



## Written evidence submitted by the Energy Technologies Institute to the Business, Innovation and Skills Committee inquiry into the Government's industrial strategy

### Executive summary

1. Delivering an efficient and productivity-enhancing pathway to decarbonising the UK economy, should be a central consideration in the UK's broader industrial strategy.
2. **The government should develop an explicit industrial strategy for low carbon energy focused on building a large scale deployment capability for a balanced portfolio of the most promising technology options.**
3. There is a clear role for government in leading and shaping an industrial strategy for the UK's successful transition to a low carbon future. The fundamental nature of the changes and investments required make them difficult or impossible for private sector investors to deliver without leadership by government to enable innovation, infrastructure and investment.
4. **The Government's industrial strategy for low carbon energy should give particular priority to the development and deployment of (a) carbon capture and storage (CCS) and (b) a range of bioenergy technologies.** These two technology groups are key industrial enablers of the UK's low carbon future, and their development would build on established UK capabilities and comparative advantage.
5. **The government should also adopt a more strategic 'whole system' approach to low carbon infrastructure and industrial strategy** based on:
  - o long term vision (**informed by advice from the Committee on Climate Change on the implications of carbon budgets for industrial strategy**)
  - o cross-departmental co-ordination to join up industrial, energy, transport and agricultural policy
  - o coherent support for research and innovation in low carbon technology, informed by sound evidence and analysis
  - o a more balanced 'whole economy' approach to incentives for decarbonisation across all sectors.

## Introduction

6. The ETI is a public private partnership which is able to draw on the business and engineering expertise of key global players engaged in the UK energy sector (ETI private sector members: BP, Caterpillar, EDF, Rolls Royce and Shell).
7. This submission distils the implications for the Government's approach to industrial strategy which arise from the ETI's strategic analysis of the UK's transition to a low carbon future. This analysis is based on rigorous whole-system analysis informed by our public and private sector members and our portfolio of technology development and knowledge building projects<sup>1</sup>.

## The importance of energy and decarbonisation to the UK economy and industry

8. **The UK spends around 7.5% of GDP directly on energy (electricity, gas and solid and liquid fuels), with a much larger proportion devoted to other goods and services required to meet our energy-related needs (e.g. heating in buildings, private and public transportation and energy for industrial processes).**
9. **The UK has committed itself to substantially decarbonising the economy by 2050. The efficiency with which the UK delivers this transition to a low carbon economy will be vital for UK economic competitiveness, productivity and living standards**
  - The cost of energy and energy-related goods and services is a key determinant of the cost of living – affecting real wages and living standards across the economy and all groups in society (particularly those on lower incomes)
  - Energy is a key input to the UK's industrial cost base, particularly many manufacturing and process industries which have important broader economic linkages
10. Our analysis shows that the UK can implement an affordable low carbon transition by 2050, based on developing, commercialising and integrating a basket of low carbon technology options, which are largely known but currently under-developed in terms of industrial deployment.
11. The incremental (average annual) costs of carbon abatement across the national energy system (i.e. electricity networks, transport, heat, industry and infrastructure) could be contained at around 1% of GDP by 2050 within a coherent economy-wide market and policy framework. Failure to successfully develop and deploy key technologies could easily double this cost to the UK economy.
12. **Within this context, the ETI contends that delivering an efficient and productivity-enhancing pathway to decarbonising the UK economy, should be a central consideration in the UK's broader industrial strategy.**
13. **Minimising the cost burden to UK businesses, consumers and taxpayers of the necessary transition to low carbon forms of energy should be a central objective of industrial strategy. In turn this will maximise UK industrial competitiveness and minimise the risk of energy intensive industries moving out of the UK.**

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<sup>1</sup> Further details can be found in the ETI report 'Options, Choices, Actions: UK scenarios for a low carbon energy system transition', available via the ETI website [www.eti.co.uk](http://www.eti.co.uk)

## An explicit industrial strategy to deploy a portfolio of key low carbon energy technologies

14. **The government should develop an explicit industrial strategy for low carbon energy focused on building a large scale deployment capability for a balanced portfolio of the most promising supply and demand technology options.** Developing a basket of options such that they are genuinely 'deployment-ready' at large scale will reduce inevitable implementation risks associated with any one technology. Explicit government action or intervention will be required to initiate or to shape key early investments in innovative technologies, systems integration or enabling infrastructure as well as creating a supportive policy environment for private sector investment.
15. The ETI's analysis has identified the following key industrial priorities for UK decarbonisation, summarised in the table below.

Energy technology	Priority areas for industrial strategy
Carbon capture and storage	Government leadership and potentially investment to develop transport and storage infrastructure  Finance for deployment of gas CCS  Incentives for capture of emissions from industrial sources
Bioenergy	Development of advanced gasification technologies  Building feedstock supply chains (both domestic & imported)
New nuclear	Deployment strategy for large new nuclear capacity  Development and early deployment of small modular reactors, with heat networks
Gaseous systems	Development of strategy and engineering systems for gas energy vectors, including hydrogen, within future low carbon energy infrastructure systems
Low carbon vehicles	Coherent strategy for system integration, business models and infrastructure requirements for new low carbon vehicles
Energy efficient buildings and low carbon heat options (including heat networks)	Strategy and policy for local area energy transitions (e.g. to smart or new heat network technologies)
Offshore wind	Continued technical innovation for cost reduction and extension of deployment to more challenging conditions

16. It is critical to focus resources in the next decade on preparing these options for wide-scale deployment. Preparedness entails not just technology development and first of a kind deployment, but also the development and proving of viable business models, operating and regulatory frameworks to underpin

stakeholder and investor confidence. By the mid-2020s crucial decisions on long life infrastructure assets for our low carbon future will need to be made, so it will be important to have greater clarity about our ability to deploy key options in practice.

### **Strategy for low carbon industrial enablers: carbon capture and storage (CCS) and bioenergy**

- 17. The Government's industrial strategy should give particular priority to the development and deployment of two key industrial enablers of the UK's low carbon economic and industrial future, namely (a) carbon capture and storage (CCS) and (b) a range of bioenergy technologies.**
18. These two technology groupings are the most important strategic enablers to position the UK to meet the challenge of decarbonisation with maximum productivity, flexibility and industrial opportunity. Current evidence based on whole system analysis suggests that successful deployment of either CCS or bioenergy can reduce low carbon UK energy system costs by more than £30 billion per annum (or around 1% of GDP), compared with the cost of meeting carbon targets without their deployment. Sensitivity analysis suggests that these findings are robust against a broad range of future risks and uncertainties, for example the future scope for cost reductions.
19. The ability (or failure) to deploy CCS or bioenergy has a huge impact on the nature of the investments the UK will need to make in future energy infrastructure (whether different sources of primary energy or alternative infrastructures to store, transmit and distribute energy). As a country we need to start making key decisions about long life infrastructures (e.g. future gas or heat networks) by the mid-2020s, and these decisions will be highly dependent on clarity about our ability to develop CCS and bioenergy in the decades ahead.
20. From the 2030's onwards there is potential for the UK to combine bioenergy and CCS to deliver net negative emissions. This would unlock major strategic value by releasing headroom for continued use of fossil fuels where they are most costly to replace with low carbon alternatives. This would enable a much broader portfolio of options for future heat and transport systems and associated infrastructure, and would enable the energy system cost savings described above. Other technology options are important, but from an energy system perspective are more easily substituted, or less strategically important to future energy infrastructure choices.
21. As well as enabling the UK to deliver low cost low carbon energy, successfully developing and deploying both CCS and bioenergy would also unlock a host of future industrial opportunities for UK industry in areas of existing UK strength and comparative advantage including chemicals, biotechnology and offshore engineering, as well as existing key regional industrial hubs (as discussed, for example, in Lord Heseltine's 'Tees Valley: Opportunity Unlimited' report).
22. Both carbon capture and storage and bioenergy are technologies (or more accurately groups of technologies) which are inherently difficult for private sector finance and enterprises to deliver within a purely market-led framework. Both have characteristics which require strategic intervention and leadership by government to shape at least the early stages of their development and proving. Carbon capture and storage (as the Committee on Climate Change and the Parliamentary Advisory Group chaired by Lord Oxburgh have pointed out) depends on the development of enabling transport and storage infrastructure and regulation. Bioenergy has enormous potential to deliver carbon benefits but this requires coherent regulation and incentives to ensure sustainability, the development of new value chains and coherent incentives to promote the most efficient and valuable end uses.

### Key elements of an industrial strategy for carbon capture and storage (CCS)

23. There is an emerging consensus on the key elements of industrial strategy required to develop the CCS sector in the UK, with many common elements in the Committee on Climate Change's 2016 progress report to Parliament, and the report by the Parliamentary Advisory Group on CCS (chaired by Lord Oxburgh). These include the need for a specific strategic approach to the financing and development of infrastructure for transporting and storing CO<sub>2</sub>, a regulatory regime to enable efficient sharing of infrastructure based around CCS clusters and a new approach to risk sharing and management to enable reductions in the cost of capital.
24. The ETI has also carried out extensive studies to inform UK strategy to efficiently and effectively unlock the potential of CCS, including, for example, by cataloguing the UK's offshore CO<sub>2</sub> storage resource base. Our most recent analysis suggests that the strategy for early development of CCS should focus on enabling the development of a large-scale (1GW or more) gas power station fitted with CCS located in Teesside or the Humber region. Our analysis shows that this could provide the anchor for the first regional CCS cluster (including industrial emitters), unlocking development of the wider sector in other regional industrial clusters, as well as delivering competitive low carbon power (at the circa £85/MWh figure cited by the Parliamentary Advisory Group) into the UK market in the 2020s. Sound strategic choices need to be made about the scale, location and technology choices for early projects, within a framework that shares risks (and benefits) sensibly between private investors and government.
- **Location:** Sites close to the coast in Teesside or the Humber region offer easy (and low cost) access both to the most promising and cost-efficient CO<sub>2</sub> storage sites in the Southern North Sea, and to grid connections and populous regions with demand for power.
  - **Scale:** Developing a 1GW-scale (or larger) CCS power station or power 'cluster' would deliver a major tranche of low carbon capacity into the grid, and unlock economies of scale (and lower unit prices).
  - **Technology:** Latest cost assessments suggest gas CCS can achieve lower unit costs than coal, with proven capture technologies to reduce risks in early projects.
  - **Risk-sharing:** Experience with DECC's UK CCS Commercialisation programme indicate that cross-chain risks and risks at the storage end of the value chain were particularly problematic for investors. The key to making early CCS investible at an acceptable cost of capital will be an offer to private sector players which takes away risks they cannot manage (as it has done for nuclear waste disposal, or stranding risk for new offshore transmission owners under the OFTO regime), but maintains the discipline and incentives on operators.
25. Industrial strategy to develop CCS should also be aligned with broader UK strategy to maximise economic and industrial opportunity in the North Sea. The development of a UK CCS industry can build on established UK value chains and capabilities in offshore engineering and industry. There is significant scope to explore synergies in the approach to maximising economic recovery in the North Sea and in infrastructure development and decommissioning.

### Key elements of industrial strategy to develop the UK's bioenergy sector

26. A number of reputable analyses demonstrate the potential for the UK to source around 10% of its low carbon energy needs from bioenergy sources, through a range of feedstocks, applications and end uses. However, this potential will almost certainly fail to be achieved unless more a strategic approach is adopted to development of the sector.
27. The ETI's analysis of the role for bioenergy suggests that:
- Advanced gasification technologies could play a key role in a low carbon future. Clean gasification of biomass, with CCS, provides a uniquely versatile and flexible medium of low carbon energy.

Hydrogen produced in this way could be stored and used flexibly in a range of energy applications including power generation, heat and transport. Currently there is no explicit industrial strategy to develop the UK's capacity to deploy advanced gasification technologies.

- While imports of biomass may well play a key role in the UK's low carbon future, ETI's analysis of the UK land resource base demonstrates that there is clear potential for the UK to develop its own sustainable biomass feedstock production and processing industry without prejudice to UK food production. Our analysis suggests that a target of converting around 30,000 hectares per year would be both deliverable and offer high economic returns. This depends crucially on a strategic approach to shaping land use choices, seizing the opportunities opened up by Brexit and the need to redesign agricultural policy support measures to support a productive UK farming and forestry sector.

28. The ETI recommends that the government develops a bioenergy industrial strategy which takes full account of the strategic role which bioenergy could play in the UK's low carbon future, and the potential to create rural incomes and employment through domestic production and exploitation of sustainable bioenergy feedstocks.

### **A strategic 'whole system' approach to low carbon infrastructure and industrial strategy**

29. The ETI's experience and analysis since its creation in 2007 has demonstrated the importance and value of taking a strategic 'whole system' approach to the UK's strategy for decarbonisation. Key strategic enablers and choices - including the importance of versatile and flexible technologies such as CCS and bioenergy - are revealed by analysing the UK's electricity, heat, transport and industrial energy infrastructure as an integrated 'whole system'.
30. **There is a clear role for government in leading and shaping an industrial strategy for the UK's successful transition to a low carbon future. The fundamental nature of the changes and investments required make them difficult or impossible for private sector investors to deliver without leadership by government to enable innovation, infrastructure and investment.** The government's strategy should seek to minimise the cost burden placed on UK businesses, consumers and taxpayers by the transition to low carbon forms of energy, while at the same time realising the opportunities for UK industry opened up within that a smart, low carbon future.
31. The government's approach to industrial strategy needs to be coherent, patient and informed by strong evidence and analysis of the most promising technologies and sectors.
32. **Long-term vision:** industrial strategy for low carbon energy needs to be based on a long term vision, given the strategic nature of choices (particularly for investment in long life energy infrastructure) and the lead times required to build entirely new value chains and successfully commercialise new technologies. Recent reductions in the cost of offshore wind are the reward for over 15 years of policy support for this and related technologies. Similar long term industrial leadership will be needed to develop and commercialise the next generation of low carbon energy technologies, enabling the UK to more deeply decarbonise electricity supply by 2030 and begin the even more challenging work of decarbonising heat, transport and energy-intensive industry.
33. The regime of carbon budgets provides an important element of long-term stability in the UK's policy framework, with the Committee on Climate Change playing an important role in advising government and reporting to Parliament on progress. The CCC should also consider the implications of carbon budgets for industrial strategy.
34. **Cross-departmental co-ordination:** to be coherent and achieve maximum impact, industrial strategy will need to be owned and co-ordinated in a genuinely cross-departmental manner. The ETI's work on the UK's approach to decarbonisation illustrates the importance of cross-departmental co-ordination. For example, the development of a coherent strategy to unlock the potential of bioenergy will require intensive collaboration across industrial, energy and agricultural policy, with the close involvement of devolved administrations, local authorities and regulators including Ofgem, the Environment Agency and others.

The development of industrial strategy for new technologies requires analysis and policies that are not bound by conventional sector-specific policies or existing statutory frameworks.

35. **Coherent support for innovation:** the government has already begun to consider how it could strengthen the alignment of research and innovation funding, building on the experience of the Low Carbon Innovation Co-ordination Group, with consideration of the potential for a stronger cross-departmental 'Energy Innovation Board'. The ETI supports this move, with the potential for a stronger 'Board' structure to play a key role in supporting the development of a coherent industrial strategy for low carbon energy. The new Energy Systems Catapult can play an important role in informing and advising these new structures, drawing on a strong capability in whole system analysis. The Government should also consider the case for a specific investment vehicle to enable it to invest directly in large-scale demonstration and/or early 'at scale' deployment of key strategic low carbon technologies.
36. **A balanced 'whole-economy' approach:** While it is important that industrial strategy for low carbon energy is informed by strong 'whole system' evidence and analysis, it is also equally important that industrial strategy for decarbonisation should be set within a more balanced framework of incentives for decarbonisation across all sectors of the economy (in effect a level playing field for emissions reduction across the economy). Current policy is piece-meal and dependent on multiple interventions and subsidy instruments. Over time the ideal would be to move towards an economy-wide system of carbon pricing or carbon intensity standards. In the short-term the government should explore the scope to improve incentives for the capture of industrial emissions and investments in large-scale decarbonisation of heat.
37. The government should also explore how to align its strategy for decarbonisation with other important policy objectives. For example:
  - the development of bio-energy can be targeted regionally to support both sustainable land use choices as well as rural and regional development objectives
  - strategy to develop CCS can be aligned with regional and industrial strategies (for example, sustaining and building the Tees Valley as a leading hub for chemical and process industries)
  - there is scope to align strategic choices in the decarbonisation of transport with transport policy objectives around managing the impact of road congestion on UK productivity and competitiveness.