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UKERC Response to the BEIS Consultation Designing the Industrial Energy Transformation Fund

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General comments

We welcome the announcement of the Industrial Energy Transformation Fund as part of the Government's plans for boosting the productivity of the UK and maximising the advantages for UK industry of the global shift to clean growth.

This response draws on the expertise within the UK Energy Research Centre (UKERC). UKERC carries out world-class, interdisciplinary research into sustainable future energy systems. It is a focal point of UK energy research and a gateway between the UK and the international energy research communities. Our whole systems research informs UK policy development and research strategy. UKERC is funded by UK Research and Innovation (UKRI) Energy Programme[1].

This response includes a number of introductory points about the need for industrial decarbonisation and the role of government policy, before responding to some of the specific questions posed by the consultation.

We support the mission-oriented approach of the Industrial Strategy and the inclusion of a specific grand challenge on clean growth. Delivering this challenge will require a holistic approach from government that includes the following objectives (Busch et al., 2018)

- innovation in low carbon technologies, business models and practices;
- managing energy demand; and
- enabling systemic change.

The first of these objectives points to the need for industrial innovation to go beyond the purely technical and to encompass new ways of doing business and capturing value. The second includes the need for greater industrial energy efficiency, but goes beyond this to include the much larger opportunities that could be realised by changing the demand for the goods and services produced by industry (Scott et al., 2019). The third necessitates an economy-wide approach to decarbonisation in the UK to maximise synergies between sectors (e.g. increased use by industry of decarbonised electricity), while ensuring that action on climate change does not lead to carbon leakage outside the UK.

We also note that recent analysis by the Committee for Climate Change of the feasibility of a net-zero emission target (CCC, 2019) finds that the scope for decarbonising industry at reasonable cost is greater than their previous analysis had suggested. The extent of decarbonisation envisaged by the CCC is also much larger than the plans laid out in the Clean Growth Strategy[2]. The CCC analysis identifies that by 2050 most industrial process and activities could reduce emissions close to zero, but that this would need to be part of a set of wider energy system changes. This includes widespread use of hydrogen and CCS, and substantially increased resource efficiency. The CCC analysis includes a greater role of

[1] For information please visit: www.ukerc.ac.uk

[2] The authors of this response were members of the UK Net-Zero Advisory Group to the Committee on Climate Change. It was set up to advise them on how the UK can reduce emissions to net-zero, and how the CCC should approach and interpret the modelling of these scenarios.

material efficiency and circular economy approaches to reducing emissions, and builds in assumptions from scenarios developed by the University of Leeds (Scott et al, 2019).

The IETF has the potential to play a significant role in realising this transition to a net zero economy. The focus on support for innovation for industry decarbonisation is particularly important. When developing and implementing the Fund, there are a number of general issues that BEIS could consider. In UKERC's recent evidence to the House of Commons Science and Technology Committee on innovation for reducing emissions, we highlighted four issues in particular (Watson and Gross, 2018):

- Scale of funding. UK government funding for low carbon innovation has increased in recent years. The new Fund, together with complementary initiatives such as the Industrial Clusters Mission, will help to address the under-funding of innovation for industry decarbonisation. However, it is very likely that further public funding will be required to scale up and deploy the innovations required to reach net zero.
- Timescales of innovation. A recent UKERC systematic review showed that innovation in the energy sector tends to take a long time. The timescales from early stage R&D to significant commercial deployment typically take 3 – 4 decades for energy sector technologies (Gross et al, 2018). This analysis suggests that it would not be wise to rely on entirely new technology breakthroughs to help meet carbon budgets and targets over the next few decades.
- Systems as well as technologies. Much of the discussion on low carbon innovation tends to focus on individual technologies. Whilst this is clearly important, a focus on systems that combines technologies with new business models will also be crucial – particularly in the industrial sector. The design of innovation programmes should therefore include support for such system innovation in their scope.
- Taking uncertainty into account. Uncertainty is inherent in the innovation process – and this is part of the rationale for public R&D funding. This means that some low carbon technologies supported by public programmes will be successful, whilst others will fail to realise their potential. It is therefore important that the IETF supports a portfolio of technologies and projects, and includes space for taking risks. This also means that the IETF should have a strong evaluation component.

Answers to specific consultation questions

1. What wider benefits could the IETF deliver, such as local growth and low-carbon leadership opportunities?

The IETF should be seen within the context of a broader set of policies that form part of the UK's Industrial Strategy. Looking internationally, we can find many examples of countries that are pursuing different versions of industrial strategy with aims including improving productivity and international competitiveness, protecting domestic employment, creating a positive balance of payments in trade, and rebalancing the distribution of domestic employment. An important question is how compatible are these different possible framings of industrial strategy? International competitiveness and productivity clearly go hand in hand. But these are both best achieved by investing in regions with existing strong competitive

advantage, risking the exacerbation of domestic employment imbalances. They would also need to be seen from a very long-term perspective to be consistent with decarbonisation of the economy.

So while in the UK dominant framing of industrial strategy is about boosting productivity, the challenge of clean growth might best be met through promoting structural change (Rodrik, 2008). In the context of the 'clean growth' agenda, such structural change would involve directing industrial development to produce efficient, decarbonised industry and wider infrastructure. The aims of the IETF would seem to be consistent with promoting such "structural change" and therefore, when seen within the context of a broader set of policies that form the UK's industrial strategy, there are grounds to believe that a range of wider benefits could be delivered.

6. Do you have views on what design features might best support achieving an appropriate balance of both IETF objectives?

7. How can we best target the IETF to maximise value for money?

We agree that the Fund should support both decarbonisation and energy efficiency projects. Due to the different barriers identified in the consultation document (Table 2), there is a strong case for ring fencing a proportion of the fund for decarbonisation projects. This would take into account the different stages of development of decarbonisation technologies – and the potential higher investment costs and risks associated with them. However, it will also be important to structure the Fund so that it doesn't require applicants to choose either efficiency or decarbonisation. More integrated projects or feasibility studies that combine both energy efficiency and decarbonisation might have wider benefits in some cases.

Overall, we suggest that the aim could be to support a portfolio of projects that span a range of industries and applications; includes significant support for energy efficiency, decarbonisation and integrated projects; and covers technologies at different stages of development. As noted in our introductory comments, this portfolio should recognise uncertainty and include space for some risks to be taken.

With respect to value for money, it will be also be important to recognise this diversity. Whilst more near term, incremental innovations might have more attractive economics, the Fund criteria should also take into account value for money in the longer-term. This could mean comparing potential projects in different industries or categories against each other, rather than using a simple value for money metric to compare all proposals.

9. Are there any additional complementary policies that the Government could consider to maximise the impact of the IETF funding?

The consultation is right to place IETF in the context of a wider set of policies to support energy efficiency and decarbonisation within industry (see Table 1 of the consultation document). This is a welcome recognition that decarbonising industry will require a co-ordinated mix of policies which will need to be subject to review and change over time.

Research on decarbonising industry has highlighted four main areas for policy action (Lechtenböhmer, 2019):

1. Developing low-carbon forms of energy through, for example, support for renewable energy (using both specific and general incentives), investment and planning support for new infrastructures (e.g. for hydrogen and CO_2).
2. Research, development and demonstration support for low and zero carbon innovations and infrastructure.
3. Market creation policies, e.g. quotas or standards for low-carbon materials and products; public procurement and carbon taxation of materials.
4. Material efficiency and circular economy policies, e.g. to support closing value chains and new business models that link across and between sectors.

The IETF clearly falls into the second category of policy action. Traditional economic approaches to low carbon innovation tend to emphasise two well-known market failures that justify government intervention. The first is that the damage costs of greenhouse gas emissions are not internalised in market transactions – and hence, government policies to price carbon are required. The second is that private companies will tend to underinvest in R&D because they can't capture the returns from higher levels of investment. Therefore, governments should provide public funding for R&D, including for low carbon technologies.

Whilst correcting these market failures is important, this is unlikely to be sufficient to support the innovation required to meet carbon targets. Based on experience to date, a broader set of policy interventions is likely to be required using an innovation systems approach (Freeman, 1992). When applied to low carbon innovation, this systems approach means combining R&D funding with more targeted policy interventions that are tailored to specific sectors (e.g. Grubler et al, 2012; Mazzucato and Semieniuk, 2017). These are often required to support the demonstration and scaling-up of technologies and systems (e.g. to get them across the well-known 'valley of death'). They also include policies to create new markets – e.g. for the capture and storage of CO_2.

The IETF is a good example of a policy that takes some of this experience into account. It is a specific intervention for the industry sector which includes support for near-market technologies as well as feasibility studies of more early-stage innovations. However, neither the Fund nor the other policies listed in Table 1 of the consultation document include clear incentives for market creation. Whilst there are some general commitments that could help create such markets, e.g. within the planned Energy White Paper and the CCUS Action Plan, more specific actions are required. These include giving serious consideration to the recommendations from the Oxburgh Review on policy and institutional changes that could create a market for CO_2 capture and storage. They also include consideration of policies that stimulate a more material efficient and circular economy, e.g. by providing incentives for materials and products that are produced in a very low carbon and/or energy efficient way. In the absence of such market creation policies, there is a high risk that the IETF will not lead to the widespread deployment of the technologies and systems it supports.

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