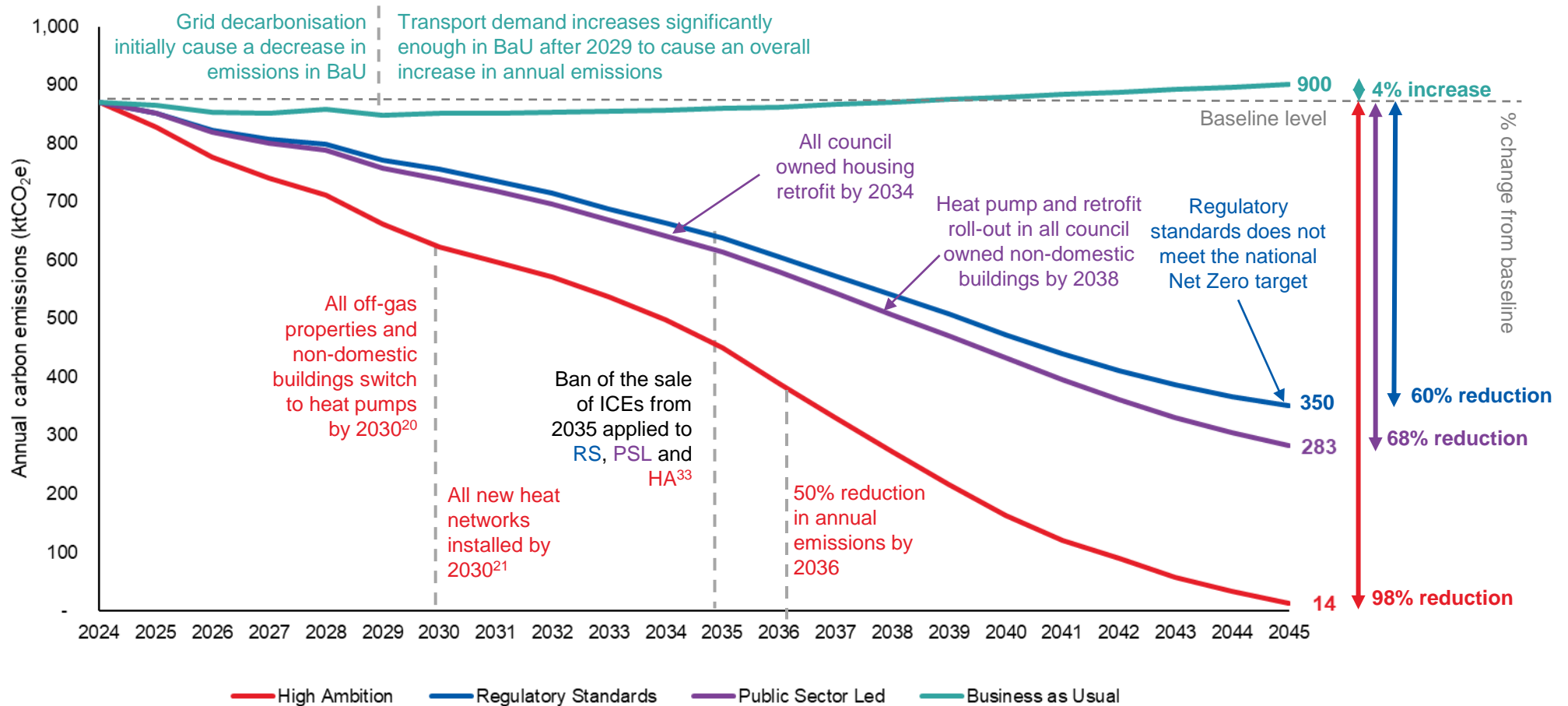


Figure 3.10: Annual carbon emissions of deployment pathways

3. Future energy system Transition pathways

Cumulative emissions

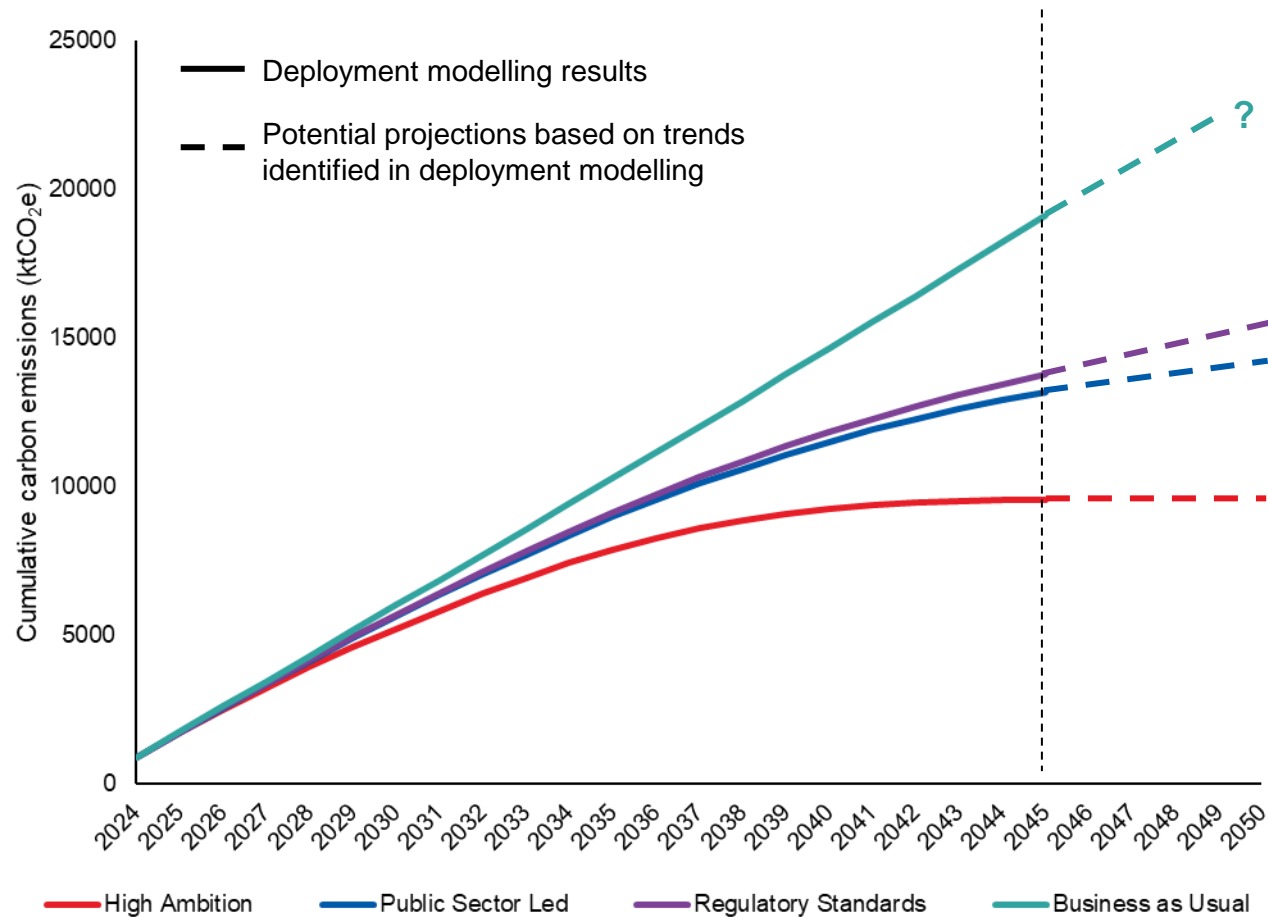


Figure 3.11 shows the difference in cumulative emissions between each pathway. This shows the scale of impact these pathways could have on their overall contribution to climate change.

It is important to note that reaching net zero will not be a fix-all and that any emissions generated up to the point of reaching net zero have a damaging effect. Reducing emissions earlier will have co-benefits such as improved air quality, reduced environmental effects and potentially reduced energy costs from efficiency improvements.

The solid lines in Figure 3.11 show the results from the deployment modelling carried out up to 2045. The dashed lines continue the trends identified within deployment modelling to show an indication of how emissions may change past this point. The wider electricity grid is expected to decarbonise, leading to the high ambition scenario reaching a plateau as the majority of demand is met by electricity across heating, power and transport in 2045.

The cumulative emissions for the BaU pathway keep growing with no signs of slowing down due to the increase in demand and annual carbon emissions with even grid decarbonisation not enough to cause a decrease in annual emissions.

Figure 3.11: Cumulative carbon emissions of deployment pathways

3. Future energy system Transition pathways

Residual emissions

Figure 3.12 shows the breakdown of carbon emissions by demand sector in 2045 and the impact of following each pathway compared to the previous one. The pathways are presented in ascending order of intervention from the local area.

Note that this does not include emissions avoided from local generation, and instead assumes all electricity demand is met by grid electricity. Local generation will reduce grid import across all sectors where electricity is used and reduces the residual emissions in 2045 for the high ambition scenario from 14.6 ktCO₂e to 13.6 ktCO₂e. This is explored more on the following page.

To achieve net zero, these residual emissions must be offset or balanced. This will require input and action from the local authority, developers and large emitters who all have a responsibility to meet net zero within their own emissions. The funding required to offset these residual emissions and where the responsibility for these payments lies should be considered by local authority and government. This should involve engaging stakeholders throughout the delivery of the LAEP to reach a consensus on the approach to compensate residual emissions. This is essential to ensure a successful transition to a net zero future.

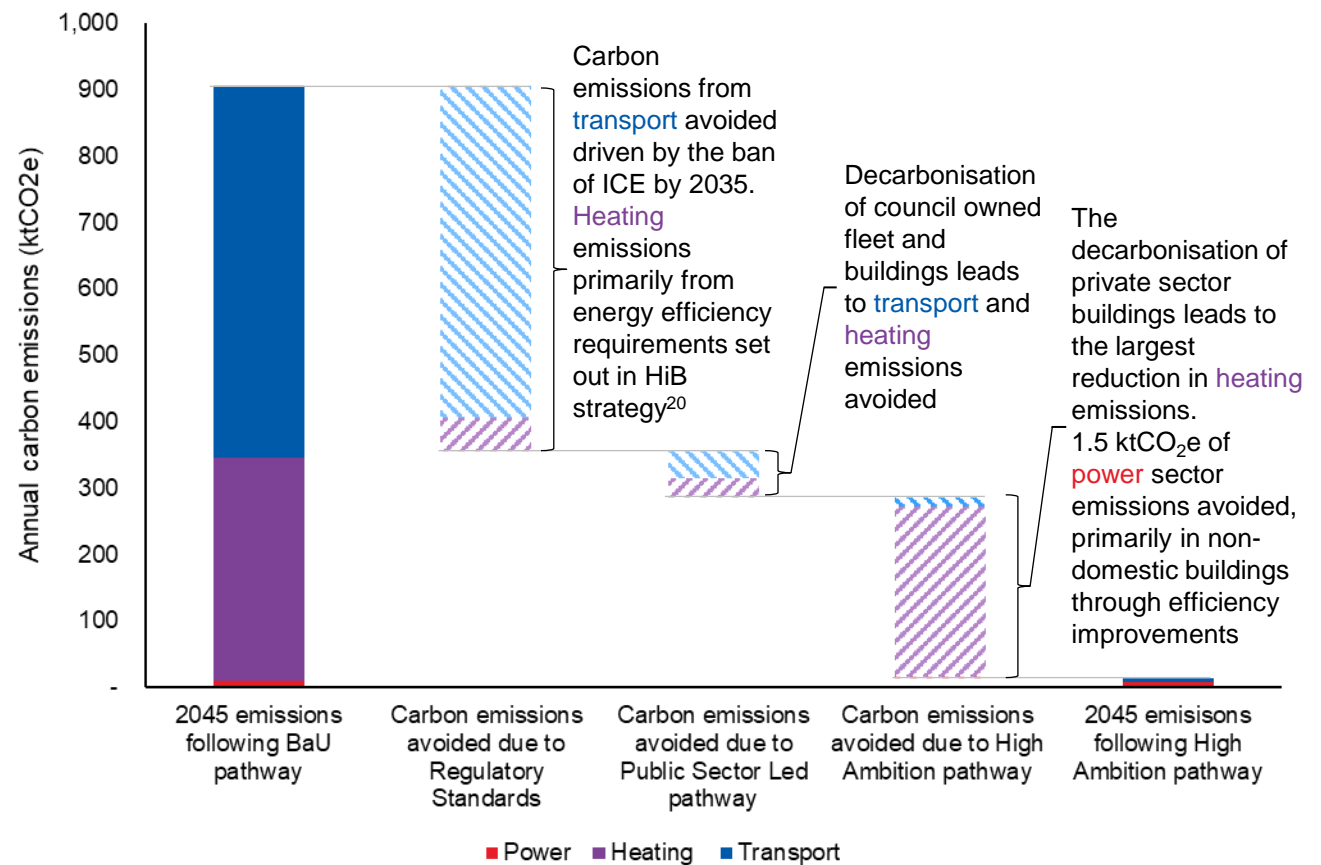


Figure 3.12: Waterfall chart showing residual emissions in 2045 and carbon emissions that can be avoided through alternative pathway implementation

3. Future energy system Transition pathways

High ambition pathway

To meet net zero targets, Perth and Kinross should aim to follow as closely as possible to the High Ambition scenario. Figure 3.13 highlights the reductions in emissions that need to be made across different demand sectors. Transport makes up the majority of emissions in the baseline and contributes to 65% of cumulative emissions, highlighting the importance of decarbonising the transport sector.

As previously discussed, the annual emissions avoided due to local generation (shown with the white dashed line in Figure 3.13) reduce in magnitude over time, despite the capacity of local generation growing. This is due to the reduction in the grid emissions factor. Local generation is still paramount however to reduce grid constraints nationally, reduce cumulative emissions and reduce fuel costs for customers. and in reducing cumulative emissions in earlier years where the grid carbon factor is higher.

The analysis carried out as part of the deployment modelling highlights the importance the of transport and heating sectors in reaching net zero targets.

Note that emissions attributed to 'Power' are those associated with power demand only. Any electricity demand for heating or transport (e.g. heat pumps or EVs) are included in 'heating' and 'transport' respectively in these figures.

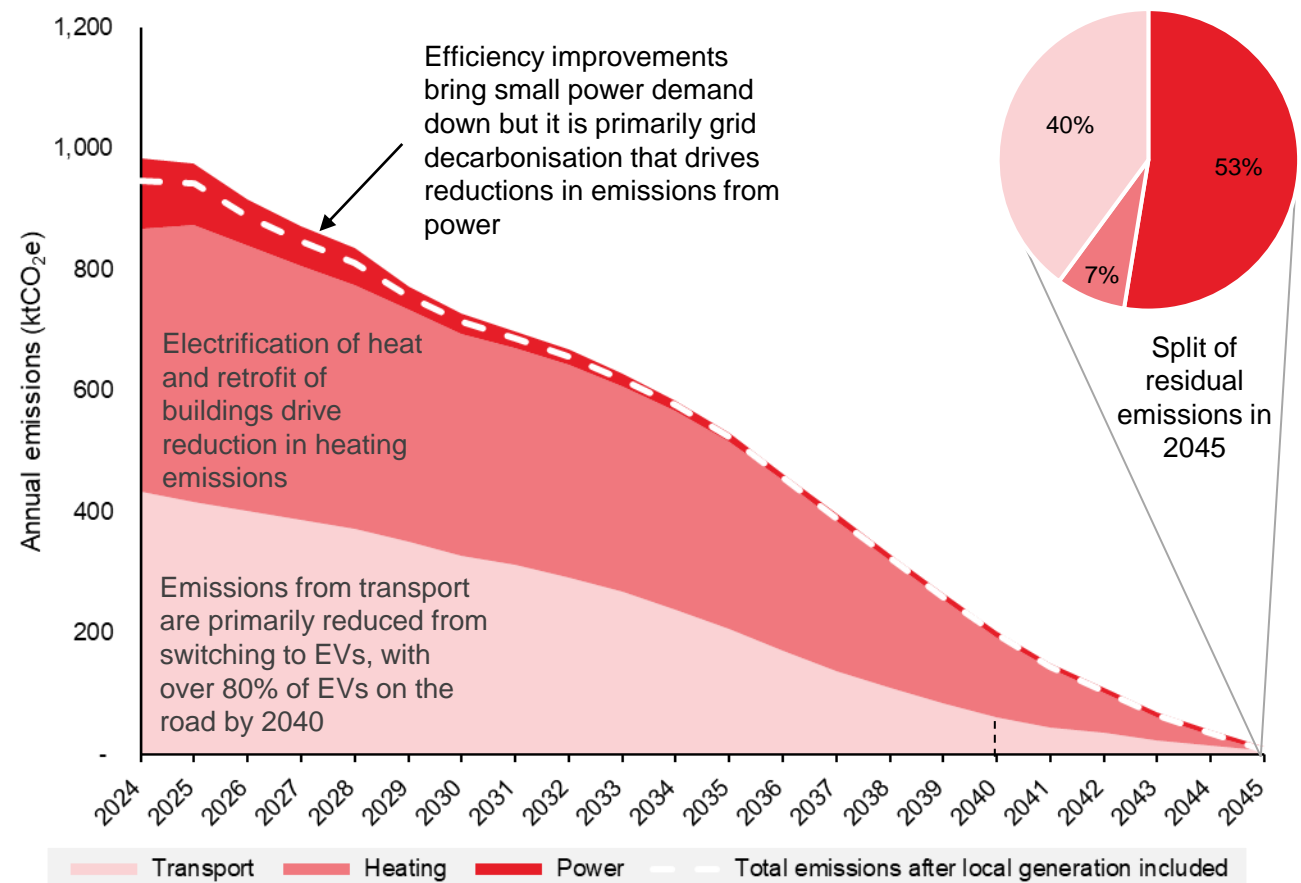


Figure 3.13: Projected annual carbon emissions for the high ambition scenario split by demand

Chapter 4: Priority intervention areas

4. Priority intervention areas

Introduction

Priority intervention areas

The modelling presented in previous pages illustrates the radical transformation necessary to create a net zero local energy system for Perth and Kinross. Through the optimisation and deployment modelling carried out for this plan, it can be concluded that a least-cost, lowest-carbon pathway to net zero will involve significant reductions in demand for heating, electricity, and transport, along with profound changes in energy use.

Figure 4.1 outlines the priority intervention areas to achieve the LAEP's objectives of the proposed future energy system and recommended pathway. These span all aspects of the area's energy system, with numerous interdependencies across them. This highlights the importance of a coordinated, whole-system approach to delivery in order to meet the 2045 net zero carbon target.

Achieving the LAEP's broader objectives will require appropriate governance, engagement, policies, and financing solutions. The radical changes modelled will involve interventions across heating, transport, electricity, and overall energy use. A coordinated effort across all facets of the energy system is vital for the net zero transition.

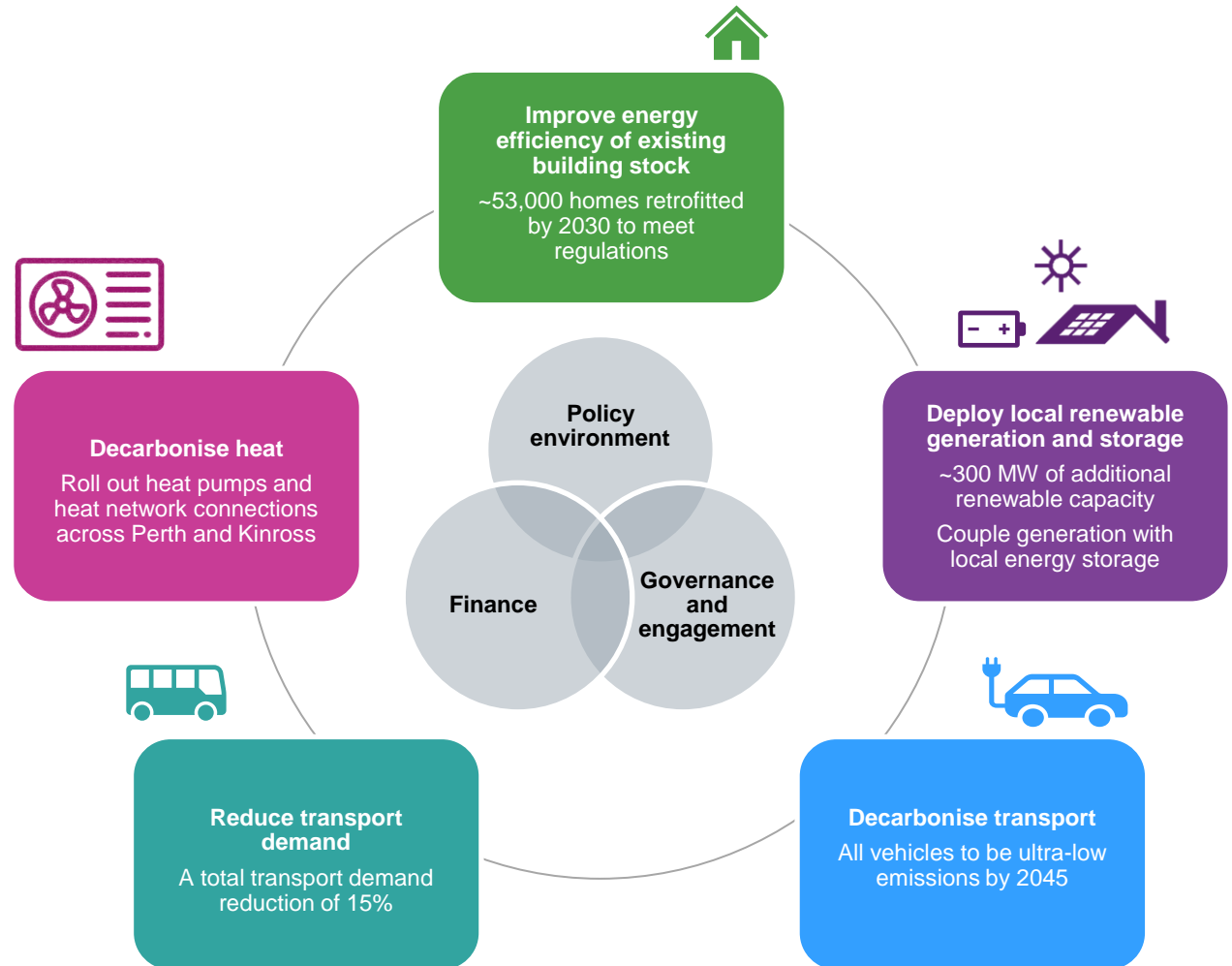


Figure 4.1: Priority intervention areas in Perth and Kinross.

4. Priority intervention areas

Focus areas for the delivery of the LAEP

Priority intervention areas

Perth and Kinross Council should aim to work collaboratively with stakeholders across the local energy system to support delivery of the net zero system as follows:

Improve the energy efficiency of the existing building stock

Reducing energy demand of Perth and Kinross's buildings through improved energy efficiency reduces the need for development of new energy generation assets, and potential required energy network reinforcements. Improving building fabric will also be crucial for facilitating the introduction of highly efficient low temperature heating systems such as heat pumps. This has the potential to reduce energy costs for residents, supporting vulnerable households facing rising prices. It also moves towards Scotland's 2040 goal of eliminating fuel poverty.

This priority intervention area aligns with the strategic priority in Perth and Kinross's first LHEES which sets out to improve buildings energy efficiency to achieve affordable warmth and regulatory compliance.

The challenge is significant, with over half of Perth and Kinross's domestic properties requiring some level of retrofit by 2033 in order to meet the targets set out in Scotland's Heat in Buildings Strategy. Additional savings can be delivered in the area's non-

domestic building stock, and an initial focus should be a rollout of energy efficiency improvement on the Council's own stock, such as schools and offices. Through community engagement, government incentives and planning measures, homeowners and private businesses also need to be encouraged and supported to carry out efficiency upgrades.

The total energy efficiency improvements across Perth and Kinross's domestic buildings alone represents approximately £900 million of investment, subject to availability of funding and skilled labour. Indeed, skills shortages in the local workforces poses a fundamental barrier to the implementation of all interventions, in particular the fast-paced delivery of energy efficiency improvements in Perth and Kinross. As such, upskilling the local workforce will be a key enabler for all priority intervention areas.

Decarbonise heat

There is a strategic priority set out in Perth and Kinross's LHEES to decarbonise heat, with a focus on heat networks and heat pumps.

In Perth and Kinross, over 36% of properties are estimated to be off the gas network, many of which are heated by carbon intensive fuels such as oil. These areas should be prioritised for air and ground source heat pumps in order to maximise carbon savings. Heat

networks should be prioritised in the urban areas, with the potential of rollout to be investigated in line with the prioritised Heat Network zones in Perth, Auchterarder, Blairgowrie and Kinross, identified as part of the LHEES. There will be a small role of other low carbon heating systems, in particular direct electric systems. These might be most suitable as a cost-effective option in properties which act as holiday homes or second homes which are not occupied year-round.

Deploy local renewables and storage

Scaling up of local renewables is an essential component of delivering Perth and Kinross's net-zero energy system. In addition to the existing ~200MW of local renewable resources, Perth and Kinross will need an additional 300MW of local scale renewables (i.e., not feeding into the wider transmission network). These include home and community scale projects that can also take advantage of energy storage systems which can be leveraged to balance supply and demand, especially as heat and transport become increasingly electrified.

The full decarbonisation of Perth and Kinross's energy system however also relies on the net zero transition of the grid, and the delivery of the priorities set out in this LAEP should be coupled with supporting the wider decarbonisation of Scotland's electricity supply.

4. Priority intervention areas

Focus areas for the delivery of the LAEP

Priority intervention areas

Reduce transport demand

The National Transport Strategy for Scotland has set out a target to reduce car kilometres travelled in Scotland by 20% by 2030. Additionally, analysis conducted by Element Energy for Scottish Transport has identified that further demand changes across all travel modes will be necessary to achieve a fully decarbonised transportation system in Scotland by 2045³¹. This includes a 15% reduction in heavy goods vehicle mileage, limiting growth in van demand to 10%, and a 10% increase in bus vehicle miles.

Achieving this shift in demand will require a coordinated approach to how goods and people travel across Perth and Kinross, focused on reducing overall travel needs, shortening trip distances, shifting toward alternative sustainable modes like active travel and public transit, and travelling more efficiently (i.e., through car-sharing schemes).

As Perth and Kinross covers a large and predominantly rural area with settlements distributed across the council area, many residents currently travel long distances by private car out of necessity to meet their mobility needs. It is therefore critical that actions and policies emerging from the LAEP not only reduce overall car travel but also ensure improvements in

rural accessibility and availability of inclusive, sustainable mobility options across Perth and Kinross.

Additionally, there are rapid ongoing changes in how people and goods travel, including new transportation technologies, evolving work and commuting behaviours stemming from the COVID-19 pandemic, and an increase in online services and online shopping. These wider shifts should also inform decisions and actions taken in Perth and Kinross going forward.

Decarbonise transport

Decarbonising transportation across Perth and Kinross will require a full transition to zero emission vehicles by 2045. This needs to be enabled by public sector fleets leading the way to shift to low emission vehicles, incentives and engagement to encourage the uptake of EVs in the private sector, adequate and expanded charging infrastructure, and the development of new technologies such as hydrogen fuel cell vehicles.

EVs offer immediate emissions reductions potentials for passenger cars, vans and some heavier traffic such as buses and HGVs. Installing more public EV charging points across the region, will be crucial to enable a just transition to decarbonised transport. This

should include a mix of rapid and fast chargers located at workplaces, travel hubs, and destinations.

Additionally, homes with off-street parking will likely require some form of home charging installation, which can be coupled with smart energy use through mechanisms such as smart charging and local generation and storage. The proportion of home, and public fast and rapid chargers will depend on the type of services which are dominant in specific areas and can be informed further by analysis carried out as part of the council's EV charging strategy. However, by 2045, at least 150MW EV charging capacity will be required across Perth and Kinross.

The Council can lead by electrifying their own fleets of cars, vans and HGVs while also working with other bodies and private actors to shift away from petrol and diesel vehicles. Some hard-to-decarbonize vehicles like long-haul HGVs may need to transition to hydrogen fuel cells rather than batteries. Developing local green hydrogen production and setting up refuelling stations within Perth and Kinross could act as a pilot to explore the role of hydrogen in decarbonizing freight travel. While this technology is still developing, a key action is to monitor opportunities for HGV fleet decarbonisation when viable models enter the market.














4. Priority intervention areas

Preferred pathway

Plan on a page

For the High Ambition pathway, the Figure 4.2 has been produced to highlight the rollout of different technologies across Perth and Kinross and areas of focus. From these targets the priority intervention areas and following action plan have been identified. Table 4.1 breaks down the final total targets for interventions by 2045.

Table 4.1: Area wide rollout needed by 2045.

Action category	Target
 Homes retrofit	~ 71,900
 Buildings with HPs installed	~ 47,700
 Properties connected to HNs	~ 3,000
 Rooftop PV panels	~ 390,000
 Hydroelectricity sites	~ 117
 Local onshore wind turbines	~ 14
 Home batteries (with PV)	~ 13,500
 Fast chargers installed	~ 10,500
 Hydrogen refuelling stations	~ 5
 HGV mileage reduction	15%
 Bus use increase	10%
 Van mileage increase	5%
 Car mileage decrease	20%

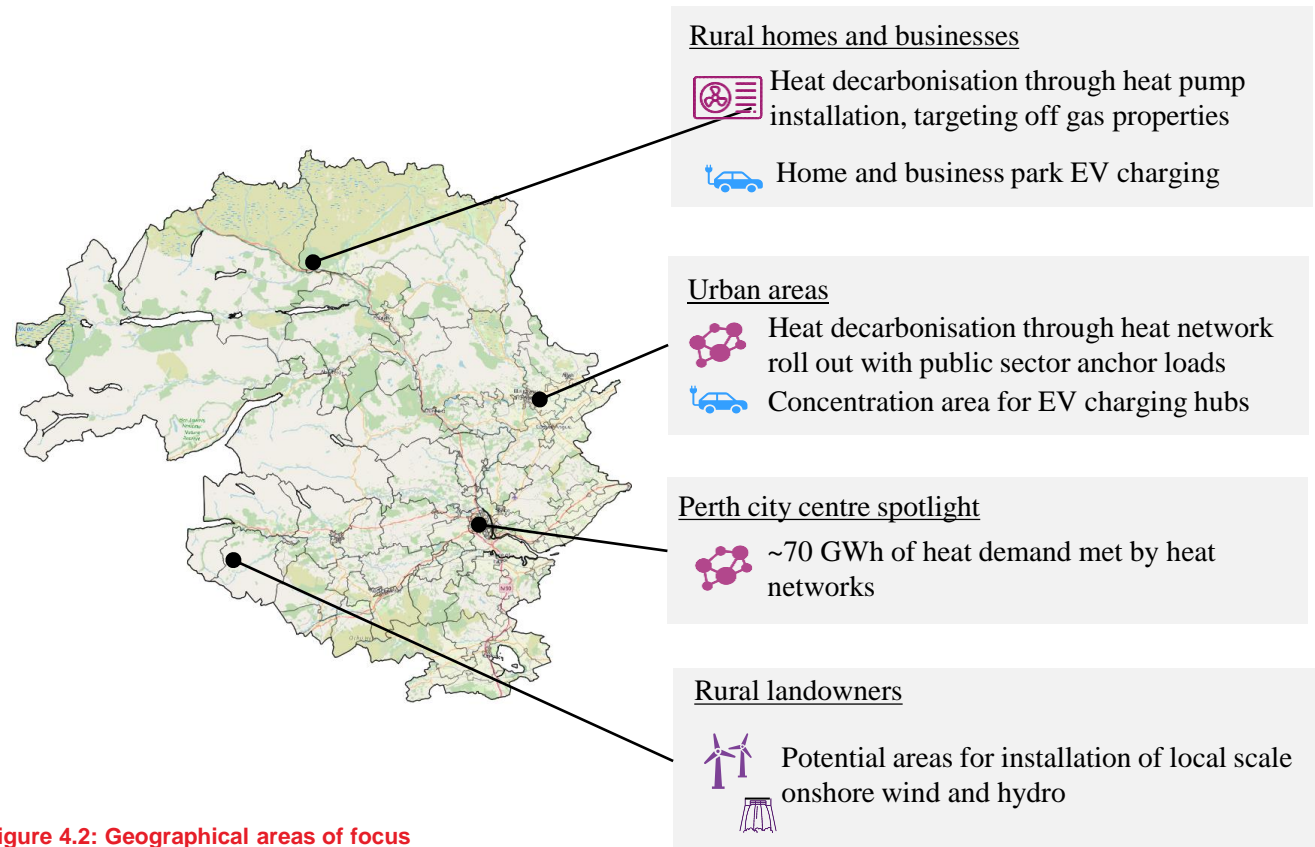


Figure 4.2: Geographical areas of focus

4. Priority intervention areas

Wider benefits

Wider benefits and a just transition

Transitioning to a low-carbon, resilient energy system will deliver significant co-benefits for residents and businesses across Perth and Kinross beyond emissions reductions alone. The priority interventions identified this LAEP, can create local jobs, reduce energy bills, alleviate fuel poverty, and improve public health.

It is estimated that delivering Perth and Kinross's clean energy transition will require a specialized regional workforce of around 27,000 job-years (~1,300 full time jobs) in areas like renewable energy installation, building insulation, EV mechanics, heat pump maintenance, and more between now and 2045. While its likely much technology manufacturing will occur outside the region, local employment opportunities will be generated for on-site installation, operation, and servicing of these local systems. For example, installing heat pumps, solar panels, and EV chargers at scale will require specialist knowledge and skills training which can be facilitated through local initiatives such as capacity building, training programmes and trade apprenticeships which can empower local actors to access green jobs and support the local energy system transition.

The widespread building upgrades and fuel switching proposed in the LAEP will provide affordable warmth for households across Perth and Kinross. Improving

insulation, replacing inefficient heating systems, and transitioning buildings off fossil fuel reliance to low carbon alternatives will help address the area's rates of fuel poverty

Additionally, eliminating petrol and diesel tailpipe emissions by electrifying all vehicles in Perth and Kinross by 2045 will lead to cleaner air. Reduced exposure to dangerous vehicular pollutants like particulate matter, nitrogen oxides and carbon monoxide has been conclusively linked to better respiratory health and lower risks of cardiovascular disease. These public health co-benefits will be felt region-wide but especially in population centres such as Perth which are likely to experience more traffic congestion and associated pollution.

A just, inclusive energy transition for Perth and Kinross will require policies and investments that maximise these benefits while supporting affected workers and communities. Collaboration with key regional stakeholders across the public, private and education sectors will facilitate reskilling, re-employment programs, and ensure no one is left behind by the low-carbon shift.

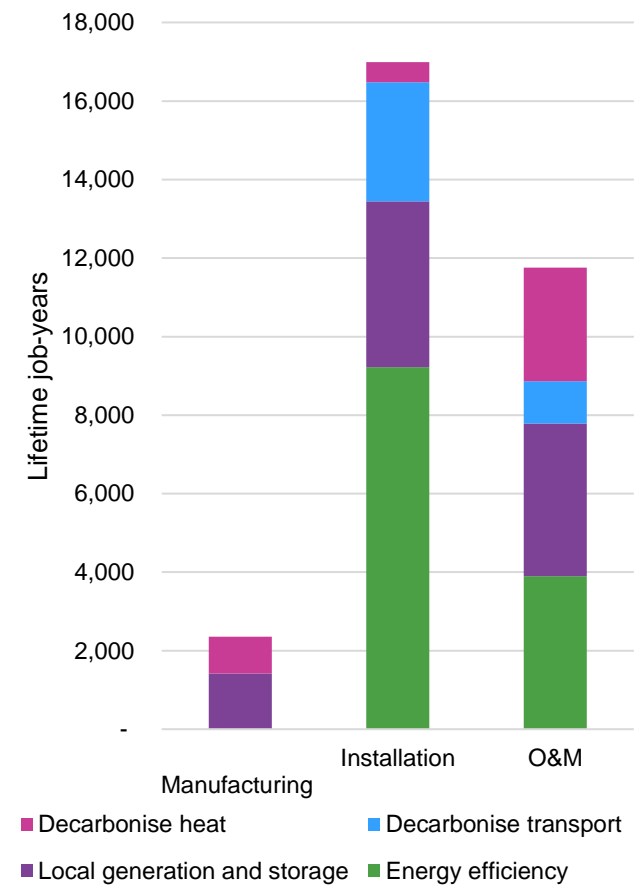


Figure 4.3: Job-years provided by priority intervention area

Chapter 5: Actions and recommendations

5. Actions and recommendations

Introduction to the action plan

Plan outline

For each priority intervention area, this action plan will set out a high level routemap showing recommended actions to enable the delivery of the preferred pathway, in the context of wider policy targets and decisions.

This routemap is shown on page 47 and 48 and presents an action plan graphic between now and 2045, with the proposed actions mapped across it by the associated priority intervention, and relevant stakeholders.

The actions fall under the following priority intervention areas, as introduced in Section 4 above:

Enabling actions

1. Energy efficiency of buildings

2. Decarbonise heat

3. Reduce transport demand

4. Decarbonise transport

5. Deploy local renewable generation and storage

Actions require joined up but differentiated efforts by the stakeholders identified in this LAEP to deliver the plan's objectives and the recommended pathway. This plan acknowledges that decarbonising the local energy system requires not only a systemic transformation but also a shift in consumer behaviour. The actions aim to spur progress through both system-led and consumer-led approaches. It sets out priority intervention areas and key recommended actions for the initial phases of implementation, focused on enabling infrastructure, in combination with incentivising consumer shifts. Effective collaboration and communication will be needed to align top-down and bottom-up efforts toward the shared goal of a zero-carbon energy system.

Despite having identified an optimised energy system and a pathway to deliver this system, uncertainty does remain over the exact form of the decarbonised energy system in 2045. The actions identified here are resilient to this uncertainty and can be taken now to create an enabling environment to maintain the ability to meet the 2045 and interim targets. Future changes will require the plan to adapt, and monitoring of the plan will be crucial. Annual reviews and full updates in line with the local plan refresh cycle are recommended.

The routemap provides a focused view of actions that will be taken in the coming decade, while also showing key milestones on the decarbonisation trajectory to 2045. Each intervention requires four key elements to be successful:

1. Mobilising finance
2. Strong and consistent policy framework
3. Delivery owners
4. Local engagement

The role that Perth and Kinross Council can play for each intervention will vary. Some actions will call for direct intervention from the Council in the material delivery of programmes, while other interventions will require the Council to act more as a facilitator for market driven change.

This action plan also aims to support the implementation of key delivery mechanisms and programmes highlighted in the Perth and Kinross Council's LHEES Strategy.

The following section provides further detail on each of the actions within each intervention area, as well as the council's key asks of others.

5. Actions and recommendations

Perth and Kinross Council’s control and influence in delivering the LAEP

Control and influence

This LAEP outlines what a zero carbon energy system could look like for the Perth and Kinross areas by 2045, including the actions needed to deliver this.

In order to deliver this plan, the Council will need to decarbonise assets within its direct control, such as council buildings and the Council’s transport fleet. Further, the Council will need to drive and influence the decarbonisation of the wider area through policy, incentivising, collaborating and engaging the community.

The Council’s sphere of influence in actions might include:

- Defining a long-term strategic investment framework
- Defining and helping to achieve project outcomes
- Identifying priorities
- Identifying potential risks and monitoring risks
- Monitoring timelines
- Monitoring the quality of the project as it develops

For each of the actions outlined in the following section the type of influence the Council has is shown in Figure 5.1.

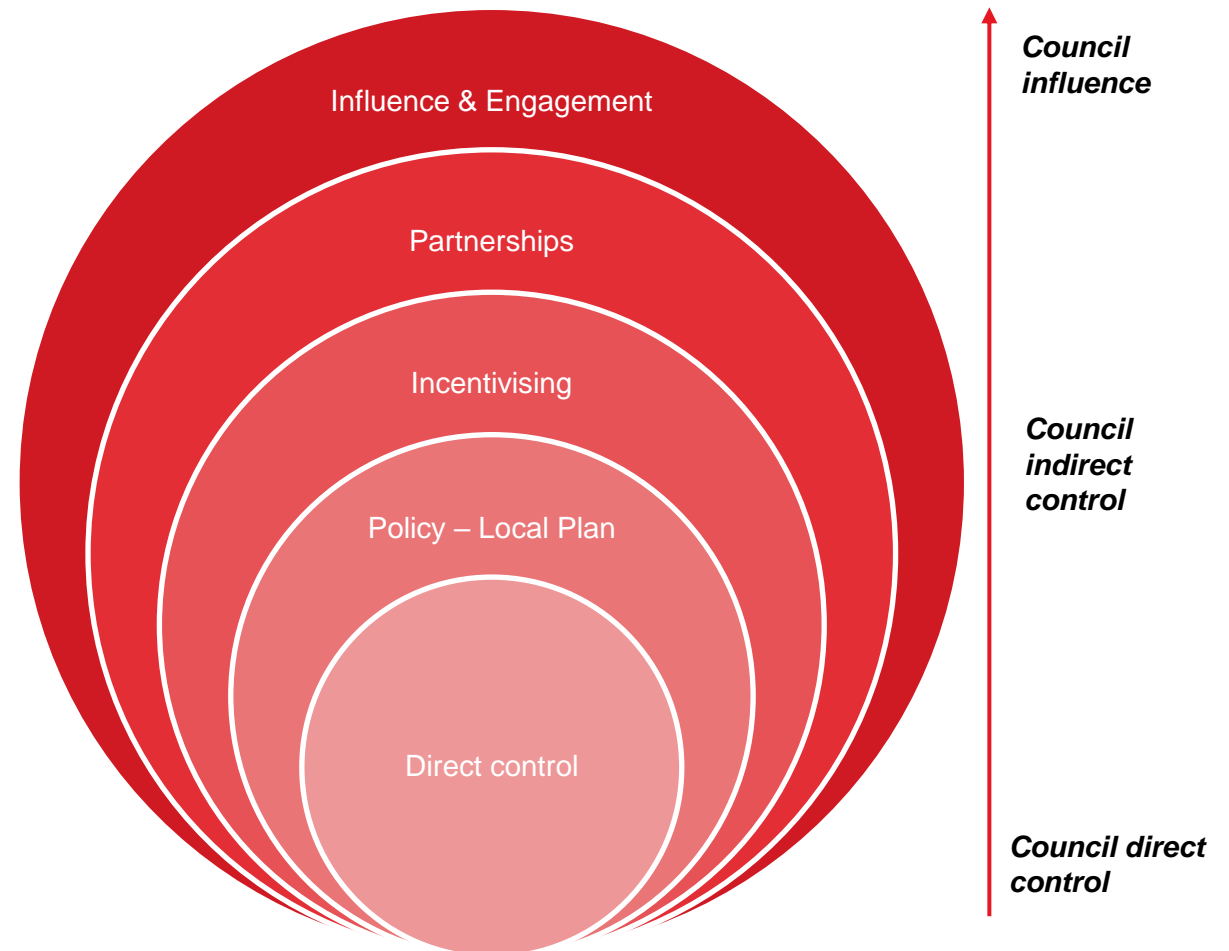


Figure 5.1: Council control and influence.

5. Actions and recommendations

Opportunities and enablers matrix

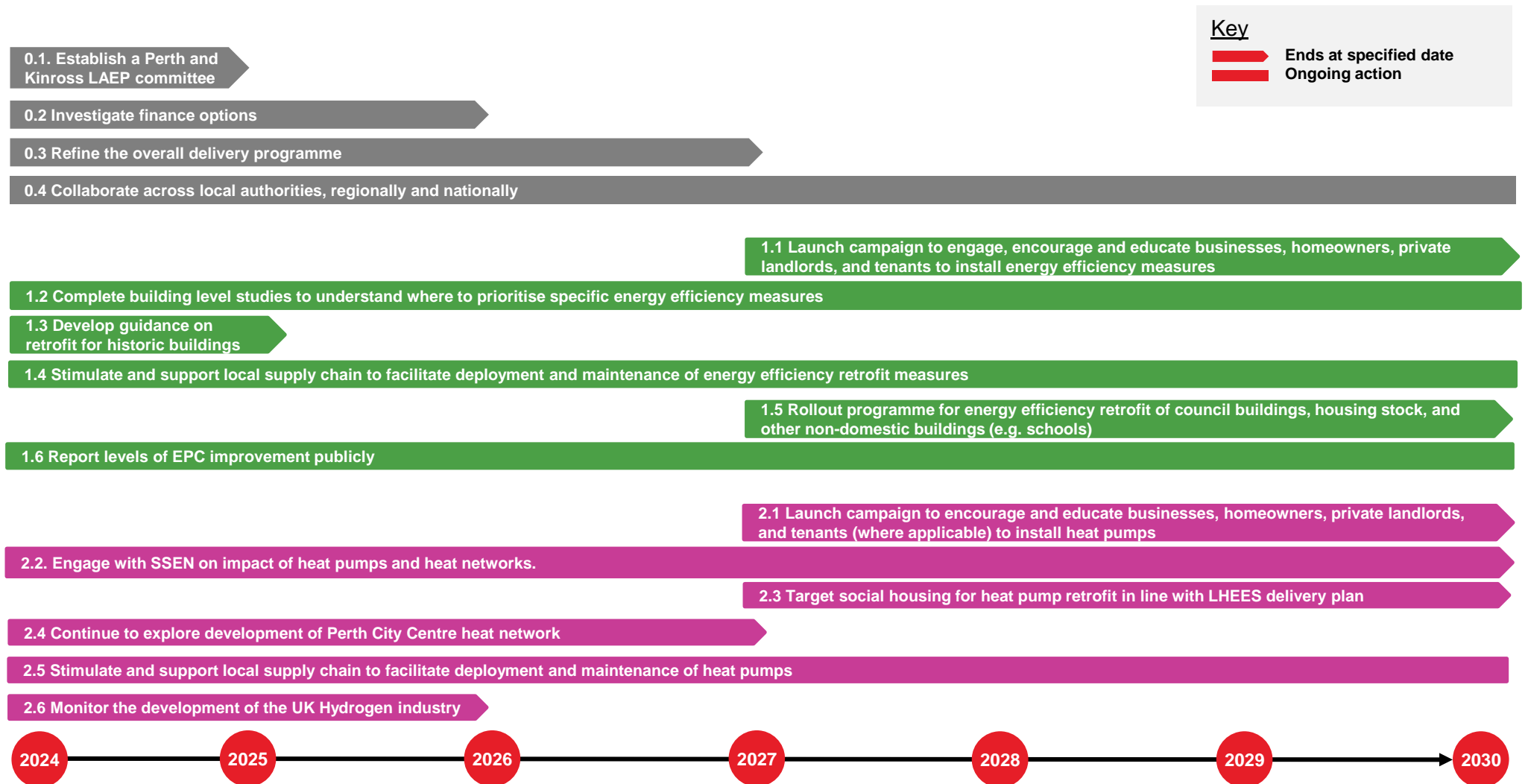
This table presents a matrix of opportunities and enablers, including funding mechanisms, relevant tools, resources and studies, and other drivers and enablers for each of the priority interventions.

Table 5.1: Action opportunities and enablers.

	Funding mechanisms & incentives examples	Tools/resources/studies	Other drivers and enablers
Increase energy efficiency of existing stock	Energy Efficient Scotland: Area Based Scheme (ABS), Energy Savings Trust (EST) Private Rented Sector Landlord Loan, Resource Efficient Scotland Small Medium Enterprise Loan Scheme, Area-based Schemes, Home Energy Scotland Grant. Energiesprong	SCARF, Warm Connections, EST, Home Energy Scotland, Council Local Housing Strategy	Housing to 2040, Fuel Poverty Act, Nation Planning Framework 4 (NPF4), LHEES Delivery Plan
Decarbonise heat	EST District Heating Loan, SGN Help to Heat, Heat Network Fund, Green Heat Innovation Support Fund, Home Energy Scotland Grant, Council Green Business Grants	Heat Network Support Unit, The HEAT Project, SCARF, Perth City Centre Heat Network Feasibility Studies	Heat Network Act, Building Assessment Reports (BARs), REMA, LHEES Delivery Plan
Reduce transport demand	Cycling Friendly programme, EST e-bike grant and loans, Network Support Grant, Community Bus Fund scheme, Smarter Choices, Smarter Places funding	The Council's Let's Talk Transport report, Transport for Scotland's National Transport Strategy Delivery Plan 2, Perth and Kinross on the Go	Under 22 Free Bus Scheme Car Demand Management Framework (2025) TACTRAN liftshare
Decarbonise transport	The OZEV EV Domestic Chargepoint Grant, EST Domestic Chargepoint Grant, Used Electric Vehicle Loan, Business chargepoint funding, Scottish zero emission bus challenge fund	Council's Fleet Decarbonisation and Infrastructure Roadmap Study, Perth and Kinross on the Go, Mission Zero for transport	Free access to chargepoints via ChargePlace Scotland Phasing out of fossil fuel vehicles
Deploy local renewable generation and storage	Community and Renewables Energy Scheme (CARES), Energy Efficiency Business Support Service, Smart Export Guarantee (SEG), PPA	Scotland's draft Energy Strategy and Just Transition Plan, Perth West Green Energy report, Energy Statistics for Scotland, Perth-SEN	Improved fuel security and resilience Unlocking energy system flexibility

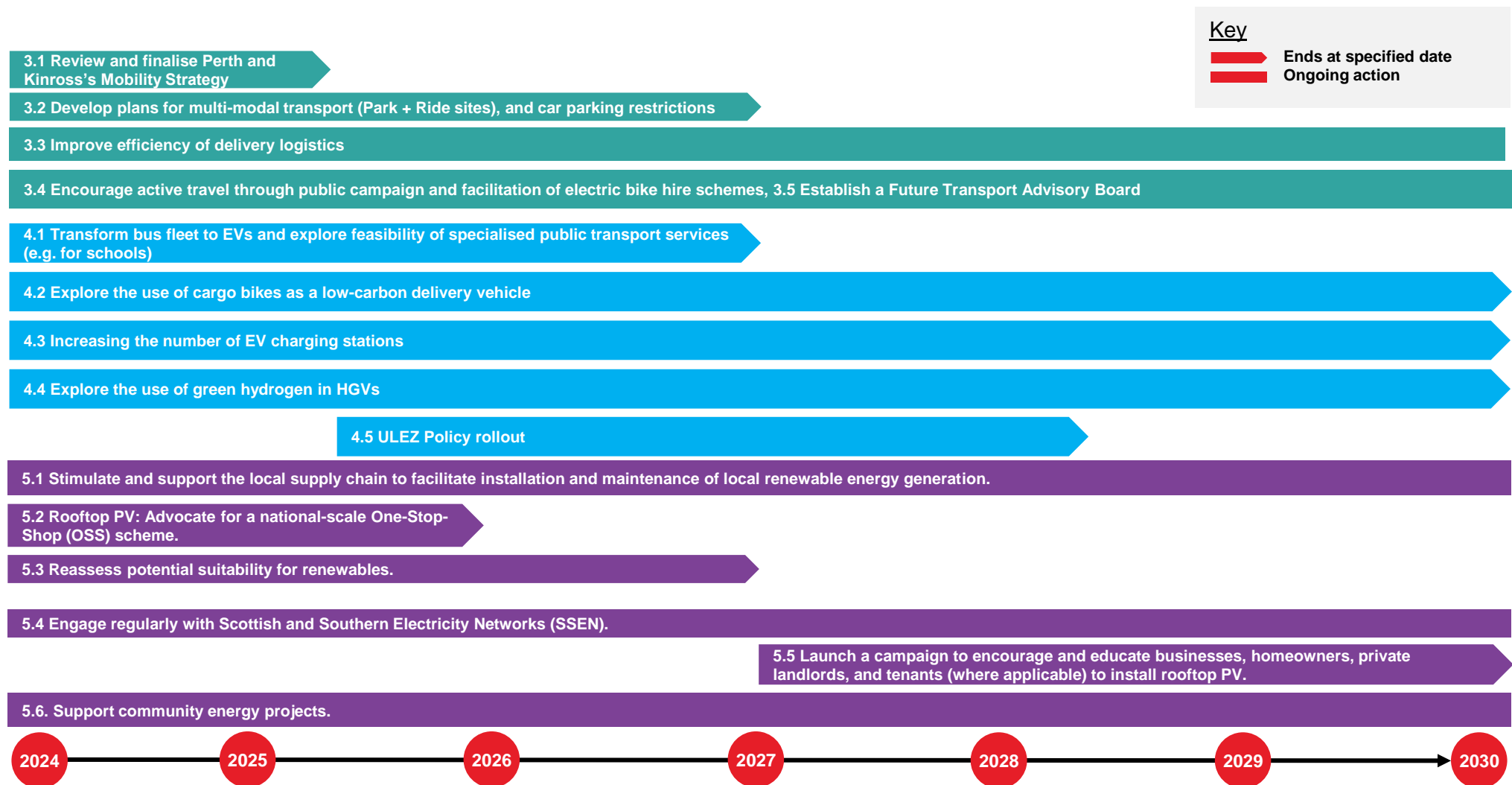
5. Actions and recommendations

Medium term routemap



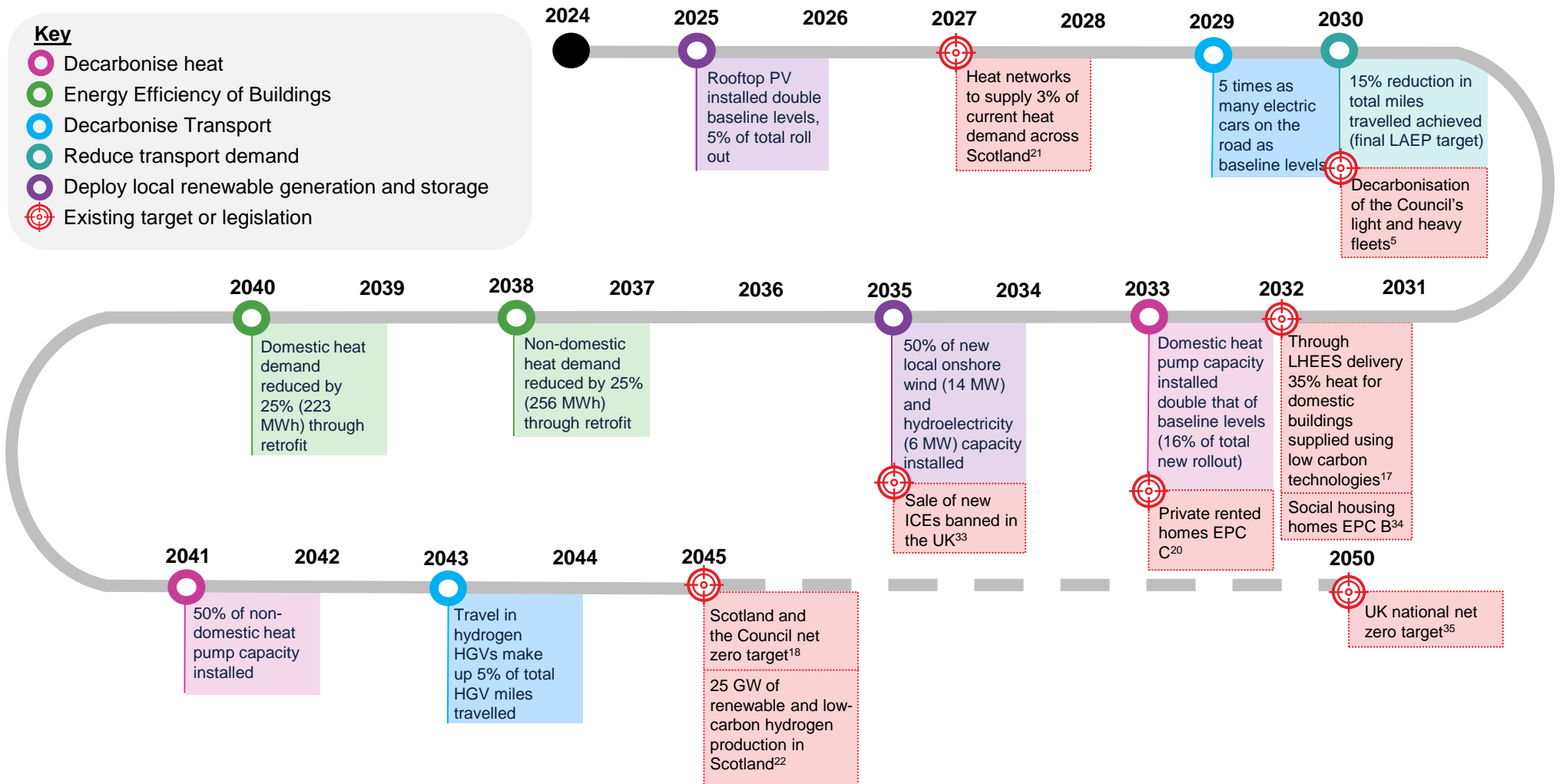
5. Actions and recommendations

Medium term routemap



5. Actions and recommendations

Long term routemap and high-level targets



5. Actions and recommendations

Action priority matrix

The actions in this LAEP were ranked based on how much effort would be required by the action owner and other stakeholders involved to implement the action and how much impact the action would have in reaching net zero in Perth and Kinross, relative to other actions presented. The result is the action priority matrix below which identifies high priority and quick win actions.



5. Actions and recommendations

Descriptions of actions

Enabling Actions

0.1. Establish a Perth and Kinross LAEP Steering Group

This Steering Group would include members from key stakeholders and businesses who want to contribute to improving the area and delivering the plan, alongside strategic partners. It would be used to track and monitor the plan and help foster ownership of actions.

Council control level: Direct control/ partnerships

Benefit: Joined up actions across stakeholders is key to delivering the LAEP.

Timescale: Immediate start, set up within first year.

Barriers: Data sharing and confidentiality, ensuring that committee members are representative.

0.2 Investigate Strategic Partnership as financing option for low carbon portfolio

Perth and Kinross Council should seek to develop a plan for funding arrangements to support the delivery of a local authority programme of works to enable the delivery of the LAEP. Some of the potential funding mechanisms already identified are listed on page 46.

Council control level: Direct control

Benefit: Funding is required to deliver the plan.

Timescale: Immediate start, funding plan to be in

place by mid 2026.

Barriers: Private sector funding is difficult to raise, and also depends on consumers' willingness to spend on decarbonisation. This is particularly challenging for domestic property interventions such as heat pumps and retrofit.

0.3 Refine the overall delivery programme

The Council should refine the overall delivery programme, following a whole systems approach so that initiatives are not siloed. This could potentially be delivered in collaboration with other programmes and plans such as RESOP and LHEES.

Council control level: Direct control / partnerships

Benefit: A coordinated delivery programme to ensure that available funding arrangements and partnerships are utilised in the most appropriate ways, and that the interdependencies are considered.

Timescale: Immediate start, refined delivery programme to be in place by mid 2027.

Barriers: Target is not met because of lack of resource and co-ordination. Continuous monitoring should be undertaken until 2045 to ensure target is met.

0.4 Collaborate across local authorities, regionally and nationally

The Council should work with the neighbouring local authorities to develop opportunities for investment in cross-boundary energy projects at scale. The Council also needs to work with others (including community groups) to provide unbiased advice for energy consumers around energy efficiency and renewables, based on the advice developed at regional or national level.

Council control level: Direct control / partnerships

Benefit: Pooling opportunities across multiple local authorities makes them more attractive to investors. Could also contribute to local employment opportunities.

Timescale: Immediate start, ongoing.

Barriers: Potential for lack of action if relying on stakeholders external to Perth and Kinross.

5. Actions and recommendations

Descriptions of actions

1. Improve energy efficiency of existing buildings stock

1.1 Launch campaign to engage, encourage and educate businesses, homeowners, private landlords, and tenants to install energy efficiency measures

Develop resources to share in residential areas where current EPC ratings are low. Engage with community groups and property owners directly, focusing initially on energy reduction, retrofit measures and associated cost benefits. This could be combined with campaigns around low carbon heating and renewables to provide a whole system campaign.

Council control level: Influence & engagement

Benefit: This action will help to foster cooperation and understanding between communities, property owners and the Council on energy efficiency action.

Action owner: Council.

Other stakeholders: Private landlords, tenants, homeowners, housing associations, community groups and other institutional landowners and businesses.

Timescale: 2027 onwards, once overall delivery programme is broadly in place to understand where to target campaigns.

Barriers: The economic case can be hard to prove for retrofit projects to convince property owners. Challenging to ensure effectiveness of campaign and targeting of efforts.

1.2 Complete building level studies to understand where to prioritise specific energy efficiency measures

Build on LHEES analysis and delivery plan to engage with property owners, large estates and relevant organisations to verify and/or improve building level data on heat demand and energy efficiency requirements.

Council control level: Partnerships

Benefit: This action will help to ensure buildings data is up-to-date as possible in order to better plan and prioritise energy efficiency interventions and enable whole system planning. Integrating LHEES will assist with identifying retrofit opportunities.

Action owner: Council, possible strategic partner assistance.

Other stakeholders: Energy Saving Trust.

Timescale: Immediate start and recurring to accommodate data refresh as required.

Barriers: Missing or incomplete data can make decisions around where to best target retrofit interventions more challenging. Reliance on data provision by external parties and system in place for regular review and updates.

1.3 Develop guidance on retrofit for historic buildings

Work with Home Energy Scotland (HES) to produce guidance and support for energy efficiency measures in historic buildings.

Council control level: Direct control

Benefit: This action will help to address the challenge around retrofitting the high proportion of historic building in Perth and Kinross.

Action owner: Council

Other stakeholders: HES

Timescale: Immediate start with guidance produced by 2025.

Barriers: Retrofit measures may be unsuitable for historic or listed buildings due to legislative/regulatory constraints.

5. Actions and recommendations

Descriptions of actions

1. Improve energy efficiency of existing buildings stock

1.4 Stimulate and support local supply chain to facilitate deployment and maintenance of energy efficiency retrofit measures

Identify and engage local businesses that can deliver energy efficiency retrofit interventions. Collaborate with local colleges and skills development organisations to establish a targeted skills programme dedicated to retrofitting.

Council control level: Influence & engagement

Benefit: This action will help to ensure that the skills and workforce is in place locally to deliver on energy efficiency improvements. Skilled local suppliers will be able to build trust with property owners and act as an enabler.

Action owner: Council, local college

Other stakeholders: Skills Development Scotland, local business, Tay Cities Skills Advisory Board

Timescale: Immediate start and recurring

Barriers: Challenge to successfully develop local supply chains in time to deliver the scale of interventions required. Provision of funding for skills development. Attracting talent to the industry.

1.5 Rollout programme for energy efficiency retrofit of council buildings, housing stock, and other non-domestic buildings (e.g. schools)

A strategic decarbonisation planning exercise undertaken across the Council's building stock, aligning with the LHEES delivery plan. Smart energy systems could also be considered as part of programme.

Council control level: Direct action

Benefit: This action will help achieve the Council's aspirations for all social housing to reach EPC B by 2032. Learnings from the programme can also support the delivery of private sector retrofit projects.

Action owner: Council, possible delivery partner assistance.

Other stakeholders: Council property management, schools, retrofit construction companies, residents.

Timescale: 2027 to 2032

Barriers:

- Competing council budgets and resource.
- Availability of supply chain.
- Complications navigating wider array of funding and grant schemes available, with varying

eligibility, suitability, etc.

- Buildings where the Council has control are only a small portion of energy consumption so the action has only limited impact on the energy system.

1.6 Report levels of EPC improvement publicly

The Council could publicly report progress in improving privately rented domestic and commercial buildings.

Council control level: Direct action & engagement

Benefit: This will hold the Council to account and ensure that minimum requirements are met. It will raise public awareness, supporting behaviour change.

Action owner: Council

Other stakeholders: Landlords, property owners.

Timescale: Immediate start until 2032.

Barriers: Awareness campaigns and behaviour change may not be enough if there is no access to funding in order to carry out necessary retrofits.

5. Actions and recommendations

Descriptions of actions

2. Decarbonise heat

2.1 Launch campaign to encourage and educate businesses, homeowners, private landlords, and tenants (where applicable) to install heat pumps

Develop resources to share in residential areas with high heat pump suitability. This could be combined with campaigns around energy efficiency measures and renewables to provide a whole system campaign.

Council control level: Direct action

Benefit: This action will encourage the uptake of heat pumps within suitable areas across Perth and Kinross. Demonstration of heat pumps could help foster understanding and trust of the new technology.

Action owner: Council.

Other stakeholders: Private landlords, tenants, homeowners, housing associations, community groups and other institutional landowners and businesses.

Timescale: 2027 onwards, once overall delivery programme is broadly in place to understand where to target campaigns.

Barriers: Challenging to ensure campaign is effective and efforts are targeted correctly. Significant upfront costs required for heat pump installation with private actors.

2.2. Engage with SSEN on impact of heat pumps and heat networks.

Ensure there is the required level of capacity to connect heat pumps and heat network assets to the network. Furthermore, the Council should share their LAEP plan through the LENSAR tool to provide an evidence base for network reinforcement requirements.

Council control level: Influence and engagement.

Benefit: This action will ensure network upgrades are prioritised to enable the planned heat pump deployment.

Action owner: Council and SSEN

Timescales: Immediate and reoccurring until 2030.

Barriers: Lack of sufficient understanding on grid constraints could result in delays to rollout of heat pumps.

2.3 Target social housing for heat pump retrofit in line with LHEES delivery plan

Create a programme for heat pump retrofit in suitable social housing, aligning with LHEES analysis and delivery plan.

Council control level: Direct control.

Benefit: This action will help rollout of heat pumps in areas that are most suitable and decarbonise heat in buildings. The learnings from this programme will provide valuable lessons to facilitate the installation of heat pumps more widely.

Action owner: Council, possible delivery partner assistance.

Other stakeholders: Property owners, landlords, heat pump installers, residents.

Timescales: 2027 onwards

Barriers: Competing council budgets and resource; availability of labour; complications navigating wider array of funding and grant schemes available.

5. Actions and recommendations

Descriptions of actions

2. Decarbonise heat

2.4 Continue to explore strategic heat network feasibility across Perth City

This would involve engaging with waste heat suppliers to assess their appetite for heat offtake, explore other heat supply options and their viability, engage with developers to understand feasible demand in the area, what future demand there may be, constraints in the road network for pipe routing and the long-term resilience of supply. Engage with HES to understand impact on conservation areas.

Council control level: Direct control

Benefit: This action will build on the feasibility study for the Perth City Centre heat network and LHEES heat network zoning work to consider long-term delivery of viable heat network.

Action owner: Council, possible delivery partner.

Other stakeholders: External consultants, Developers, SSEN, other waste heat process owners/operators, residents, businesses.

Timescale: 2024-2027

Barriers: Economic and logistic difficulty to deliver heat networks of significant scale, uncertainty over the business and policy environment to facilitate heat network development.

2.5 Stimulate and support local supply chain to facilitate deployment and maintenance of heat pumps

Identify and engage local businesses that can deliver heat pump installation. Collaborate with local colleges and skills development organisations to establish a targeted skills programme dedicated to heat pump installation.

Council control level: Influence & engagement

Benefit: This action will help to ensure that the skills and workforce is in place locally to deliver on the required number of heat pump installations. Skilled local suppliers will build trust with property owners.

Action owner: Council, local educational organisations.

Other stakeholders: Skills Development Scotland, local business.

Timescale: Immediate start and recurring.

Barriers: Challenge to successfully develop local supply chains in time to deliver the scale of heat pump installations required. Provision of funding for skills development. Attracting talent to the industry.

2.6 Monitor the development of the UK Hydrogen industry

Although there are no plans for hydrogen pipelines to serve the LAEP area currently, this may change in future.

Council control level: Direct control

Benefit: May enable faster decarbonisation in the long run, however UK Government decision does not take place until 2026.

Action owner: Council.

Timescale: Starting now, decision in 2026.

Barriers: There are many barriers to hydrogen, but none to monitoring the industry.

5. Actions and recommendations

Descriptions of actions

3. Reduce transport demand

3.1 Review and finalise Perth and Kinross's Mobility Strategy

Finalise the Council's draft mobility strategy to align with the outcomes presented in this LAEP, and explore opportunities to enhance stakeholder collaboration, address potential barriers, and ensure effective implementation.

Council control level: Direct, Influence & engagement

Benefit: The adoption of the Mobility Strategy will set out a key guiding document to achieve transport demand reductions in line with the targets set out in this LAEP. **Action owner:** Council

Other stakeholders: Tactran, public transport providers, residents

Timescale: Draft strategy to be complete by Spring 2024, Final strategy late 2024.

Barriers: Limited resources, political opposition, community resistance, regulatory challenges, technical complexities, time constraints, communication issues, and balancing environmental and economic considerations.

3.2 Investigate the use of multi-modal transport hubs and inner-city car parking restrictions to increase public transport usage.

Development of multi-modal transport hubs such as 'Park & Ride' systems, which encourage parking outside of congested areas and travelling in via public transport. Urban area car parking restrictions, preventing long-stays, would further encourage multi-modal travel, including cycling.

Council control level: Direct

Benefit: This will help reduce congestion, traffic and emissions within the city via the increased uptake of public transport.

Action owner: Council

Other stakeholders: Stagecoach, other transport providers

Timescale: Immediate start and recurring.

Barriers: Community resistance to parking restrictions and ensuring access remains for those that need it. Attractive alternative transport modes will need to be readily available before implementation.

3.3 Investigate improvements in last mile delivery logistics within Perth to reduce emissions.

Collaborate with local delivery partners on how last mile delivery in Perth can increase efficiency to reduce emissions.

Council control level: Direct & Engagement

Benefit: A reduction in unnecessary transport from deliveries and a potential increase in delivery efficiency.

Action owner: Council

Other stakeholders: Delivery companies operating in Perth and Kinross

Timescale: Immediate and recurring.

Barriers: The lack of infrastructure in place to improve delivery logistics. Delivery companies unwilling to collaborate.

5. Actions and recommendations

Descriptions of actions

3. Reduce transport demand

3.4 Encourage the uptake of home-working / co-working spaces to reduce transport demand

Introduce potential support schemes for home-working equipment to encourage working from home when appropriate. Council-owned spaces can be used as local co-working spaces for free, to reduce transport demands, especially at rush-hour.

Council control level: Direct

Benefit: A reduction in rush-hour congestion, pressure on public transport and transport demand.

Action owner: Council

Other stakeholders: Local employers

Timescale: Immediate and recurring.

Barriers: Companies may want to steer away from working from home and start working towards being face-to-face more often again.

3.5 Encourage active travel through public campaign and facilitation of electric bike hire schemes.

Encourage active travelling through the promotion of key health and environmental benefits. Introduce electric bike/scooter schemes where they can be loaned or hired for both short-term or long-term, especially in rural areas. Potential to introduce grants/ interest-free loans for low-income households to increase bike uptake

Council control level: Direct

Benefit: Mitigating the demand for high-carbon transport methods, with a focus on the appeal of electric bikes and scooters, especially in rural areas characterised by large travel distances or challenging terrain where non-electric bicycles may be impractical.

Action owner: Council

Other stakeholders:

Timescale: Immediate and recurring.

Barriers: The lack of available bike/ scooter infrastructure such as safe bike storage and cycle lanes.

3.6 Establish a Future Transport Advisory Board to monitor data on active travel and private car use against targets.

Develop a Future Transport Advisory Board to monitor the rates of active travel and trends of private car use, in order to ensure progress is being made towards the set target and identify any problem areas.

Council control level: Direct

Benefit: Progress is constantly monitored, and any potential problem areas can be identified early on and be resolved immediately.

Action owner: Council

Other stakeholders: Tactran,

Timescale: Immediate and recurring.

Barriers: The gaps in transport data could mean that some issues will not be monitored.

5. Actions and recommendations

Descriptions of actions

4. Decarbonise transport

4.1 Explore the potential for all buses to be EVs and encourage uptake via specialised services for specific groups

Collaborate with local transport companies such as Stagecoach to ensure all buses are electrified. Investigate the curation of specialised, cost-effective services e.g. for students, key workers etc. to provide a reliable service and increase public transport uptake and reduce reliance on cars.

Council control level: Direct & Engagement

Benefit: The reduction in public transport emissions and the potential increase in uptake of public transport via regular users that require a reliable and cost-effective transport option.

Action owner: Council

Other stakeholders: Stagecoach (+ other bus companies), schools, NHS

Timescale: Immediate and recurring.

Barriers: Rural areas have poor and unreliable public transport, which can make it off-putting for those who need to adhere to a strict schedule. Some people tend to feel unsafe on public transport and so avoid it. The potential high travel costs are a concern for some due to the cost-of-living crisis. The potential lack of grid capacity is also a barrier for large-scale EV use.

4.2 Investigate the use of cargo bikes within Perth to reduce emissions.

Collaborate with local delivery partners and explore the possibility of using cargo bikes for moving goods locally.

Council control level: Direct & Engagement

Benefit: A reduction in emissions from deliveries. There is also a potential for increased job opportunities via the cargo bike deliveries.

Action owner: Council

Other stakeholders: Local delivery companies

Timescale: Immediate and recurring.

Barriers: Delivery companies refusing to collaborate. Lack of adequate cycle-friendly infrastructure

4.3 Explore increasing the number of rapid EV charging stations.

Encourage the uptake of EVs via increasing the number of on-street charging stations. Utilise the aims of the Proactive Mobility Strategy 2023.

Council control level: Direct

Benefit: This will help reduce emissions within the city via the increased uptake of EVs.

Action owner: Council

Other stakeholders:

Timescale: Immediate start and recurring.

Barriers: The negative public perception of faulty charges and the safety of EV cars due to the influx of electrical fires reported recently. The high cost of EVs and lack of grant funding for EV charging points at domestic properties is off-putting to the public during the cost-of-living crisis. Potential concerns with regards to grid capacity.

5. Actions and recommendations

Descriptions of actions

4. Decarbonise transport

4.4 Explore opportunities for the use of hydrogen in HGVs

Collaborate with Binn Ecopark to investigate opportunities to fuel the Council's refuse lorries with green hydrogen. Utilise the findings of this pilot study to determine the feasibility of fuelling more of public sector HGV fleets with green hydrogen.

Council control level: Direct

Benefit: This will help increase infrastructure for green hydrogen use in transport and increase the use of renewable energy.

Action owner: Council

Other stakeholders: the Binn Group

Timescale: Immediate start (the Council has signed a £50 million 10-year Energy from Waste contract with Binn Ltd in June 2023).

Barriers: The lack of current green hydrogen infrastructure. The high cost of green hydrogen and the lack of technological maturity within heavy transport vehicles could pose unknown risks.

4.5 Ultra Low Emission Zones (ULEZ) Policy roll-out

Investigate the roll-out of ULEZ policy in urban areas, to reduce congestions of cars within high demand areas and increase public transport uptake. Utilise the findings of TACTRAN Regional Transport Strategy 2024-2034, which provides a regional target of ULEV achieving 72.2% of the 56% CO2 reduction by 2030.

Council control level: Direct

Benefit: This will help reduce congestion, traffic and emissions within the city via the increased uptake ULEZ compliant cars and public transport.

Action owner: Council

Other stakeholders: Residents, public transport providers, TACTRAN

Timescale: To commence following finalisation of Mobility Strategy.

Barriers: Resistance to the implementation of ULEZ in an area where reliance on private vehicles is high, and the cost of EVs is high, posing challenges in fostering widespread acceptance and compliance with the transition to cleaner transportation alternatives.

5. Actions and recommendations

Descriptions of actions

5. Deploy local renewable generation

5.1 Stimulate and support the local supply chain to facilitate installation and maintenance of local renewable energy generation.

Collaborate with local colleges to establish a targeted skills programme dedicated to renewable energy generation. This educational outreach will raise awareness about the prospects within the renewable energy sector, with specific focus on opportunities within the supply chain. The initiative should aim to inspire individuals to pursue careers that actively contribute to the energy transition. Furthermore, the Council should continue to invest in current staff, retraining them to have the required skillset.

Council control level: Partnerships.

Benefit: Establishing a proficient local installer network should instil trust amongst residents, ensuring that installations are conducted to high standards and maintenance requests are promptly addressed.

Action owner: Council and local colleges.

Other stakeholders: renewable energy installation companies, developers and manufacturers.

Timescales: Immediate start and reoccurring.

Barrier: The attractiveness of career prospects relies on maintaining a consistently high demand for installations.

5.2 Rooftop PV: Advocate for a national-scale One-Stop-Shop (OSS) scheme.

Emphasise to Scottish Government the significance of centralising installation information and issuing through a reliable authority. Consistency is crucial to provide standardised advice, directing users to preapproved sources that guide them through the rooftop installation process. Additionally, the OSS can serve as a valuable resource for information on energy efficiency and heat decarbonisation, encouraging a holistic approach to whole-house retrofit solutions.

Engaging with Energy Saving Trust could support this initiative.

Council control level: Influence and engagement.

Benefit: This initiative aims to raise awareness about the rooftop PV installation and maintenance procedures, equipping residents and building owners with the necessary information to confidently initiate and manage the process.

Action owner: Council.

Other stakeholders: Scottish Government and Energy Saving Trust.

Timescales: Immediate start until 2026 (depending on response).

Barrier: There may be resistance to set up a OSS that refers user to installers due to risk of liability claims.

5.3 Reassess potential suitability for renewables.

Identify locations suitable for onshore wind, hydroelectricity, and rooftop PV installations. This assessment should differentiate between public and private land ownership to determine the most viable deployment approach. The preliminary evaluation should leverage information available in the LAEP and other existing Council assessments. Additionally, this assessment should investigate opportunities for co-locating generation assets with battery storage. Note that the analysis conducted within the framework of the LAEP suggests that the greatest potential for increased generation lies in hydroelectricity and rooftop PV installations.

Council control level: Direct control.

Benefit: This action will maximise renewable energy development in Perth and Kinross.

Action owner: Council.

Other stakeholders: Renewable energy developers

Timescales: Immediate start until 2027.

Barrier: Land availability may be limited due to planning policy restrictions.

5. Actions and recommendations

Descriptions of actions

5. Deploy local renewable generation

5.4. Engage regularly with Scottish and Southern Electricity Networks (SSEN).

Ensure there is the required level of capacity to connect renewable energy generation assets to the network. Furthermore, the Council should share their LAEP plan through the LENSAR to evidence base for network reinforcement.

Council control level: Influence and engagement.

Benefit: This action will ensure network upgrades are prioritised.

Action owner: Perth and Kinross Council and SSEN

Other stakeholders: None.

Timescales: Immediate and reoccurring.

Barriers: Lack of sufficient understanding on grid constraints could result in delays to new renewable projects.

5.5 Launch a campaign to encourage and educate businesses, homeowners, private landlords, and tenants (where applicable) to install rooftop PV.

Collaborate with local community groups to organise educational workshops. Refer landlords and residents to key available funding schemes. Leverage insights from the assessment conducted on rooftop suitability for solar PV, derived from the outcomes of Action 5.3. Promote the resources available on the Council's Climate Action website.

Council control level: Partnerships.

Benefit: This action will drive private sector rooftop solar PV uptake.

Action owners: Perth and Kinross Council and community energy groups.

Other stakeholders: Owner-occupiers, tenants, private landlords, housing associations.

Timescales: 2027 until 2030.

Barriers: Challenging to ensure effectiveness of campaign. Other deterrent factors such as high upfront costs and limited availability of labour may diminish the appeal of installation.

5.6 Support community energy schemes.

Collaborate with Community Energy Scotland to identify potential local community energy projects. These initiatives provide a fresh avenue for involving individuals in local climate action, empowering communities to make an impact. Additionally, the Council should actively advocate for the economic advantages and heightened energy resilience that community energy projects can bring to the local area

Council control level: Partnerships.

Benefit: Increase in renewable energy generation and enhanced awareness amongst the local community.

Action owners: Perth and Kinross Council.

Other stakeholders: Community Energy Scotland and other local community energy groups.

Timescales: Ongoing.

Barriers: Resistance from residents to install renewable energy generation assets.

Chapter 6: Conclusions

6. Governance, monitoring and review

The structures required to deliver the plan

Governance

The delivery and review of Perth and Kinross’s LAEP will align with the Council’s Governance arrangements and relationships for the LHEES Strategy and Delivery Plan.

Perth and Kinross Council’s Climate Change and Sustainability Committee will provide scrutiny, assess performance and consider LAEP and LHEES reviews.

Perth and Kinross Council Climate Board will provide strategic directions and monitor progress and performance. An Executive Sponsor and a Senior Responsible Owner will be identified.

Perth and Kinross Council Climate Change Working Groups and external partners will deliver actions via identified project managers and agreed workstreams.

Perth and Kinross Council LHEES/LAEP co-ordination team will ensure coordination and monitoring of LAEP/LHEES Delivery Plan actions and will report to the Board.

Monitoring and review

Monitoring and evaluation should also be considered as part of the Delivery Plan process. A monitoring and evaluation plan (MEP) will be developed, building on existing MEPs, such as those used for Local Housing Strategies. These MEPs should also set out how the

Council is working towards national and local targets and any key performance indicators. Examples of outputs metrics include:

- Number of homes retrofitted
- Number of non-domestic buildings retrofitted
- Number of public EV charging points installed
- MW renewables installed
- Number / MW of heat pumps installed
- MW of heat demand served by a heat network

To monitor these metrics publicly available datasets can be used, such as the Energy Performance Certificate Register and the Micro Generation Certification Scheme. The Council will need to develop a baseline understanding of these metrics based on existing data. Carbon emissions reduction should also be tracked, recognising that available data will lag a few years behind.

They should also set out, as far as reasonably possible, a portfolio of projects that are to be taken forward, and track progress of ongoing projects related to the LHEES/LAEP.

Monitoring reports will be produced every quarter for the Steering Group and the Board and annually for the

Climate Change & Sustainability Committee. There will be a full review of the Strategy and Delivery Plan every 5 years to take account of key factors, including:

- Policy changes both at a local and national level.
- Changes in costs and effectiveness of technologies
- Progress to date.

The next full review will be in 2029. A Risk register will be developed and has been included as one of the early actions of the Delivery Plan.

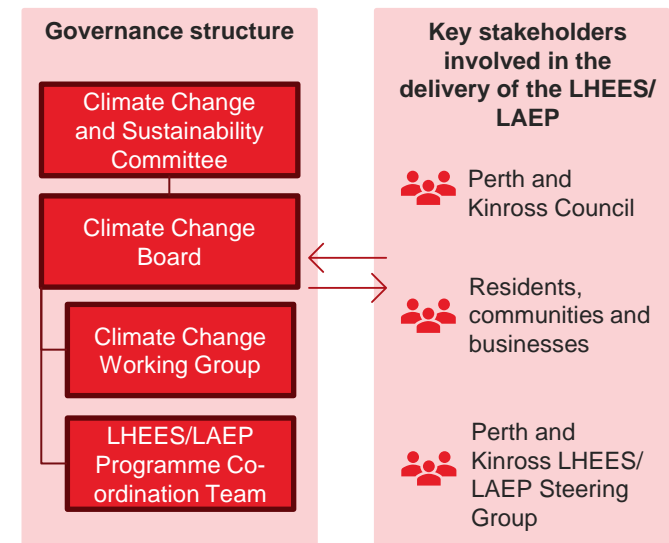


Figure 6.1: Proposed LAEP Delivery structure

6. Governance, monitoring and review

The structures required to deliver the plan

Support and engagement

Perth and Kinross Council LHEES/LAEP co-ordination team will provide support and its main tasks will include:

- Data: update data and support access to data to all stakeholders
- Communication and engagement: co-ordinate communication and engagement plan
- Risk & Monitoring: develop risk register and monitoring and evaluation plan and produce monitoring report
- Reviews: prepare and co-ordinate LAEP/LHEES Strategy and Delivery Plan reviews
- Best practices and training: provide support to project managers in the form of templates, best practices and training.
- LHEES/LAEP Steering Group: coordinate and support LHEES Steering Group

Engagement will be maintained and developed with key stakeholders through the LHEES/LAEP Steering Group and between the Steering Group, Perth and Kinross Council and our residents, communities and businesses to achieve a successful LAEP and LHEES Strategy and Delivery plan delivery. A Communication and Engagement Plan will be

developed by the Steering Group and has been included as one of the early actions of the Delivery Plan. The Plan will set out how the Steering Group will conduct regular consultation and engagement with stakeholders. Engagement with residents, communities, businesses and private landlords would be particularly important. It will also ensure there is awareness of the key heat transition and energy efficiency priorities for Perth and Kinross until 2029.



Powerlines in Lochay

6. Conclusions

Delivering change in the face of uncertainty

Moving to a complex energy system

The challenge to achieve net zero carbon emissions energy system in Perth and Kinross by 2045 is considerable.

The current energy system comprises three largely separate systems for heating, electricity and transport. Transitioning successfully to net zero requires an interconnected system which will need coordination and collaboration between these sectors, alongside careful management by a diverse set of stakeholders to maintain reliability while enabling an equitable transition.

Perth and Kinross Council declared a climate emergency in 2019 and to effectively respond to this with meaningful action, it is recommended that the Council embraces the LAEP's findings. The Council plays a vital role in facilitating whole-system action where it wields influence, as well as leading directly on initiatives within its remit.

To truly realise the aims set out in this LAEP, as well as take further action on the climate emergency, the Council should consider redirecting resources towards deployment of renewable technologies, infrastructure development, community engagement and other transitional programmes. The scale of investment

across all priority intervention areas will be required to increase significantly in the coming years.

Pace of change in an uncertain world

The pace and scale of change outlined in the LAEP is significant - from increasing local renewable electricity generation, the electrification of heating and transport, infrastructure rollouts and leveraging localised heat network potential. Delivering and retaining skills and capacity to deliver these solutions as soon as possible is crucial.

Uncertainties remain regarding the future of Perth and Kinross's energy system. This includes unknowns around future policy decisions taken by the UK and Scottish Governments (e.g. the planned Funding Reform), the advancement of new low carbon technologies and the costs associated with these technologies. Another key uncertainty is the willingness of private actors to adopt new ways of using and consuming energy in the future.

This uncertainty however, should not forestall immediate action. The recommended pathway presented in this LAEP is expected to best meet objectives despite unknowns. The routemap prioritises the no-regrets, short-term measures to initiate the pathway to net zero in Perth and Kinross. Updating

the plan through monitoring is essential as influential policies evolve and breakthrough technologies emerge.



Drumderg Windfarm

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