Aldersgate Group response to Enabling Industrial Electrification: A call for evidence on fuel-switching to electricity (Part 1)

October 2023

Background

The Aldersgate Group represents an alliance of major businesses, academic institutions and civil society organisations, which drives action for a competitive and environmentally sustainable UK economy.[1] Our corporate members represent all major sectors of the economy, such as Associated British Ports, Aviva Investors, BT, CEMEX, the John Lewis Partnership, Johnson Matthey, Michelin, Nestlé, Siemens, SUEZ, Tesco, and Willmott Dixon. They believe that ambitious environmental policies make clear economic sense for the UK, and we work closely with our members when developing our independent policy positions.

Chapter 1 – The role of electrification in decarbonising industry

19) Do you know of any other advantages associated with electrification of industrial processes that have not been described here? If yes, please provide details.

Highly liquid, well-established markets:

Electricity markets are much more liquid than hydrogen and other low-carbon alternative fuels. This means that energy-intensive industries moving away from fossil fuels (or opting for electrification over hydrogen fuel switching) will benefit from greater price certainty, and fewer fluctuations in commodity prices (generally speaking, and particularly when looking towards a future with greater renewable saturation). This not only presents an opportunity for lower costs, but also greater price certainty, and more reliable fuel supplies, which can be baked into companies' business models and therefore provide an opportunity to recover energy costs in contracts/on the market with greater predictability. This helps overall competitiveness, smoothness of operation, and future commercial viability.

Reduced demand for hydrogen and CCUS:

The electrification of some parts of industry would also provide the advantage of increased supplies of low-carbon hydrogen (or other alternative fuels) for processes that cannot be electrified. For example, brick ovens and cement kilns may be able to partially switch to electrification, but it is highly unlikely that they will be able to produce the same products without either fossil fuels or a combustible fuel, such as biomass, biomethane, hydrogen, or other alternative fuels. However, over the next 10 years, supplies of these fuels are likely to

[1] Individual recommendations cannot be attributed to any single member and the Aldersgate Group takes full responsibility for the views expressed.

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be very low at a cross-economy scale. Therefore, the more processes that we can electrify, the lesser the competition for other fuels. It is incredibly important then, that electrification is supported where it is a viable option, rather than the pursuit of other means for decarbonisation - such as hydrogen fuel-switching or CCUS.

True low emissions:

If using low-carbon electricity, electrified processes do not carry the risk of releasing harmful emissions, or leaking greenhouse gases. Even low-carbon hydrogen carries the risk of leakage into the atmosphere which is a concern as hydrogen emissions can have a more harmful warming impact than carbon emissions. Similarly, even if you classify bioenergy as renewable, its combustion releases harmful particulate matter into the atmosphere, negatively impacting air quality. Biomass feedstocks also have geopolitical implications, as they require significant amounts of land (for the UK's bioenergy sector, this land is mostly overseas), that competes with the agriculture sector. Additionally, the processing and transportation of biomass feedstocks alone emits more CO2 emissions than is incurred throughout the lifetime of solar, offshore and onshore wind. Electrification carries none of these risks.

For more evidence on the emissions intensity of biomass feedstocks, please see Ember (2020), The Burning Question: https://ember-climate.org/insights/research/the-burning-question/#supporting-material

20) Are there any disadvantages of electrification of industrial processes? If yes, please provide details.

Lack of certainty regarding electricity supply and associated infrastructure

Electricity is forecast to supply over half of industrial energy demand by the mid-2030s and is a leading decarbonisation option for some of the most carbon-intensive sectors, such as steel.[2] This rapid increase in demand for electricity (alongside increasing demand for electricity in other areas of the economy), will necessitate large, rapid changes in the capacity and profile of electricity generation - and electricity networks in the UK - adding to the strain on the UK's electricity grid, markets, and renewables sector. Should electrified industrial sites be unable to access plentiful supplies of affordable clean power, they may have to interrupt or permanently reduce production, resulting in reduced revenues at best, and plant closures/offshoring at worst. It is imperative, therefore, that Government produces

[2] For more information on power sector decarbonisation, please see The Aldersgate Group (2023), Low Carbon Power and Industrial Electrification: Delivering on a Twin Challenge: https://www.aldersgategroup.org.uk/content/uploads/2023/04/AG-UCL-Low-Carbon-Power-Industrial-Electrification-Report-1.pdf

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a coordinated industrial strategy that sets out a spatial plan for the electrification of industry in tandem with a more detailed plan for the decarbonisation and expansion of the UK's power sector. This must include details of how a decarbonised power system will service electrified industry, and how grid connections for electro-intensive offtakers will be developed over time to enable electrification.

In 2023, the Aldersgate Group commissioned UCL to produce a report detailing the steps needed to address this twin challenge, resulting in 6 key recommendations for decarbonising power, within the context of electrifying industry. These are as follows:

1. Accelerate reforms to the grid connection process to significantly cut connection waiting times and prioritise projects that are ready to deploy. As part of this, ensure industrial network connections/upgrades are included.
2. Include a commitment in the promised action plan on accelerating network development to further develop the regulatory RIIO Framework to enhance anticipatory investment in network capacity.
3. Treat construction of the necessary grid infrastructure as a national endeavour, requiring collaboration with supply chains to make best use of scarce resources.
4. Streamline the planning process for low-carbon and network infrastructure by installing a presumption in favour of net zero aligned projects, creating a priority fast-track for significant projects, and scaling up personnel at national and local level to manage the increased demand on these bodies.
5. Extend the Contracts for Difference (CfD) scheme while developing it to support greater locational diversity (e.g., through some weighting/differentiation by zones) and exploring incremental reforms to improve operational signals.
6. Continue to explore the REMA option of transitioning to a dual-market approach, creating a Green Power Pool alongside the wholesale market to allow consumers to directly access reliable and increasingly cheap renewable electricity.

23) Listed below are the areas of focus for innovation of electrification technologies. Please rate their importance using the following scale: 0 = Don't know, 1 = Not at all important, 2 = Slightly important, 3 = Moderately important, 4 = Important, 5 = Extremely important.

Area	Importance
Reducing the cost of commercially ready electrification technologies.	4
Scaling up technologies to meet commercial production requirements.	5
Demonstration of electrification technologies on sites.	5
Research and development of high temperature electrification equipment (such as for glass, ceramics, and metals).	3
Targeted innovation in a particular sector, technology or process	3
Improved reliability and/or performance of electrification technologies	4

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24) If you rated "Targeted innovation in a particular sector, technology or process" at a 3 or above in the previous question, please provide details on your reasoning for this.

Electrification is particularly well suited to low temperature processes, and at a sectoral level, metal production and processing. Other sectors will be far less suited for electrification. For example, the decarbonisation of the cement and ceramics sectors will likely be achieved through a varied combination of hydrogen and CCUS, with electrification playing an extremely limited role - this is due to physical constraints of electric kit, such as the inability to achieve certain temperatures.

However, the glass and chemicals sectors can partially electrify some of their activities, so targeted innovation could be a valuable way of accelerating these emissions reductions (and the variety of options at these sectors' disposal). Similarly, improving the safety of partially electrified processes should be prioritised, as safety concerns relating to electric kit have been cited by several of our industrial stakeholders as a reason for halting trials of partially electrified furnaces in the glass sector. This is where targeted innovation is extremely important.

There is, however, also moderate importance for targeted innovation of electrification technologies in sectors that will likely not pursue electrification as their primary means for decarbonisation. These sectors will be dependent on hydrogen, biofuels, and CCUS, but should these technologies/fuels be unavailable at the appropriate cost, or unavailable altogether, then they will be unable to decarbonise - therefore facing closure or the prospect of long-term emissions as they develop other means to decarbonise. It remains true that the cheapest, most effective option for emissions reductions should be used for each sector (assuming a cross-economy strategy for the sharing of limited fuel/power supplies is in place), however, there should be some degree of focus on 'hedging our bets' when it comes to the different decarbonisation options. This may mean understanding how to electrify sectors that may not necessarily pursue electrification.

It should also be recognised that dispersed industrial sites (Archetypes 1 and 3), may require a different approach to decarbonisation than almost identical sites in Archetypes 2 and 4, given their geographical constraints. For example, an industry well suited to electrification may face difficulty in getting a good quality grid connection (and the associated transmission infrastructure) to its dispersed location. This may lead to an uptake of hydrogen, biomethane, and/or CCUS instead. Conversely, a dispersed site well-suited to hydrogen, may find it impossible to transport and store the fuel (via pipeline and road freight), and instead look at electrification of its processes if grid infrastructure already exists nearby. In both examples, this would subvert the obvious choice for a given sector and would likely require some degree of innovation to find a workable solution. This also highlights the needs to produce a detailed spatial plan for the decarbonisation of the UK's industrial sectors, so that we can understand the likely decarbonisation routes for different sectors and individual sites. This will allow for more effective planning and investment, and greater certainty as

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regards to the route to reducing emissions in different geographical locations. For industry, this would also make clearer the technology that needs funding, allowing them to deploy capital now.

25) Do you agree with the site archetypes defined in this chapter?

Somewhat. We agree with the definition of sites, but not entirely with the role of electrification at those sites. Please see our response to questions 24 and 26.

26) Do you agree with the role of electrification of these archetypes presented here?

Somewhat. We largely agree with the definitions and likely uptake of electrification across various site archetypes and also agree with the overall conclusions of the role of electrification across each Archetype. However, Archetypes 1 and 3 (dispersed sites), do not adequately reflect the fact that a grid connection will not always be available to dispersed sites, and therefore a less traditional decarbonisation route for these sectors may be pursued (as per our response to question 24).

There is going to be enormous demand for clean electricity across the economy, and looking specifically at industry: electricity is forecast to supply over half of industrial energy demand by the mid-2030s. This is already placing significant strain on the electricity system, and in the early years of grid decarbonisation, significant transmission and distribution constraints will affect the availability of clean power. New clean electricity demand across the economy will also affect the pace of grid development, and the speed at which electro-intensive industries can secure a good quality grid connection (connection delays and transmission constraints plague the system at current, creating significant wait-times not just for new generators, but also offtakers).

Industrial companies consulted in the research for the Aldersgate Group's report, 'A Zero Carbon Power Grid and the Electrification of Heavy Industry: How to Deliver on a Twin Challenge', noted that their electricity network connections would require upgrading if they were to electrify their operations and thus increase their load on the electricity system. Companies that have attempted to explore such upgrades already, report receiving long timelines for network connection upgrades, and state that this has disincentivised them from pursuing electrification or simply weakened their competitiveness and slowed their decarbonisation. This issue is clearly related to the delays faced by renewables developers, and therefore we urge Government to better include industry and offtakers in the REMA process to ensure that barriers to their electrification are considered in the overhaul of the UK's electricity market arrangements.

One of the most important ways of overcoming this hurdle is to introduce new queue management rules for the grid connections queue, as is being explored by National Grid. Moving away from a first-come-first-serve approach towards one that requires projects to demonstrate that they have financing and a robust business plan to join/proceed through the queue can help accelerate shovel-ready projects.

Smoother planning processes for grid development infrastructure and industrial infrastructure that achieves decarbonisation of sites should also be prioritised. Additional resources also need to be granted to planning inspectorates, and a skills-plan initiated to provide more workers to the energy industry. Aldersgate Group stakeholders across the sectors have repeatedly cited a lack of available engineers to install connections upgrades as a major barrier to electrification.

For more evidence on the emissions intensity of biomass feedstocks, please see please see The Aldersgate Group (2023), Low Carbon Power and Industrial Electrification: Delivering on a Twin Challenge: https://www.aldersgategroup.org.uk/content/uploads/2023/04/AG-UCL-Low-Carbon-Power-Industrial-Electrification-Report-1.pdf

AND

The Aldersgate Group (2023), Powering Britain Affordably: Policy Priorities to Deliver a Decarbonised Power System: https://www.aldersgategroup.org.uk/publications/post/powering-britain-affordably-policy-priorities-to-deliver-a-decarbonised-power-system/?origin=/key-policy-areas/

Chapter 2 – Industrial electrification barriers and enablers

27) Please rate the barriers to industrial electrification in terms of their severity using the following scale: 0 = don't know, 1 = Not a barrier, 2 = low severity, 3 = moderate severity, 4 = severe, 5 = extremely severe.

Barrier	Importance
Technology innovation and demonstration	4
Financial	5
Infrastructure and supply	5
Organisational	
Regulatory/policy	3

28) If you rated any of the above barriers as 4 or higher, please provide further details.

Financial – capex:

Although largely proven in concept, the technologies to electrify some industrial processes, including in the chemicals sector, remain expensive, inefficient and with uncertainties associated with deployment at scale.

In many sectors – including steel and cement production – the technologies with which to electrify key processes are already known and broadly available. The main challenge is driving the large capital investments for their deployment. The capacity to invest depends on a combination of a sector's own resources, and its attractiveness to capital markets. There is an important interaction with electricity options, as greater clarity and confidence about electricity prices will reduce the uncertainties, and hence perceived risks and cost of capital, for capital markets.

The chemicals sector broadly has access to sufficient resources to invest in electrification and other decarbonisation technologies, should the wider policy framework tackle prohibitively high electricity prices and support the required grid upgrades. However, this is not the case in all sectors – the steel sector in particular stands out.

The trade body UK Steel estimates that to convert the remaining blast furnace steel-making capacity to EAF-based production, around £3.6 billion in capital investment would be needed. It has been widely reported that steel producers in the UK are operating with very tight margins, or even at a loss, due to a combination of international competition and high UK production costs, as a result of high energy prices. Steel producers themselves do not have sufficient capital to deliver this investment, and where international parent companies may have such resources, they tend to be channelled to sites in other countries with a greater comparative advantage. Steel producers in the UK are also unlikely to receive any

substantial finance from any other private source. Public resources are therefore likely to be necessary, if the UK is to retain and transition its steel industry.

The Government's agreement with Tata Steel to transition their Port Talbot plant to electric arc furnace technology is therefore incredibly important for the decarbonisation of that site. A wider plan for the UK's remaining blast furnace site, at British Steel's Scunthorpe works, must also be put in place, as well as a wider industrial strategy that provides a pathway for the retention and decarbonisation of the downstream elements of both Tata and British Steel's businesses. This is needed to retain jobs and a wider part of the UK's steel supply chain.

Financial – electricity prices:

Even if UK industry can fund the transition to electrified technologies, they still face industrial electricity prices that are far higher than both gas - high electricity prices on an absolute basis - and the electricity prices paid by industry in other countries - high electricity prices on a relative basis. This means that electrification is not an economically competitive option due to fuel costs.

A strong ETS price would help to shift the balance in favour of electrification, as would the levelling of policy costs between gas and electricity bills. At current these are both issues that shift the balance in favour of fossil fuel use. But longer-term measures are needed to ensure that industry can access cost-competitive electricity price.

Supporting industry in striking a Power Purchase Agreement with a generator, perhaps by underwriting contracts or creating a market for the trade of such contracts, would enable electro-intensive industries that are currently unable to sign-up to long-term electricity contracts, to benefit from long-term, predictable, and affordable power supplies.

Regulatory/policy:

Aside from the recent government decision to extend the IETF by £185m from 2024, there is currently no additional UK government funding available to specifically support industrial electrification, despite the extremely high capital costs of transitioning plants to electrified technologies.

In the steel sector, one of the areas where electrification will produce significant emissions reductions, the main source of proposed funding for steel sector decarbonisation is the Clean Steel Fund. Announced in 2019, this promised £250 million to the industry from 2023. However, the level of funding is far below what is needed (with industry stakeholders suggesting at least £1 billion is required), and there has been little discussion of the fund by Government since mid-2021, with some industry stakeholders now of the view that it is unlikely to happen (the Fund no longer appears in government funding spreadsheets). Compared with similar funds in other countries, stakeholders believe that this places the UK

steel sector at an even greater structural disadvantage – particularly if they are outside the European Carbon Border Adjustment Mechanism (CBAM).

In response to the Government and Tata's 'steel deal', we have seen the importance of funding the sector's decarbonisation, not just one element of one site. A well-funded clean steel fund, combined with appropriate consultation with unions and the downstream steel sector, could address this issue head on - securing jobs and economic activity in a much more holistic manner.

Industry stakeholders consulted for the Aldersgate Group's report, 'Low Carbon Power and Industrial Electrification: Delivering on a Twin Challenge', were also largely united in their belief that existing policy measures and processes broadly fail to address second-order issues of importance to industrial electrification, such as planning for and appropriately funding significant upgraded electricity network and connection capacities (please see above answers for more information).

Beyond the presence or absence of suitable individual measures, a commonly reported issue was a general lack of policy coherence, stability, and longevity. Industry stakeholders felt that for individual funds to directly support electrification, application windows and the time in which the projects that receive funding must take place are often too short, and often do not facilitate sequentially between R&D, demonstration, and deployment (including because not participating in one mechanism sometimes precludes a firm from participating in a subsequent mechanism). More broadly, they felt the current policy framework is often a patchwork of complex individual measures that fail to act as a coherent whole. This is evident in the various
overlapping funds on offer.

Despite the publication of the Industrial Decarbonisation Strategy in 2021, some stakeholders felt that these issues are symptomatic of a lack of sufficient commitment among policymakers to a serious, long-term industrial strategy that includes energy-intensive manufacturing industries. They point to the historical collaborative creation of sector-specific decarbonisation roadmaps in which the needs of individual sectors (including chemicals and cement) to facilitate decarbonisation were laid out, but to which governments have not subsequently acted upon as a further example. Given the fact that different industrial sectors will need a different combination of clean electricity, low carbon hydrogen, and CCUS to decarbonise, and that this combination will sometimes differ even across the same sector, an overarching strategy that acknowledges, accommodates, and plans for this level of diversity is essential to creating certainty and confidence for different companies and investors, that currently do not know how to allocate capital. No single company can lay down the infrastructure needed to decarbonise the sector, but together they have the means to do so. It is the role of government to coordinate this effort and create the conditions in which investors have the confidence to choose certain technologies that will last for several decades.

29) Are there any other barriers preventing the switch away from fossil fuels towards electricity?

The availability of materials used in electrified processes - scrap steel:

If the UK's steel sector is to electrify it will need access to high quantities of high-quality scrap steel. Although around 96% of steel used in the UK is recovered and recycled, around three-quarters is currently exported (and often converted into new steel products before being re-imported), as production costs are too high in the UK due to industrial electricity prices. Measures must be implemented to retain this material in order to feed into electric arc furnaces.

One remedy would be to develop sustainability criteria on exports of waste that match those applied to sales of waste materials within the UK. At present, waste materials sold as indiscriminate bundles to other countries do not have to meet the same sustainability criteria as those sold directly to UK industry. This can make exporting specific materials or indiscriminate bundles of waste cheaper than meeting the regulatory standards needed to sell to the UK market. By developing similar criteria for exported materials, Government can improve both the UK's reputation for the responsible handling of its own waste, and incentivise the retention and reprocessing of valuable materials.

However, even if this material is retained, much of it is not of sufficient quality to make certain products. For example, the average level of residual materials in the UK's scrap supply is 0.3%. Tata's products have a residual material tolerance of 0.1%, meaning they would need to add a significant amount of virgin products to their process. If the UK does not improve its scrap steel sorting processes (which requires investment in known but expensive technologies) or retain the ability to produce virgin materials, then the transition to electrified steelmaking will lead to an inability to produce certain products.

31) Please rank the following factors to describe the underlying reason(s) for fuel cost as a barrier to electrification using the following scale: 0= don't know, 1 = not a factor, 2 = slightly important, 3 = moderately important, 4 = important, 5 = extremely important.

Factor	Importance
High electricity price relative to gas	5
Uncertainty about future electricity prices	5
Uncertainty regarding other fuel options (e.g. future hydrogen price)	4
Uncertainty of future energy prices in general	4
High price relative to other countries causes competitiveness issues	5

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33) Please rank the following factors to describe the underlying reason(s) for electricity grid access as a barrier to electrification using the following scale: 0 = don't know, 1 = not a factor, 2 = slightly important, 3 = moderately important, 4 = important, 5 = extremely important.

Factor	Importance
Additional grid access takes too long	5
Additional grid access is too costly	
Additional grid access application refused	5

Chapter 3 – Exploring policy options

38) Are there other policies (either current or in development) that could positively or negatively impact industry's ability to switch away from fossil fuels to electricity?

The UK Emissions Trading Scheme:

At current, prices in the UK ETS have dropped to less than half of the EU ETS price. This severely weakens the UK ETS' price incentive to decarbonise. This could be remedied via the linkage of the UK and EU carbon pricing regimes, which would also enable UK carbon market participants to benefit from the increased liquidity of a larger scheme. It would also reduce the administrative burden for UK and EU ETS participants, and ensure that efficiency benchmarks against which UK firms are measured reflect the range of technologies and best practices employed in the UK and by its key competitors - accelerating take-up of the best available technologies (BATs). Regardless of linkage, the ETS Authority should also (re)introduce an auction reserve price that places an effective 'floor' on the carbon price to protect against sudden drops in the carbon price. The Aldersgate Group and a number of other
organisations advocated for this in our responses to the Government's consultation on Developing the UK ETS last year, when price falls were unexpected - now with a such a fall having taken place, we suggest Government explore this option. This would not affect day-to day price discovery, but instead, allow it take place within a 'collared' carbon price (together with a cost containment mechanism). Such a mechanism protects the incentive while also ensuring that carbon prices do not spike to unaffordable levels.

The rebalancing of policy costs from electricity to gas:

At current, policy costs are recovered more heavily from electricity than gas bills. This artificially inflates the price of electricity relative to gas, and leverages industrial consumers to pay for legacy projects that can reasonably be argued to have provided a positive social benefit (see Aldersgate Group 2023). By rebalancing policy costs either equally between electricity and gas (to level the playing field), more heavily on gas (to incentivise fuel switching), or the general taxation (to ensure those unable to shift from gas are not unfairly penalised), the Government can significantly improve the absolute and relative competitiveness of electrification.

Industry-/sector-wide funding support:

As mentioned above, apart from the relatively modest IETF, there is no specific funding for electrification. This compares to dedicated funds for Net Zero Hydrogen and CCUS Infrastructure (£240m and £1bn+, respectively). In light of the Inflation Reduction Act (IRA) and EU Green Deal Industrial Plan (GDIP), the Government should seek to level the playing

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field between different technologies by providing similar funding for the transition of industrial sectors to clean electricity use.

Demand side mechanisms (for information on Product Standards, please see Question 43):

To support industrial electrification, an ambitious Green Public Procurement Strategy should be implemented to provide a strong market signal to industry and help kickstart the market for low-carbon products. The UK government spent £292bn on public procurement in 2018/19, with a large share on industrial products in the construction and defence sectors. This purchasing power should be harnessed to create demand for low carbon products by setting a limit on the emissions intensity of goods purchased by government in these areas.

Involvement of industry in the REMA process:

As discussed above, industrial stakeholders have reported to the Aldersgate Group that they have not been central to discussions on the REMA process, with much greater focus paid to market participants than users. They argue that this is reflected in the withdrawal of market decoupling as an option in the coming consultation and the lack of ongoing user stakeholder fora.

39) Considering the whole impact of existing policies and the exploratory/planned policies: is further electrification specific intervention needed to enable the electrification of industry in the 2020s and 2030s?

Funding support:

As above, we need intervention to create a more attractive investment environment for investing in the capital-intensive infrastructure that is needed to facilitate a transition from fossil fuels to electricity in industry and manufacturing. This is particularly at a time when the IRA and EU GDIP are attracting companies overseas with lucrative support packages. To encourage near-term investment in electrification, the UK must provide financial incentives, such as full expensing of investments in clean industry by making the existing capital allowances increase permanent (rather than ending in 2026).

But, it is inevitable that the UK will need to put forward some public funding to support the electrification of industry. The Tata Steel deal is a very good start, but such funding must be scaled up and made available to entire sectors rather than individual sites. We recommend that a bold support fund for industrial decarbonisation is set up to secure private co-investment in innovation and deployment of new low carbon production technologies at the scale required to meet net zero. This should consolidate existing funds to maximise the funds available while minimising the administrative burden on companies hoping to apply and compete for funding.

Carbon pricing:

As discussed throughout this response, there also needs to be policy support in the form of appropriate 'sticks', such as a strong carbon price that incentivises a shift away from gas or other fossil fuels, and a carbon price applied to imports so that domestic producers are not undermined by imports (particularly cheaper high carbon imports that have not paid a carbon price). A UK CBAM should be announced as early as possible (with implementation in 2026), to signal the direction of travel for the UK's industrial product market, regardless of the progress of the EU CBAM. This would also give the UK an opportunity to reassert itself as a world leader on low-carbon policy.

Electrification business model:

There are currently plans for both hydrogen and CCUS business models, but no such equivalent exists for electrification. Nor does a carbon contract for difference (CCfD), which could provide a similar function, albeit on a technology-agnostic basis. The Government should seek to address this distortion in the suite of support available to the industry by providing either an electrification business model or CCfD.

41) How could Government facilitate an enabling environment for electrification?

Please see the above answers. The most important factors to enable industrial electrification are capital support and financial incentives to encourage private investment; affordable electricity prices (both relative to gas and to electricity prices in key competitor nations); certainty as regards the availability of low-cost, plentiful clean power; a planning regime conducive to the fast roll-out of major infrastructure; a power system set up to rapidly expand and deliver mass low carbon power; and measures designed to improve the competitiveness of low carbon production, namely a CBAM.

43) What regulatory approaches could the Government explore to incentivise or enable electrification?

In a report with Frontier Economics (2022), 'How product standards can grow the market for low-carbon industrial products', the Aldersgate Group set out in detail how regulations on industrial products, such as mandatory product standards that limit a product's lifecycle emissions, can grow the market for low carbon industrial products and enable investment in electrification.

Product standards can play a key role in supporting decarbonisation (including via electrification) of industry in the UK. There are two overall types of product standards:

1. Mandatory standards, which directly specify the emissions and/or production standards a product must meet to be eligible for sale in the market; and
2. Voluntary standards, which attempt to nudge consumers and businesses towards purchasing low-carbon products by increasing transparency around products' emissions footprints and/or wider environmental impacts. They can also be used as a

transition mechanism to a mandatory standard. The voluntary standard met is often communicated in the form of a product label.

These policies can be used to overcome key market failures. Product standards can reduce information asymmetry between manufacturers and consumers and can better inform consumers about the environmental impacts of their purchasing decisions. They can also ensure that manufacturers with lower emissions-intensity production can compete with higher emission, lower price competitors. Overall, product standards can shift demand towards lower-emissions products and create a greater incentive for manufacturers to invest in electrification.

Depending on the standard set, mandatory standards can have a significant impact on the emissions intensity of in-scope products by imposing a defined cap on the maximum allowed carbon content. For example, the EU Ecodesign Directive, which imposes mandatory energy efficiency standards on energy-related products sold in the EU, is estimated to have led to a 41% reduction in the electricity consumption of washing machines in 2020 relative to the scenario where no standards were in place. The impact of mandatory standards is also relatively certain when compared to other demand-side measures, as policymakers can enforce a strict ceiling in terms of emissions or other sustainability measures which manufacturers must meet. This is much more direct than other demand-side policies such as taxes and voluntary standards, which rely on potentially uncertain consumer reactions to create incentives for manufacturers to decarbonise.

Mandatory standards which apply to all products sold in the UK can also limit the risk of carbon leakage. Mandatory product standards can be used alongside other policies such as free emissions allowances and carbon border adjustment mechanisms (CBAMs) to mitigate the risk of carbon leakage. Where decarbonisation policies lead to increased costs for UK-based manufacturers, there is a risk of offshoring production to other, less-regulated jurisdictions with lower production costs and higher emissions intensities. Product standards that apply to all products in a given market can significantly reduce this risk, as they can be used to ensure that foreign manufacturers meet the same standards as domestic industry in the UK. However, ensuring that product standards apply equally to all products may require increased transparency of the import supply chain and coordination with policymakers abroad.

Beyond reducing the risk of carbon leakage, mandatory standards can also lead to positive spillovers to other markets. UK-based manufacturers that need to comply with product standards to sell their products domestically may also reduce the emissions intensity of their exports due to the need to adapt production methods for their whole supply chain rather than just for those products sold in the UK. Product standards also create an incentive to decarbonise for non-UK manufacturers for which the UK is a significant export market. Overall, these standards can therefore lead to reductions in emissions intensity both domestically and internationally, even where they only apply to products sold within the UK.

For more information, please see the Aldersgate Group (2023) How Product Standards can Grow the Market for Low Carbon Industrial Products: https://www.aldersgategroup.org.uk/content/uploads/2022/12/stc-How-product-standards-can-grow-the-market-for-low-carbon-industrial-products.pdf

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