Written evidence submitted by the Energy Demand Research Centre and the UK Energy Research Centre (BAE0048)

1 What is the potential for industry to electrify by 2030 and 2050?

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1.1. The potential for widespread industrial electrification by 2030 is limited, but substantially greater by 2050 if structural and organisational barriers are addressed. Our ongoing research with industry stakeholders suggests that, at present, electrification is seen as an important future route to decarbonisation, but the business case for investment is difficult to justify.

Structural barriers to 2030

1.2. Two well-documented[1] structural barriers are slowing uptake: high industrial electricity prices relative to the rest of the world, including the high differential (spark gap) between gas and electricity prices; and constraints on grid capacity and subsequent long connection times.[2]

1.3. Our ongoing research also suggests high upfront capital costs deter investment. Stakeholders perceived the loss of the Industrial Energy Transformation Fund as signalling reduced government interest in industrial decarbonisation. Companies with the motivation and capital to electrify report they are prioritising electrification at sites outside the UK.

Organisational barriers to 2030

1.4. The potential for electrification at site level varies across industrial sectors, reflecting differences in technology readiness. The food and drink and paper and pulp sectors are strong near-term prospects for electrification through high temperature heat pumps (HTHPs) which are a mature technology.

1.5. Our ongoing research on HTHP adoption suggests a key barrier is integration. Limited information on existing site energy use makes integration challenging, while changes to equipment, operating practices and safety procedures place additional demands on engineering and maintenance teams. These challenges are compounded by wider manufacturing skills gaps.[3]

1.6. Firms want evidence that HTHPs can operate reliably at scale without compromising product quality or operating economics. Demonstration projects remain limited, while feasibility studies and external technical advice involve incurring upfront costs before firms know whether investment will be commercially viable. Larger firms with greater financial and technical capacity are therefore better placed to explore industrial electrification.

1.7. This creates a particular challenge in the food and drink sector, which is the UK's largest manufacturing sector by sales. However, 98.8% of firms in the sector are SMEs,[4] meaning a sector with some of the strongest near-term technical potential for electrification may have relatively limited organisational capacity to realise it.

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[1]UK Government (2024), *Enabling Industrial Electrification: Summary of Responses*.
[2]Gailani, A. and Taylor, P. G. (2025), Assessing electricity network capacity requirements for industrial decarbonisation in Great Britain, *Energy Policy*, 201, 114559.https://doi.org/10.1016/j.enpol.2025.114559
[3]Make UK (2025), *Skills for Success: The Reforms Essential to Our Economic Future*.
[4]UK Government (2025), *Food Statistics in Your Pocket*.

1.8. Uneven policy coverage is a further barrier. The Modern Industrial Strategy does not identify food and drink as a priority sector, despite its significant industrial energy use. Our stakeholder research suggests this weakens investment signals.

Potential to 2050

1.9. Realising the greater potential for electrification by 2050 will require action on these structural barriers, alongside skills investment, demonstration projects, SME support and policy direction.

1.10. The key challenge is timing. Industrial investment decisions are timed according to asset replacement cycles. Our research shows that the next few years are a critical period for UK energy-intensive industries. Many key industrial assets are reaching major reinvestment points after decades of operation. Because these decisions are typically made only every 25 to 50 years, the choices taken in the 2020s will shape industrial competitiveness and emissions for decades. However, the electricity infrastructure needed to support low-carbon investment is not expected to be widely available until the early 2030s, creating an urgent timing gap between industrial investment needs and infrastructure delivery.

2 Would electrification of industry contribute to economic growth?

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2.1 Electrification has the potential to contribute to economic growth through higher productivity, new investment, the development of new industrial supply chains and the use of a fuel (electricity) with a greater domestic component compared to fossil fuels. However, our research suggests that these gains are not automatic. The contribution of electrification to UK economic growth will depend on whether it enables firms to improve or maintain their international competitiveness, and on whether the UK captures the wider value created by associated investment. The economic case for electrification should therefore be considered alongside electricity costs, infrastructure, skills, supply chains and demand for UK-produced goods and services, rather than in isolation.

2.2 Competitiveness is particularly important. Our economy-wide modelling of the impacts of carbon pricing shows that the macroeconomic consequences of decarbonisation depend significantly on producers' ability to reduce their use of higher-cost energy, as well as on labour-market conditions and the extent to which higher production costs affect export demand. Where producers have limited flexibility to reduce energy use and higher costs are passed through into prices, the resulting loss of domestic and international competitiveness can reduce output (including exports), employment, investment and GDP. In one modelled scenario combining limited flexibility in energy use, labour market pressures and price-sensitive export demand, UK GDP fell by 1.86% in the long run. Therefore, decarbonisation policies must support firms to adapt production and maintain competitiveness rather than simply absorbing additional costs. [5]

2.3 Electrification could maintain economic activity in regions where carbon-intensive industries are declining. Research on Sullom Voe in Shetland illustrates the risks of failing to establish a transition pathway, with declining oil-processing activity potentially causing substantial losses in

[5]Turner, K. et al. (2022), *Carbon Tax Impacts on Producer Costs and Competitiveness as the Main Determinant of Macroeconomic Outcomes*, Centre for Energy Policy, University of Strathclyde. https://doi.org/10.17868/strath.00081038

local income and employment. Modelling suggests that an early transition to e-methanol production using renewable electricity could help retain local economic activity. However, e-methanol production is more capital- and less labour-intensive than the oil-processing activity it replaces. Establishing low-carbon industries could therefore increase productivity and value-added while reducing labour requirements in particular processes.[6] [7]

2.4 The economic benefits of investing in electrification, or any industrial decarbonisation approach, depend on the availability of skills and other resources. Our research on developing and operating a low-carbon sector, such as a nascent UK CO_2 T&S sector, found that in the presence of labour-market constraints, deploying a T&S sector could drive a sustained, long-run GDP uplift of £960 million per year along with net employment gains of 4,395 FTE jobs. Stronger labour-market constraints can erode the GDP gains by £98 million and the employment gains by over 1,600 FTE, while completely removing any constraints can boost the GDP gains by over £800 million per year and expand the employment gains by almost 13,200 FTE.[8] Skills shortages and resource constraints may similarly limit economic gains from electrification if they are not addressed alongside investment.

3 What needs to be in the Industrial Decarbonisation Strategy?

Imogen Rattle, Peter Taylor, Katherine Sugar

3.1 The 2021 Industrial Decarbonisation Strategy (IDS) placed considerable emphasis on using industrial clusters to de-risk the deployment of carbon capture and storage and hydrogen infrastructure in areas of high industrial activity ("mega-clusters"). The updated IDS should address the next set of priorities for decarbonisation in more detail, through the following measures:

3.2 Set out a strategy for dispersed sites, which account for over half of UK industrial emissions. Dispersed sites mostly lack governance structures equivalent to the cluster organisations operating in mega-clusters.[9] Our research on Local Industrial Decarbonisation Plans suggests that funding local industrial clusters strengthens capacity and supports the development of credible local plans for industrial decarbonisation.[10] Further funding is needed to sustain existing local cluster organisations, establish new ones, and develop the shared infrastructure required for them to deliver decarbonisation.

3.3 Set out where hydrogen pipelines are expected to be deployed and the criteria that will determine which industrial sites can access them. Our ongoing research suggests some businesses are postponing electrification because they believe hydrogen offers a less disruptive

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[6]Turner, K. et al. (2026), *Hundreds of Jobs at Risk from Inaction at Sullom Voe Terminal.* Centre for Energy Policy (CEP) University of Strathclyde https://doi.org/10.17868/strath.00095478

[7]Turner, K. et al. (2026), *An Early Shift to Low-Carbon Fuel Production at the Sullom Voe Terminal ('SVT') Could Provide the Backbone for a Successful Transition of the Shetland Economy*, Centre for Energy Policy, University of Strathclyde https://doi.org/10.17868/strath.00095477

[8]Turner, K. et al. (2024), *Industrial carbon capture utilisation and storage in the UK: The importance of wage responses in conditioning the outcomes of a new UK CO_2 transport and storage industry emerging in a labour supply constrained economy.* Journal of Cleaner Production, 434, 140084. https://doi.org/10.1016/j.jclepro.2023.140084

[9]Rattle, I. et al. (2024), *Decarbonisation strategies in industry: Going beyond clusters*. Sustainability Science, 19(1), pp.105-123. https://doi.org/10.1007/s11625-023-01313-4

[10]Rattle, I. and Taylor, P. G. (2026), *Decarbonization from the ground up: what Local Industrial Decarbonization Plans reveal about place-based approaches to decarbonizing industry in the UK*. Climate Policy, pp.1-17. https://doi.org/10.1080/14693062.2026.2685655

future alternative. The IDS should be published alongside an updated Hydrogen Strategy to reduce the risk that firms delay electrification while waiting for hydrogen supply that may not materialise.

3.4 To address the timing gap identified in s.1.10, use NESO's Strategic Spatial Energy Plan and Regional Energy Strategic Plans (RESPs) to coordinate electricity, hydrogen and CO_2 infrastructure with industrial investment cycles, ensuring industrial locations and infrastructure requirements are fully considered. Establish structured engagement between industry, government, regulators, NESO and infrastructure providers to improve visibility of future infrastructure deployment, identify time-critical industrial sites, reduce uncertainty, and align infrastructure delivery with investment needs. Encourage proactive industry participation in the RESP process to support timely and coordinated investment decisions.

3.5 Develop a market for low carbon goods. The updated IDS should establish a framework for embodied carbon reporting, including definitions of "low carbon", and progressively tighter product standards.[11] Public procurement should use these standards to create reliable demand for lower-carbon goods and, building on the Procurement Act 2023, strengthen social value through greater SME participation.[12]

3.6 Set out an approach to support mega-clusters to lead the testing and scaling of approaches to reduce industrial energy and material demand, including resource efficiency, industrial symbiosis and shared heat.

3.7 Establish the Government's approach to mapping the supply-chain links between the foundational industries and the strategic growth sectors (IS-8) identified in the Modern Industrial Strategy 2025. It is unclear which foundational industries underpin the competitiveness and resilience of the IS-8, and therefore where decarbonisation support should be prioritised.

3.8 Clarify responsibility for delivering industrial decarbonisation. While some areas have established cluster organisations, most do not. The IDS should define the roles of Combined Authorities, regulators, industry organisations, Network Operators, Devolved Administrations and others in delivery, and address capability gaps where responsibility is devolved regionally or locally.

4 What should the Government be doing to incentivise SMEs to decarbonise?

Imogen Rattle, Katherine Sugar, Christian Calvillo Munoz

4.1 We distinguish between the general SME population, where fossil fuel is used primarily in space heating, and manufacturing SMEs, where fossil fuel is used primarily in energy-intensive production processes requiring high-temperature heat. Our ongoing research suggests the following policy interventions:

Incentivising all SMEs to decarbonise

[11]Taylor, P. G., and Rattle, I. (2026), *A policy-relevant research agenda to support accelerated industrial decarbonisation in the UK*. Sustainability Science, pp.1-8. https://doi.org/10.1007/s11625-026-01804-0

[12] Sugar, K. (2026), *Public Procurement for a Just, Net Zero Transition.* Connected Places Catapult: London. Available here Public procurement for a just, net zero transition - Connected Places Catapult

4.2 Focus on changing the commercial incentives facing SMEs, rather than relying primarily on awareness raising or information provision. Financial incentives should aim to reduce upfront costs and improve the payback period of investment.

4.3 Create stronger market incentives for action. Public procurement, supply-chain requirements and carbon reporting make decarbonisation commercially relevant by linking emissions performance to access to customers, contracts and finance (see also s.3.5).[13] However, requirements should be standardised and proportionate so that they do not impose an excessive administrative burden on SMEs.[14]

Incentivising manufacturing SMEs to decarbonise

4.4 Consider CAPEX support to strengthen the incentive to invest when firms are planning to replace production equipment. Manufacturing SMEs face higher upfront costs, longer payback periods and greater operational risks than the general SME population, and major equipment is replaced infrequently. Support should make lower-carbon options more commercially attractive when these investment windows arise.

4.5 Any CAPEX support should be accompanied by low-burden application processes and practical assistance to help firms identify, develop and apply for eligible projects. Stakeholders report many manufacturing SMEs lack the time and internal capacity to identify suitable schemes, develop investment cases and complete applications.

4.6 Manufacturing SMEs need specialist technical support in addition to that provided to all SMEs. Government should ensure that manufacturing SMEs can access trusted, sector-specific technical advice and implementation support when investment decisions arise.

4.7 Consider the capacity of the wider market to deliver SME decarbonisation. Competition for skilled workers and other resources can increase wage and project costs and reduce wider economic benefits of investment. Incentives that increase demand for decarbonisation technologies must therefore be matched by sufficient supply-chain and skills capacity. Government should monitor emerging bottlenecks in sectors providing energy audits, engineering, installation and maintenance services to manufacturing SMEs, and use skills and supply-chain policy to ensure that financial support translates into completed projects rather than higher demand for scarce capacity.

5 Is the biggest barrier to SMEs the high cost of electricity?

Imogen Rattle, Christian Calvillo Munoz, Katherine Sugar

5.1 While high electricity prices are a recognised structural impediment to industrial decarbonisation (see also s.1.2), our ongoing research suggests there is no single barrier to SME decarbonisation. Rather, firms face a combination of economic, organisational, informational and capability constraints that vary by sector, firm size and circumstance, including limited time, finance and technical expertise. In addition, decarbonising manufacturing requires changes to core production processes, increasing cost, technical complexity and operational risk.

Barriers to manufacturing SME decarbonisation

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[13] Sugar, K., and Rattle, I., *Place-based Governance and Local Public Procurement: Engaging Small and Medium Enterprises in Low Carbon, Inclusive Transitions* (under review)

[14] Rattle, I., and Sugar, K., *A Rapid Evidence Assessment of routes for engaging industrial SMEs in energy efficiency: implications for the UK* (under review)

5.2 For a manufacturing SME, failure following a change to a core production process can pose an existential risk. Larger firms may be able to absorb disruption by moving production to other lines or sites, whereas SMEs often have little redundancy. This can favour like-for-like replacement over the adoption of unfamiliar equipment or processes.

5.3 For suppliers to highly regulated sectors, such as aerospace, changes to production processes can also trigger process requalification. This can be costly and time-consuming, creating a further barrier to change.

5.4 A linked barrier is the lack of specialist skills and expertise needed to identify and implement lower-carbon production technologies. Manufacturing processes are often bespoke and optimised around the requirements of individual sites and customers, limiting the scope for standardised solutions. SMEs may lack the engineering capacity to assess and integrate alternatives, and may be unsure where to obtain independent, credible advice.

Enabling SME decarbonisation

5.5 Evidence suggests that energy networks can support peer-to-peer learning among SMEs, while demonstration projects are valuable in providing evidence on implementation, reliability and operational impacts.[15]

5.6 However, these interventions appear most valuable for firms already taking a proactive approach to decarbonisation. Participation requires time that many SMEs lack, while commercial sensitivities may limit information sharing about production processes.

5.7 The importance of electricity prices also depends on firms' ability to respond. As discussed in s.2.2, our economy-wide research on the impacts of carbon pricing finds that producers' ability to change their energy input mix and reduce energy use is a key determinant of the wider economic effects of changes in energy costs.[16] This is relevant to SMEs because high electricity prices are particularly problematic for firms that lack the capital, technical expertise or operational flexibility to invest in more efficient equipment or alternative processes. Policy should address both sides of the problem: improving electricity price competitiveness and supporting SMEs' capacity to respond to energy-price differentials through efficiency and technology investment.

6 How should the Government be engaging banks and financial services to drive the decarbonisation of the UK's SMEs?

Imogen Rattle, Katherine Sugar, Christian Calvillo Munoz

6.1 Our review identified little primary evidence on how government should engage banks and financial services to drive SME decarbonisation.[17] However, the wider policy literature suggests four areas where government engagement with the sector could support this work.

6.2 Standardise SME sustainability data requirements. Fragmented reporting approaches create costs for SMEs and limit banks' ability to assess climate-related risks and design green finance products. Common data standards would reduce the need for additional reporting.

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[15]Rattle, I., and Sugar, K., *A Rapid Evidence Assessment of routes for engaging industrial SMEs in energy efficiency: implications for the UK (*under review*)*

[16]Turner, K. et al. (2022), *Carbon Tax Impacts on Producer Costs and Competitiveness as the Main Determinant of Macroeconomic Outcomes*, Centre for Energy Policy, University of Strathclyde. https://doi.org/10.17868/strath.00081038

[17]Rattle and Sugar *op.cit.,* n.16.

6.3 Mainstream decarbonisation within ordinary SME finance, rather than treating it as a specialist green product. This could include common approaches to assessing energy-efficiency investments, building technical expertise within financial institutions and encouraging banks to identify suitable projects proactively.

6.4 Develop common standards for financial products tailored to SME decarbonisation. Products developed to these standards could include dedicated credit lines, simplified and standardised application processes, and flexible financing terms, including preferential or below-market interest rates, interest-free loans, longer repayment periods and reduced collateral requirements.[18]

6.5 Combine finance with project development support. Many SMEs lack the time and expertise to turn opportunities into investment-ready projects, so finance should be accompanied by audits, administrative and technical advice, and support to develop business cases.

6.6 In addition, government should recognise that some SME decarbonisation investments may generate wider economic benefits that are not fully captured in an individual firm's financial return. Our research on industrial decarbonisation shows that investment can generate additional value through domestic supply chains, employment and new markets, with benefits extending beyond the firm or region making the initial investment.[19] There is a role for government in reducing the risk faced by lenders when projects have wider strategic value but uncertain or relatively long payback periods. This could be through appropriate guarantees, co-financing or other forms of risk-sharing to make viable but higher-risk decarbonisation investments financeable for SMEs.

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[18]OECD (2025), *Scaling Up Public Financial and Non-Financial Support for SME Sustainability: Innovations and Good Practices*, OECD Studies on SMEs and Entrepreneurship, OECD Publishing, Paris, https://doi.org/10.1787/bf835159-en

[19]Turner, K. et al. (2026), *CO2 Transport & Storage as a Driver of Scottish Economic Growth and Industrial Decarbonisation*, Centre for Energy Policy, University of Strathclyde. https://doi.org/10.17868/strath.00095794