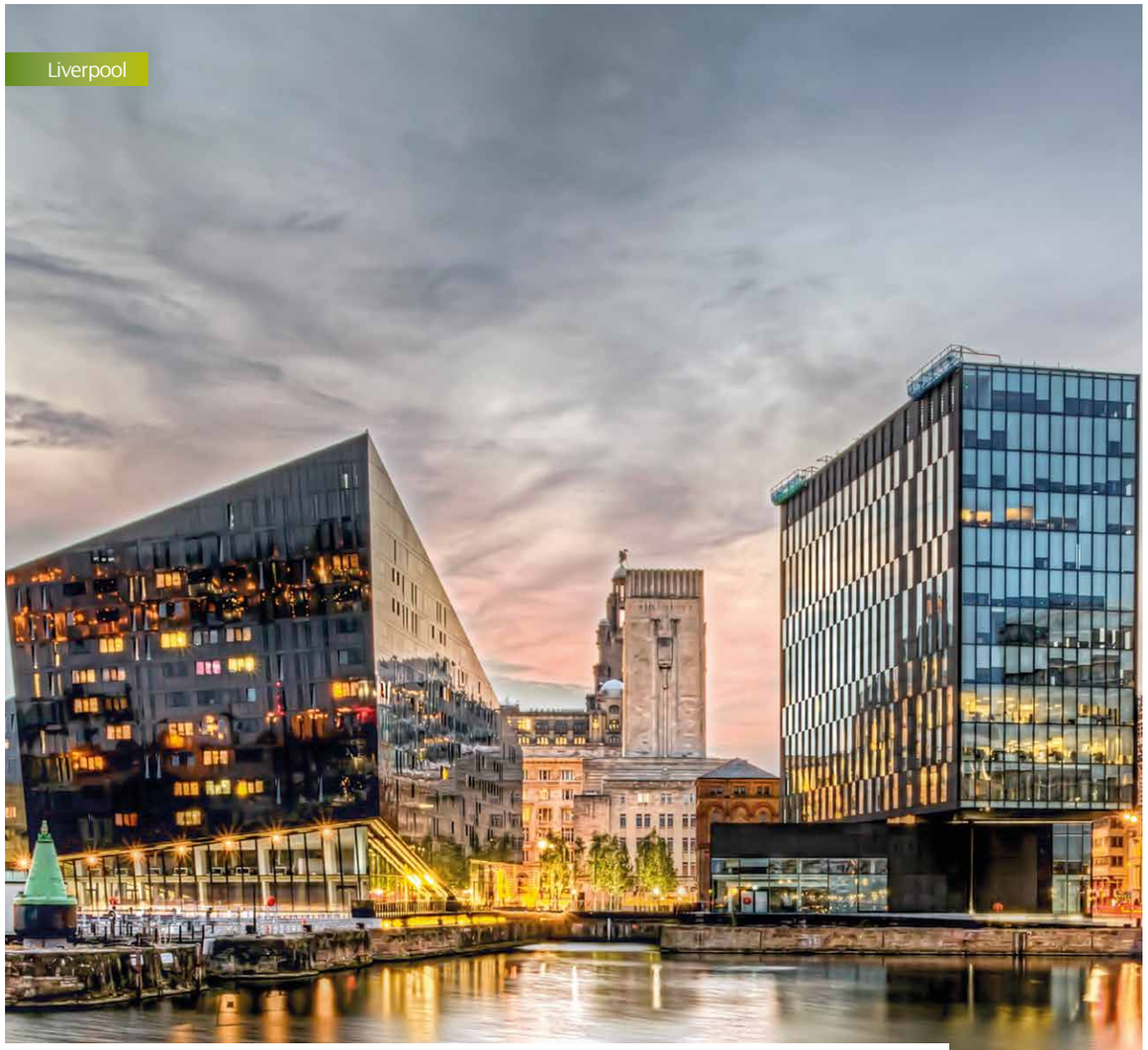
ZERO CARBON COMMUNITIES

Understanding the transport, heat and energy infrastructure that communities across the UK need to reach Net Zero

SCOTTISHPOWER


Liverpool

CONTENTS

1. FOREWORD

At ScottishPower, we're committed to playing a leading role in the fight against climate change.

We're the first integrated energy company in the UK to generate 100% green electricity. Our retail business is developing new products and services to support the clean transport and heating needs of our customers. And we're investing in our energy networks to deliver a greener future – the critical infrastructure that's at the heart of efforts to decarbonise the UK's energy system.

We recognise that the fundamental shift we need to make – away from a reliance on fossil fuels towards green energy powering clean lives – is an urgent and monumental task for us all. It's the defining challenge of our time.

That's why we're launching Zero Carbon Communities – an initiative that aims to help and guide local communities along the path to Net Zero.

In a few short years, our roads will look very different. Electric cars and buses will dominate daily commutes and weekend travel. Communities across the UK will need a whole network of electric vehicle charging points to support this change.

The way we heat our homes and businesses will change dramatically as well. The gas that has provided warmth on winter nights for decades will be replaced by energy efficient systems based on heat pumps and other technologies.

Crucial to the UK's future electric transport and heating needs are the transmission and distribution energy networks that – quite literally – underpin our daily lives. But the importance of this infrastructure – the wires and cables that move electricity from wind turbines and solar farms to points of demand, the substations and transformers that ensure energy is supplied to every community in the land – is often overlooked.

The Net Zero targets now established at national and local levels – ranging for 2050 for the UK as a whole and 2045 for Scotland, to 2040 for Liverpool and 2030 for Glasgow – demonstrate the appetite for change. Although some might think these dates still seem far away, the reality is that there's no time to lose. It's time now to develop robust plans of action to realise these ambitions, and we're determined to play our part as a key delivery partner for communities across the regions we serve. Without smart and timely investment in our networks, it's hard to chart a path to Net Zero.

We're proud of our track record in delivering the green transition. We've helped bring nearly one-third of the UK's renewable electricity onto the system, and we're already working with the communities we serve to realise their Net Zero plans. But we know we need to do more.

Zero Carbon Communities builds on this approach:

- For the first time, we've used independent research to identify the path that local communities in our network areas need to take to decarbonise – helping us to understand the type and number of EV charging points they'll require, and the number of homes to make the shift from gas to electric heating.
- Across ScottishPower's networks, retail and renewables generation businesses, we want to work as closely as possible with each of our communities, helping to ensure that no one is left behind and that local zero carbon targets are met.
- By shining a light on the future needs of local communities, we want to contribute to the debate about how best government and regulatory policy-making can best accommodate local priorities within a framework for national action on Net Zero.

We're launching Zero Carbon Communities in Liverpool. It's a city we're proud to serve. A city that has already committed to go further than many others, with a Zero Carbon target of 2040.

Over the coming months, we'll roll out our Zero Carbon Communities approach to other areas – working in partnership with great cities like Glasgow and Edinburgh, wonderful rural communities like Anglesey and Fife. We'll update this report as we go.

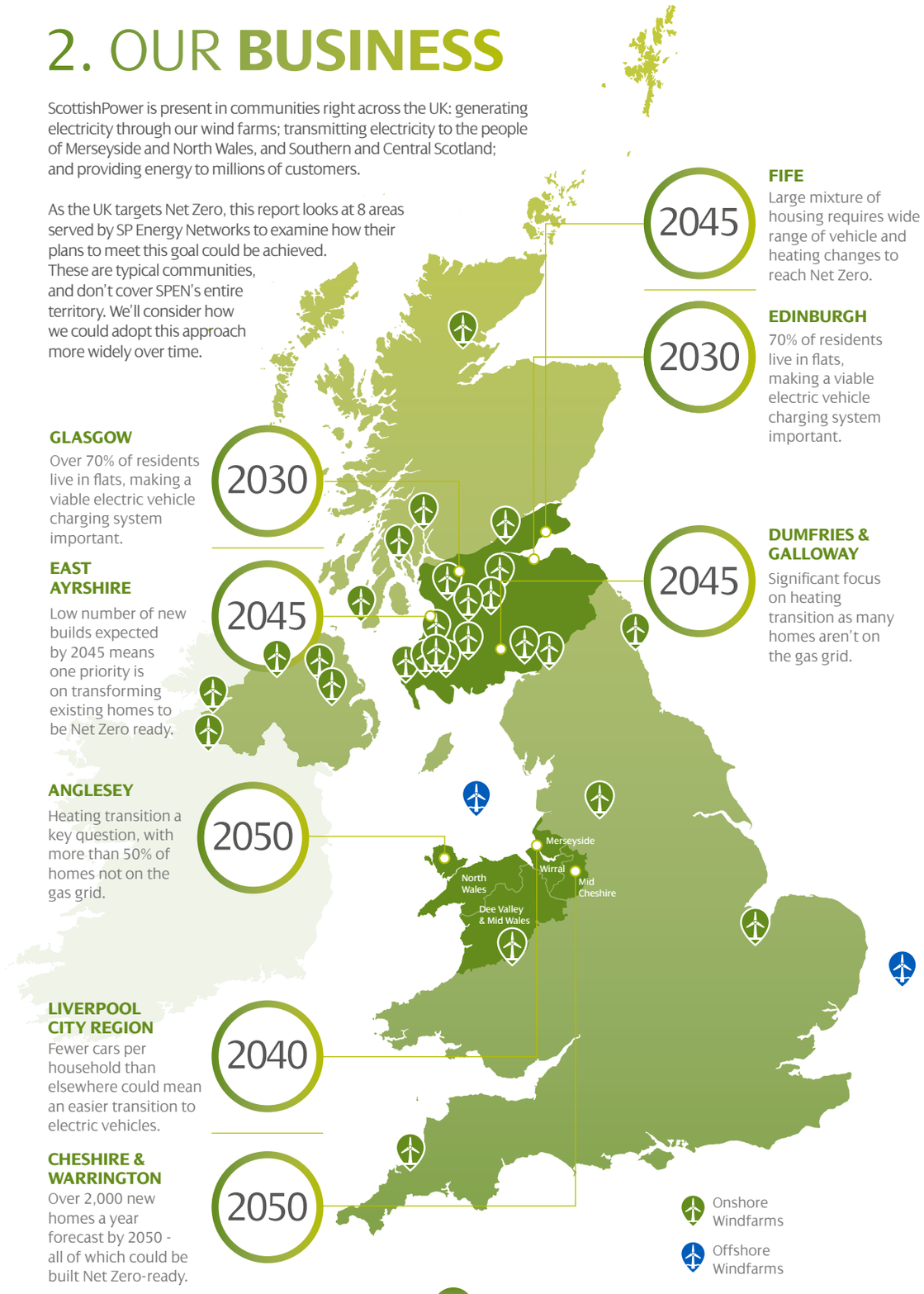
Getting to Net Zero means changes for us all – how we operate as a business, how the energy sector is regulated, and how we live our everyday lives.

Keith Anderson - CEO, ScottishPower

2. OUR **BUSINESS**

ScottishPower is present in communities right across the UK: generating electricity through our wind farms; transmitting electricity to the people of Merseyside and North Wales, and Southern and Central Scotland; and providing energy to millions of customers.

As the UK targets Net Zero, this report looks at 8 areas served by SP Energy Networks to examine how their plans to meet this goal could be achieved. These are typical communities, and don't cover SPEN's entire territory. We'll consider how we could adopt this approach more widely over time.



FIFE
Large mixture of housing requires wide range of vehicle and heating changes to reach Net Zero.

EDINBURGH
70% of residents live in flats, making a viable electric vehicle charging system important.

GLASGOW
Over 70% of residents live in flats, making a viable electric vehicle charging system important.

EAST AYRSHIRE
Low number of new builds expected by 2045 means one priority is on transforming existing homes to be Net Zero ready.

DUMFRIES & GALLOWAY
Significant focus on heating transition as many homes aren't on the gas grid.

ANGLESEY
Heating transition a key question, with more than 50% of homes not on the gas grid.

LIVERPOOL CITY REGION
Fewer cars per household than elsewhere could mean an easier transition to electric vehicles.

CHESHIRE & WARRINGTON
Over 2,000 new homes a year forecast by 2050 - all of which could be built Net Zero-ready.

3. WELCOME TO **ZERO CARBON COMMUNITIES**

The UK energy landscape is evolving at pace as the way we use, generate and distribute energy changes rapidly.

Facilitating the UK's low carbon transition is certainly not a new area of endeavour for SP Energy Networks, but we have seen our service provision broaden into industries such as heat and transport in recent years, as part of the drive to reduce greenhouse gas emissions through increased use of electric vehicles and smart space heating devices.

These changes mean that we have to look at new and innovative solutions, so that we can continue to deliver value to customers while ensuring that costs are fair and equitable for all.

At the same time as we stand ready to facilitate the Government's low carbon aims, we understand the value of engaging with our stakeholders and customers on the journey to Net Zero.

We're committed to a tailored and locally focused approach that helps to prioritise their wants and needs in a consistent manner across our business. That, in turn, helps us to deliver safe, reliable services, sustainable value, and a better future, quicker.

Becoming Net Zero offers us a huge economic opportunity. Many everyday activities will decarbonise and switch to all-electric technologies, and it's essential for businesses and communities to start planning now for the transition to a cleaner and greener future.

Working in partnership with local councils, businesses, residents and stakeholders, Zero Carbon Communities aims to develop a unique roadmap for regions served by SP Energy Networks in order to help them plan and prepare.

We've started by looking at eight typical communities in the area served by SP Energy Networks, to reflect how different places have differing needs. Learning from this work, we're keen to explore how, over time, we can extend this approach across our complete territory.

To reach Net Zero, every community will need to make changes. And each community will be unique in that journey – a national plan only goes so far. In that sense, one size does not fit all, and we understand the importance of being responsive to local communities.

Our aim is simple. To help local communities understand the steps they have to take to manage the Net Zero transition successfully, by giving them a clear sense of the scale of the change, and an understanding of how every household will be affected.

With our decades of experience and service provision to date, we are confident that we can prepare for the future.

Frank Mitchell - CEO, SP Energy Networks

4. THE UK'S DECARBONISATION CHALLENGE

At both national and municipal levels, the UK is setting the global pace by committing to, and legislating for, zero carbon targets.

In 2019, the UK made a legally binding commitment to a zero carbon future, mandating a 2050 end date to its contribution to global warming. Scotland has gone still further and set a Net Zero target of 2045. We are also now seeing individual cities and regions committing to their own targets. These dates may seem a long way off. For planning and investment purposes, they are anything but remote. The challenge is enormous and requires far-reaching change – not only for government, regulators and industry, but for the public too.

An electric future

As the Committee on Climate Change has identified, investing in renewable generation alone is not going to be enough. We need to reduce emissions significantly in many other areas of our daily lives:

Transport: Accounting for 23% of UK greenhouse gas emissions, transport requires urgent action.[1] The CCC recommends that all new cars and vans should be electric by 2035 and advocates the earlier switchover of 2030 if possible. This is a more ambitious aim than the Government's own targets to phase out diesel and petrol cars by 2040, although the Scottish Government has identified 2032 as the date to phase out the need for diesel and petrol cars. The challenge is immense – currently fewer than 5 in every 1000 miles driven are by low-carbon vehicle[2]. With the latest predictions suggesting that electric cars will be cheaper than conventional ones by the mid-2020s[3], the need for electricity and EV charging infrastructure to support this demand will intensify.

Heating: The sector faces a significant decarbonisation challenge, with 23 million UK properties heated by gas today – that's roughly 83% of homes. [4]The UK Government has already announced that gas boilers will no longer be fitted in new homes from 2025, but currently less than 5% of homes use low carbon sources for heating. Getting to Net Zero will mean the end of gas heating as we know it, and the mass conversion of existing homes to electric-powered heat pump technology.

With energy networks as the enabler

The Committee on Climate Change sets out scenarios to address this extensive electrification of transport and heating, involving "around a doubling of electricity demand." [5]To support this, we'll need to ensure we plan carefully and cost-efficiently for the investments required in our transmission and distribution networks.

Driven by local demands

While nationally binding targets for climate change are welcome, we know that the journey each community takes to zero carbon will be very different. One size does not fit all. Communities across the UK are unique in size, geography and economic focus, and they require tailored solutions that take account of their needs and are developed in partnership with them.

Take, for example, the differences in housing stock across the UK. In communities like Glasgow and Edinburgh, around 70% of residents live in flats. Meanwhile in Liverpool, there is a higher than average proportion of terraced housing. Both these types of housing present particular challenges for installing electric vehicle chargers, especially when off-street parking isn't widely available.

There is similar variety in how homes are heated across the UK. While many communities are connected to the national gas grid, communities like Anglesey and Dumfries and Galloway have as many as 50% of homes off-grid. These rely on localised oil, gas or other forms of heating. Yet all of these communities will ultimately need to convert to electric heating systems in the race to Net Zero.

[1] Committee on Climate Change, Net Zero: The UK's contribution to stopping global warming, May 2019, p. 48
[2] Ibid., p. 139
[3] Bloomberg New Energy Finance, Electric car price tag shrinks along with battery cost, 12 April 2019, https://www.bloomberg.com/opinion/articles/2019-04-12/electric-vehicle-battery-shrinks-and-so-does-the-total-cost
[4] https://www.nationalgrid.com/group/news/heating-our-homes
[5] Committee on Climate Change, Net Zero: The UK's contribution to stopping global warming, May 2019, p. 23

HOME TYPES INFLUENCE INFRASTRUCTURE CHOICES AND COSTS

	Detached		Semi-Detached		Terrace		Flat		Total	
	Number	%age share	Number	%age share	Number	%age share	Number	%age share	Number	%age share
The UK	6421	22.59%	8570	30.15%	6886	24.23%	6545	23.03%	28422	100.00%
Scotland	567	21.68%	518	19.81%	539	20.61%	991	37.90%	2615	100.00%
Glasgow	12	3.86%	35	11.25%	38	12.22%	226	72.67%	311	100.00%
Edinburgh	24	9.60%	25	10.00%	31	12.40%	170	68.00%	250	100.00%
Fife	41	23.16%	37	20.90%	50	28.25%	49	27.68%	177	100.00%
Dumfries and Galloway	25	33.33%	19	25.33%	20	26.67%	11	14.67%	75	100.00%
East Ayrshire	12	20.69%	17	29.31%	15	25.86%	14	24.14%	58	100.00%
Liverpool	94	13.20%	273	38.34%	223	31.32%	122	17.13%	712	100.00%
Cheshire and Warrington	133	31.00%	154	35.90%	94	21.91%	48	11.19%	429	100.00%
Anglesey	17	47.22%	8	22.22%	8	22.22%	3	8.33%	36	100.00%

Based on data and evidence

Exactly how many EV charging points will residents of Glasgow, Liverpool or Anglesey need? What type of chargers are required to ensure access and adoption? Where can they be installed most cost-efficiently, once current and future demands on the network are taken into account? How many homes in each local authority will need to switch from gas heating to electricity or heat pumps? To make the journey to zero carbon, every community will need to answer these questions, and more. And they'll need to focus on the solutions that best meet their future requirements.

Rolled out community by community

Zero Carbon Communities is starting with the Liverpool region, which is why it is featured in section 9 of this report. We've also selected seven other areas served by SP Energy Networks to reflect typical communities across the territory. These are Edinburgh, Glasgow, Fife, Dumfries and Galloway, East Ayrshire, Cheshire and Warrington, and Anglesey. Over the coming months, the report will be updated as we roll out our approach in these areas. We'll also look at how we can extend the Zero Carbon Communities initiative to other areas, over time.

With a commitment and plan for action in each

- We'll engage with local government bodies to help identify their unique needs for their electrical futures – in particular, helping to identify what they need in terms of infrastructure for electric vehicles and heating, and ensuring the grid is resilient and robust.
- We'll aim to ensure that the smart networks of the future that facilitate the roll-out of electric vehicles are flexible, resilient and accessible to all.
- We'll raise public awareness of the environmental and financial benefits of the energy grid, and how it can help with smart city growth and development.
- We'll add our voice to those of local leaders seeking greater flexibility to develop their own plans and targets for Net Zero.
- We'll make the case for anticipating future demands on our networks and for investing ahead of need where that's the most cost-effective solution for everyone.

Requiring new skills and creating new green jobs

Decarbonising communities across the UK will require an army of engineers, electricians, plumbers, energy network and transport planners. As we begin this transformation, understanding how many roles will be required, and how to provide the training necessary for these skills will be another element for companies, politicians and local communities to consider.

THE DATA BEHIND ZERO CARBON COMMUNITIES– BY CAPITAL ECONOMICS

Leading consultancy Capital Economics was commissioned to consider the following for this report:

- The total number of electric vehicle charging points to be installed, the number of residential and non- residential charging points and the number by type
- Equipment and installation cost for charging points
- The number of homes that will be on the gas grid
- The number of heat pumps to be installed
- The cost of converting homes from gas-grid to heat pump heating.
- The cost to reinforce and upgrade the network in order to cope with the significantly increased demand

For each of these considerations, Capital has produced data based on two scenarios: a 'normal' pace of decarbonisation, based on the original targets set by the Climate Change Act in 2008; and a 'rapid' pace of decarbonisation, designed to meet the amended Climate Change Act commitment made in 2019 to reach Net Zero by 2050. The majority of this report focuses on this latter goal.

The forecasts set out an ambitious vision for 2050, taken at this current point in time. For the number of electric vehicle charging points required, Capital has assumed that each dwelling with off-street parking would install a charger.

5. THE KEY FINDINGS FROM ZERO CARBON COMMUNITIES

"Responding to climate change is not simply a moral obligation. It is also an economic and social opportunity. It provides us with an incentive to make our air cleaner, our lifestyles healthier, and our cities and landscapes even more beautiful. We will act to ensure that Scotland benefits economically from being one of the first countries in the world to move to a Net Zero future."

Rt Hon Nicola Sturgeon MSP, First Minister of Scotland
Scottish Parliament, 3rd September 2019

Key UK targets for the path to Net Zero by 2050

Number of electric vehicle charging points needed by 2050:
25,299,147

Number of these installed in non-residential areas:
2,627,280

Estimated cost to install chargers across UK:
£45.9 billion

Number of homes that will install heat pumps by 2050:
22,808,780

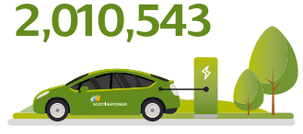
Estimated cost of installing these heat pumps:
£192.2 billion

Estimated network investment required by 2050:
£48.5 billion*

Estimated skilled jobs supported by decarbonisation investment:
115,780

Key Scotland targets on the path to Net Zero by 2045:

Number of electric vehicle charging points needed by 2045:
2,010,543



Number of these installed in non-residential areas:
198,774

Estimated cost to install chargers across Scotland:
£3.6 billion

Number of homes that will install heat pumps by 2045:
1,964,438

Estimated cost of installing these heat pumps:
£16.5 billion

Estimated network investment required by 2045:
£5.2 billion*

Estimated skilled jobs supported by decarbonisation investment:
10,081

* Based on SPEN analysis, the co-ordinated and strategic use of SMART planning and active management techniques has the potential to reduce overall network reinforcement costs by 30%-40%.

6. A CALL TO ACTION: HOW NATIONAL POLICY-MAKERS CAN HELP DELIVER LOCAL PRIORITIES

"We can all say a date. It can trip off the tongue – Net Zero by 2050 or 2030 – but how do we actually get there? That is exactly what the Government are trying to set out. My team is looking at pathways to Net Zero."

Rt Hon Kwasi Kwarteng MP, Minister of State for Business, Energy and Clean Growth
House of Commons, 8th October 2019

This report sets out a blueprint for the steps that local communities can take to meet climate change targets, and to ensure they are not left behind.

We're ready to help mobilise industry, local government and local communities to help us get there – but we also need the right action from national government, and from the energy regulator Ofgem, to enable us to take the practical actions necessary to achieve Net Zero.

We think it boils down to three key areas:

1. Devolve more power so that communities have a proper say in setting carbon priorities in their areas.

The Net Zero transition cannot simply be done to people, or imposed from above. To succeed, it needs to be done with their engagement and support, in ways that reflect the priorities and needs of local communities. And because communities have their own unique needs, a 'one size fits all' approach will not provide the tailored solutions they'll require to get to Net Zero.

A stronger local voice in the low carbon transition could be achieved through:

- Ofgem giving local communities a greater say and accountability in network investment decisions.
- National and local government, and Ofgem, developing localised solutions to clean transport networks and heat supply planning.
- Government at all levels using the new citizens' forum to give voice to the local perspective in developing low carbon delivery plans.

2. Don't wait. Allow future investment to meet the needs of communities in making the transition to Net Zero.

There is no time to waste. We need to start making the necessary plans and investments now. Adopting a strategic and forward-thinking approach to accelerating progress towards Net Zero could deliver these benefits in ways that are more cost-effective and save the consumer money.

This could be achieved through:

- Policy-makers showing a greater understanding of the urgency of the task, and of the importance of innovation in delivering a better future, quicker.
- Policy-makers providing a strategic steer for the energy regulatory, Ofgem, on the promotion of anticipatory investment in network infrastructure, helping to facilitate the roll-out of electric vehicles and low carbon heating.
- Ofgem developing policy and guidance on how the infrastructure costs of local initiatives could be recovered through network charges. For example, consumer bills could distinguish between investment to support national objectives (decarbonisation) or local objectives (air quality, amenity).
- Ofgem considering how the recovery of infrastructure investment costs could be compatible with social justice, so that vulnerable consumers do not bear unfairly costs that would benefit primarily the better off.

3. Ensure that all regulation has the ambitions of meeting decarbonisation targets at its core.

When evaluating policy decisions, it's important for the success of the Net Zero transition that national government and Ofgem give proper weight to the impact of different options on progressing with decarbonisation. That's a view echoed by the National Infrastructure Commission in its Strategic Investment and Public Confidence report in October 2019.

One element in achieving this goal could be through:

- Ofgem working with network companies to accelerate the development of the 'DSO concept', recognising the key role it can play in facilitating regional and local decarbonisation objectives through the most efficient distribution network solutions.

7. THE PATH TO ZERO CARBON: THE UK'S JOURNEY

The new workforce driving the UK's green economy

Preparing the UK for Net Zero will require large scale investment in electric vehicle charging points, electric heating, and many other projects to lower emissions from manufacturing, shipping and agriculture.

The UK's energy network will need considerable upgrades to support these changes. Indeed, the forecasts prepared for this report by Capital Economics suggest more than £48 billion will need to be spent to achieve this by 2050. With co-ordinated and strategic use of SMART planning and active management techniques, SP Energy Networks believes there is potential to reduce these overall network reinforcement costs, which could result in overall savings for UK consumers in the region of £15 billion.

This 30-year project will also create a wealth of new jobs. According to the forecasts produced for this report, over 115,000 new jobs will be created by the race to Net Zero. Many of these will be skilled jobs as plumbers, electricians and engineers to convert the UK's homes and streets to a low emission economy.

Jobs supported 2019-2050:

Construction: **63,233**

Manufacturing: **18,124**

Services: **33,158**

Total: **115,780** Primary activities including energy: **1,265**

Preparing for Electric Vehicles

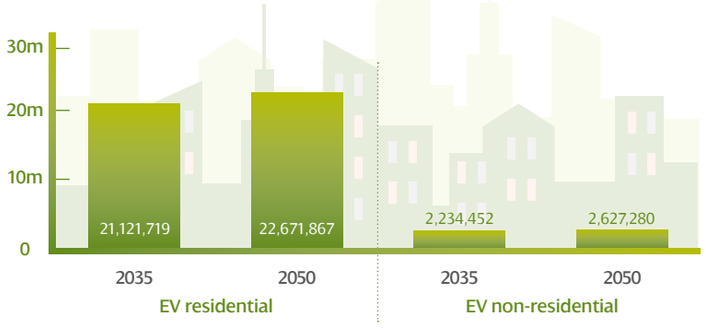
The UK Government has pledged to phase out diesel and petrol cars by 2040 (and the Scottish Government by 2032), with tens of millions of vehicles needing to be replaced as a result. Enough electric vehicle chargers will be crucial to driving the take-up of electric vehicles across the UK.

With a population living in a broad mixture of housing, installing the 25 million plus electric vehicle chargers needed by 2050 will require significant planning at a national, regional and local level.

According to projections by Capital Economics for this report, over 90% of the UK's electric vehicle chargers will need to be installed by 2035, as electric vehicle usage surges ahead of the 2040 diesel and petrol car ban.

Most of these chargers will be residential, but the UK is also projected to need more than 2.5 million chargers in non-residential areas by 2050. These include places to charge electric vehicles in supermarkets, cinemas, high streets, office buildings and service stations.

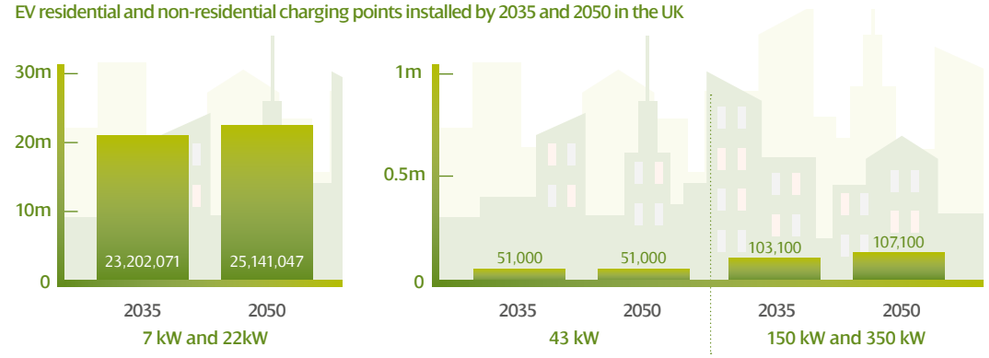
EV residential and non-residential charging points installed by 2035 and 2050 in the UK



From the mid-2030s onwards, electric vehicle numbers are also forecast to exceed the off-street parking available to homeowners. This will accelerate the increase in the number of non-residential chargers required.

Rapid chargers, which refill a car's battery in 30 minutes or less, will also dramatically increase after 2035.

EV residential and non-residential charging points installed by 2035 and 2050 in the UK



The cost of catering for electric vehicles in the UK will reach more than £45 billion by 2050, with three quarters of this spending required before 2035.

Converting to heat pumps

While electric vehicle chargers will be a priority in the race to Net Zero, converting homes from gas to electric heating will also begin in earnest.

Forecasts compiled by Capital Economics for this report suggest more than 22 million homes across the UK will have electric heat pumps installed by 2050. Crucially, almost two-thirds of these will be in place by 2035.

Hybrid heat pumps, which are a more practical technology for many existing buildings, will be the most commonly installed type in homes currently heated by gas. Forecasts suggest that more than 9 million of these will be in place in the UK by 2035, and a total of 13.4 million by 2050.

In total, the cost of switching from fossil fuel-based heating to heat pump technology is forecast by Capital Economics to be £192 billion by 2050. The majority of this spending - £137 billion - will need to happen by 2035.

	2019	%	2025	%	2035	%	2050	%
Natural gas	24,051,901	84.0	22,680,137	76.1	13,395,089	42.3	2,189,534	6.4
Biogas	0	0.0	277,810	0.9	1,063,146	3.4	2,660,106	7.8
Full Heat Pumps	217,000	0.8	1,034,508	3.5	5,315,088	16.8	9,375,656	27.5
Hybrid Heat Pumps	24,793	0.1	1,498,762	5.0	9,390,952	29.6	13,433,124	39.4
Other low-carbon	4,342,484	15.2	4,328,147	14.5	2,518,065	7.9	6,454,547	18.9
Total	**28,636,178**	**100.0**	**29,819,364**	**100**	**31,682,340**	**100**	**34,112,967**	**100.0**

8. THE PATH TO ZERO CARBON: SCOTLAND'S JOURNEY

ScottishPower is committed to helping Scotland to meet its ambitious Net Zero targets. Going further than the UK government, following the advice from the Committee on Climate Change, Scotland is committed to hitting zero carbon by 2045.

As one of Scotland's largest onshore wind developers, and as an energy network provider serving Scotland's two biggest cities and swathes of rural Scotland, it's fair to say that supporting the electric economy is at the heart of everything we do.

Our plans to support Scotland on its journey are already well underway. This work includes:

- The North/South Lanarkshire public charging initiative. This joint initiative with Transport Scotland will see chargers installed across both regions.
- Working in partnership with Edinburgh City Council to deliver public electric vehicle charging across the city. The first phase of these will see 65 fast chargers installed by 2020.
- Working in partnership with Glasgow City Council to deliver public charging points for electric vehicles. The first phase in 2020 will focus on a number of hubs, including a taxi rank charging facility

Through our Green Economy Fund we are also supporting a variety of projects across Central Scotland.

Round 1 projects supported by the Fund include:

- One of Scotland's most ambitious regeneration projects in Dalmarnock, introducing a self-sufficient local energy supply through introducing heat pump technology into its waste water treatment centre.
- Hepling transition a community transport organisation in Glasgow which supports more than 75,000 elderly and vulnerable passengers to become fully low carbon.
- The establishment of two new EV car clubs in North Ayrshire and Hawick in the Scottish Borders.
- And the introduction of Glasgow's first large electric bus route operating within the city centre.

Round 2 projects to be supported by the Fund will include:

- The HALO Kilmarnock project. This will deliver a sustainable low carbon energy system, using 100% renewable energy, to service businesses and the residential community. It is set to revitalise the centre of Kilmarnock and support the growth and resilience of the Ayrshire economy through training and re-skilling of the community's young people.
- The Warmworks initiative, which will create a 'virtual power plant' in Dumfries and Galloway, by installing battery storage technology in 150 off-gas homes in the Stewartry area, and in doing so, help reduce residents' energy bills.

New jobs for Scotland's green economy
Preparing Scotland for Net Zero will require large scale investment in electric vehicle charging points, electric heating, and many other projects to lower emissions from manufacturing, shipping and agriculture.

Scotland's energy network will need considerable upgrades to support these changes. Indeed, around £5.2 billion is forecast by Capital Economics to be spent to achieve this by 2050.

This 30-year project will also create a wealth of new jobs. According to the forecasts produced for this report, over 10,000 new jobs will be created by the race to Net Zero. Many of these will be skilled jobs as plumbers, electricians and engineers to convert Scotland's homes and streets to a low emission economy.

Jobs supported 2019-2045:

Total: **10,081**

Construction: **5,825**

Manufacturing: **1,383**

Services: **2,647**

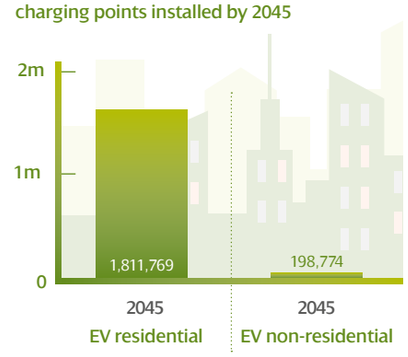
Primary activities including energy: **225**

Switching to electric vehicles
The Scottish Government set clear and ambitious Net Zero targets. Comprising a wide mixture of cities, densely populated urban areas and small rural communities, Scotland's challenge to meet these targets will require careful planning and investment.

Scotland is expected to require over 2 million electric vehicle chargers by 2045. This transition will need to be done quickly, with 60% of chargers to be installed in the decade from 2025 and 2035.

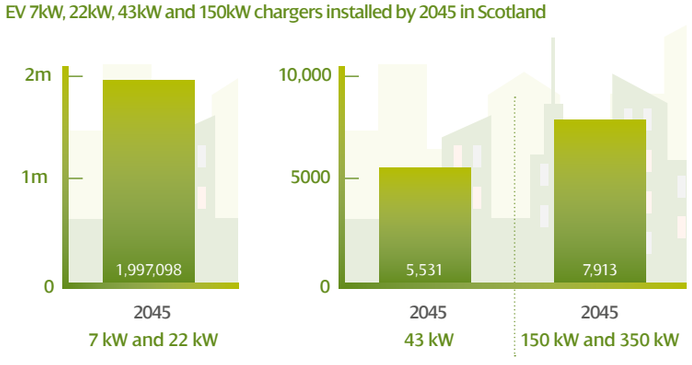
90% of the chargers will need to be residential, while a further 198,000 will be required in public areas in Scotland's more urban areas or on travel routes.

EV residential and non-residential charging points installed by 2045



From the mid-2030s onwards, electric vehicle numbers are also forecast to exceed the off-street parking available to homeowners. This will accelerate the increase in the number of non-residential chargers required. Rapid chargers, which refill a car's battery in 30 minutes or less, will also dramatically increase after 2035.

EV 7kW, 22kW, 43kW and 150kW chargers installed by 2045 in Scotland



All told, the cost of catering for electric vehicles in Scotland will reach £3.5 billion by 2045, with over 75% of this spending required before 2035.

From gas heating to electric heat pumps

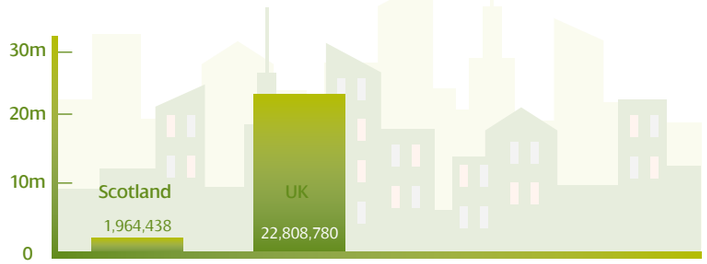
While electric vehicle chargers will be a priority in the race to Net Zero, converting homes from fossil fuel heating to electric systems will also need to happen at scale.

Forecasts compiled by Capital Economics for this report suggest that almost 2 million homes in Scotland will have electric heat pumps installed by 2045. This changeover will be rapid, with over two-thirds of these in place by 2035.

For many homes with existing gas heating, the most practical choice will be to convert to hybrid heat pumps. These are cheaper than full heat pump systems, while still delivering a reduction in carbon emissions, and could account for around 60% of Scotland's heat pumps.

The total cost for the switch from fossil fuel systems to electric heat pumps in Scotland is forecast by Capital Economics to be £16.5 billion. The majority of this spending - £11.9 billion - will need to happen before 2035.

Heat pump roll out in Scotland versus the UK average to reach Net Zero



9. THE PATH TO ZERO CARBON IN OUR FIRST ZERO CARBON COMMUNITY: LIVERPOOL CITY REGION

"As a city region we are already making huge progress in this area. We were the first in the country to adopt a Zero Carbon target of 2040 – ten years earlier than the national target – we have launched a £10m Green Investment Fund, we have the first fleet of 25 zero emission hydrogen buses coming to the city region next year, we have the Mersey Tidal Commission and we already have one of the biggest wind farms in Europe in Liverpool Bay.

"But I think we are all aware that we can always look to do more, so we will declare a climate emergency in the Liverpool City Region."

Steve Rotheram, Metro Mayor of the Liverpool City Region
Annual Meeting of the Liverpool City Region Combined Authority, 28th May 2019

SP Energy Networks has been present in the Liverpool region for 25 years. Today, our network distributes electricity to around 550,000 homes and businesses in the region, working 24/7, 365 days a year with the aim of maintaining a constant supply.

We're extremely proud to be providing the energy network infrastructure that will power the Liverpool City Region's drive to zero carbon by 2040. This work, over the next 20 years, should prepare the network for the mass adoption of electric vehicles, electric heating and other low or zero carbon activities.

We've set in train the planning and preparations for a range of projects that can help Liverpool on this journey. These include:

- Installing public chargers for electric vehicles in the Baltic Triangle area
- Building a network of electric vehicle charging points at commuter train stations across the Liverpool region
- Setting aside funding for programmes that incentivise adoption of electric vehicles
- Supporting the energy demands for a range of projects on Liverpool's waterfront, including a 5MW heat network, a new cruise terminal for the city, and 30,000 new homes

Building Liverpool's green economy

Factors that will influence Liverpool City Region's race to Net Zero

- The Liverpool City Region comprises the five local authorities of Liverpool, Knowsley, Sefton, St. Helens and Wirral, plus the Halton Unitary Authority
- The region's population will increase by an estimated seven per cent and reach just under 1.7 million people by 2050
- Nearly 40 per cent of homes are semi-detached, while the share of detached homes is below the national average at a little over ten per cent
- The estimated share of terraced houses is above the national average, while the share of flats is relatively low
- The average number of cars and vans per household is 0.95 and 0.10, respectively
- Around 70 per cent of homes are estimated to have off-street parking spaces

Preparing the Liverpool region for Net Zero will require large scale investment in electric vehicle charging points, electric heating, and many other projects to lower emissions from manufacturing, shipping and agriculture.

Liverpool's energy network will need considerable upgrades to support these changes. Indeed, £1.37 billion is forecast by Capital Economics to be spent to achieve this by 2050.

This 30-year project will also create a wealth of new jobs. According to the forecasts produced for this report, approximately 12,460 new jobs will be created in the North West in the journey to Net Zero. Many of these will be critical skilled jobs such as plumbers, electricians and engineers to convert Liverpool's homes and streets to a low emission economy.

Jobs supported 2019-2040:

Total: **12,466**

Construction: **6,729**

Manufacturing: **2,252**

Services: **3,387**

Primary activities including energy: **99**

Converting Liverpool to electric vehicles

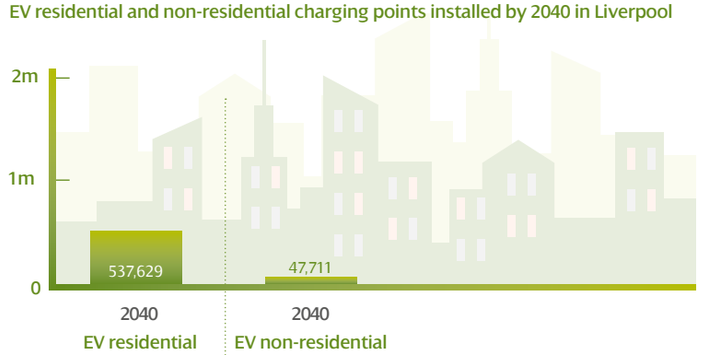
The challenge for the Liverpool city region to reach Net Zero is clear. The city has a diverse mixture of housing types and a particularly high percentage of terraced housing.

Levels of offstreet parking available are comparable to the UK average, but one advantage the city does hold is a lower number of cars and vans per household than elsewhere.

The conversion to electric vehicles will happen quickly in order to meet the region's own Net Zero target. According to Capital Economics, over 90% of the region's 585,000 projected charging points will need to be installed by 2035, as electric vehicle usage surges.

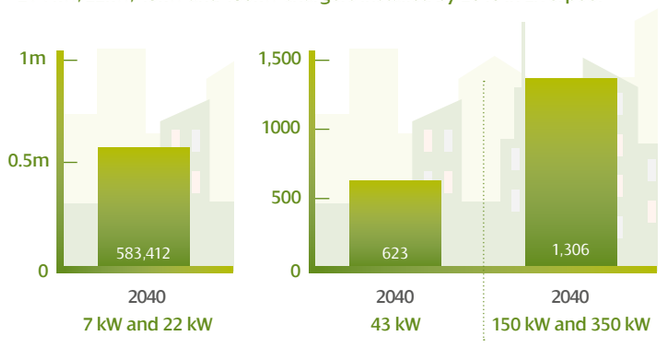
Most of these chargers will be residential, but Liverpool is also projected to need nearly 48,000 chargers in non-residential areas in total. These include places to charge in supermarkets, cinemas, high streets, office buildings and service stations.

EV residential and non-residential charging points installed by 2040 in Liverpool



Given Liverpool has good availability of off-street parking, the city region is likely to have a large number of fast chargers installed. These chargers, which charge vehicles in three to four hours, will comprise a larger share of the city region's overall charging points than the national average.

EV 7kW, 22kW, 43kW and 150kW chargers installed by 2040 in Liverpool



All told, the cost of catering for electric vehicles in Liverpool will reach £890 million by 2040.

Heat pumps

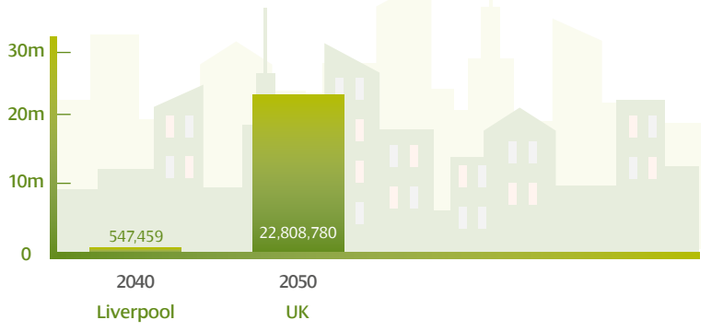
While electric vehicle chargers will be a priority in the race to Net Zero, converting homes from gas to electric heating will need to happen as well.

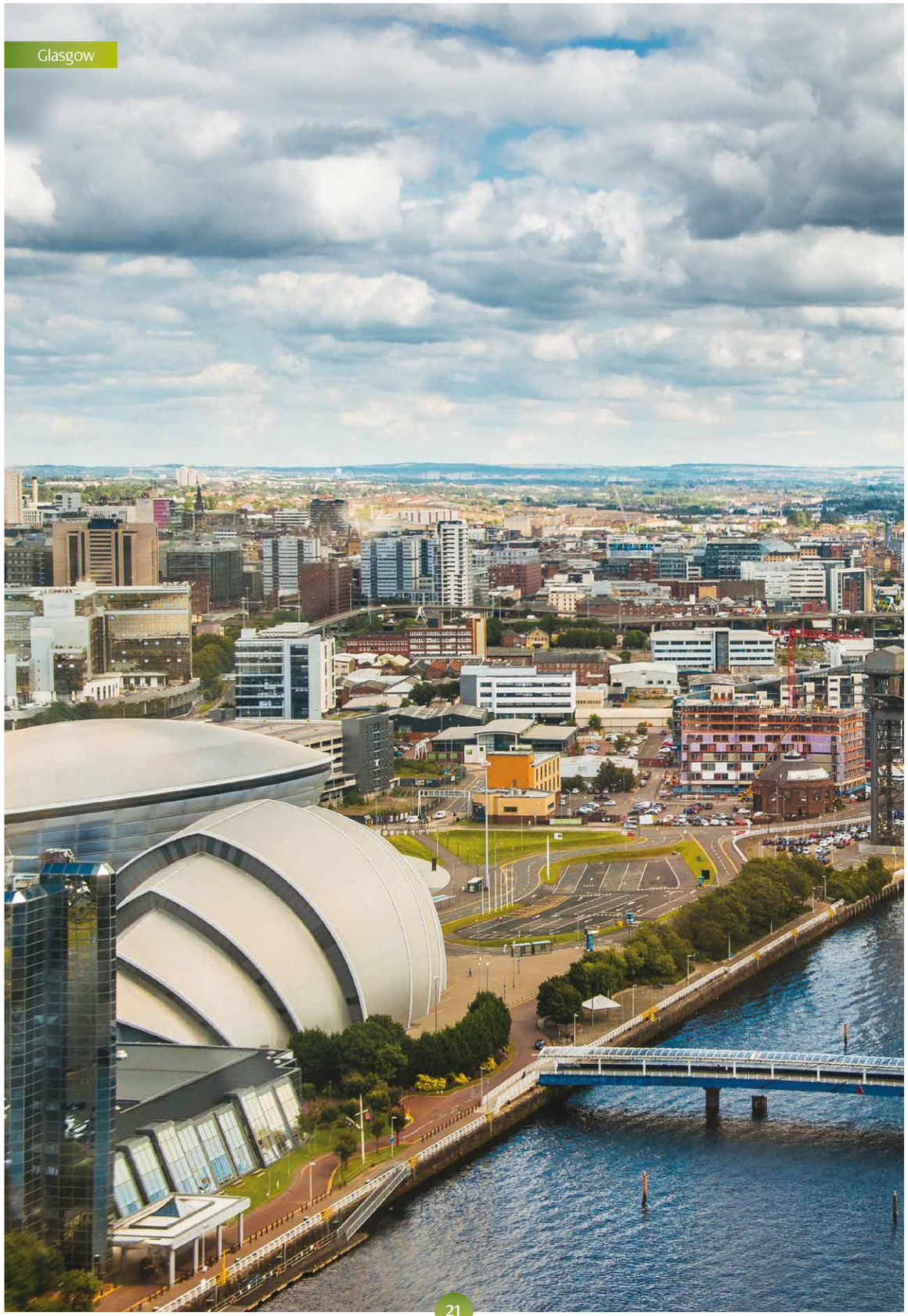
Forecasts compiled for this report suggest more than 545,000 homes in the Liverpool region will have electric heat pumps installed to reach the Net Zero target.

The city region has a far higher share of homes connected to the gas grid than elsewhere, which means it is particularly well suited to so-called hybrid heat pumps. Around two-thirds of all the city region's heat pumps will be of this kind.

However, this will require significant investment. Converting much of the Liverpool City Region to electric heating will require around £4.8 billion. The larger than average number of hybrid heat pumps and a rapid programme of new home building will inflate the cost of this transition above the national average across the UK.

Heat pump roll out in Liverpool versus the UK average





10. THE PATH TO ZERO CARBON IN GLASGOW

"Glasgow is determined to lead the UK's 'race to zero'…We simply have to act now and the City Government will develop those partnerships necessary to get to where we simply have to be.

"There is a historic pertinence that Glasgow should lead the transition into a carbon neutral future and that we should collaborate with those driving the technological innovation to take us there."

"I welcome Scottish Power's comments as a significant step in that direction, a mutual recognition that there is much to achieve in collaboration."

Glasgow City Council Leader Susan Aitken,
May 2019, The Herald

ScottishPower has been headquartered in the Glasgow region for over 65 years and we've pledged to make Glasgow the UK's first Net Zero City. Glasgow City Council has set out its clear intention to reach net zero by 2030, and across ScottishPower's networks, retail and renewables generation businesses, we want to work closely with local communities to help them meet this ambitious net zero target.

In November 2020, the eyes of the world will be on Glasgow as it welcomes the UN Climate Change Conference, COP26. We're extremely proud to be providing the energy network infrastructure, new products and green energy solutions that will help to power Glasgow's drive to zero carbon by 2030. This work, over the next decade and beyond, should prepare the city for the mass adoption of electric vehicles, electric heating and other low or zero carbon activities.

Stand in the centre of Glasgow and you'll be able to see the turbines of Whitelee, the UK's largest onshore windfarm, on the horizon. Just 20 minutes from the city, Whitelee's 215 turbines can generate more than 500 megawatts of electricity – enough to power nearly 300,000 homes per year.

In addition to generating clean green power, we've set in motion a wide range of projects that can help Glasgow on the journey to net zero. These include:

- Funding the first of Glasgow's new fleet of electric buses on commercial routes through the SP Energy Networks Green Economy Fund
- Working through SP Energy Networks' partnerships to help deliver Glasgow's public electric vehicle charging infrastructure
- Investing in significant local network upgrades to increase network capacity by 2025
- Partnering with Glasgow City Council on the 'Ruggedised' smart city lighthouse project – a solar, battery & SMART system pilot
- Starting work on battery storage at Whitelee

Powering Glasgow's Future

Across Glasgow City the electrical network dates to the 1950s and 1960s. To support the future decarbonisation of our economy through the electrification of heat and transport, the network now needs to be modernised to mitigate any future constraints and potential for power interruptions.

SP Energy Networks is investing £20m between 2020 – 2022 to deliver a series of network modernisation works across Glasgow. This investment includes an initial capital expenditure of £7-8m this year, delivering not only modern electrical infrastructure but also facilitating an increase in the network capacity available.

The planned investment also supports many other regeneration initiatives, such as Glasgow University's Innovation Triangle, as well as plans surrounding the Waterfront and West End Innovation Quarter as part of the Glasgow City Region City Deal which will see the Council invest more than £100m in the project.

Significant regeneration and investment in new infrastructure across Glasgow is also driving up demand for power supplies. SP Energy Networks is investing now to meet this future energy demand, whilst ensuring continued delivery of a safe and reliable service to the communities and customers we serve.

Works will include;

- Redevelopment of six major Electrical Substations that have already served Glasgow for over 70 years
- Installation of 80-90km of underground cable that will be laid in a corridor stretching from Pollokshaws Road to Helen Street within the Ibrox area of the city

Building Glasgow's green economy

Factors that will influence Glasgow's race to net zero

- Glasgow City Council has agreed an ambitious programme to reach net zero emissions by 2030
- The region's population will increase by an estimated three per cent and reach 645,000 by 2030
- The housing mix in Glasgow is dominated by flats, which account for 72 per cent of dwellings – much higher than the share in Scotland and the UK
- Detached homes make up less than fifth of dwellings – around 20% of the average in the UK
- The average number of cars and vans per household is 0.7 and 0.09, respectively
- Around 40 per cent of homes are estimated to have off-street parking spaces

Preparing Glasgow City for net zero will require large scale investment in electric vehicle charging points, electric heating, and many other projects to lower emissions from manufacturing, shipping and agriculture.

Glasgow's energy network will need considerable upgrades to support these changes. Indeed, £648 million is forecast by Capital Economics to be spent to achieve net zero.

By investing in a planned and strategic way, SP Energy Networks believes there is potential to reduce significantly network investment costs.

We know this demand is coming, and in order to invest in a strategic and cost-effective way to meet this future demand, we believe cities like Glasgow need anticipatory investment ahead of need to ensure that the city's infrastructure can cope. Glasgow's target is already ambitious, which is why it needs flexibility and autonomy to develop its own plans to get there.

According to the forecasts produced for this report, over 10,000 new jobs will be supported in Scotland in the journey to net zero. Many of these will be critical high skilled jobs such as plumbers, electricians and engineers to convert Glasgow's homes and streets to a low emission economy.

Jobs supported in Scotland2019-2045:

Construction: **5,825**

Manufacturing: **1,383**

Services: **2,647**

Total: **10,081**

Primary activities including energy: **225**

Converting Glasgow to electric vehicles

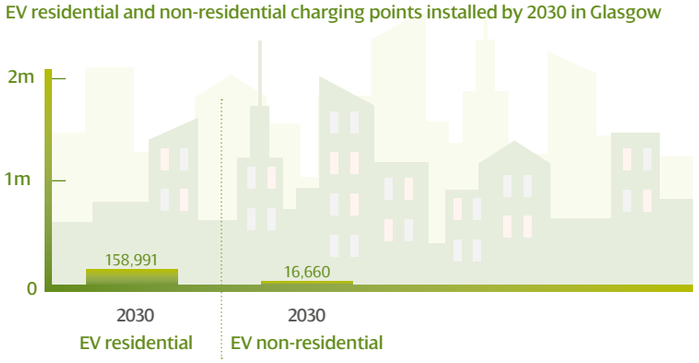
The challenge for Glasgow to reach net zero is clear. The city is urban and densely populated, with a particularly high percentage of flats, meaning there is limited access to off-street parking.

Levels of off-street parking available are below the UK average, but an advantage for the city is a lower number of cars and vans per household than elsewhere.

The conversion to electric vehicles will need to happen quickly in order to meet the region's own net zero target. According to Capital Economics, over 175,000 chargers will have to be installed in the city to help become carbon neutral, as electric vehicle ownership surges.

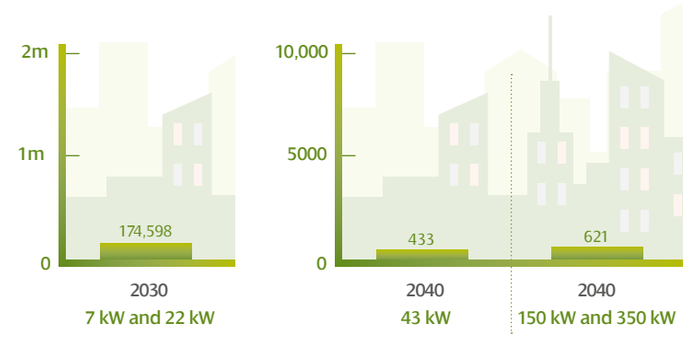
Most of these chargers will be residential, but Glasgow is also projected to need nearly 17,000 chargers in non-residential areas in total. These include places to charge in supermarkets, cinemas, high streets, office buildings and service stations.

EV residential and non-residential charging points installed by 2030 in Glasgow



Despite Glasgow's low availability of off-street parking, residential chargers will still account for 91 per cent of all chargers by 2030, consistent with the national average. In terms of the types of chargers needed, Glasgow requires 175,000 fast chargers, as well as 1,000 rapid and ultra-rapid chargers, which provide top-ups in minutes rather than hours.

EV 7kW, 22kW, 43kW and 150kW chargers installed by 2030 in Glasgow



According to the forecasts Capital Economics prepared for this report, the cost of catering for electric vehicles in Glasgow will reach £298 million.

Heat pumps

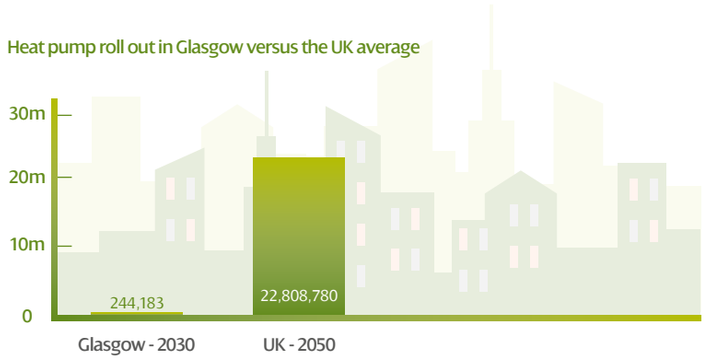
While electric vehicle chargers will be an early priority in the race to net zero, converting homes from gas to electric heating will need to happen as well.

Forecasts compiled for this report suggest more than 244,000 homes in Glasgow will have electric heat pumps installed to reach the net zero target.

Glasgow still has a high share of homes connected to the gas grid, which makes them well suited to so-called hybrid heat pumps. Based on the Capital Economics forecasts, we can expect around 60% of all the city's heat pumps will be of this kind.

However, this will require significant investment. Converting Glasgow to electric heating will require around £1.4 billion.

Heat pump roll out in Glasgow versus the UK average



11. ZERO CARBON COMMUNITIES DATA, CONTACTS AND FURTHER INFORMATION

The Zero Carbon Communities campaign has been launched by ScottishPower to ensure that the communities in which we operate are not left behind in the race to Net Zero carbon by 2050.

As well as this report, the latest updates on this initiative can be found at:
www.scottishpower.com/zerocarboncommunities.

If you would like to speak to someone at ScottishPower about Zero Carbon Communities activities in your area, you can contact **pressoffice@scottishpower.com**

The data in this report was compiled by leading consultancy, Capital Economics. For further information about the methodology and research data, please contact Grant Colquhoun at Capital Economics.

Grant Colquhoun
Capital Economics
+44 (0) 20 7823 5000
Grant.Colquhoun@capitaleconomics.com

Capital Economics is a leading independent international macro-economic research consultancy, providing research on Europe, the Middle East, United States, Canada, Africa, Asia and Australasia, Latin America and the United Kingdom, as well as analysis of financial markets, commodities and the consumer and property sectors.

www.capitaleconomics.com

12. ZERO CARBON COMMUNITIES APPENDICES

The Net Zero dictionary

Net Zero: any emissions would be balanced by schemes to offset an equivalent amount of greenhouse gases from the atmosphere, such as planting trees or using technology like carbon capture and storage

Household: Definition given by the Office for National Statistics: one person living alone, or a group of people (not necessarily related) living at the same address who share cooking facilities and share a living room or sitting room or dining area

Dwelling: A self-contained unit of accommodation that only the household living at that address can use.

Additional dwellings: Additional dwellings are the number of new dwellings added every year. They include new build dwellings and property conversions, such as office blocks being converted to flats.

Central/base case scenario: Based on the Committee on Climate Change's "Core Scenario" in which net greenhouse gas emissions are reduced by 80 per cent in 2050 compared to their level in 1990. Presently the most likely outcome.

Rapid scenario: Based on the Committee on Climate Change's "High ambition" scenario in which net greenhouse gas emissions are reduced to net zero by 2050. In this scenario there is a faster, more widespread, behavioural change and as yet unproven or unknown technologies are assumed to develop to enable the net removal of remaining residual emissions

Electric vehicle charger types: Fast**:** 7kW and 22kW, capable of charging an EV in 3-4 hours. Rapid: 43kW, capable of charging an EV to 80% in 30 minutes. Ultra-rapid: 150kW to 350kW, capable of charging to a range of 100 miles in 10 minutes.

Biogas: Biogas is produced from decomposing organic matter, such as food and agricultural waste, and can be converted to bio-methane. Burning bio-methane releases carbon dioxide into the atmosphere but prevents methane, a more harmful greenhouse gas, from being emitted. Bio-methane can be injected into the gas grid, allowing consumers to continue using existing boilers and does not require changes in efficiency requirements of buildings.

Other heat sources: Alternative sources of heat, such as district heat networks, combined heat and power, hydrogen, electric storage heaters, geothermal heat, water source heat or waste heat, amongst others

Heat pump: Full electric heat pumps use electricity to extract heat from an external source (air or ground water). Heat pumps heat more efficiently than direct electric heating. Hybrid heat pumps are installed alongside gas boiler heating. The gas boiler supplements the hybrid heat pump in meeting peak heating demand. Hybrid heat pumps are assumed to use natural gas and are therefore not fully de-carbonised.

Off-grid: The existing stock of homes that are not connected to the gas grid. Any home not connected to the gas grid (using natural gas or biomass) is considered to be "off-grid".

APPENDIX 1: UK-LEVEL DATA

Appendix 1.1: UK population: 2019 – 2050 (000s of people)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	627	638	652	667
Liverpool region (2040 target)	1,555	1,584	1,626	1,668
Scotland (2045 target)	5,491	5,579	5,671	5,710
Wales	3,163	3,211	3,251	3,256
England	56,705	58,506	60,905	63,884
United Kingdom	67,255	69,235	71,814	74,874
Great Britain	65,358	67,295	69,828	72,850

Appendix 1.2: UK households: 2019 – 2050 (000s of households)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	295	307	325	347
Liverpool region (2040 target)	684	702	732	772
Scotland (2045 target)	2,501	2,591	2,709	2,832
Wales	1,362	1,404	1,453	1,499
England	23,386	24,372	25,978	28,123
United Kingdom	27,985	29,131	30,940	33,292
Great Britain	27,249	28,367	30,140	32,454

Appendix 1.3: UK dwellings: 2019 – 2050 (000s of dwellings)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	314,008	324,900	342,460	365,797
Liverpool region (2040 target)	716,364	737,947	771,377	814,989
Scotland (2045 target)	2,636,644	2,733,505	2,857,995	2,987,690
Wales	1,444,234	1,495,260	1,547,445	1,596,610
England	24,555,300	25,590,600	27,276,900	29,528,666
United Kingdom	29,436,698	30,650,649	32,553,194	35,026,677
Great Britain	28,636,178	29,819,365	31,682,340	34,112,966

Appendix 1.4: UK additional dwellings: 2019 – 2050 (000s of dwellings)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	3,492	2,164	2,471	2,147
Liverpool region (2040 target)	4,646	3,989	4,493	3,743
Scotland (2045 target)	23,198	17,155	16,245	13,323
Wales	10,262	8,789	5,803	4,533
England	195,948	202,127	199,228	185,243
United Kingdom	233,726	234,674	226,177	207,041
Great Britain	229,408	228,071	221,276	203,098

Appendix 1.5: UK demolitions: 2019 – 2050 (000s of demolitions)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	-931	-773	-681	-729
Liverpool region (2040 target)	-382	-835	-1,152	-1,219
Scotland (2045 target)	-1,738	-3,440	-5,695	-5,961
Wales	-425	-1,334	-1,543	-1,594
England	-13,066	-28,877	-40,678	-44,081
United Kingdom	-15,774	-34,816	-49,504	-53,255
Great Britain	-15,230	-33,651	-47,916	-51,636

APPENDIX 2: ROAD TRANSPORT

Appendix 2.1: Electric vehicle chargers to reach net zero

Appendix 2.1.1: Total number of chargers (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	1,101	58,572	161,439	175,652
Liverpool region (2040 target)	2,902	175,962	551,346	585,340
Scotland (2045 target)	17,347	722,439	1,901,545	2,010,543
Wales	7,152	453,592	1,211,414	1,258,725
England	228,928	7,944,488	20,243,213	22,029,880
United Kingdom	253,427	9,120,518	23,356,171	25,299,147

Appendix 2.1.2: Number of residential chargers (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	917	55,294	147,192	158,991
Liverpool region (2040 target)	2,670	166,131	510,148	537,629
Scotland (2045 target)	15,260	681,378	1,727,859	1,811,769
Wales	6,716	428,215	1,103,100	1,136,054
England	211,966	7,500,904	18,290,760	19,724,044
United Kingdom	233,942	8,610,497	21,121,719	22,671,867

Appendix 2.1.3: Number of non-residential chargers (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	184	3,278	14,246	16,660
Liverpool region (2040 target)	232	9,831	41,198	47,711
Scotland (2045 target)	2,087	41,061	173,686	198,774
Wales	436	25,377	108,314	122,671
England	16,962	443,584	1,952,452	2,305,835
United Kingdom	19,486	510,021	2,234,452	2,627,280

Appendix 2.1.4: Number of 7 kW & 22kW chargers (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	1,072	58,510	160,408	174,598
Liverpool region (2040 target)	2,893	175,840	549,467	583,412
Scotland (2045 target)	17,094	721,415	1,888,393	1,997,098
Wales	7,133	453,241	1,204,525	1,251,658
England	228,061	7,939,064	20,109,153	21,892,291
United Kingdom	252,288	9,113,721	23,202,071	25,141,047

Appendix 2.1.5: Number of 43 Kw chargers (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	30	58	433	433
Liverpool region (2040 target)	9	114	623	623
Scotland (2045 target)	253	967	5,531	5,531
Wales	19	320	2,276	2,276
England	847	4,976	43,193	43,193
United Kingdom	1,119	6,264	51,000	51,000

Appendix 2.1.6: Number of 150 & 350 Kw chargers (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	0	4	598	621
Liverpool region (2040 target)	0	7	1,257	1,306
Scotland (2045 target)	0	56	7,620	7,913
Wales	0	30	4,613	4,791
England	20	447	90,866	94,396
United Kingdom	20	534	103,100	107,100

Appendix 2.2: Electric vehicle charger investment costs to reach net zero

Appendix 2.2.1: Total cost (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£1	£59	£224	£298
Liverpool region (2040 target)	£2	£182	£682	£890
Scotland (2045 target)	£14	£750	£2,720	£3,547
Wales	£4	£470	£1,707	£2,200
England	£68	£8,063	£30,091	£40,118
United Kingdom	£87	£9,283	£34,518	£45,862

Appendix 2.2.2: Cost of residential chargers (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£0	£49	£125	£134
Liverpool region (2040 target)	£1	£148	£430	£451
Scotland (2045 target)	£5	£603	£1,468	£1,532
Wales	£3	£382	£939	£964
England	£56	£6,601	£15,538	£16,633
United Kingdom	£64	£7,586	£17,945	£19,130

Appendix 2.2.3: Cost of non-residential chargers (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)Liverpool	£1	£10	£99	£164
region (2040 target)	£1	£34	£252	£439
Scotland (2045 target)	£9	£146	£1,252	£2,015
Wales	£1	£89	£768	£1,236
England	£13	£1,462	£14,553	£23,485
United Kingdom	£23	£1,697	£16,573	£26,733

Appendix 2.2.4: Cost of 7kW & 22kW chargers (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£1	£57	£167	£240
Liverpool region (2040 target)	£2	£176	£564	£769
Scotland (2045 target)	£10	£706	£1,987	£2,798
Wales	£4	£453	£1,307	£1,790
England	£64	£7,825	£22,321	£32,140
United Kingdom	£78	£8,984	£25,615	£36,724

Appendix 2.2.5: Cost of 43kW chargers (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£0	£2	£18	£18
Liverpool region (2040 target)	£0	£5	£33	£33
Scotland (2045 target)	£4	£39	£237	£237
Wales	£0	£15	£100	£100
England	£4	£206	£1,883	£1,883
United Kingdom	£9	£260	£2,220	£2,220

Appendix 2.2.6: Cost of 150kW & 350kW chargers (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£0	£0	£39	£40
Liverpool region (2040 target)	£0	£1	£86	£89
Scotland (2045 target)	£0	£4	£495	£512
Wales	£0	£2	£300	£310
England	£0	£32	£5,888	£6,095
United Kingdom	£0	£39	£6,682	£6,918

APPENDIX 3: HOME HEATING

Appendix 3.1: Homes using natural gas

Appendix 3.1.1: Total number of homes connected to the gas grid (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	241,047	143,999	152,380	49,022
Liverpool region (2040 target)	659,615	623,995	393,097	131,198
Scotland (2045 target)	2,082,857	1,987,086	1,245,363	403,878
Wales	1,155,652	1,101,444	698,760	244,066
England	20,813,392	19,869,416	12,514,112	4,201,696
United Kingdom	24,051,901	22,957,947	14,458,235	4,849,639

Appendix 3.1.2: Total homes using natural gas (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	257,038	241,047	141,035	20,635
Liverpool region (2040 target)	659,615	616,339	363,798	57,890
Scotland (2045 target)	2,082,857	1,963,008	1,153,219	173,324
Wales	1,155,652	1,088,073	647,590	116,032
England	20,813,392	19,629,055	11,594,281	1,900,178
United Kingdom	24,051,901	22,680,137	13,395,089	2,189,534

Appendix 3.1.3: Share of homes using natural gas (%)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	82%	74%	41%	6%
Liverpool region (2040 target)	92%	84%	47%	7%
Scotland (2045 target)	79%	72%	40%	6%
Wales	80%	73%	42%	7%
England	85%	77%	43%	6%
United Kingdom	84%	76%	42%	6%

Appendix 3.1.4: Number of homes using biogas (units)prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	0	2,965	11,345	28,387
Liverpool region (2040 target)	0	7,656	29,299	73,308
Scotland (2045 target)	0	24,078	92,144	230,554
Wales	0	13,371	51,170	128,034
England	0	240,361	919,831	2,301,518
United Kingdom	0	277,810	1,063,146	2,660,106

Appendix 3.1.5: Other heat sources (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	56,970	80,888	190,081	316,775
Liverpool region (2040 target)	56,749	113,952	378,280	683,791
Scotland (2045 target)	553,787	746,419	1,612,632	2,583,812
Wales	288,581	393,816	848,685	1,352,544
England	3,741,908	5,721,184	14,762,788	25,326,970
United Kingdom	4,584,276	6,861,418	17,224,105	29,263,327

Appendix 3.1.6: Total homes not using natural gas (units)prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	56,970	83,853	201,426	345,161
Liverpool region (2040 target)	56,749	121,608	407,579	757,099
Scotland (2045 target)	553,787	770,497	1,704,776	2,814,366
Wales	288,581	407,187	899,855	1,480,578
England	3,741,908	5,961,545	15,682,619	27,628,488
United Kingdom	4,584,276	7,139,228	18,287,251	31,923,433

Appendix 3.2: Number of heat pumps to reach net zero

Appendix 3.2.1: Total number of heat pumps (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	2,419	27,932	158,574	244,183
Liverpool region (2040 target)	1,535	55,216	356,525	547,459
Scotland (2045 target)	44,858	257,252	1,319,296	1,964,438
Wales	14,648	129,411	690,986	1,007,077
England	182,286	2,146,607	12,695,758	19,837,265
United Kingdom	241,793	2,533,270	14,706,040	22,808,780

Appendix 3.2.2: Full heat pumps (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	1,593	11,342	58,363	102,020
Liverpool region (2040 target)	848	14,179	101,052	182,588
Scotland (2045 target)	38,164	122,782	502,300	803,358
Wales	13,905	57,856	240,103	358,242
England	164,931	853,870	4,572,685	8,214,056
United Kingdom	229,396	1,046,904	5,327,484	9,388,052

Appendix 3.2.3: Full heat pump share of total (%)prices)prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	66%	41%	37%	42%
Liverpool region (2040 target)	55%	26%	28%	33%
Scotland (2045 target)	85%	48%	38%	41%
Wales	95%	45%	35%	36%
England	90%	40%	36%	41%
United Kingdom	95%	41%	36%	41%

Appendix 3.2.4: Hybrid heat pumps (units)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	827	16,590	100,211	142,162
Liverpool region (2040 target)	687	41,037	255,473	364,871
Scotland (2045 target)	6,694	134,471	816,996	1,161,080
Wales	744	71,555	450,884	648,836
England	17,355	1,292,736	8,123,073	11,623,208
United Kingdom	12,396	1,486,366	9,378,556	13,420,728

Appendix 3.2.5: Hybrid heat pump share of total (%)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	34%	59%	63%	58%
Liverpool region (2040 target)	45%	74%	72%	67%
Scotland (2045 target)	15%	52%	62%	59%
Wales	5%	55%	65%	64%
England	10%	60%	64%	59%
United Kingdom	5%	59%	64%	59%

Appendix 3.3: Total cost of heat pump investment costs – Central scenario (£ millions – 2018 prices)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£4	£183	£1,010	£1,443
Liverpool region (2040 target)	£5	£594	£3,454	£4,855
Scotland (2045 target)	£78	£2,317	£11,942	£16,497
Wales	£12	£1,277	£6,772	£9,332
England	£199	£20,955	£117,812	£166,353
United Kingdom	£289	£24,549	£136,527	£192,182

APPENDIX 4: NETWORK INVESTMENT COSTS

Appendix 4.1: Network investment costs to reach net zero (£ millions)

Local Authority / Region	2019	2025	2035	2050
Glasgow (2030 target)	£12	£205	£504	£561
Liverpool region (2040 target)	£29	£501	£1,232	£1,368
Scotland (2045 target)	£112	£1,909	£4,692	£5,207
Wales	£52	£880	£2,147	£2,392
England	£871	£14,837	£36,489	£40,904
United Kingdom	£1,035	£17,626	£43,329	£48,504

APPENDIX 5: ECONOMIC IMPACT STUDY

Appendix 5.1: Annual average employment supported by the estimated decarbonisation investment

Appendix 5.1.1: North West (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	4,996	12,148	21,499	24,146	6,187	12,466
Primary activities including energy	38	95	169	193	49	99
Construction	2,538	6,447	11,557	13,259	3,335	6,729
Manufacturing	1,077	2,317	3,944	4,108	1,121	2,252
Services	1,343	3,289	5,830	6,587	1,681	3,387

Appendix 5.1.2: Scotland (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	3,980	9,770	17,310	19,650	5,012	10,081
Primary activities including energy	87	217	385	440	112	225
Construction	2,197	5,581	10,005	11,478	2,887	5,825
Manufacturing	648	1,402	2,364	2,582	699	1,383
Services	1,048	2,570	4,556	5,150	1,314	2,647

Appendix 5.1.3: Wales (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	1,940	4,676	8,256	9,235	2,369	4,781
Primary activities including energy	29	73	129	147	37	75
Construction	936	2,378	4,263	4,891	1,230	2,482
Manufacturing	482	1,020	1,727	1,782	485	982
Services	492	1,206	2,138	2,416	617	1,242

Appendix 5.1.4: England (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	40,253	98,157	173,735	195,933	50,123	100,918
Primary activities including energy	375	930	1,653	1,886	481	964
Construction	20,714	52,625	94,336	108,226	27,223	54,926
Manufacturing	7,566	16,185	27,376	28,884	7,887	15,759
Services	11,598	28,417	50,370	56,938	14,532	29,269

Appendix 5.1.5: Great Britain (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	46,173	112,603	199,302	224,819	57,504	115,780
Primary activities including energy	491	1,219	2,167	2,473	630	1,265
Construction	23,847	60,584	108,604	124,595	31,341	63,233
Manufacturing	8,696	18,607	31,467	33,247	9,070	18,124
Services	13,139	32,192	57,064	64,504	16,462	33,158

Appendix 5.2: Annual average gross value added supported by the estimated decarbonisation investment

Appendix 5.2.1: North West (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	247	602	1,067	1,197	306	618
Primary activities including energy	7	16	29	33	8	17
Construction	114	289	518	595	150	302
Manufacturing	56	125	216	225	60	122
Services	70	171	304	344	88	177

Appendix 5.2.2: Scotland (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	201	496	879	1,001	255	512
Primary activities including energy	17	43	76	86	22	44
Construction	100	254	456	523	132	266
Manufacturing	32	72	123	137	36	72
Services	52	127	225	255	65	131

Appendix 5.2.3: Wales (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	89	216	382	427	109	221
Primary activities including energy	4	11	20	22	6	11
Construction	38	95	171	196	49	99
Manufacturing	23	50	85	88	24	48
Services	24	60	106	120	31	62

Appendix 5.2.4: England (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	1,869	4,572	8,102	9,137	2,333	4,703
Primary activities including energy	62	153	271	310	79	158
Construction	884	2,245	4,025	4,617	1,161	2,343
Manufacturing	376	827	1,418	1,508	403	813
Services	548	1,346	2,389	2,703	689	1,388

Appendix 5.2.5: Great Britain (number)

Local Authority / Region	2019	2020-2025	2026-2030	2031-2035	2036-2050	2019-2050
Total	2,160	5,283	9,364	10,565	2,697	5,436
Primary activities including energy	83	207	367	419	107	214
Construction	1,022	2,595	4,651	5,336	1,342	2,708
Manufacturing	431	949	1,626	1,733	463	933
Services	624	1,533	2,720	3,078	785	1,581

SCOTTISHPOWER

ScottishPower
320 St Vincent St, Glasgow G2 5AD
www.scottishpower.com/zerocarboncommunities