Cross-Departmental Coordination in the UK's Net-Zero Transition: Progress, Challenges and Insights

Po Hu*

University of Manchester, Manchester, UK

*Corresponding author's email: hupo2027@163.com

Abstract. As the UK's transition to net zero continues, significant disparities in emissions reduction progress have emerged across different industrial sectors. The **electricity** and **industrial** sectors have achieved substantial reductions, while the **transport** and **building** sectors have transformed more slowly. Against a backdrop of relatively mature technological pathways and policy frameworks, these disparities are more indicative of a lack of coordination between departments than of an insufficient technical capability in any one area. Based on this, this paper provides a systematic review of the key policy developments and actual emissions reduction performance in the UK's electricity, transport, buildings, and industrial sectors since 2008. Drawing on government reports, academic research, and news sources, the paper analyses the main obstacles to cross-sectoral coordination and potential solutions. Research indicates that, to achieve sustained and effective emissions reductions, it is essential to enhance integrated governance and collaborative capabilities across all sectors.

Keywords: cross-sectoral coordination, net-zero transition, UK decarbonization, electricity, transport, buildings, industry.

1 Introduction

For many years, the United Kingdom has regarded the transition toward a low-carbon society and economy as a long-term development objective, centred on sustained reductions in greenhouse gas emissions. As can be seen from Fig. 1, the United Kingdom has made significant progress in emissions reductions in recent years, though these achievements are unevenly distributed across different sectors. According to official government statistics, the power and industrial sectors saw emissions fall much more quickly, while progress in the transport and building sectors remained slow by comparison, highlighting the ongoing structural differences in decarbonisation pathways across sectors.

Adapted from Department for Energy Security and Net Zero (DESNZ), "2024 UK Greenhouse Gas Emissions, Provisional Figures", GOV.UK, 2025, under the Open Government Licence v3.0.

Many studies have already discussed this uneven pattern of emission reduction and have examined the trends in different sectors as well as the technological approaches

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used in each of them from various perspectives [1-4]. However, the potential for reducing emissions through cross-sector collaboration, and the possible links between these sectors, have received limited attention to date. Furthermore, the question of how emission reduction measures across different sectors interact with one another remains insufficiently explored under the current policy framework.

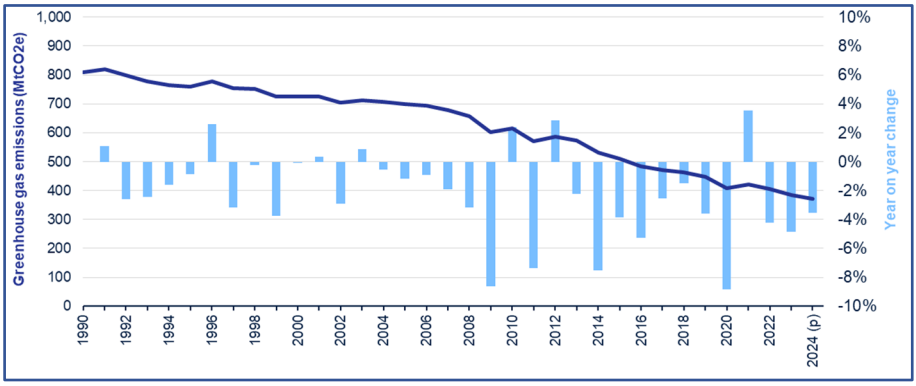

Fig. 1. Trends in UK territorial greenhouse gas emissions and year-on-year changes, 1990–2024.

This study examines the progress of emission reductions in four key sectors — electricity, transport, buildings, and industry — in order to analyse the United Kingdom's transition to a low-carbon economy. It primarily references UK government policy documents on emissions reduction issued since 2008, as well as research reports published by environmental organisations and academic institutions, and relevant news materials. The study provides a structured analysis of the UK's progress in its transition to a low-carbon economy, and aims to serve as a reference for researchers and practitioners in related fields.

2 The United Kingdom Low Carbon Policy Framework

From 2008 to 2012, the United Kingdom began systematically formulating greenhouse gas emission reduction targets and establishing a relevant legal and policy framework. The Climate Change Act 2008 stipulated an 80% emissions reduction by 2050 compared to 1990 levels and introduced a legally binding carbon budget system. The UK Low Carbon Transition Plan published (2009) outlined a national low-carbon strategy, while the 2011 Carbon Plan refined sectoral targets and cross-departmental policies.

From 2013 to 2018, the UK embedded decarbonisation in the electricity system and extended targets to other sectors. The Energy Act 2013 supported electricity market reform and low-carban investment. The Clean Growth Strategy published in 2017 expanded the focus beyond the electricity sector to encompass broader economic domains.

From 2019 to 2022, the UK shifted to a formal net-zero framework. In 2019, the Climate Change Act was amended to enshrine a 2050 net-zero target in law. A series of sectoral action plans followed, and the Net Zero Strategy integrated departmental pathways to provide a unified policy framework.

Since 2023, policy has gradually shifted from a focus on strategy and planning towards a greater emphasis on practical implementation and delivery. the government refined delivery measures for carbon budgets and updated endrgy regulation. Current efforts emphasise improving the feasibility and enforcement of existing decarbonization pathways.

3 Advancements in Emissions Mitigation by Sectors

3.1 Electricity Sector

The electricity sector is a fundamental to UK decarbonization, enabling electrification in transport, buildings, and industry. In 2024, the sector emitted 37.5 MtCO2e, accounting for 10% of total emissions. Carbon dioxide constituted 98% of these emissions.

As Fig. 2 shows, emissions fell by 82% between 1990 and 2024, driven by coal-to-gas switching and rapid growth of wind and solar. By 2024, coal accounted for just 1% of power generation fuels, while nuclear and renewables reached 60%.

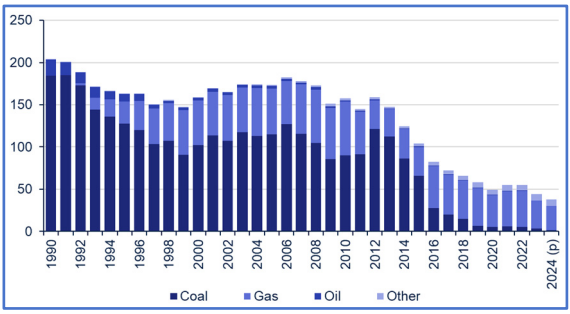

Fig. 2. Greenhouse gas emissions from electricity supply, UK, 1990-2024 (MtCO2e).

Data adapted from the Department for Energy Security and Net Zero (DESNZ), "2024 UK Greenhouse Gas Emissions, Provisional Figures", GOV.UK, under the Open Government Licence v3.0.

The UK aims for around 95% low-electricity by 2030, supported by renewables, hydrogen, and CCUS. To address infrastructure bottlenecks, the government plans to accelerate gird connections and approvals, targeting £40 billion annual energy investment by 2030.

However, cross-departmental coordination gaps remain severe. Grid connection delays stretch to 10–15 years, with average waits exceeding five years, slowing renewable deployment and hindering end-use electrification. Rising equipment costs, inflation, and higher interest rates have also increased investment pressure, raising transition costs across sectors.

Overall, the electricity sector provides the UK decarbonization. Its capacity and cost structure directly determine the pace of transport, construction, and industrial sectors. However, generation-side progresse alone is insufficient, Grid bottlenecks and investment uncertainty highlight the need for stronger coordination between supply and demand-side sectors.

3.2 Transport Sector

The transport sector has long been the UK's largest emissions source, accounting for around one-third of total emissions, with road vehicles responsible for 98% of CO_2. From 1990 to 2024, transport emissions fell by only around 15%, far behind the electricity sector's 82% reduction.

As shown in Fig. 3, Emissions rose until 2007, then gradually declined, returning to 1990 levels by 2019. They remain below pre-pandemic levels, with a further 2% reduction in 2024. Slow progress reflects fossil fuel dependence, long vehicle replacement cycles, limited infrastructure, and travel behaviour inertia.

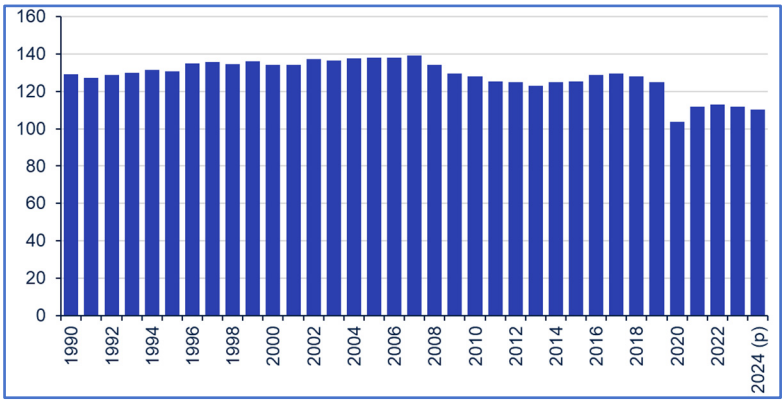

Fig. 3. Greenhouse gas emissions from domestic transport, UK, 1990-2024 (MtCO2e).

Data adapted from the Department for Energy Security and Net Zero (DESNZ), "2024 UK Greenhouse Gas Emissions, Provisional Figures", GOV.UK, under the Open Government Licence v3.0.

Policy responses focus on electrification: a 2035 ban on new petrol and diesel cars, rising zero-emission vehicle sales mandates, the Renewable Transport Fuel Obligation, and electric vehicle purchase grants. The UK also plans 300,000 public charging points.

Public transport electrification is also expanding, with funding for electric buses in city regions to improve air quality and urban mobility.

Ultimately, transport decarbonisation depends heavily on external systems. While electrification is technically mature, its impact is constrained by grid capacity, electricity carbon intensity, charging infrastructure, and low-carbon supply chains. Slow progress thus reflects coordination challenges rather than technological limits. Deeper cuts require cross-sector collaboration with electricity and industry.

3.3 Building Sector

As shown in Fig. 4, the building sector accounted for over 21% of UK emissions in 2024, mainly from natural gas for heating, with CO_2 making up 93% of emissions. Between 1990 and 2024, emissions fell by around 27%.

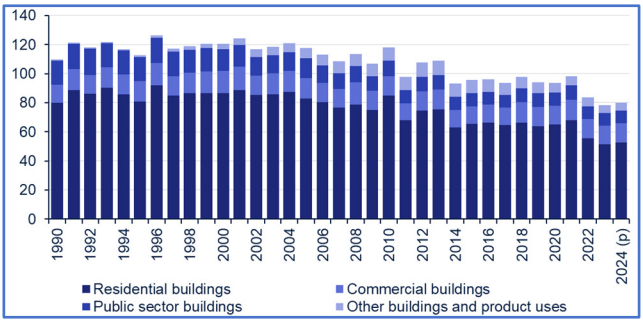

Fig. 4. Territorial greenhouse gas emissions from buildings and product uses, UK, 1990-2024 (MtCO2e).

Data adapted from the Department for Energy Security and Net Zero (DESNZ), "2024 UK Greenhouse Gas Emissions, Provisional Figures", GOV.UK, under the Open Government Licence v3.0.

The building sector links energy supply and end use, with strong connections to power, transport, and industry. Although energy efficiency has improved, progress has slowed since 2014, with large regional and age-based disparities. Over 60% of homes were built before 1960, making large-scale retrofitting essential. However, policy and funding instability have limited consistent action.

Key policies focus on reducing demand and decarbonising heating: subsidies for low-carbon heating systems, insulation upgrades, support for vulnerable households, stricter new-build standards, and low-carbon heating regulations.

At the urban level, buildings interact closely with other sectors. Urban form and density shape travel demand, while rooftop solar and vehicle-to-grid systems strengthen building–transport–energy synergies. Building-related emissions also depend on low-carbon materials from industry.

The building sector faces severe structural constraints: long asset lifetimes, fragmented ownership, and reliance on external systems. Further progress requires coordinated action across power planning, industrial supply chains, urban design, and social policy, not just building-focused measures.

3.4 Industrial Sector

Emissions from the industrial sector include emissions from industrial sites, fuel combustion and production processes. As shown in Fig. 5, In 2024, the industrial sector accounted for 13% of UK emissions, 97% as CO_2. Since 1990, industrial emissions have fallen by 69%.

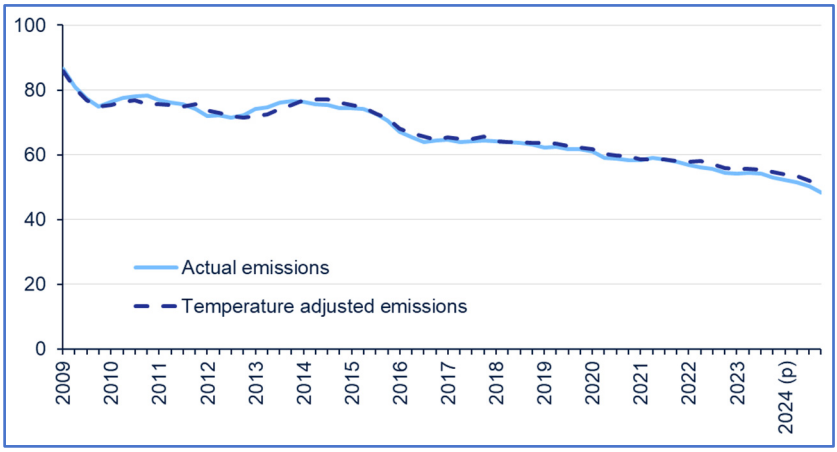

Fig. 5. Actual and temperature adjusted greenhouse gas emissions from the industry sector, UK, year ending Q1 2009-year ending to Q4 2024 (MtCO2e).

Data adapted from the Department for Energy Security and Net Zero (DESNZ), "2024 UK Greenhouse Gas Emissions, Provisional Figures", GOV.UK, under the Open Government Licence v3.0.

Industry both emits large volumes of GHGs and supplies materials and equipment that determine lifecycle emissions in other sectors. UK industry is diverse, with very different profiles for energy-intensive industries and lighter manufacturing. Past emission reductions reflect efficiency gains, fuel switching, structural change, and offshoring of high-energy activities [5].

Key abatement approaches include improved efficiency, waste heat recovery, and combined heat and power (CHP). For deeper long-term cuts, the UK prioritises CCUS and low-carbon hydrogen. CCUS is viewed as critical for hard-to-abate sectors such as steel, cement, and chemicals, but faces high costs, financing risks, and infrastructure challenges. Blue hydrogen depends on effective carbon capture and methane control, while green hydrogen relies on affordable renewable electricity, which remains costly in the short term [6,7].

Industry thus plays a dual role: a major emissions source and an enabler of cross-sector decarbonisation. Future reductions depend on integrated energy and infrastructure systems, requiring coordinated planning across electricity, transport, and buildings.

4 Discussion

4.1 Uneven Decarbonisation Across Sectors

UK emission reduction progress is highly uneven. Electricity has decarbonised rapidly, providing a platform for system-wide electrification. Transport and buildings have lagged despite available technologies. Industry has achieved large cuts through efficiency and structural change but now needs system-integrated technologies.

These differences show that sectoral performance no longer depends primarily on individual technological maturity, but on cross-sector interactions around electricity supply, infrastructure, and industrial supply chains.

4.2 The Growing Necessity of Cross-sectoral Coordination

The UK net-zero transition now requires multi-system coordination. Electrification in transport and buildings depends on clean power, grid capacity, and flexibility. Meanwhile, end-use decarbonisation is constrained by batteries, low-carbon materials, and clean heating supply chains.

Inadequate coordination has slowed progress: grid delays, patchy charging infrastructure, slow retrofitting, and uncertainty around hydrogen and CCUS. Future success will depend less on sector-specific targets and more on integrated infrastructure planning, industrial investment, and cross-departmental governance.

These findings reveal three key insights:

(1) The effectiveness of emissions reductions in each department depends on system-level coordination.

(2) The infrastructure is becoming an increasingly critical bottleneck.

(3) Industrial supply chains are pivotal to all sectors.

5 Conclusion

This study reviews decarbonisation progress in the UK's electricity, transport, buildings, and industrial sectors, with a focus on cross-sector interactions. It finds that the net-zero transition can no longer be pursued in sectoral silos, as reductions increasingly depend on system-wide coordination. Uneven progress reflects gaps in electricity system rollout, infrastructure coordination, and industrial supply chain transformation.

The core contribution is to interpret uneven decarbonisation through the lens of cross-departmental coordination. Slow progress in transport and buildings is not primarily technological, but stems from insufficient inter-sector support. This highlights that future abatement depends on system-level governance rather than isolated sectoral improvements.

The study has limitations. It focuses on four sectors, excluding agriculture, land use, waste, and regional governance. It relies on aggregated data rather than household, corporate, or local micro-behaviours.

Nevertheless, the UK has built a leading net-zero policy framework and achieved strong reductions in electricity and industry. The challenges identified reflect the rising difficulty of system coordination, not weak ambition.

Future progress will depend less on standalone technological breakthroughs and more on stable, long-term cross-sector governance. A coordinated framework centred on clean electricity, integrated infrastructure, and low-carbon industrial supply chains is essential for sustained decarbonisation. While focused on the UK, the coordination challenges identified are widely relevant for countries pursuing net-zero targets.

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