

ECONOMIC POLICIES FOR AFFORDABLE, SECURE AND CLEAN ENERGY

INSIGHTS FROM THE UK

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ABBREVIATIONS

BESS: British Energy Security Strategy
BEV: Battery Electric Vehicle
BIK: Benefit In Kind
CCC: Climate Change Committee
CEM: Clean Energy Mission
CfD: Contracts for Difference
DESNZ: Department of Energy Security and Net Zero
DUKES: Digest of UK Energy Statistics
EBRS: Energy Bill Relief Scheme
ECO: Energy Company Obligation
EEPI: European Energy Poverty Index
EPC: Energy Performance Certificate
EPG: Energy Price Guarantee
ESO: Electricity System Operator
ETS: Emissions Trading Scheme
EV: Electric Vehicle
GB: Great Britain
GDP: Gross Domestic Product
GHG: Greenhouse Gas
GW: Gigawatt
ICE: Internal Combustion Engine
IEA: International Energy Agency
IMF: International Monetary Fund
KWh: Kilowatt hours
LEZ: Low Emission Zone
OECD: Organisation for Economic Cooperation and Development
PHEV: Plug-in Hybrid Electric Vehicle
PM: Particulate Matter
PV: Photovoltaic
SHDF: Social Housing Decarbonisation Fund
SMMT: Society of Motor Manufacturers and Traders
TWh: Terawatt hours
ULEZ: Ultra Low Emission Zone
UK: United Kingdom
VAT: Value Added Tax
WHD: Warm Home Discount

SUMMARY

The United Kingdom has made substantial progress in transforming its energy system.

Territorial consumption of primary energy has declined by one-fifth over the past five decades, while real GDP has almost tripled.¹ This reflects a significant improvement in energy efficiency, together with a shift in the economic structure toward low-carbon activities. The power sector has closed its last coal-fired plant later in late September 2024. The role of fossil fuels in the electricity system is being rapidly replaced by renewable sources such as wind, solar, and biomass. In surface transportation, vehicles have become more fuel-efficient, and car drivers are gradually adopting cleaner electric vehicles. Additionally, the use of the railway system is slowly recovering from its lowest levels post-lockdown. The residential sector is also transitioning to cleaner energy, with improvements in heating efficiency and a rise in the deployment of heat pumps.

However, numerous challenges still stand. Fossil fuels still play a key role – natural gas in electricity generation and home heating, petroleum products in the transport sector – which exposes consumers to the volatility of international commodity markets during periods of geopolitical tensions, as experienced in 2022 when Russia invaded Ukraine. The transport sector relies on imported fuels, such as diesel purchased from Russia until recently. High prices during – and after – the surge of inflation in 2022 have exacerbated the existing problem of energy poverty, with well over two million consumers now burdened with heavy energy debts.

Transitioning to a more affordable, secure and clean energy system is a key priority for the UK government. Elected in July 2024, the new government led by Prime Minister Keir Starmer has adopted ambitious energy targets, which were announced in the 2024 King's Speech. The government aims at making the country a “clean energy superpower” with:

- A fully decarbonised electricity sector by 2030;
- Large investments in wind energy power and the transmission grid;
- Lower energy bills for consumers;
- A modernised and well-functioning British railway;
- And faster adoption of electric vehicles and installation of public charging points.

To reach these ambitious goals, adopting the right framework will be key:

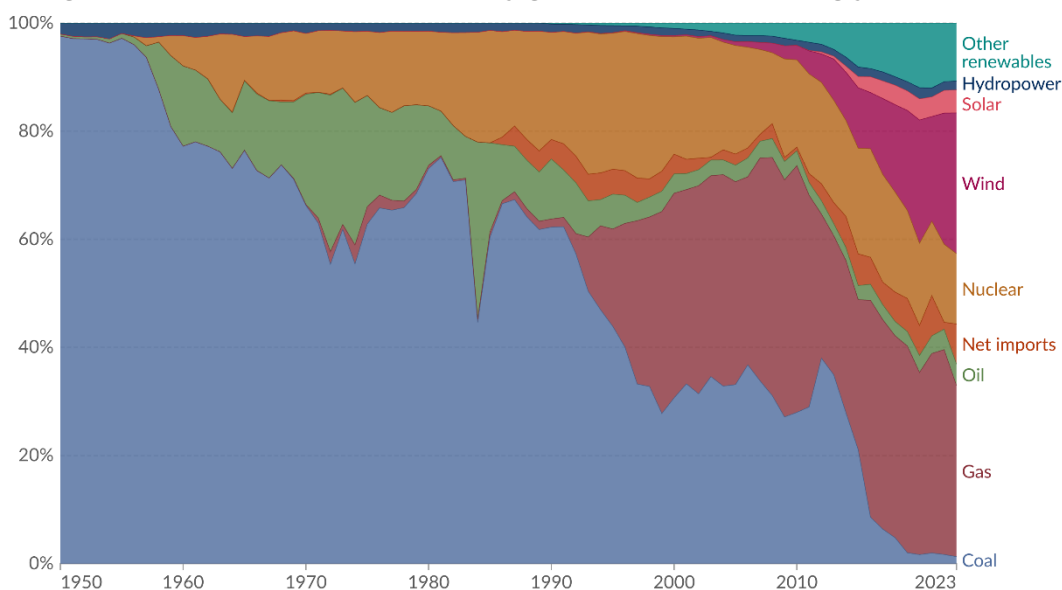
- Price signals are decisive in choices made by producers and consumers; realigning tax rates to incentivise cleaner choices will be important for the transition.
- Highly cost-effective policies will be needed, in light of the fiscal constraints that the new UK government is operating under.
- Targeted support for low-income households and consumers suffering from energy poverty will be essential to ensure an equitable transformation across income groups and jurisdictions.
- Information campaigns reaching out to diverse stakeholders will be crucial to hasten adoption of new technologies and unlock the energy transformation.

¹ Department for Energy Security and Net Zero, Digest of Energy Statistics: DUKES chapter 1 – statistics on overall energy production and consumption. Table 1.1.4

1. REFORMING THE UK ELECTRICITY MIX

The UK has made substantial progress in decarbonising its electricity sector, with a remarkable drop in greenhouse gas (GHG) emissions from the sector by 78% since 1990 according to [preliminary figures for 2023](#). The National Grid's electricity system operator (ESO) has reported short periods when the share of fossil fuels in power generation fell as low as 2.4% in early 2024. Figure 1 illustrates the increasingly important role that electricity from low-carbon sources such as solar, wind, and nuclear is playing in meeting Great Britain's electricity demand. In 2023, electricity from low-carbon domestic sources amounted to [150 TWh, about 58%](#) of the annual demand for electricity.

Figure 1 - Great Britain's electricity generation is increasingly decarbonised²



Source: [Our World in Data](#), with data taken from Ember, Energy Institute – Statistical Review of World Energy and the Department for Energy Security and Net Zero

Over the last two decades, the UK's electricity demand has dropped, from 313 TWh in 2008 to 296 TWh in 2023³, with domestic consumption making up the largest end-use of electricity. The fall in demand since 2008 has been driven by a combination of increased energy efficiency and the de-industrialisation of the UK's economy. However, electricity demand is expected to rise rapidly over the next two decades due to the uptake of technologies such as electric vehicles and heat pumps.

At the same time, energy poverty among struggling households is of pressing concern. Over 40% of respondents in 2024 who pay energy bills said it was very or somewhat difficult to pay them, with 44% using less fuel and electricity in their homes because of rising prices.⁴ The drastic price rises over the last two years were driven by the impacts of Russia's invasion

² Northern Ireland is excluded from this figure as it is part of a separate Irish electricity system to the rest of the United Kingdom.

³ [Evans and Vissainen \(2024\), Analysis: UK Electricity from Fossil Fuels Drops to Lowest Level Since 1957.](#)

⁴ Office for National Statistics, Cost of Living Insights, 2024.

of Ukraine on global gas prices, highlighting the price exposure of the UK power system to disruptions in global gas markets. Meeting the rising demand for electricity whilst ensuring an affordable, secure and clean electricity supply will be essential to delivering on the UK's energy objectives.

This section provides background information on the UK's electricity system, with a focus on the current energy mix and policy landscape. It reviews the policy measures and political targets that have been implemented to address rising bills, ensure secure and reliable electricity supply, and encourage the scale up of low-carbon generation. In that context, it also discusses three key challenges that UK policymakers face in achieving the objective of affordable, secure and clean power supply:

1. Addressing increased scale and volatility of future electricity demand.
2. Ensuring security of supply whilst navigating substantial uncertainties.
3. Acting to reduce energy bills to affordable levels following the global gas crisis.

Historical emissions reductions in the UK's power sector have come from the replacement of coal and oil power with renewables and gas. Coal met over 75% of the UK's power supply in the early 1970s⁵, but the so-called "dash for gas" saw this drastically fall over the 1990s and early 2000s as falling gas prices, high interest rates and market reforms made gas power more economical. The last coal-fired power plant remaining active in the UK power system closed in late September 2024. Remaining emissions from the UK's power system now come from a fleet of 32 gas-fired power stations, with a total installed capacity of 28 GW, which are mainly used for periods of low wind or high demand. Despite substantial production in the North Sea, the UK is a net importer of natural gas, which poses a potential risk to future energy security.

Clean electricity generated using renewable technologies (e.g., solar PV and wind power) has rapidly increased in the UK over the last decade. Wind power rose from less than 1 GW of capacity in 2010 to nearly 15 GW at the end of 2023 and is now playing a key role in the UK's electricity mix.⁶ The UK has the largest capacity of offshore wind installed globally after China, leading many to describe the UK as a "world leader" in offshore wind. A fleet of nine aging nuclear reactors also plays an important role in providing low-carbon power, accounting for 14.2% of generation in 2023⁷, though the majority of these are set to close by the end of the decade. Over 200 biomass-fired plants also contribute to meeting the UK electricity demand (5.7% in 2023), though concerns have been raised over the sustainability of using imported biomass for power in the UK.⁸

The new government led by Keir Starmer has set out an ambitious target for a clean power system by 2030⁹, with a string of deployment targets.¹⁰ Deployment and emissions targets go further and faster than ambitions from previous governments, with Figure 2 comparing the targets set out by the previous conservative government under the British Energy Security Strategy (BESS) with the new targets in the Clean Energy Mission

⁵ Department for Energy Security and Net Zero, UK Electricity capacity and generation by fuel between 1920 and 2020, 2023.

⁶ [Department for Energy Security and Net Zero, Energy Trends, 2024.](#)

⁷ Drax Electric Insights, 2024.

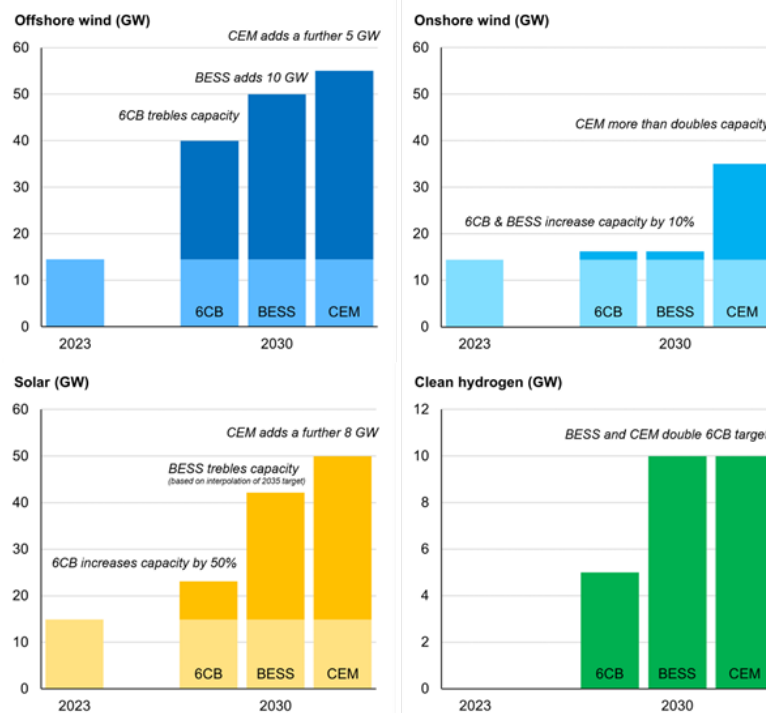
⁸ [Environmental Audit Committee, Seeing the Wood for the Trees: The Contribution of the Forest and Timber Sectors to Biodiversity and Net Zero goals, 2023.](#)

⁹ Department for Energy Security and Net Zero, Chris Stark to lead Mission Control to deliver clean power by 2030, 2023.

¹⁰ [Labour Party, Make Britain a Clean Superpower, 2023.](#)

(CEM). The pathway modelled by the Climate Change Committee, the UK’s independent advisory body, in its Sixth Carbon Budget in 2020 is also included.

Figure 2 – Deployment Targets under the Sixth Carbon Budget (6CB), the British Energy Security Strategy (BESS) and the Clean Energy Mission (CEM)
(GW of installed capacity)



Source: Johnson et al¹¹,

To drive electricity system decarbonisation, the UK has implemented a range of policy measures over the last two decades to support the scale up of low-carbon generation

The Contracts for Difference (CfD) scheme guarantees a “strike price” for renewable electricity generation, to provide certainty to investors by shielding renewable generators from price volatility. Subsidies are paid to generators when the market price dips below the strike price, whilst generators pay back the difference between the market and strike price when market prices are higher. Strike prices are set in each Allocation Round, with competitive annual auctions to encourage innovation and further cost reductions in the supply chain. Many stakeholders consider the CfD scheme to have been widely successful in supporting cost reductions for renewables.¹²

The UK also has a carbon “cap and trade” scheme, the UK Emissions Trading Scheme (ETS).¹³

The UK ETS replaced the UK’s participation in the European Union’s ETS at the start of 2021 and sets an annual cap on the total greenhouse gas emissions from the aviation, power and heavy industrial sectors. Notably, the UK’s ETS applies to operators of the UK’s fleet of gas-fired power stations. Companies that are covered by the ETS receive a certain

¹¹ Johnson et al., *Evaluating Clean Electricity Transition progress across UK Political Pledges and G7 countries*, Energy Strategy Reviews 2024.

¹² Department for Business, Energy & Industrial Strategy. *Evaluation of the Contracts for Difference Scheme*.

¹³ Department for Business, Energy & Industrial Strategy. *Participating in the UK ETS*. 2024.

number of permits (referred to as “free allowances”), which must be surrendered to cover their carbon emissions. Any shortfall must be made up by buying permits from other companies, at the risk of high financial penalties. The total number of permits made available to companies follows a planned reduction over time, providing a financial incentive for companies to invest in decarbonisation measures.

Other strategic targets and policy initiatives have been aimed at ensuring the UK’s energy security whilst supporting investment into emerging technologies such as hydrogen and carbon capture. Following Russia’s invasion of Ukraine in 2022, the previous conservative government published the British Energy Security Strategy¹⁴, which set out how it intended to ensure affordable, secure, and clean energy for the UK. It placed a heavy emphasis on the role of nuclear power and offshore wind in the future electricity system, whilst doubling the target for low-carbon hydrogen, which could provide long-duration storage and help replace the use of natural gas to meet peak demand.

Whilst the new Labour government has only recently taken power, a range of policy measures covering the power sector have already been announced. The planning regime for onshore wind has been reformed, removing the de-facto ban that was in place since 2015. Funding of £8.3bn has been announced for GB Energy, a publicly owned energy company that will invest in low-carbon projects across the UK. The budget for the next round of support under the Contract for Difference scheme has been increased by £500m to over £1.5bn, making it the largest budget yet.

Policymakers in the UK face a difficult balancing act in addressing the three objectives of affordable, secure and clean energy under governmental spending constraints. Following the impacts of Brexit, the Covid-19 pandemic and Russia’s invasion of Ukraine in 2022 on the UK’s national debt, policymakers are under substantial pressure to deliver on their objectives in a cost-effective way and navigate fiscal rules.¹⁵ As of September 2024, this pressure has increased further due to new estimates of a fiscal gap of £22bn caused by underbudgeting for asylum seeker support and public sector pay rises, reducing the fiscal space available to the new government.¹⁶

Whilst electricity demand in the UK has fallen since 2008, it is expected to rapidly increase over the next two decades. Figure 3 shows the Climate Change Committee’s projections of electricity demand out to 2050. Demand is estimated to nearly double from an estimate of 313 TWh per annum in 2022 to between 422-514 TWh per annum by 2035, driven by the widespread adoption of electric vehicles, heat pumps, and industrial electrification.¹⁷ Demand in 2050 could reach up to 890 TWh per annum in scenarios with very high levels of economy-wide electrification.

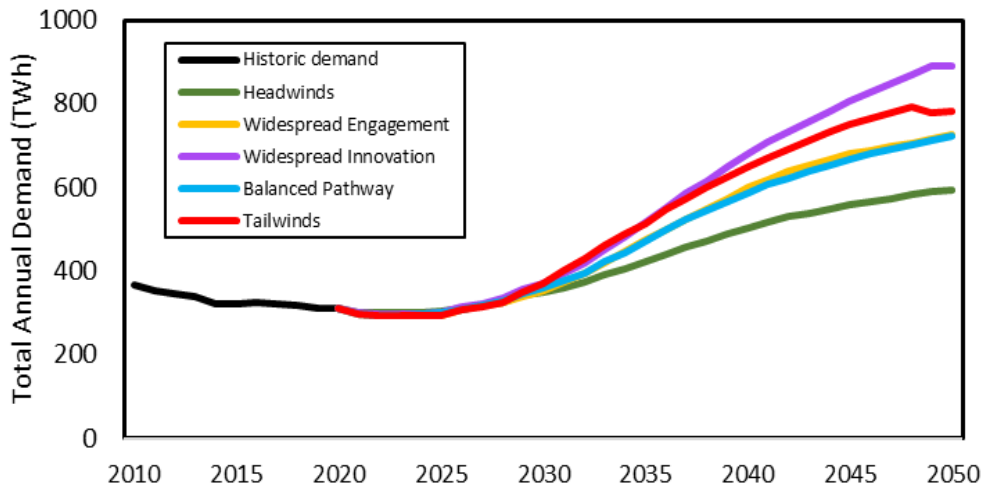
¹⁴ [Department for Energy Security and Net Zero, *British Energy Security Strategy*, 2022.](#)

¹⁵ [Institute for Fiscal Studies, *Constraints and trade-offs for the next government*, 2024.](#)

¹⁶ [The £22bn ‘black hole’ was obvious to anyone who dared to look, Paul Johnson, 2024.](#)

¹⁷ [Climate Change Committee, *The Sixth Carbon Budget*, 2020.](#)

Figure 3 - Electricity demand projections for 2010-2050 under the Climate Change Committee's five exploratory scenarios
(Annual electricity demand in TWh, 2010-2050)



Source: 6th Carbon Budget.

Electricity demand is already highly seasonal, with changing demands for lighting and heating leading to a fall in monthly consumption in 2023 from January to July of over 6 TWh, nearly 23% of January's consumption.¹⁸ Deployment of heat pumps and other low-carbon sources of heating could increase the seasonality of electricity demand further, placing additional stress on the electricity system to meet demand across the winter months and retaining a reliance on costly imports of natural gas to meet seasonal mismatches of electricity supply and demand.

On the other hand, the demand flexibility enabled by low-carbon technologies such as heat pumps and electric vehicles could help contribute to security of supply. In winter 2022/23, National Grid ESO trialled a Demand Flexibility Service, where households and small businesses were offered rebates on energy bills in return for reducing their energy demand during peak periods of system demand.¹⁹ Scaling up this service could help address issues associated with seasonal demand, particularly in winter periods.

Meeting the rising demand for electricity whilst reducing emissions will require the rapid deployment of low-carbon generation, including solar PV and both onshore and offshore wind. The scale-up of low-carbon generation to meet future demand and replace unabated fossil fuel generation will require substantial capital investment into the electricity sector. The Climate Change Committee is estimating in its Sixth Carbon Budget that annual energy investment will need to reach up to £25 bn per year between 2025-2035 for the UK to stay on track to achieve net zero by 2050. Supply chain and labour constraints for renewables, particularly offshore wind, will also be a barrier to the rapid scale-up of generation and will require substantial coordination between industry and government.²⁰

Integrating the rapid expansion of low-carbon generation will require an expansion of the UK's transmission and distribution network, which the National Grid estimates

¹⁸ [National Grid, Monthly Electricity Statistics, 2024](#)

¹⁹ [National Grid ESO, Demand Flexibility Service, 2024](#)

²⁰ [Baringa Partners, UK Renewables Deployment Supply Chain Readiness Study, 2024.](#)

will cost £58 bn over the next decade.²¹ Grid connection has been identified by many as a key factor holding back the deployment of new generation capacity, with a total “connection queue” of over 400 GW of capacity in 2022. Many new electricity generation projects currently have waits of up to 15 years for grid connections, posing a substantial barrier to scaling up their deployment. Transmission costs are funded through levies on consumer bills, typically making up an average of 26-32% of bills²², but the current funding structure is highly regressive (as low-income households spend a higher proportion of their income on energy bills). The UK’s independent regulator, Ofgem, is currently examining how transmission costs should change in a less centralised, more flexible energy system to support net-zero.²³

Proposals from stakeholders to phase out the use of unabated fossil fuels whilst scaling up low-carbon generation include:

- **Ensure strike prices in the Contracts for Difference scheme are achievable for industry whilst increasing the budget for future Allocation Rounds.**²⁴ Contracts for Difference have been extremely effective in driving down the cost of capital for renewable technologies by providing a stable revenue stream. However, the Contracts for Difference allocation round in 2023 was widely condemned by the industry, as low strike prices below the cost of generation led to a failure to attract investment bids for offshore wind. To deliver the rollout of renewables at the pace required and to meet policy objectives, both the budgets and strike prices for renewable projects will need to be carefully matched to renewable deployment targets.
- **Use the £8.3 bn of funding for Great British Energy, a state-owned enterprise, effectively to accelerate the deployment of low-carbon generation.** Energy companies in other countries that are wholly or majority-owned by the state, such as Denmark’s Ørsted and Sweden’s Vattenfall, have grown to play a substantial role in their countries’ electricity systems and beyond. Five key roles have been set out for GB Energy²⁵, ranging from project investment and development to working with industry to develop and strengthen UK’s supply chains. However, there is a risk that GB Energy could be too widely stretched across these roles and questions remain over how to effectively crowd in, rather than out, private investment into energy projects.
- **Include an investment allowance for renewables, that is equal to or improves on the investment allowance for oil and gas extraction.**²⁶ UK oil and gas producers are currently eligible to deduct a significant share of the cost of their extraction projects from the tax they pay. Preferential treatment to investments in oil and gas extraction, rather than in renewables, is sending the wrong price signals to investors. Changes to the tax regime should be made to incentivise investment into renewable sources. As capital costs make up a large proportion of the renewable electricity costs, such tax regime changes would also help to deliver more affordable electricity.
- **Establish a Strategic Spatial Energy Plan to predict future electricity supply and demand and identify where transmission networks need to be expanded.**²⁷

²¹ [National Grid, *Beyond 2030*, 2024.](#)

²² [Imperial College London, *Electricity Bill Charges*, 2024.](#)

²³ [Ofgem, *Transmission Network Use of System Charges*, 2022.](#)

²⁴ [EnergyUK, *Spring Budget 2024 Energy UK Submission*, 2024.](#)

²⁵ [Department for Energy Security & Net Zero, *Great British Energy founding statement*, 2024.](#)

²⁶ [EnergyUK, *How to prevent an investment hiatus in UK low-carbon generation*, 2023.](#)

²⁷ [Electricity Networks Commissioner, *Accelerating electricity transmission network deployment*, 2023.](#)

Developing a clear, long-term plan that contains details on the strategic priorities for the electricity system and transmission network would address the current queues for grid connections. It would also increase investor confidence in new low-carbon generation projects, lowering the cost of capital and price of electricity generation.

- **Set out clear commitments and a timeline for the policy landscape for nuclear power under a “Nuclear Strategic Plan”.**²⁸ Nuclear power’s contributions to the UK’s electricity mix will fall substantially by 2028, as the majority of power plants approach the end of their lives. Whilst the previous conservative government set a target of 24 GW of nuclear capacity by 2050, the new government needs to set out a comprehensive, detailed strategy demonstrating what nuclear ambitions, if any, it seeks to achieve, and how to achieve them. To that end, developing a strategy with relevant industry stakeholders and ensuring with cross-party support will be crucial.

Despite the UK’s reserves of oil and gas in the North Sea, it has a strong reliance on gas imports to meet its territorial consumption, including in the electricity sector.

Natural gas accounted for 38% of total UK energy demand in 2022, of which electricity generation was the largest consumer.²⁹ Despite falling demand and increases in domestic production in 2022, gas imports made up nearly half of total demand, including from countries such as Norway, the USA and Qatar. Beyond sustainability considerations, reliance on imported gas poses issues to energy security and affordability, so there is an imperative need for the UK to transition away from using natural gas in the electricity system.

The new Labour government’s heavy emphasis on solar PV and wind power increases the reliance on critical minerals such as copper, zinc, and silicon.³⁰

China dominates the supply chain for many critical minerals, with the majority of renewable manufacturing (e.g., solar PV panels) also located in China. The dominance of China in technology manufacturing and supply chains poses a risk to the UK of trading the electricity system’s current reliance on imported gas for a supply chain reliance on China.

Whilst moving away from the use of natural gas will reduce import dependence and exposure to global gas market disruptions, natural gas currently plays a principal role in balancing the UK’s electricity grid.

Electricity systems with higher proportions of variable renewables will require additional back up generation (“dispatchable” power) and/or large-scale energy storage to maintain a secure electricity supply. A range of low-carbon technologies could be used to replace some of these roles currently met by unabated natural gas (e.g., hydrogen, large-scale batteries, pumped hydropower or natural gas equipped with carbon capture). However, uncertainties over their future cost, relative performance and future supply chain security poses difficulties for a secure, cost-effective pathway towards a low-carbon system.

Proposals from stakeholders that aim to address security of supply include:

- **Provide further funding for research and innovation into long duration storage technologies, including hydrogen and battery energy storage systems, which could increase system flexibility.**³¹ Natural gas currently fulfils a key role in keeping energy supply and demand balanced, but exposure of the UK’s electricity system to natural gas poses risks to affordability and security of supply. Additional innovation funding for

²⁸ [Science, Innovation and Technology Committee, *Delivering Nuclear Power*, 2023.](#)

²⁹ [Department for Energy Security and Net Zero, *Digest of UK Energy Statistics 2023: Natural Gas*, 2024.](#)

³⁰ [International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions*, 2021.](#)

³¹ [RenewableUK, *Roadmap to Net Zero: A Manifesto for a Fully Decarbonised Power System by 2035*, 2022.](#)

emerging storage technologies such as hydrogen and battery storage will drive cost reductions and allow the role of natural gas on the electricity system to be replaced by low carbon technologies in a cost-effective manner.

- **Reform the Contracts for Difference Scheme to support flexible technologies.** Technologies that increase flexibility in the electricity market (e.g., energy storage or interconnectors) are not eligible for support from the Contracts for Difference Scheme, as it is not designed for their operational profiles. Developing a similar support scheme that would provide financial incentives and a clear revenue stream for these technologies would help to reduce their financing costs and scale up investment. Energy security would then be increased by a more rapid development of low-carbon dispatchable power.
- **Enable further investment into interconnectors to Ireland and continental Europe.** Interconnectors allow the UK to import or export electricity at times of low supply or demand, improving reliability and operability whilst improving the UK's energy security. Interconnection capacity is expected to grow from 8.4 GW to 15.6 GW in 2025 but changes to the current "cap and floor" mechanism for developers (which sets a minimum and maximum revenue that the interconnector can earn, with excesses paid to and shortfalls made up by the GB energy operator) could increase investment into interconnector capacity.³²
- **Provide financial support to encourage investment into critical minerals recycling and processing facilities.** Whilst the UK has published a Critical Minerals Strategy, it has received criticism for not providing additional funding or financial support to develop UK's resilience to disturbances in the critical mineral supply chain. Australia, for example, established the AU\$4 bn Critical Minerals Facility to support critical mineral projects by providing loans, loan guarantees and working capital support to new facilities to address gaps in private finance and ensure that viable projects are financed.³³
- **Develop a strategic, public funded reserve of energy storage to insulate the UK against energy supply shocks.** In spite of future reforms to policy support, markets may not be able to deliver the level or every type of energy storage that the grid may require.³⁴ The National Infrastructure Commission has recommended a strategic reserve of 25 TWh of electricity storage by 2040 alongside commercially operated storage to address supply shocks, e.g., periods of very low wind or global energy market disruptions.³⁵

Phasing out natural gas will also help to deliver more affordable energy bills for consumers. Replacing natural gas with renewables or other low-carbon sources will break the coupling between electricity and gas prices, highlighted in Figure 4, caused by current market dynamics. Bids to supply electricity are accepted from generators through a "merit order" (from lowest to highest), with the market price set by cost of supplying the final portion of demand. Bids from renewable generators are typically low, as they have negligible running costs. Bidding prices from gas operators, however, are typically higher and are strongly dependent on the price of purchasing gas. The current structure means that bids from gas operators often set the market price, even if they only meet a small portion of demand. Russia's invasion of Ukraine in 2022 highlighted the exposure of electricity prices

³² [Ofgem, *Interconnectors*, 2024.](#)

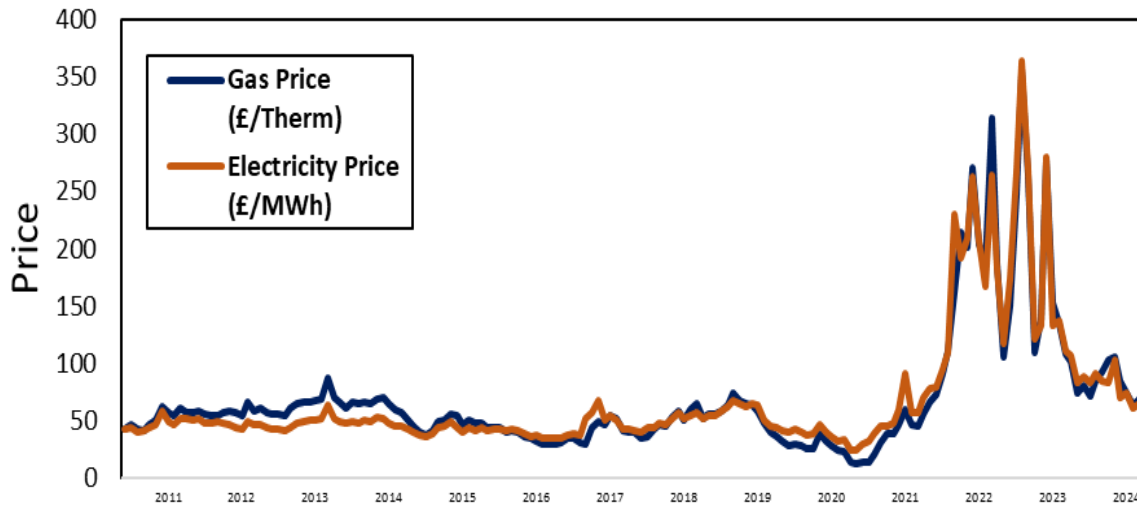
³³ [International Energy Agency, *Policy Tracker: Critical Minerals Facility*, 2023.](#)

³⁴ [House of Lords, *Long-Duration Energy Storage: Get On With It*, 2024.](#)

³⁵ [National Infrastructure Commission, *Strategic Energy Reserve*, 2023.](#)

to global gas prices, with weekly average electricity prices jumping from £192/MWh in January to highs of £511/MWh by August.³⁶

Figure 4 - Average UK gas and electricity wholesale market prices
(In £/Therm and £/MWh for gas and electricity, respectively)



Source: [Ofgem, Wholesale Market Indicators.](#)

The lower costs of renewable electricity will take time to be reflected in lower consumer and businesses energy bills, so targeted support will be crucial to ensuring affordability. The rapid deployment of renewables by 2030 could bring wholesale costs of electricity in the UK down by two thirds compared to their 2023 levels³⁷, but the combination of prevailing high gas prices and the “merit order” bidding process means that electricity prices are unlikely to fall in the short term. The total debt that consumers owe to energy companies now exceeds £3 bn³⁸, despite efforts over the last two years by the conservative government to insulate consumers from price rises caused by Russia’s invasion of Ukraine. With over 40% of respondents in 2024 who pay energy bills saying it was very or somewhat difficult to pay them³⁹, targeted government support is needed to return to affordable levels of expenditure on energy.

Schemes to decarbonise the power system (e.g., CfDs) are currently funded through levies on consumer electricity bills, which are regressive and increase the burden on lower-income households. Additional costs on consumers to fund government policies and support schemes made up 12% of the Energy Price Cap in Q3 2024.⁴⁰ Whilst spending on energy bills increases slightly with income, the lowest income households spend nearly double the share of their weekly expenditure on energy.⁴¹ Price rises and electricity levies have a disproportionate impact on lower income households, which needs to be addressed through future policy decisions.

³⁶ [Ofgem, Wholesale Market Indicators, 2024.](#)

³⁷ [Cutting the bills: UK households profit from clean power, Ember, 2023.](#)

³⁸ [Ofgem, Debt and Arrears Indicators, 2024.](#)

³⁹ [Office for National Statistics, Cost of Living Insights, 2024.](#)

⁴⁰ [Bolton & Stewart, Domestic Energy Prices, 2024.](#)

⁴¹ [Office for National Statistics, Family spending in the UK: April 2021 to March 2022, 2023.](#)

Energy affordability is a cross-cutting issue over both the power and residential heating sectors. Here, we focus on proposals from stakeholders that address issues with electricity affordability, whilst the “Transforming energy demand in home heating” section focuses on affordability issues relating to gas and home heating.

Proposals from stakeholders to address issues with electricity affordability include:

- **Fund power sector decarbonisation schemes directly out of government spending, rather than from levies on domestic electricity bills.**⁴² Government spending programmes are funded through general taxation, so funding schemes directly instead of through levies on electricity bills would address the regressive nature of the current funding structure. Whilst additional tax rises may be required to meet the estimated £5 bn of costs currently met through levies, there are various options to fund the costs progressively, including phasing out tax expenditures to broaden the income tax base.
- **Redistribute any remaining levies towards gas bills rather than electricity bills, making low-carbon technologies more cost-effective.**⁴³ Current policy levies (e.g., the CfD scheme) are paid through electricity bills, rather than on gas bills. Rebalancing the distribution of any remaining policy costs (those that are not shifted to funding from government spending) would ensure a fairer distribution of costs. Low-carbon technologies such as heat pumps would become more cost-effective relative to conventional technologies such as gas boilers, accelerating their uptake.
- **A National Energy Guarantee which would entitle every household to a set amount of free or discounted.**⁴⁴ Electricity and gas bills are still drastically higher than pre-2022 levels, but government support has been withdrawn over the last year. A National Energy Guarantee would ensure that the lowest income households have a basic safety net of cheap and/or free electricity (and would also encompass gas consumption). It would allow households to run daily essential appliances and heat their homes to a sufficient level.

⁴² [EnergyUK, *Mission Possible: The steps to make Britain a clean energy superpower*, 2024.](#)

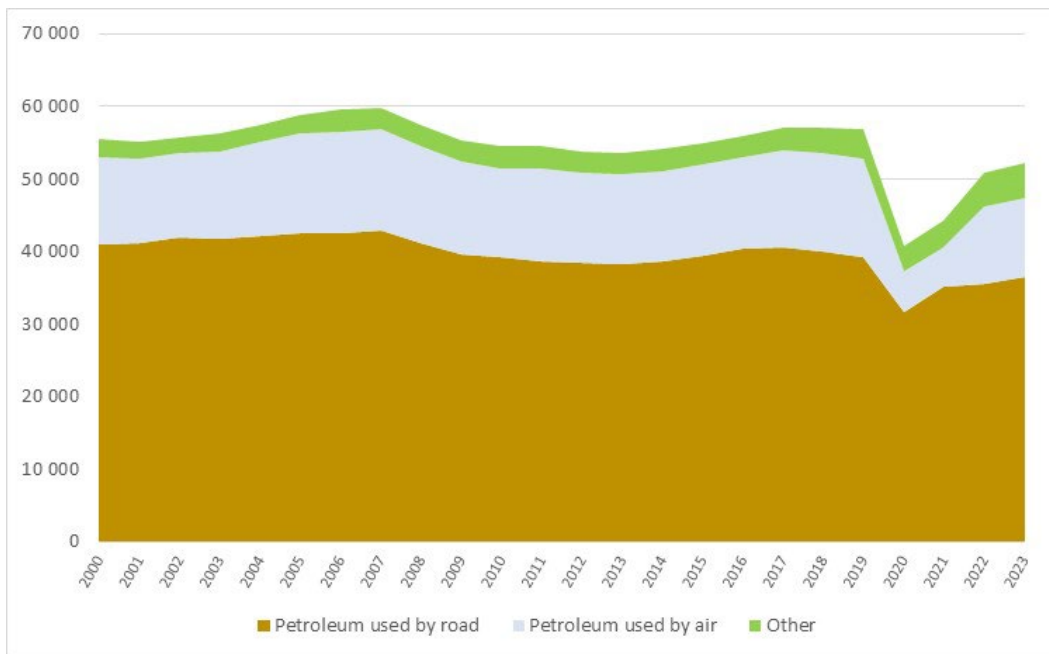
⁴³ [EnergyUK, *Mission Possible: The steps to make Britain a clean energy superpower*, 2024.](#)

⁴⁴ [New Economics Foundation, *Government could Reduce Bills for Almost 90% of Households with a National Energy Guarantee*, 2023.](#)

2. RETHINKING MOBILITY IN THE UK

The UK transport sector has reduced its energy consumption over the past 15 years, but its use of fossil fuels remains high (Figure 5). The decline in energy consumption is largely attributed to ongoing efforts to enhance fuel efficiency. Nevertheless, transport remains a major consumer of energy in the United Kingdom, accounting for nearly 40% of the country's final energy consumption, and it is the largest source of greenhouse gas emissions as well as local air pollution.⁴⁵ Various fiscal and regulatory measures are encouraging the adoption of cleaner vehicles, yet battery electric vehicles (BEVs) only made up 2.7 % of the UK vehicle fleet in 2023 and plug-in hybrid electric vehicles (PHEVs) only 1.6 %.⁴⁶

Figure 5 – Transport's energy consumption remains high
(thousand tonnes of oil equivalent)



Source: [Department for Energy Security & Net Zero \(DESNZ\)](#)

There is a widely held view that current policies are insufficient to achieve affordable, secure and clean energy usage in the UK transport sector, and that additional policies will need to be implemented by the new Labour government. This section is focused on road transport, which account for the bulk of transport's energy consumption, but the energy use of aviation and shipping raises also substantial challenges for policymakers.^{47,48} It reviews the current policy measures aimed at encouraging the switch of the road transportation sector to new energy sources and discusses policy reforms to accelerate this energy transformation. A discussion is also provided on how to improve the security of the

⁴⁵ [Department for Energy Security and Net Zero, *Energy consumption in the UK, 2023*.](#)

⁴⁶ [Society of Motor Manufacturers and Traders \(SMMT\), *Motor Vehicles in Use, 2023*.](#)

⁴⁷ [Road transport represented 75% of total transport energy consumption in 2022. Source: UK Department of Transport; *Energy and environment: data tables*.](#)

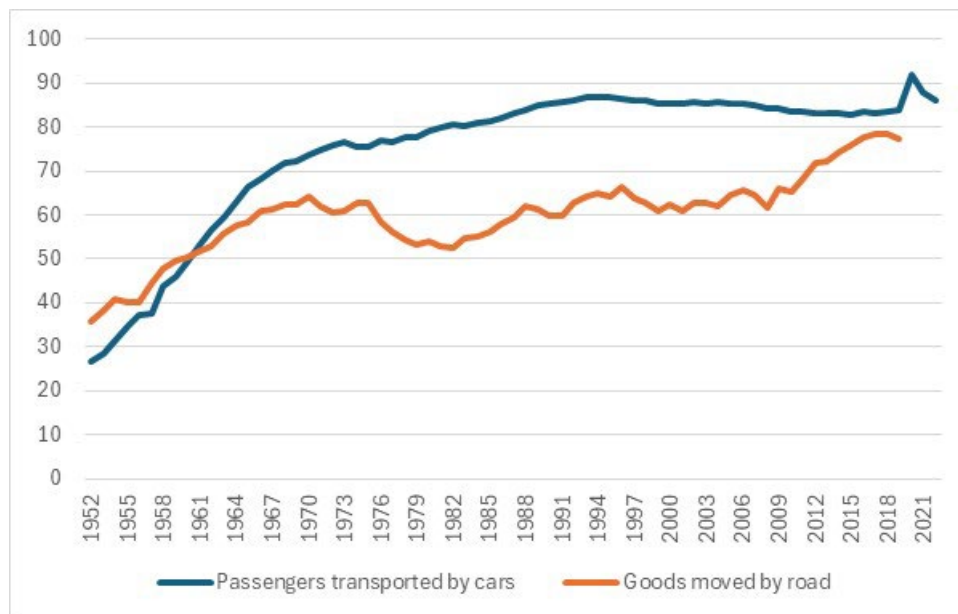
⁴⁸ [Transport and Environment, *Briefing: Successful Transport Decarbonisation, 2024*.](#)

car fuels supply chain. Finally, this section discusses how to react to China’s fast rise in the UK market for electric vehicles.

Cars account for the bulk of the UK’s passenger transport, with only a limited role played by public transport.⁴⁹ The dominance of cars is strongly established (86% in terms of passenger-kilometres), with no significant change over the past four decades (Figure 6) despite increasing fuel prices and growing road congestion. Reflecting the continued attractiveness of road transport, the number of cars has continued to increase: a record total of 41.4 million vehicles were on UK roads in 2023, an increase of 1.7% from the previous year.^{50,51}

In addition, car owners keep driving their vehicles for longer. Almost 31% of cars are now more than 12 years old, limiting the contributions of recent improvements in energy efficiency to UK transport emissions.⁵² One plausible reason is the rising popularity of used cars among households – [7.2 million](#) used cars changed hands in 2023, while 1.9 million new cars were sold – making it possible to extend the lifespan of vehicles on the road. In addition, it is likely that car drivers are waiting for improvements in the EV market, such as reduced prices, enhanced driving range, and increased availability of charging stations, prior to transitioning to electric mobility. The expansion in the car fleet and the increase of its average age heightens the environmental strain, thus exacerbating issues like air pollution, noise, traffic congestion, and the occurrence of accidents.

Figure 6 – Road transport dominates for both passengers and goods
(in % of passenger kilometres and tonne kilometres)



Source: National travel survey statistics, and Transport statistics.

⁴⁹ [UK Department of Transport, *Modal Comparisons*, 2023.](#)

⁵⁰ [Society of Motor Manufacturers and Traders \(SMMT\), *EVs drive down carbon emissions and lift vehicle ownership to record high*, 2024.](#)

⁵¹ This includes 35.7 million cars, 5 million vans, and the remainder are buses and trucks.

⁵² [Society of Motor Manufacturers and Traders \(SMMT\), *Motorparc 2023*, 2023.](#)

Ownership of road vehicles is unequal across social groups. About 34% of households own two or more vehicles and are therefore likely to be large energy consumers.⁵³ By contrast, about 22% of households – most frequently low-income households – do not own a car and therefore do not contribute to the negative externalities associated with individual road traffic. A contributing factor is that households in the bottom income quintile struggle to meet the upfront and maintenance cost associated with owning a car.⁵⁴ Among these households, it is estimated that 37% do not have access to a car.

Rethinking mobility needs to take into account this unequal distribution. Paying attention to transport affordability is essential, as a significant share of people already cannot afford to own a conventional car. According to the Transport Energy Poverty Index compiled by OPENEXP, the UK was ranked 16th out of 28 European countries in 2019, mainly due to the high cost of both fuel and of public transport.⁵⁵ When transport is unaffordable, low-income households face difficulties with commuting to work or accessing public services such as healthcare, education, and culture. Helping low-income households improve their mobility goes hand in hand with a path toward cleaner energy. An imperative will be to ensure that all families have access to electric vehicles as the country progresses further toward its objective of net zero in 2050.

Electric vehicles are still beyond the reach of many households at current prices. Although the total cost of ownership of electric vehicles may be competitive relative to ICE cars, households face difficulties purchasing new electric vehicles because of high upfront retail prices in Europe and the United States.⁵⁶ This reflects the strategy of automakers to specialize in high-value market segments (luxury cars, SUVs) and to opt for high mark-ups. The International Energy Agency (IEA) reports that, in 2023, “the cheapest electric cars in the United Kingdom were priced from £27,000 to £30,000” while “best-selling small ICE options could be found from £10,000 to £17,000 and medium options below £25,000”.⁵⁷ In [mid-2024](#), apart from low-end small BEVs exclusively for urban transport, BEVs remained significantly more expensive.

Enabling access to BEVs for all households will be essential. Early adopters, often urban high-income households, can willingly afford to pay for premium vehicles, but other households face cash constraints preventing them from making the switch. Making BEVs affordable for low-income households will become essential as dates for the ban of new petrol and diesel cars (2035 at the time of writing) approaches. Outside the UK, some automakers are already selling BEVs at lower prices than conventional cars. The IEA reports that, in China, “60% of electric cars sold in 2023 were already cheaper than their average combustion engine equivalent”.⁵⁸ While opening borders to electric vehicles made in China would increase competition pressure and hasten price declines, this is not without risk for the UK manufacturing industry, which employs 182,000 workers directly. Reinstating BEV subsidies, for instance based on their full carbon content as in France, is an option – yet fiscal space might be a constraint.

⁵³ [UK Department of Transport, National Travel Survey 2022: Household car availability and trends in car trips, 2022.](#)

⁵⁴ [The Health Foundation, Trends in households without access to a car, 2024.](#)

⁵⁵ [OpenExp, European Energy Poverty Index, 2019.](#)

⁵⁶ [International Energy Agency, Global EV Outlook 2024, 2024.](#)

⁵⁷ [International Energy Agency, Global EV Outlook 2024: Electric Car Sales, 2024.](#)

⁵⁸ [International Energy Agency, Global EV Outlook 2024: Executive Summary, 2024.](#)

The dependence on imported car fuels raises concerns about national security. Despite the UK's crude oil production in the North Sea, cars and vans primarily rely on imported petrol and diesel, or fuels refined from imported crude oil. This dependency arises from the technical characteristics of North Sea's crude oil, which contains too much sulphur to be processed in UK's refineries and sold to domestic drivers. As a result, the majority of North Sea crude oil is exported to nations with compatible refineries, while the UK needs are met with imported car fuels and with imported low-sulphur crude oil processed in its refineries.

About half of diesel used in the UK is imported. The UK consumes 20 to 25 million tonnes of diesel a year, around half of which comes from imports. Domestic production of diesel has steadily declined in recent years, and demand has been met by rising imports. Around a third of diesel imports came directly from Russia until the country's invasion of Ukraine triggered international sanctions and the UK sought alternative suppliers to reduce its dependence. Oil firms are now seeking to [expand UK refineries](#) to supply diesel starting in early 2025.

With the right policies, the electrification of road transport will improve national security. Instead of relying on foreign suppliers of diesel and petrol, the UK should accelerate the uptake of vehicles running on domestically-produced electricity. Such measures would significantly enhance the UK's security and diminish its reliance on regions vulnerable to geopolitical instability. The recent sharp drop of diesel sales in London shows what can be done, with benefits in terms of security, climate and health of citizens.⁵⁹ A concern that shifting to EVs will strain the power grid is not warranted according to recent analysis. The [National Grid](#) estimates that switching to 100% electric vehicles would increase electricity demand by only 10%, a demand that can be easily accommodated using the existing unused capacity, thanks to the decline in peak electricity demand over the past two decades.

Providing equitable access to public charging stations throughout the UK will require further investment. Many residents who do not have a driveway will be reliant on public chargers, making equitable access to BEV charging a crucial priority for public investment.⁶⁰ Although pylons are typically installed near roadways, the transmission and distribution networks will need to be upgraded to provide power to new charging points. This is being funded by government initiatives, such as the green recovery fund, rapid charging fund, and local EV infrastructure fund.

The switch to BEVs will increase electricity demand but provides also new flexibility opportunities. Smart chargers allow BEVs to charge when there is less demand on the grid, or more supply from renewable sources, thus helping to balance the electricity system and cope with the intermittency of solar and wind power. In the future, BEV batteries will also be able to feed power back into the grid, thus providing crucial storage capacity, thanks to vehicle-to-grid technology. Automakers are increasingly installing the inverters required for bidirectional charging. Car drivers will benefit from selling power back to the grid, making BEV ownership more attractive.

Emissions from domestic transport are gradually declining. Greenhouse gas emissions from the domestic transport sector have declined since 2007 and not returned in 2023 to their pre-pandemic levels (Figure 7).⁶¹ The decline in GHG emissions from transport reflects

⁵⁹ [Transport and Environment, *Capital Gains*, April 2024.](#)

⁶⁰ [Global Sustainable Mobility Partnership, *Policies for a mature, flourishing EV charging ecosystem*, 2021.](#)

⁶¹ [UK Department of Energy Security & Net Zero, *2023 UK greenhouse gas emissions*, 2024.](#)

the lower average mileage of cars, as trips tend to be shorter and less frequent.⁶² In addition, new cars are cleaner: average tailpipe CO₂ emissions for newly registered cars have decreased by 31.2% since 2000.⁶³ Corporate car fleets are particularly cleaner, thanks to their rapid adoption of EVs, under the impulse of an accelerated capital depreciation tax incentive. In 2022, average CO₂ emissions of newly registered cars were 111.4 g/km, lower than before but still significantly higher than the target of 95 g/km adopted by the EU.^{64,65}

Congestion pricing and low emission zones have helped to improve air quality. Since 2003, a congestion charge (£15 per day) must be paid by most cars and motor vehicles driven within central London during traffic peak hours.⁶⁶ In addition, since 2008, commercial vehicles driven in Greater London's Low Emission Zone (LEZ) must meet specific emission standards or pay daily fees ranging from £100 to £300. Finally, since 2019, cars need to meet minimum emissions standards when travelling within the London Ultra Low Emission Zone (ULEZ) or pay a daily charge (£12.50).⁶⁷ The proceeds of these various fees are generally earmarked to invest in the public transport network, and therefore help mobility while improving air quality. Thirteen other UK cities have also adopted similar clean air programmes, with tariffs or outright bans on driving diesel vehicles (e.g., Bristol).

Research finds that the LEZ and ULEZ have “significantly improved air quality, benefiting Londoners’ physical and mental health”.⁶⁸ This research – based on comparison between pre-reform and post-reform air quality – suggests that the LEZ has helped to reduce particulate matter (PM_{2.5} and PM₁₀) in Greater London and that the ULEZ has helped to reduce nitrogen dioxide (NO₂) in Central London, with health benefits such as lower cardiovascular diseases, asthma, bronchitis and improve mental health. Nonetheless, the levels of PM_{2.5}, PM₁₀ and NO₂ remain significantly higher than both national and international targets, with costs in terms of health, productivity and well-being.⁶⁹ Further decline in transport's emissions of pollutants remains therefore crucial.

Notwithstanding improvements in air quality, GHG emissions from transport need to decline faster. Emissions were provisionally estimated to have been 111.6 MtCO₂e in 2023 (29% of territorial GHG emissions).⁷⁰ To reach carbon neutrality in 2050, the legally binding target for the UK government, the Climate Change Committee (CCC) estimates that transport emissions must decline by 24% during the fourth (2023-27) to sixth budget period (2033-37).⁷¹ A faster adoption of battery electric cars will be central to this declining path of emissions: the CCC estimates that the market share of new battery electric vehicles in new car sales should increase from 16.5% in 2023 to close to 100% in 2030.

⁶² [UK Department of Transport, National Travel Survey 2022, 2023.](#)

⁶³ [Society of Motor Manufacturers and Traders \(SMMT\): CO₂ Progress, n.d.](#)

⁶⁴ [Society of Motor Manufacturers and Traders \(SMMT\), *MOTOR INDUSTRY FACTS 2023* MOTOR INDUSTRY FACTS 2023, 2023.](#)

⁶⁵ [European Commission, *CO₂ emission performance standards for cars and vans, 2019.*](#)

⁶⁶ [Transport for London, *Congestion Charge*, n.d.](#)

⁶⁷ [Transport for London, *Congestion Cars*, n.d.](#)

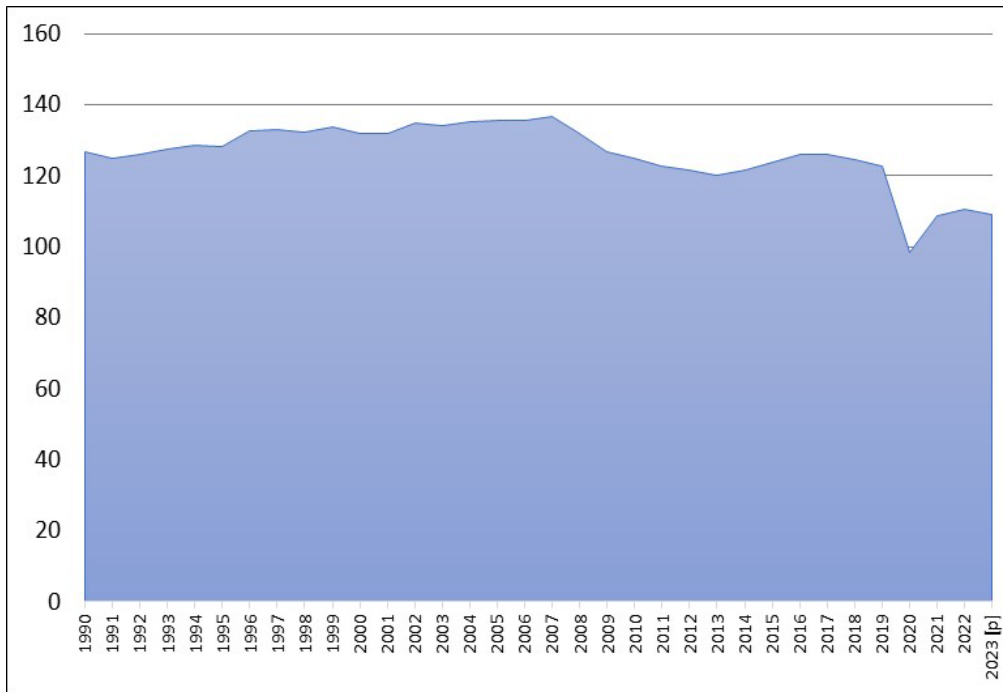
⁶⁸ [Fichera, Eleonora, Habtamu Beshir, and Andrea Serna Castaño, *Low Emission Zones improve air quality, physical health and mental well-being*, IPR Policy Brief, University of Bath, 2023.](#)

⁶⁹ [Maarraoui, G., Wossink, G., Saliba, F., & Marrouch, W., *Willingness to Pay for Clean Air: Evidence from the UK. \(WP/23/35 ed.\) International Monetary Fund*, 2023.](#)

⁷⁰ [Department of Energy Security & Net Zero, *2023 UK greenhouse gas emissions, provisional figures*, 2024.](#)

⁷¹ [Climate Change Committee, *UK action on climate change*, 2024.](#)

Figure 7 - Emissions from transport remain high, despite their recent decline
(CO₂ emissions from domestic transport in MtCO₂e)



Source: [Department for Energy Security & Net Zero](#)

A more diversified transportation mix would help to shift to more affordable, secure and clean energy sources. Various policies can help to encourage a modal shift away from passenger cars to public transport and other alternative transportation modes. This includes more railway infrastructure, more frequent passenger trains, more parking space near train stations (“Park & Ride”), more carpooling and car sharing, and more bicycle lanes. The new UK government plans to reform railways, with the objective of bringing all passenger rail into national ownership as contracts with private operators expire.⁷² The objective is to reduce costs, streamline a complex organisation, and reopen closed rail services – to the benefit of passengers in terms of fares, reliability and comfort. These policies could further improve the modal share of passenger rail transport, which was only 6% in 2000 and has gradually progressed since then to reach 9% in 2022.⁷³ The Labour government also plans investments and reforms in bus services and cycle paths.⁷⁴

While more support for public transport could help, large changes in the transportation mix are hard to achieve. Only a few countries have achieved a substantial share of public transport in their modal mix (e.g., China, India, Japan, Russia and Switzerland). A high share of public transport typically reflects historical factors, such as territorial development and urban planning. Significant funding is also essential to pay for the maintenance of public transport facilities and invest in new railway infrastructure. While funding needs could be covered by higher fares, consumer demand for public transport appears to have a high price elasticity in some segments, especially in inter-urban

⁷² [UK Department of Transport, Public ownership of rail takes centre stage as government plans radical overhaul of transport, 2024.](#)

⁷³ [UK Department of Transport, Modal Comparisons, 2023.](#)

⁷⁴ [UK Department of Transport, Transport Secretary kickstarts 'bus revolution' as she promises to support local leaders to deliver better buses up and down the country, 2024.](#)

transportation – with the risk that higher fares could lead to a significant and self-defeating drop in ridership.⁷⁵ In addition, research suggests that most citizens approve the expansion of public transport only if there is increased financial support by the public sector, though not all citizens are ready to pay higher taxes for this purpose.⁷⁶ The UK government's financial contribution to railways was £11.9 billion in 2022 and it is unclear if this could increase markedly due to constraints in fiscal space.⁷⁷

A fast adoption of zero-emission vehicles is therefore essential to reduce carbon emissions. The Climate Change Committee has stated that a zero-emission vehicle mandate is the single most important mechanism to deliver the UK's net zero commitment. To this end, the previous government led by Prime Minister Rishi Sunak adopted a pathway for zero emission vehicle transition with the following shares of zero-emission cars in new registrations:

- 22% of cars and 10% of vans in 2024.
- 80% of new cars and 70% of vans by 2030.
- 100% of cars and vans by 2035.⁷⁸

While this objective still prevails in the legislation at the time of writing, this could change to reflect the pre-election pledge by the Labour Party in its Manifesto to reinstate the phase-out by 2030 repealed by Prime Minister Rishi Sunak.

The prevailing zero-emission vehicle mandates are meant to be implemented through market-based mechanisms. Each manufacturer will receive “[allowances](#)” to sell ICE cars and vans, with permission to sell unused allowances. Vice versa, the manufacturers will have to pay the government £15,000 for each polluting car sold over their allowance.⁷⁹ Staying within the limits of these mandated allowances will require a fast pace of adoption. The share of battery electric cars was only 16.6% during the first half of 2024, an only slightly higher proportion than during the first half of the previous year (16.1%). This makes it unlikely that the target of 22% BEV market share in 2024 will be observed. For light commercial vehicles (vans), the EV market share was only 4.7%, making it also unlikely that the separate market share target of 10% will be reached this year. According to the rules adopted by the previous government, this will imply significant fines to be paid by automakers, although mechanisms allowed by the government under the Vehicle Emissions Trading Scheme (VETS) [could be used](#), such as “borrowing” from future allowances. A more rapid pace of adoption of BEV is essential to get back on track and reach zero-emission vehicle targets.

The Climate Change Committee has called for all new passenger cars to be fully battery electric vehicles by 2030, including passenger vehicles, taxis, vans, motorbikes and mopeds. This would require trebling the current Installation rates of public electric vehicle charging points by 2030. The CCC also called on the government to “make electricity cheaper [by] removing policy costs from electricity price”. A decline in electricity prices

⁷⁵ Wardman, Mark, “*Meta-analysis of price elasticities of travel demand in Great Britain: Update and extension*”, Transportation Research Part A: Policy and Practice, Volume 158, 2022.

⁷⁶ Lichtin, Florian & Smith, E. Keith & Axhausen, Kay W. & Bernauer, Thomas. “*How much should public transport services be expanded, and who should pay? Experimental evidence from Switzerland*,” OSF Preprints, 2024.

⁷⁷ [HM Treasury, Chancellor statement on public spending inheritance, 2024.](#)

⁷⁸ [UK Department of Transport, Pathway for zero emission vehicle transition by 2035 becomes law, 2024.](#)

⁷⁹ [Society of Motor Manufacturers and Traders \(SMMT\), New car market hits ‘million motors’ milestone at half year, 2024.](#)

relative to car fuel prices would lower the total cost of owning an electric vehicle and encourage faster adoption.⁸⁰

In addition to accelerating the adoption of electric cars, it is imperative to decarbonize heavy truck transportation, which accounts for around one fifth of UK transport emissions. Like for passengers, road transport dominates for merchandise: heavy goods vehicles (HGV) account for 81% of tonnes of goods moved, compared to 12% by water and a mere 7% by railways. A plan to phase-out the purchase of new non-zero emissions HGVs was repealed by Prime Minister Rishi Sunak. Reinstating phase-out dates will be essential to provide clarity to transport companies. This will require public support for clean battery electric trucks, including dedicated charging stations and greater allowances in terms of weights to reflect the weights of batteries.

Several tax benefits and subsidies are currently offered to encourage the adoption of electric passenger vehicles:

- **Road tax.** Zero emission vehicle owners are exempt from paying the “road tax” ([vehicle excise duty](#)) until end-March 2025.
- **Congestion charge.** Zero emission car drivers do not need to pay the [congestion charge](#) in London until 24 December 2025.
- **Ultra Low Emission Zone (ULEZ) financial charges.** EVs are exempt from these charges.
- **Corporate capital allowance.** Company cars emitting less than 50g/km of CO2 qualify for 100% first-year capital allowances, offering substantial tax benefits at the time of purchase. This provision holds particular significance as numerous new vehicles, including electric ones, are procured by businesses for their vehicle fleets, availing them of a considerable tax benefit.
- **Benefits in kind.** When company cars are used privately by employees, this is considered as a benefit in kind (BIK). The taxation of this benefit in kind is much lower when an electric vehicle is provided by the company: for 2023/2024 and 2024/2025 financial years, the taxation of BIK on electric cars is [set at 2%](#). After this it will increase by one percentage point per year, reaching 5% by 2027/2028.
- **Chargepoints.** For individual car drivers, installing a chargepoint comes with a generous fiscal incentive: the EV chargepoint grant provides up to 75% of the cost of a home car electric charger and its installation. The coverage of the grant is comprehensive: it is available to landlords, renters, homes with a driveway, homes without a driveway, residential car park, and for business parking space for staff and car fleet.

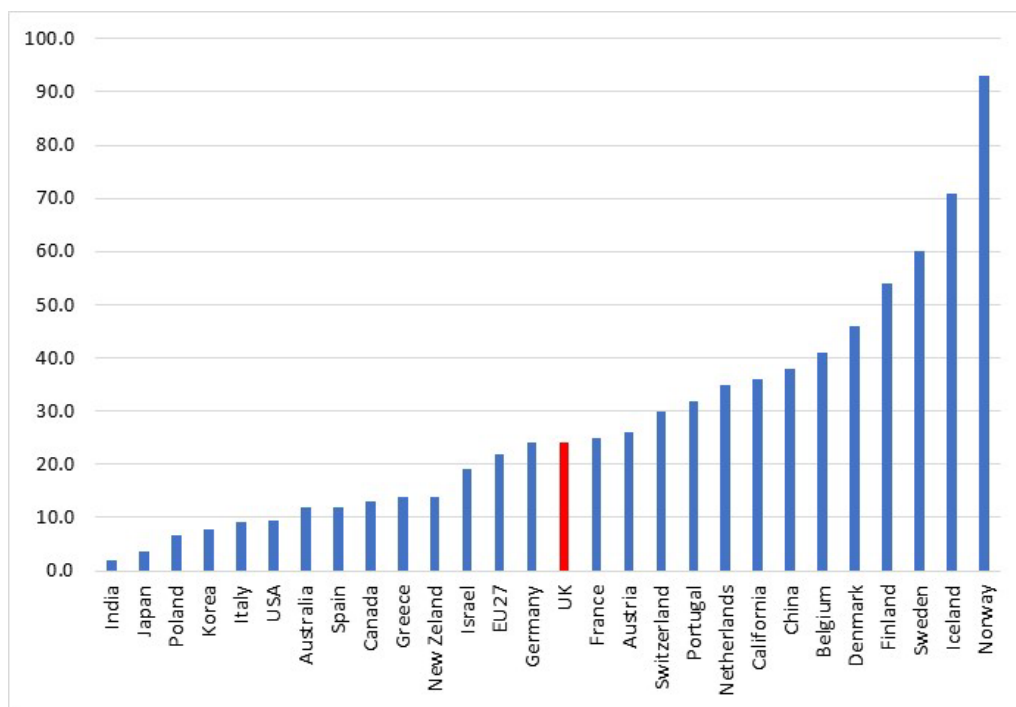
More extensive policy support will be needed to decarbonise road transport. While these various incentives currently offered have resulted in battery electric cars gaining a market share of 16.6% of new registration in the first half of 2024, they still accounted for only 2.7% of all passenger cars on the road. The mandated phase out of new ICE cars under the 2035 mandate sends a signal, but modelled projections by the UK Energy Research Centre (2023) predict that it will not be enough to avoid a small uptick in CO2 emissions in the short term. The UK could learn from the experience of other countries – notably the Nordics, Switzerland, China and California – which have experienced a rapid adoption of

⁸⁰ [Climate Change Committee, UK action on climate change, 2024.](#)

BEVs, often with a mix of incentives ranging from lower taxes to road toll exemptions and permission to use bus lanes (Benoit and Lenain, 2023).

Expanding the adoption of electric vehicles beyond early adopters to the wider population necessitates behavioural shifts. In more developed markets, the uptake of BEVs typically follows the familiar S-curve pattern observed with innovative products: initially, enthusiastic early adopters eagerly embrace the new technology. However, transitioning beyond this group to the "early majority" proves challenging – a phase often termed the "chasm" – yet it is crucial for mainstream acceptance.

Figure 8 - The UK's adoption of new electric vehicles is in line with the EU average
(EV share in new car sales, in %, 2023)



Note: Includes BEVs (battery electric vehicles) and PHEVs (plug-in hybrid electric vehicles).

Source: [IEA, Global EV Outlook 2024](#)

Successfully traversing the chasm requires concerted efforts from all stakeholders.

Governments must offer predictable prospects about incentives, businesses need to address consumer concerns, and the media should play a critical role in fostering factual public debates. A cohesive collaboration among stakeholders is pivotal to instilling consumer confidence and addressing inevitable apprehensions associated with significant shifts. Regrettably, key stakeholders in the UK have thus far failed to provide these critical factors to bolster confidence in EVs.⁸¹ Frequent alterations in government incentives, unreliable public charging infrastructure, absence of multiyear warranties on battery manufacturing, and dissemination of inaccurate information via social media all contribute to fostering

⁸¹ Transport and Environment, *From Early Adopters to Early Majority: Accelerating the Electrification of Cars*, Research report, Briefing Note, 2024.

doubt and dissuading potential car buyers from opting for EVs. A more coordinated coalition of EV stakeholders is imperative to rectify this situation.

Several proposals have been made to accelerate EV adoption:

- **Restore the 2030 zero-emission vehicle mandate.** The Climate Change Committee has called for all new passenger cars to be battery electric vehicles by 2030, including passenger vehicles, taxis, vans, motorbikes and mopeds. The 2030 target date was in place until the announcement by UK's prime minister, Rishi Sunak, in September 2023 that the target date will be pushed back from 2030 to 2035.
- **Ban the sales of new plug-in hybrid electric vehicles (PHEVs) as of 2030.** The UK Energy Research Centre (2023) has recommended moving the current ban of hybrids forward from 2035 to 2030. Similarly, the Climate Change Committee has called for a ban of PHEVs and has highlighted research showing that carbon savings from PHEVs are three to five times lower than previously assumed.⁸² PHEVs are often the main option selected in company car fleets but tend to be used for longer mileage and are heavier than other types of vehicles. They are not zero emission and are therefore already subject to a sales ban as of 2035, but an earlier ban is favoured by the UK Energy Research Centre.
- **Accelerate the installation of public charging points.** The international evidence is that the rollout of public charging points needs to keep pace with EV sales (Figure 9). Drivers need to gain confidence that charging will not be an issue during long trips – an essential factor when adopting a zero-emission vehicle. In rural areas, the lack of charging points is a key obstacle to the adoption of battery electric vehicles. Public charging is needed, even though most charging takes place privately in residential and workplace settings. According to the IEA, the UK had 43,000 slow charging points and 10,000 fast charging points in 2023, significantly less than France and Germany. In addition, customer service is perceived as poor, with complex and costly charging costs. The previous government planned to invest in the rollout of public charging points, with the goal of at least 300,000 public chargers being available by 2030.⁸³ The new Labour government committed to accelerating the roll out of public chargers in their manifesto, but there has not yet been a clear target announced.
- **Bring VAT on public charging into line with home charging.** In its recent report, the House of Lords noted that VAT is higher on public charging points (20%) than on charging at home (5%). It found that VAT equalisation could improve the affordability of public chargepoints by bringing prices down to roughly the same as petrol and diesel prices for rapid and ultra-rapid chargepoints. Thus, it recommended to explore options for equalising the VAT differential between public and domestic charging by reducing the 20 % VAT rate applied to public charging to 5% in line with domestic electricity.
- **Temporarily halve VAT on zero emission vehicles.** The Society of Motor Manufacturers and Traders (SMMT) has recommended to temporarily halve VAT on the purchase of new BEVs from 20% to 10% in the next three years.⁸⁴ SMMT estimates that "it would put more than a quarter of a million BEVs on the road above current expectations, remove more than five million tonnes of CO2 emissions, and give

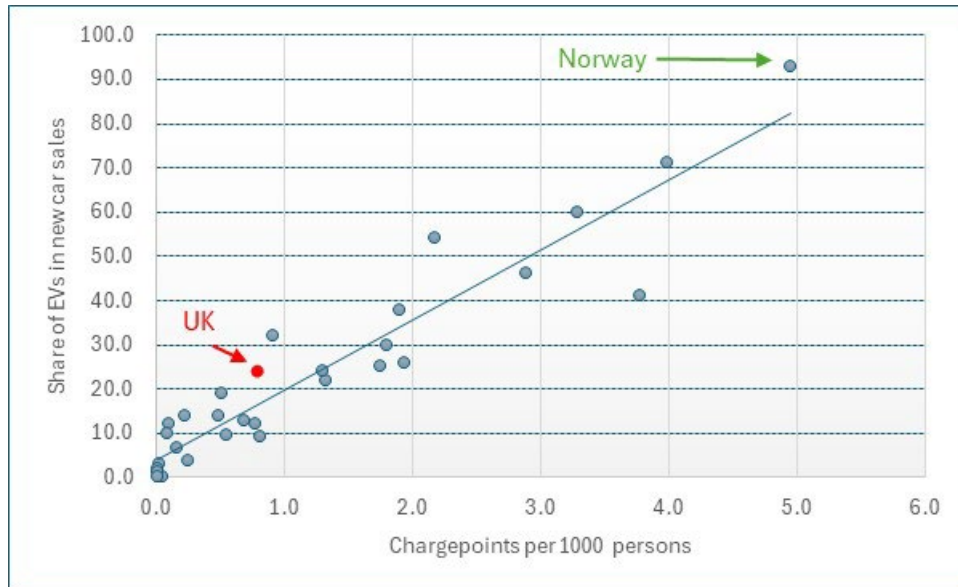
⁸² [Climate Change Committee, *Progress in reducing emissions 2023 Report to Parliament, 2023.*](#)

⁸³ [HM Government, *Taking charge: the electric vehicle infrastructure strategy, 2022.*](#)

⁸⁴ [Society of Motor Manufacturers and Traders \(SMMT\), *Car industry urges 'fair tax for a fair transition' to put EVs back in the fast lane, 2024.*](#)

consumers £7.7 billion in additional buying power”. SMMT argues that “halving VAT on new BEVs would give consumers a fiscal incentive at a level similar to that enjoyed by businesses and fleets”.⁸⁵ SMMT argues also that buyers of other CO2-saving technologies such as heat pumps and solar panels benefit from VAT incentives, but motorists pay the full 20% regardless of whether they buy a zero emission or fossil-fuel powered car.

Figure 9 – The UK is lagging behind in offering public charging stations relative to the adoption of EVs (2023, percent)



Source: IEA, Global EV Outlook, 2024

- Reintroduce battery electric passenger car grants.** The government offered a plug-in hybrid car grant until June 2022, when it was discontinued. There is currently no grant in place for battery electric vehicles, apart from grants offered for the purchase of electric taxis, vans, and motorcycles. BEV purchase grants or tax credits are currently offered in several countries (e.g. United States and France), while others have discontinued (Germany) or restricted them (China and Norway). Concerned about the higher cost of BEVs relative to petrol car, the House of Lords in its recent report has suggested that “the government should explore targeted grants to incentivise the purchase of BEVs with a view to facilitating a list price under an appropriate threshold”.⁸⁶
- A means-tested scheme to make BEVs more affordable for vulnerable households.** The problem with providing grants or tax credits to all purchasers is that this benefits high-income households who would have purchased an electric car even without a subsidy. A better approach is to target low-income households, who are cash constrained and who are less likely to adopt an electric car without financial support. This can be done, as illustrated recently by France, with a social leasing scheme. In early 2024, France introduced a government-sponsored scheme allowing low-income

⁸⁵ [Society of Motor Manufacturers and Traders \(SMMT\), A VAT cut for private EV consumers will put Britain ahead of the competition, 2024.](#)

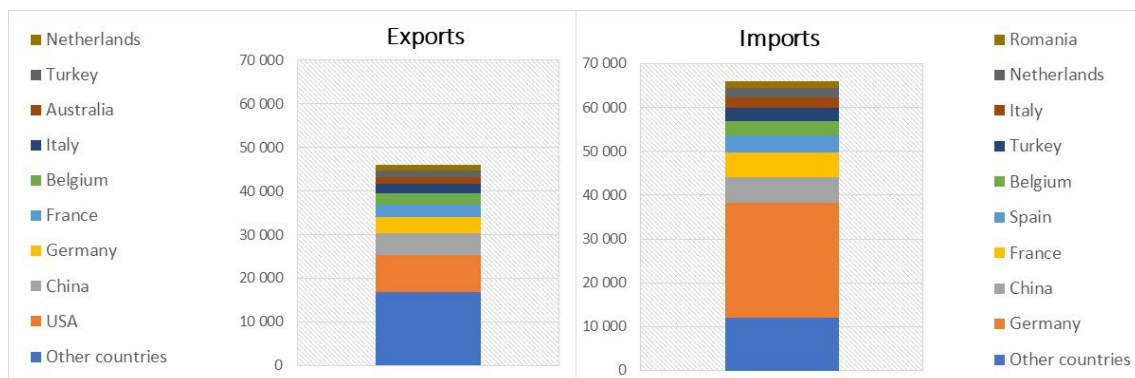
⁸⁶ [UK Parliament, Government EV strategy needs rapid recharge warns Lords committee, 2024.](#)

households to lease a BEV for €100/month. Leasing reduces the cash constraints faced by low-income households, it simplifies the transactions, and it removes uncertainties about resale values. A social leasing scheme makes new entry-level BEVs accessible by removing the upfront cost barrier, even for low-income drivers.

- **Establish a new scrappage scheme.** To speed up the decarbonisation of the car fleet, a scrappage scheme should be aimed at the least efficient and most polluting vehicles. A means-tested scrappage subsidy would provide resources to low-income households and help them afford the purchase of an EV, including used ones. In France, the “[Prime à la conversion](#)” can reach €5000 or more for low-income families scrapping a diesel car and purchasing a zero-emission vehicle. This could be combined with the leasing scheme mentioned above for even greater effectiveness.

In assessing these and further policy measures, their impacts on the country’s automobile manufacturing sector is a critical aspect to consider. The automotive industry is an important sector of the UK economy. It employs 182,000 workers directly, and some 780,000 people in total including suppliers to automotive sector. Eight out of 10 cars produced in the UK are exported to the European Union, the United States, China, Japan and other markets. In 2022, the UK ranked 17th among global automotive manufacturers. However, the UK’s automobile trade balance is sharply negative, as imports significantly exceed exports (Figure 10). In addition, there is an ongoing trade deficit in automotive components, mostly in trade with the EU, of the order of £12 bn per annum.

Figure 10 – More imports than exports of road vehicles
(In millions of £, 2023, UK foreign trade)



Source: Office of National Statistics

China is the second largest supplier of road vehicles to the United Kingdom. Chinese-built cars have seen their market share increase from less than 1% in 2019 to account for 9.2% of all car imports in the first half of 2023 – a consequence of the rising electrification of the UK’s new car market, with likely prospects that China will gain additional market shares as its automakers progress further with their technology and cost advantages (particularly in EVs). The UK seems to be facing a dilemma: it could allow imports of Chinese cars without restrictions and thereby achieve more rapid decarbonisation while keeping costs more affordable. That approach, however, may exacerbate the existing challenges for the UK automotive sector.

Alternatively, the UK could consider applying import tariffs on Chinese BEVs. The United States decided in May 2024 to increase its import tariffs on EVs made in China to

100%. In July 2024, the European Union introduced provisional countervailing duties on imports of BEVs from China ranging from 17.4% to 37.6%⁸⁷. [It has been suggested](#) that the UK government tasks the Trade Remedies Authority with scrutinizing Chinese government subsidies for BEVs. This may result in UK tariffs being aligned with or exceed those set by the EU. However, implementing import tariffs would carry negative implications for both affordability and decarbonization efforts.

A third approach involves “soft industrial policy”. This would aim at incentivizing UK automakers to make substantial investments in innovation and production capacity, strengthening them to be able to compete with BEVs imported from China. Establishing policy certainty regarding incentives and energy regulations, coupled with the strict introduction of the zero-emission vehicle mandate, would likely spur UK automakers to advance their EV production. Additionally, [exploring strategic alliances](#) with the EU in battery production and recycling could prove beneficial. Coordinating supply chains across the Channel would leverage the comparative advantages of each production site, enhancing efficiency and competitiveness.

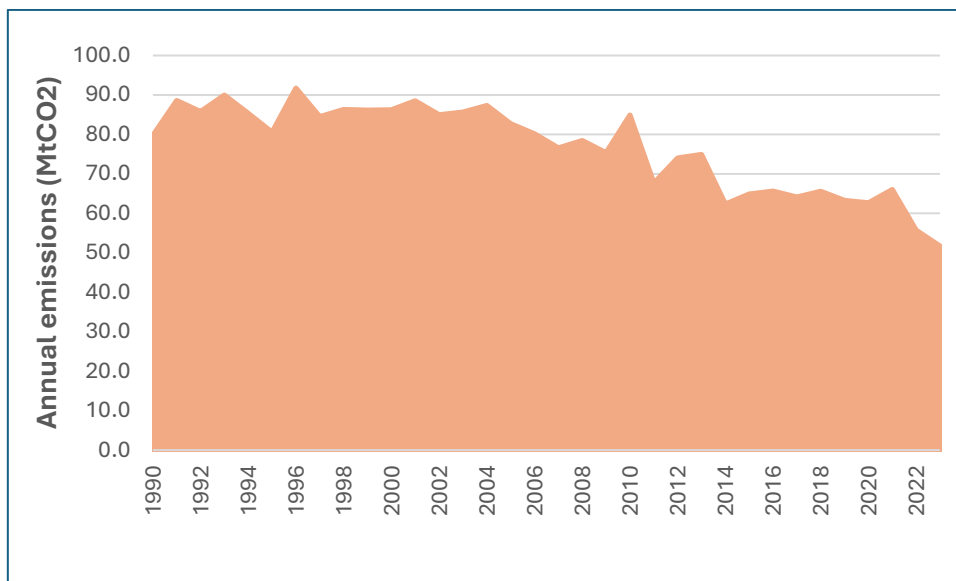
⁸⁷ [European Commission, Commission imposes provisional countervailing duties on imports of battery electric vehicles from China while discussions with China continue, 2024.](#)

3. TRANSFORMING ENERGY DEMAND IN HOUSING

Housing accounts for the second largest share of energy consumption in the UK, amounting to 20% of total consumption across the economy. Homes represent a particularly large part of UK's natural gas consumption (56% in 2023), which is used predominantly for heating.⁸⁸ The UK features a large number of “leaky houses”, due to insufficient retrofit investments and the late strengthening of building standards. The less energy-efficient buildings are often occupied by low-income households, who have to consume more energy to warm their homes. Together with high energy prices, this explains a large part of the problem of energy poverty among households.

Residential energy demand plays a substantial role in the country's greenhouse gas emissions, primarily through the strong reliance on natural gas (Figure 11). Despite recent declines, GHG emissions remain high. Greater strides are necessary to curtail residential natural gas usage, all while addressing energy poverty concerns. Direct residential CO₂ emissions per capita are higher in the UK than in the average OECD country (Figure 12). This imperative takes on heightened significance in achieving net-zero emissions by 2050. The journey to this goal presents complex challenges.

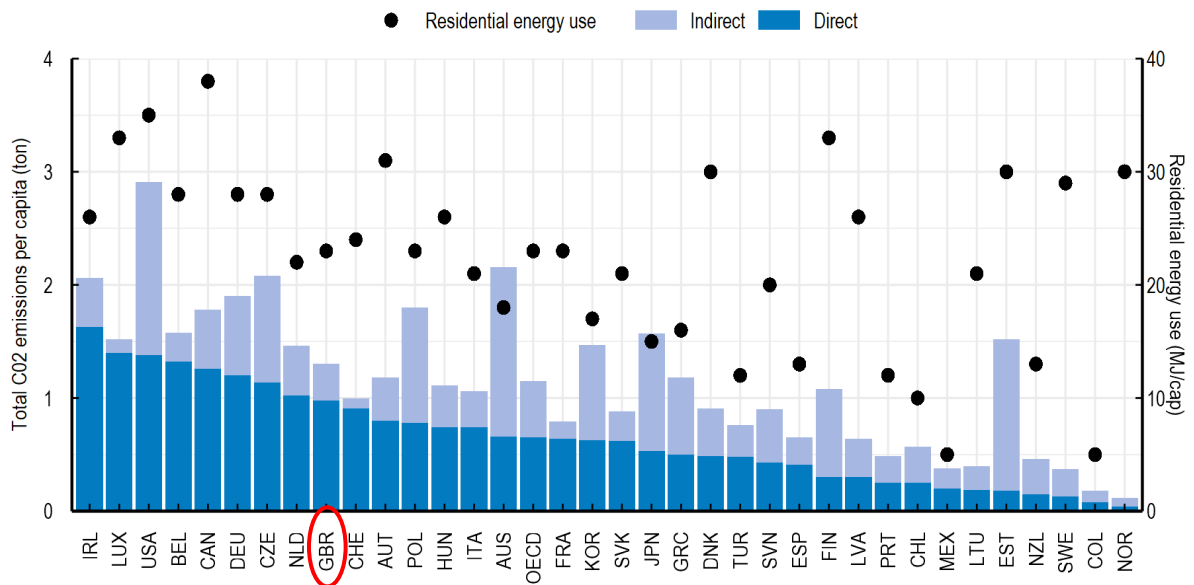
Figure 11 – Despite recent declines, residential GHG emissions remain high
(Residential sector emissions in MtCO₂e, 1990-2023)



Source: [2023 Provisional greenhouse gas emissions data tables](#)

⁸⁸ [Department for Energy Security and Net Zero, Digest of UK Energy Statistics, 2024.](#)

Figure 12 - UK's residential direct CO2 emissions exceed the OECD average
Per capita CO2 emissions (bars, left axis) and residential energy use (dots, right axis)



Source: OECD, Chapter 2 of [Brick by Brick - Vol.2](#) using IEA data and projections. Indirect emissions refer to emissions from electricity generation and district heating.

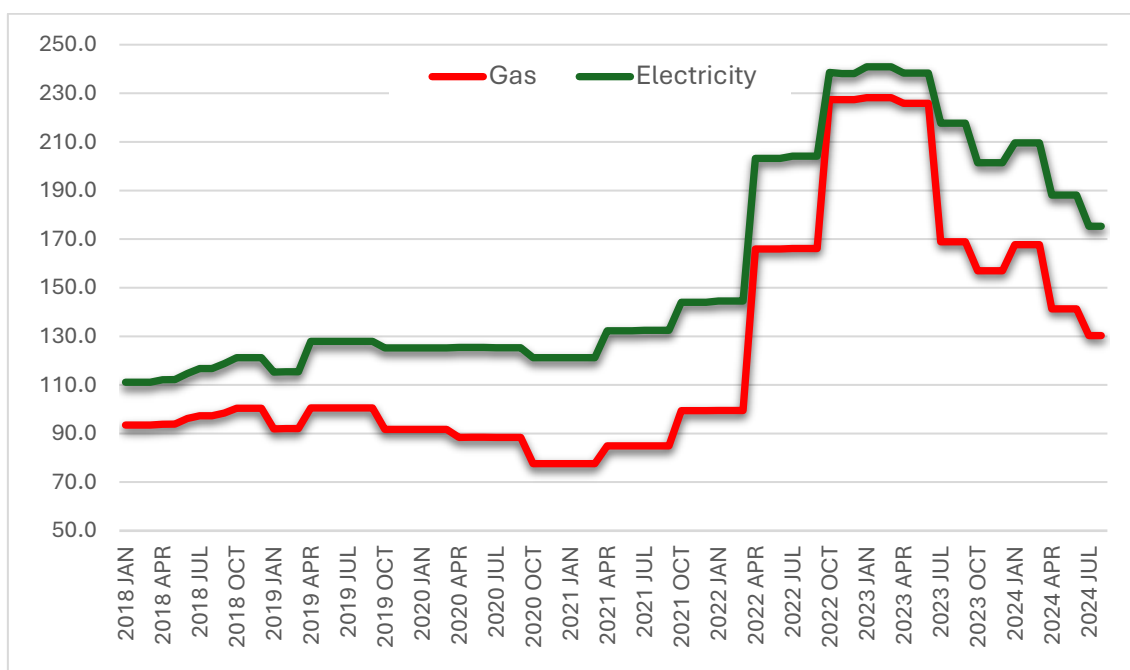
Against this background, this section focuses on the issue of energy affordability in the UK's residential sector, picking up from topics discussed in the power section. It reviews the policy measures that have been implemented over the last few years to address rising bills whilst examining the challenges to accelerating the deployment of low-carbon technologies (e.g., heat pumps). It also discusses the role of energy efficiency in meeting political ambitions to address the “cost of living” crisis.

After a steady decline over the past decade, the number of UK households struggling with soaring energy bills has risen drastically in recent years. This is in large part due to soaring gas and electricity consumer prices since Russia's invasion of Ukraine in 2022 (Figure 13). Public income support schemes introduced by the government have reduced, but not eliminated, the problem. Fuel poverty is a devolved policy area and is defined and measured differently in different parts of the UK.⁸⁹ Not all UK jurisdictions use the same definition, nor do they follow the same calendar for updating their statistics. Using the benchmark of spending more than 10% of income on keeping their home at a satisfactory heating level, National Energy Action estimates that the number of households in fuel poverty across the UK was 6 million as of April 2024 (21% of the total number of UK households).⁹⁰

⁸⁹ [Hinson, S. and Bolton, P., Fuel Poverty, House of Commons Library, 2024.](#)

⁹⁰ [National Energy Action, Fuel poverty statistics explainer, 2024](#)

Figure 13 - Gas and electricity consumer prices remain high
(2015=100, January 2018 to August 2024)



Source: Office of National Statistics

In England, the energy crisis has widened the "fuel poverty gap" significantly.^{91,92} On average, to lift a fuel-poor household out of fuel poverty in England would require a £417 reduction in their energy costs per year. This average fuel poverty gap was 66% higher in real terms in 2023 compared to 2020, marking the highest level recorded since data collection began in 2010.

In Scotland, 31% of all households (791,000 households) were estimated to be in fuel poverty and 19% in extreme fuel poverty^{93,94}. This is higher than the 2019 estimates. Like in England, the energy crisis has led to a sharp increase in 2022 by 65% of the fuel poverty gap for fuel-poor households, which has reached £1,240 for that year. In Scotland, fuel poverty is highly correlated with income poverty: almost all (95%) income poor are also fuel poor. These households tend to live in more energy efficient dwellings than other fuel poor households, potentially because of high energy efficiency standards in the social rented sector. They are more likely to use gas for heating, live on the gas grid and live in urban locations compared to other fuel poor households.

⁹¹ The Department of Energy Security and Net Zero (DESNZ) measures the fuel poverty gap as the reduction in fuel costs needed for a household to not be in fuel poverty. This reduction in fuel costs could stem either from improvements in homes' energy efficiency or from reductions in fuel prices sufficient to make energy use affordable given households' incomes.

⁹² [Department of Energy Security and Net Zero, Annual Fuel Poverty Statistics in England, 2024 \(2023 data\), 2024.](#)

⁹³ [Scottish Government, Scottish House Condition Survey: 2022 Key Findings, 2023.](#)

⁹⁴ In Scotland, households are considered to be in fuel poverty if they need to spend more than 10% of their net adjusted disposable income on energy. Extreme fuel poverty refers to households having to spending more than 20%.

Although they have now declined from record levels in 2022, energy costs remain significantly higher than they used to be (Figure 13). Due to the gradual withdrawal of government support schemes, fuel prices paid by customers remain high. According to the data by the Office of National Statistics for the consumer price index for August 2024, electricity and gas prices were 21% and 31% higher than in January 2022, respectively. As discussed in the power section, due to the links between natural gas and electricity prices it will take time for the lower costs of renewables to feed through to consumer energy bills.

Struggling households have to self-restrain their use. Limiting energy use for heating results in under-heated homes, which can contribute to a range of health issues. National Energy Action highlights that “cold homes can cause or worsen a range of serious health conditions including heart attacks, strokes, bronchitis, and asthma”.⁹⁵ It also estimates that, “each year, around 10,000 people die as a result of living in a cold home. Fuel poverty can also have a significant impact on mental health and is a known risk factor for suicide”.

Many households have built up substantial debt due to the high cost of energy, on top of existing financial burdens. Total energy debt and arrears due by 2.3 million households have increased from roughly £2 bn to £3 bn from 2022 to 2023.⁹⁶ This cost-of-living crisis will not be resolved simply by limited declines in energy prices. A more structural approach, based on a combination of targeted social benefits and help to pay for energy efficiency improvements, will be needed. However, this is easier said than done. Improving affordability, reducing the reliance on gas boilers while lowering emissions will require significant changes.

To help the many households hit by soaring prices while living in homes with poor energy efficiency, the UK government has provided financial support through various schemes. These schemes have included:

- **The Energy Price Guarantee (EPG)** introduced in October 2022 and withdrawn in April 2024 was a government subsidy that brought bills down to £2,500 a year for a typical household. The UK scheme was similar to those introduced in other countries (e.g. France’s “energy price shield”) to protect consumers from skyrocketing energy prices and contain the level of inflation, and its undesirable economic effects. As a result, an average household was estimated to save £1,000 a year. Energy suppliers were fully compensated by the government for the savings delivered to households.
- **The Energy Price Cap** puts an upper limit on the unit rate that suppliers can charge customers on default tariffs (also known as standard variable tariffs). It limits the price per unit of energy that suppliers can charge and aims to prevent households on expensive variable tariffs from overpaying for energy.
- **The [Warm Home Discount Scheme](#)** was first introduced in 2011 to help persons living in Great Britain on low-income and who are vulnerable to cold-related illness or living wholly or mainly in fuel poverty. It has provided a rebate of £150 off electricity bills to approximately 2.2 million households in 2022/23 and is expected to help approximately 2.8 million households in 2023/24.
- The **[Winter Fuel Payments](#)** were first introduced in 1997 and provide an annual, tax-free lump sum payment typically ranging between £200-£300 to pensioners who receive certain entitlement conditions. During 2022/2023 and 2023/24, households received an additional Pensioner Cost of Living Payment of £300 alongside the Winter Fuel Payment.

⁹⁵ [National Energy Action, What is fuel poverty?, n.d.](#)

⁹⁶ [Ofgem, Affordability and debt in the domestic retail market – a Call for Input, 2024.](#)

Around 11.6m people received a Winter Fuel Payment in 2023/24. The new government announced in September 2024 that they will be changing the eligibility for Winter Fuel Payments to those who receive Pension Credit or certain other means tested benefits, reducing it to an estimated 1.5m payments.⁹⁷

- **The Energy Bill Relief Scheme (EBRS).** The Energy Bill Relief Scheme was introduced to provide businesses with a level of protection from rising energy costs over the winter of 2022/23. It was replaced by the Energy Bills Discount Scheme in April 2023 which ended without a successor in March 2024.
- **Other measures** announced to help households through the period of high energy costs included the Council Tax rebate, support to devolved authorities, one-time discounts on bills, the conversion of loans to grants, and one-off payments to people receiving disability benefits and to pensioners.

Government interventions to shield households from the drastic rises in energy prices have come at a steep fiscal cost. The Office of Budget Responsibility has estimated that these interventions over two fiscal years came at a cost for the Treasury of 3.1% of GDP.⁹⁸ Using a slightly different methodology, the IMF has estimated a cost of 4.4% of GDP – among the costliest programme introduced in European countries. The high fiscal cost in the UK reflects the share of natural gas in final energy consumption, a source of energy directly affected by sanctions against Russia that saw a global spike following the invasion of Ukraine, especially in Europe.⁹⁹

Whilst government support measures were critical to slow the rise in fuel poverty, especially for low-income households, interventions have done little to improve resilience to future crises. Sensitivity analysis conducted by the Department for Energy Security and Net Zero (DESNZ) suggests that many more households would have been in situations of fuel poverty if the government had not acted.¹⁰⁰ However, measures were mainly focused on providing financial support, both targeted and non means-tested. Support for measures such as energy efficiency retrofits, which would reduce the extent of household exposure to future fluctuations in gas prices, was minimal.

The majority of government support has now been withdrawn as energy prices have partly retreated from their peaks in 2022, but fuel poverty still remains a substantial issue. Energy prices are still higher than pre-2022 levels, and the problem of household energy debts built up through the crisis will need to be addressed through more targeted measures. Ofgem, the regulator for the sector, has recently called for input from stakeholders on “Future Price Protection” and “Affordability and debt in the domestic retail market” to explore measures that could address issues around fuel poverty.¹⁰¹ In addition, the “Energy Crisis Commission”, composed of energy experts, has been set up to review the impact of high gas prices and ensure the UK is better prepared in the future.

⁹⁷ Mackley, Kennedy, Hobson and Harker, *Changes to Winter Fuel Payment eligibility rules*, House of Commons Library, 2024.

⁹⁸ [Office for Budget Responsibility, An international comparison of the cost of energy support packages, 2023.](#)

⁹⁹ [Office for Budget Responsibility, Economic and fiscal outlook, 2023.](#)

¹⁰⁰ [Department for Energy Security and Net Zero, Annual Fuel Poverty Statistics in England, 2024.](#)

¹⁰¹ [Ofgem, Future Price Protection Discussion Paper, 2024.](#)

As discussed in the power section, energy affordability is a cross-cutting issue over both the power and residential heating sectors. Here, we focus on proposals from stakeholders that address issues with energy affordability relating to heating.

Proposals from stakeholders to address energy affordability issues include:

- **Reforming the Warm Home Discount (WHD), under which the government provides £150 per year to eligible households.**¹⁰² The WHD offers targeted support for energy bills over the winter to households in need, but current levels of support are lower than the typical household pays in levies. Doubling the support for the most vulnerable households, as well as tiering support to a wider range of households, would ensure that energy bills are affordable for those most in need.
- **Reform the Energy Price Cap to tier energy prices using a social tariff, which could address the higher share of expenditure on energy by low-income households.**¹⁰³ Degrees of support for energy prices would depend on income and/or energy consumption, providing lower cost energy to the lowest-income households. It would also disincentivise excessive energy use by those who can afford it, helping reduce overall energy demand. Separate electricity tariffs could apply for those with an EV, so not to disincentivise the uptake of low-carbon technologies with high electricity demands.
- **Improve the targeting of payments to ensure that fuel-poor households are sufficiently supported, using a broader suite of indicators for fuel poverty than just benefits or income.**¹⁰⁴ A criticism of the new government's decision to means-test the Winter Fuel Payments was that some pensioners on low-incomes but would lose out due to not being eligible for pension credit and/or were eligible but not under receipt due to difficulties in applying. Targeting support schemes based on a suite of indicators (e.g., energy consumption, income, energy efficiency of homes) would ensure that fuel-poor households are supported effectively.

Shifting away from the use of natural gas for home heating will be key both to ensuring energy affordability and decarbonising the residential sector. The UK government is committed to decarbonising the sector as part of its legal target of net zero by 2050, but there are substantial barriers to the rollout and retrofitting of new technologies that need to be overcome. Achieving the target will require large investments, with the retrofitting of an estimated 25 million homes.¹⁰⁵

Similar to surface transport, whether decarbonisation will take place at the speed required will depend on consumers' investment decisions. The deployment of energy efficiency measures and replacement of gas-based central heating with clean sources of heat depends on landlords or homeowners. They face upfront costs when making these investments, while savings only occur over a multi-year period and with significant uncertainty over the extent and how quickly investments will eventually pay off. This uncertainty is likely to have contributed to under-investment in home retrofits. A multi-pronged strategy by the government is needed to address these challenges.

¹⁰² [EnergyUK \(2024\), Taking Immediate Action to Make Bills Affordable this Winter.](#)

¹⁰³ [Cornwall Insight, What are social tariffs and why might we need them, 2023.](#)

¹⁰⁴ [Committee on Fuel Poverty \(2024\), Can Fuel Poverty Be Ended? Annual Report 2024.](#)

¹⁰⁵ [Li, X., H. Arbabi, G. Bennett, T. Oreszczyn, and D. Densley Tingley \(2022\), "Net zero by 2050: Investigating carbon-budget compliant retrofit measures for the English housing stock", Renewable and Sustainable Energy Reviews, Volume 161, 2022.](#)

In 2020, the government released its UK Energy Performance Certificate (EPC) action plan aimed at making energy performance data more accurate, reliable, and accessible. Understanding current energy performance will be crucial to informed decisions on energy efficiency measures by consumers, ensuring improvements are appropriate to them and to the property. The new Labour government has committed to an EPC target of Band C by 2030 for landlords, aiming to address the lack of control that tenants in the private rental sector have over home efficiency measures. However, there are concerns that landlords will be unable to meet these targets based on current rates of retrofitting.¹⁰⁶

Electrified technologies (e.g., heat pumps) will play an essential role in decarbonising residential energy consumption. Gas boilers will need to be replaced with an electrified heating system, which when taken together with the commitment to decarbonise electricity production by 2030, would ensure widespread decarbonisation of the sector. Ofgem recommends the widespread use of heat pumps in residential buildings both to reduce emissions and to cut the cost of running heating systems. However, high upfront costs for heat pumps mean that for many households they are currently not an option. Historic rates of deployment have fallen far below what is needed to reach the previous government's target of 1.6 million annual installation of heat pumps by 2035.¹⁰⁷

Cost savings from heat pumps under current market prices is heavily dependent on heat pump performance, which varies significantly.¹⁰⁸ It depends on the heating system configuration, installation, and control, on the building fabric, and user operation. In addition, heat pumps are only efficient in well insulated buildings. Deep retrofit of lower quality older UK homes are required for heat pumps to deliver the anticipated energy consumption reduction and energy bill benefits. Training contractors to deliver these retrofits adequately is essential to ensure that they work along the technical characteristics required for the efficient operations of heat pumps.

The UK government currently provides the following schemes in support of the rollout of clean technologies and energy efficiency retrofits:

- **Boiler Upgrade Scheme.** The Boiler Upgrade Scheme provides grants of up to £7500 towards the upfront costs of installing heat pumps and biomass boilers, with the intention to stimulate demand across the industry and ultimately bring down overall costs. Over 90% of applications and grants have been for air-source heat pumps. Evidence suggests, however, the remaining cost after the grant is still a considerable barrier to heat pump uptake in less well-off households.
- **Social Housing Decarbonisation Fund and the Home Upgrade Grant.** The UK government is allocating dedicated funding to local authorities, providers of social housing and charities to subsidise energy-efficient home retrofits, with a focus on social housing, through both its Home Upgrade Grant scheme and the Social Housing Decarbonisation Fund (SHDF). This includes loft insulation and new windows. Funding is also awarded to reduce carbon emissions of hospitals, schools, museums, universities and other public sector buildings across England.
- **The Great British Insulation Scheme** (previously the ECO+ scheme) aims to upgrade the least energy efficient homes in England, Wales and Scotland. The scheme provides

¹⁰⁶ [Tom Dunstan, *Landlords will struggle to meet government's EPC target*, Financial Times, 2024.](#)

¹⁰⁷ [National Audit Office, *Low heat pump uptake slowing progress on decarbonising home heating*, 2024.](#)

¹⁰⁸ [Carroll, P., M. Chesser, and P. Lyons \(2020\), *Air Source Heat Pumps field studies: A systematic literature review*, Renewable and Sustainable Energy Reviews, Volume 134, 2020.](#)

for free or cheaper home insulation to limit unnecessary heat loss and helps to keep homes warm for longer. The process is arranged by the energy supplier, which gets the funding directly from the government. Households can be eligible depending on their income and the energy performance of the house where they live.

- **ECO4** is an Energy Company Obligation, with government funding, mandating energy suppliers to work toward a minimum energy efficiency for private rentals.
- Businesses are also eligible for various subsidies, tax incentives, and green loans to help with their building retrofits.

A multi-faceted approach will be needed to transform the energy use in residential buildings. Many policies can steer the residential building sector in the direction of affordable, secure and clean energy – but none of these instruments can do it alone. It is the combination of various policies, in a pragmatic way and based on regular evidence-based evaluation that can help to make progress. A carbon tax would help because the use of gas in the UK residential sector is almost untaxed – as opposed to the practice in Scandinavian countries, Switzerland, Italy and Germany. Energy regulations such as boiler bans are unpopular and can result in distortions and excess costs. Subsidies are welcome by homeowners and contractors, but can help investment that would have happened anyways, and come at a cost for public budgets. Governments can also impose regulations requiring landlords to retrofit rented homes – as currently done in France – but landlords can be cash strapped. Financial regulation can help to reduce credit constraints, although there is a risk of rent seeking by banks. Combining all these policies reduce these risks and allow governments to adapt to changing circumstances and adjust policies in view of prior experience.

Measures proposed by stakeholders to help accelerate the rollout of low-carbon technologies and energy efficiency measures in the housing sector include:

- **Phase out the installation of gas boilers in new homes.**¹⁰⁹ Gas boilers are no longer allowed in newly-built homes from 2035, where alternative technologies such as heat pumps must be used. In existing homes, used gas boilers can be replaced with new ones until 2035. The former government led by Prime Minister Rishi Sunak relaxed this plan, with 20% of premises exempt from the ban. The Climate Change Committee has recommended to remove this exemption of 20% of premises from the 2035 phase-out of new gas boilers. to speed up of the pace of decarbonisation of home energy use, but it is unclear whether the new Labour government will act upon this recommendation.
- **Reform the Boiler Upgrade Scheme to provide better levels of support for low-income households.**¹¹⁰ Take up of the Boiler Upgrade Scheme has been focused in high-income regions and there are concerns that upfront costs are too high for many households even with the help of the grant. Whilst the grant was increased to £7,500 in 2023, it is still provided without any forms of means testing, meaning that the economic savings from heat pumps are limited to high-income households who can afford the upfront costs of heat pumps remaining after the grant is applied.
- **Provide low-interest loans for domestic energy efficiency measures to householders.**¹¹¹ Whilst the government has provided support for low-carbon

¹⁰⁹ Climate Change Committee, *Progress in reducing emissions: 2024 Report to Parliament*, [2024](#).

¹¹⁰ Baroness Parminter, *Letter to Lord Callanan: The Boiler Upgrade Scheme and the wider transition to low-carbon heat*, [2023](#).

¹¹¹ House of Commons Environmental Audit Committee, *Energy Efficiency of Existing Homes*, [2021](#).

technologies such as heat pumps through the Boiler Upgrade Scheme, there has been limited provision of support for energy efficiency investments by homeowners and/or landlords. The last scheme that addressed this was the Green Homes Grant, which ended in 2021. High upfront costs of energy efficiency measures and long payback periods are a substantial barrier to investments. Provision of low or zero rate financing for energy efficiency measures, which has been successful in countries such as France and Germany, would address this barrier.

- **Prioritise financial support for energy efficiency measures for low-income and fuel-poor households.**¹¹² The new government has committed to investing an extra £6.6 billion in energy efficiency measures over five years, a doubling on previous levels, but it is unclear how the investment will be used or which households it will support. With the highest expenditures as a share of income on energy consumption across all income levels, support and investment into energy efficiency measures should be prioritised for low-income households.
- **Invest in a government-run campaign to help widen household awareness levels of heat pumps and home heating decarbonisation.**¹¹³ The Department for Energy Security and Net Zero is yet to release a long-term plan to address low levels of awareness amongst households about the steps required to decarbonise home heating. As progress will be strongly dependent on consumer decisions, awareness of low-carbon technologies such as heat pumps will be important to the rate of the transition.
- **Work together with education providers and industry stakeholders to address the skills and training gap for heat pump and retrofitting installations.** A report from the think tank Nesta found that the second largest challenges for heat pump installers, after a lack of demand, was an inability to find suitably qualified staff.¹¹⁴ Between 4,000 and 6,000 installers need to be trained up every year to meet the government's heat pump targets for 2030, compared to about 3,000 trained annually in 2023.

¹¹² [National Energy Action, *Energy Crisis: Two Years In – Urgent Action on Fuel Poverty Policy*, UK Fuel Poverty Monitor, 2023.](#)

¹¹³ [National Audit Office, *Low heat pump uptake slowing progress on decarbonising home heating*, 2024.](#)

¹¹⁴ [Nesta, *How to install more heat pumps: insights from a survey of heating engineers*, 2024.](#)

REFERENCES

- Climate Change Committee, *The Sixth Carbon Budget*, 2020.
- Baringa Partners, *UK Renewables Deployment Supply Chain Readiness Study*, 2024
- Baroness Parminter, *Letter to Lord Callanan: The Boiler Upgrade Scheme and the wider transition to low-carbon heat*, House of Lords Environment & Climate Change Committee 2023
- Bolton & Stewart, *Domestic Energy Prices*, House of Commons Library, 2024.
- Carroll, P., M. Chesser, and P. Lyons (2020), Air Source Heat Pumps field studies: A systematic literature review, *Renewable and Sustainable Energy Reviews*, Volume 134, 2020
- Climate Change Committee, *Progress in Reducing Emissions: 2023 Report to Parliament*, 2023
- Climate Change Committee, *UK Action on Climate Change*, 2024
- Cornwall Insight, *What are social tariffs and why might we need them*, 2023
- Department for Business, Energy & Industrial Strategy. *Evaluation of the Contracts for Difference Scheme*, 2022.
- Department for Business, Energy & Industrial Strategy. *Participating in the UK ETS*, 2024
- Department for Energy Security & Net Zero, *Great British Energy founding statement*, 2024
- Department for Energy Security and Net Zero, *Annual Fuel Poverty Statistics in England*, 2024
- Department for Energy Security and Net Zero, *British Energy Security Strategy*, 2022
- Department for Energy Security and Net Zero, *Chris Stark to lead Mission Control to deliver clean power by 2030*, 2023
- Department for Energy Security and Net Zero, *Digest of UK Energy Statistics*, 2024
- Department for Energy Security and Net Zero, *Energy consumption in the UK*, 2023
- Department for Energy Security and Net Zero, *Energy Trends*, 2024
- Department for Energy Security & Net Zero, *Great British Energy founding statement*, 2024
- Department for Energy Security and Net Zero, *UK Electricity capacity and generation by fuel between 1920 and 2020*, 2023
- Department for Energy Security & Net Zero, *2023 UK greenhouse gas emissions, provisional figures*, 2024
- Drax Electric Insights
- Electricity Networks Commissioner, *Accelerating electricity transmission network deployment*, 2023
- Ember, *Cutting the bills: UK households profit from clean power*, 2023
- EnergyUK, *How to prevent an investment hiatus in UK low-carbon generation*, 2023
- EnergyUK, *Mission Possible: The steps to make Britain a clean energy superpower*, 2024
- EnergyUK, *Spring Budget 2024 Energy UK Submission*, 2024
- Environmental Audit Committee, *Seeing the Wood for the Trees: The Contribution of the Forest and Timber Sectors to Biodiversity and Net Zero goals*, 2023
- European Commission, *CO₂ emission performance standards for cars and vans*, 2019
- European Commission, *Commission imposes provisional countervailing duties on imports of battery electric vehicles from China while discussions with China continue*, 2024
- Evans and Vissainen, *Analysis: UK Electricity from Fossil Fuels Drops to Lowest Level Since 1957*, 2024.

Fichera, Eleonora, Habtamu Beshir, and Andrea Serna Castaño, *Low Emission Zones improve air quality, physical health and mental well-being*, IPR Policy Brief, University of Bath, 2023

Global Sustainable Mobility Partnership, *Policies for a mature, flourishing EV charging ecosystem*, 2021

Hinson, S. and Bolton, P., *Fuel Poverty*, House of Commons Library, 2024

HM Government, *Taking charge: the electric vehicle infrastructure strategy*, 2022

HM Treasury, Chancellor statement on public spending inheritance, 2024

House of Lords, *Long-Duration Energy Storage: Get On With It*, 2024

Imperial College London, *Electricity Bill Charges*, 2024

Institute for Fiscal Studies, *Constraints and trade-offs for the next government*, 2024

International Energy Agency, *Global EV Outlook 2024*, 2024

International Energy Agency, *Policy Tracker: Critical Minerals Facility*, 2023

International Energy Agency, *The Role of Critical Minerals in Clean Energy Transitions*, 2021

Johnson et al., Evaluating Clean Electricity Transition progress across UK Political Pledges and G7 countries, *Energy Strategy Reviews*, 2024

Labour Party, *Make Britain a Clean Superpower*, 2023

Li, X., H. Arbabi, G. Bennett, T. Oreszczyn, and D. Densley Tingley (2022), "Net zero by 2050: Investigating carbon-budget compliant retrofit measures for the English housing stock", *Renewable and Sustainable Energy Reviews*, Volume 161, 2022

Lichtin, Florian & Smith, E. Keith & Axhausen, Kay W. & Bernauer, Thomas. "How much should public transport services be expanded, and who should pay? Experimental evidence from Switzerland," *OSF Preprints*, 2024

Maarraoui, G., Wossink, G., Saliba, F., & Marrouch, W., *Willingness to Pay for Clean Air: Evidence from the UK*. (WP/23/35 ed.) International Monetary Fund, 2023

Mackley, Kennedy, Hobson and Harker, *Changes to Winter Fuel Payment eligibility rules*, House of Commons Library, 2024

National Audit Office, *Low heat pump uptake slowing progress on decarbonising home heating*, 2024

National Audit Office, *Update on the Rollout of Smart Meters*, 2023

National Energy Action, *Energy Crisis: Two Years In – Urgent Action on Fuel Poverty Policy*, UK Fuel Poverty Monitor, 2023.

National Energy Action, *Fuel poverty statistics explainer*, 2024

National Grid ESO, *Demand Flexibility Service*, 2024

National Grid, *Beyond 2030*, 2024

National Grid, *Monthly Electricity Statistics*, 2024

National Infrastructure Commission, *Strategic Energy Reserve*, 2023

Nesta, *How to install more heat pumps: insights from a survey of heating engineers*, 2024

New Economics Foundation, *Government could Reduce Bills for Almost 90% of Households with a National Energy Guarantee*, 2023

Office for Budget Responsibility, *An international comparison of the cost of energy support packages*, 2023

Office for Budget Responsibility, *Economic and fiscal outlook*, 2023

Office for National Statistics, *Cost of Living Insights*, 2024

Office for National Statistics, *Family spending in the UK: April 2021 to March 2022*, 2023

Ofgem, *Affordability and debt in the domestic retail market – a Call for Input*, 2024

Ofgem, *Debt and Arrears Indicators*, 2024

Ofgem, *Future Price Protection Discussion Paper*, 2024

Ofgem, *Interconnectors*, 2024

Ofgem, *Transmission Network Use of System Charges*, 2022

Ofgem, *Wholesale Market Indicators*, 2024

OpenExp, *European Energy Poverty Index*, 2019

RenewableUK, *Roadmap to Net Zero: A Manifesto for a Fully Decarbonised Power System by 2035*, 2022

Science, Innovation and Technology Committee, *Delivering Nuclear Power*, 2023

Scottish Government, *Scottish House Condition Survey: 2022 Key Findings*, 2023

Society of Motor Manufacturers and Traders (SMMT), *MOTOR INDUSTRY FACTS 2023*, 2023

Society of Motor Manufacturers and Traders (SMMT), *A VAT cut for private EV consumers will put Britain ahead of the competition*, 2024

Society of Motor Manufacturers and Traders (SMMT), *Car industry urges 'fair tax for a fair transition' to put EVs back in the fast lane*, 2024

Society of Motor Manufacturers and Traders (SMMT), *EVs drive down carbon emissions and lift vehicle ownership to record high*, 2024

Society of Motor Manufacturers and Traders (SMMT), *Motor Vehicles in Use*, 2023

Society of Motor Manufacturers and Traders (SMMT), *Motorparc 2023*, 2023

Society of Motor Manufacturers and Traders (SMMT), *New car market hits 'million motors' milestone at half year*, 2024

The Health Foundation, *Trends in households without access to a car*, 2024

Tom Dunstan, *Landlords will struggle to meet government's EPC target*, Financial Times, 2024

Transport and Environment, *Briefing: Successful Transport Decarbonisation*, 2024

Transport and Environment, *Capital Gains*, April 2024

Transport and Environment, *From Early Adopters to Early Majority: Accelerating the Electrification of Cars*, Research report, Briefing Note, 2024

Transport for London, *Congestion Charge*, n.d.

UK Department of Transport, *Modal Comparisons*, 2023

UK Department of Transport, *National Travel Survey 2022: Household car availability and trends in car trips*, 2023

UK Department of Transport, *Pathway for zero emission vehicle transition by 2035 becomes law*, 2024