

Written evidence submitted by the Centre for Research into Energy Demand Solutions (CREDS) (FEI0044)

CREDS is a research centre established in 2018 with a vision to make the UK a leader in understanding the changes in energy demand needed for the transition to a secure and affordable, low carbon energy system. CREDS' ambition is to transform the energy demand landscape in the UK.

Introduction

1. This submission is from the Centre for Research into Energy Demand Solutions (CREDS). CREDS is a major initiative of the Energy Programme of UK Research and Innovation. It is a distributed centre, involving 13 universities, with a core team based at the University of Oxford. It began in April 2018 and will run to March 2023. More information is on the website: creds.ac.uk.
2. The submission has been prepared by the CREDS Director, Nick Eyre (University of Oxford), with input from a wide range of colleagues across the CREDS consortium.
3. We have no relevant interests to declare.
4. Our summary assessment of key issues is provided below. We would be happy to provide more detail and/or oral evidence to the Committee.

Executive summary

5. Investment in reducing energy demand has historically been more important than investment in new supply for delivering secure, affordable and sustainable energy services. Because energy services are critical to almost all aspects of a modern economy, there are no 'silver bullet' solutions. However, we suggest that four principles should be followed.
- **Implement energy demand solutions with at least the same priority as decarbonisation of energy supply.** Both will require research, innovation and finance, as well as the political capital needed to implement and enforce regulation. Reducing energy demand makes it possible to achieve a zero carbon energy system faster and more cheaply.
 - **Consider all the benefits of energy demand policies.** Reduced demand and improved energy efficiency have a wide range of benefits, notably for health and employment, that justify policy support.
 - **Scale up policies that work.** UK energy efficiency policy has become significantly less effective in recent years. Many policy instruments that were well-designed and effective have been abandoned or reduced in scale. This should be reversed.
 - **Develop long term plans for innovation.** Energy demand reduction, flexibility and decarbonisation will need to play a critical role in a low carbon economy and this should be recognised in energy innovation policy.

Introduction

6. CREDS' analysis shows that changing the UK's energy demand is critical to the development of future energy systems that are secure, affordable and sustainable. In particular, meeting the ambitious climate goals of the Paris Agreement and the UK's Climate Change Act involves a systemic change in the energy sector – for energy demand as well as for energy supply.
7. We deliberately use 'changing energy demand' to emphasise that the demand-side agenda now goes far beyond modest efficiency improvements. We use this term to include action on the fundamental drivers of energy demand – the human activities that require energy services. It also increasingly involves flexibility: changing when energy is used; and decarbonisation: the fuels used. So, the energy demand agenda is complex.
8. Supporting energy efficiency is consistent with the central goal of the Industrial Strategy of improving UK productivity. Energy efficiency is not just a 'nice to have' add-on to energy policy. It is, by definition, energy productivity. It is productive investment, creating employment, supporting competitiveness and contributing to an innovative economy.
9. A vision for energy demand is missing, yet is required. There has been a drift in public policy towards assuming that energy demand is solely a consumer responsibility. Of course, improvements in energy efficiency result in financial benefits for households and businesses, both of which should be encouraged to invest without financial support where possible. However, changes to energy demand will also have important public benefits: improved energy security, better public health and urban environments, and major employment opportunities, as well as lower carbon emissions.
10. In households, businesses and transport, what is needed is more than marginal efficiency improvement. To facilitate the transition to a society powered largely by renewables, demand needs to be reduced and made more flexible. Flexibility is a newer challenge and is particularly important for electricity use. It can be delivered both by enabling energy-using practices to be more flexible and by using various forms of energy storage. Our judgement is that both approaches are likely to be required, and that both need policy support.
11. Below we address some of the specific questions set out in the terms of reference of the inquiry.

How do recent investment decisions on nuclear and trends in low carbon investment affect the UK investment outlook for energy infrastructure? Is there a case for changing the Government's current approach to delivering a low cost, low carbon energy system? How could the 'nuclear gap' be filled?

12. The relevance of nuclear power should be put in perspective. It provides only 4% of UK final energy use. However, we agree with the assumption in the question that there are challenges for low carbon investment.
13. Historically, energy efficiency that has been the main driver in decoupling energy demand from economic growth. It has contributed more new energy services and carbon emissions reduction than the combined effects of the UK's programmes in nuclear, renewable and gas-fired power generation. It has made energy services more affordable to households and businesses. It has

improved UK energy security, both by reducing energy imports and enabling peak electricity demand to be met with less generation capacity.

14. This approach has major implications for energy policy. Currently policy tends to assume that, because energy efficiency investment delivers private benefits, businesses and households should invest, with limited Government involvement. However, CREDS proposes that the transition to a low carbon economy is a collective goal with multiple public benefits, and thus Government should play a central role in helping business and householders. This requires intervening in markets to overcome barriers to investment, which can be done by a variety of means, ranging from support and advice, to market and supply chain construction, to changing financial incentives and regulation.
15. Energy investment policy has traditionally focussed on securing investment in fossil fuel extraction, transmission and refining, and on large scale thermal power plants (coal, gas and nuclear). These are technologies of the past. Future investment needs to focus on the technologies of the future: energy efficiency, renewable energy and the technologies to integrate them into a future zero-carbon energy system such as demand response, smart grids, energy storage, and new and emerging vectors such as hydrogen and heat.
16. Many of the assets requiring energy efficiency investment, notably buildings and mass transit systems, have the characteristics of infrastructure – they are capital intensive, long-lived and provide public benefits. They currently do not receive the same focus and support as energy supply infrastructure, leading to a serious imbalance in energy investment policy. The last IPCC Assessment report concluded that most of the investment required beyond 'business as usual' will be in energy efficiency in buildings, transport and industry.
17. Within a re-focussed policy portfolio, clear and well-enforced standards have an important role, as shown by the effectiveness of efficiency standards for key products such as domestic heating boilers. Good energy efficiency standards essentially require product manufacturers to make energy saving investments for their customers, and the evidence shows this tends to be highly cost effective. There is uncertainty about future product standards if the UK leaves the EU Single Market and this needs to be resolved urgently. Building regulations are determined directly by UK and devolved governments. Historically, they have proven very effective in reducing energy demand, addressing the barrier that the complexity of different stakeholders' motivations makes normal market mechanisms inadequate to deliver optimal outcomes. The ambition of energy performance standards needs to be increased for both new buildings and existing buildings.

How has Government policy improved the UK energy investment environment over the last three years?

18. Much UK Government policy in this area has become less ambitious and effective in recent years. The scale of policy-driven investment in home energy efficiency has been reduced substantially.
19. In 2012 direct, publicly funded support for both business and household energy efficiency, estimated at around £100m pa, was removed from the Energy Saving Trust and the Carbon Trust. In 2013 the Carbon Emissions Reduction Target (CERT) energy efficiency obligation was replaced by the Energy Company Obligation (ECO) which stopped support for energy efficiency in most

households and for all lighting and appliance programmes. CERT funding was replaced with the Green Deal, which was predicted to lead to a significant reduction in investment, comprehensively failed to achieve its objectives. Requirements for zero carbon targets for new homes were abolished in 2015. The CRC Energy Efficiency scheme for businesses was progressively reduced in ambition and abolished in April 2019. Enhanced Capital Allowances of energy efficiency equipment will be abolished in April 2020. Transport energy use has begun to rise again as fiscal measures have weakened and investment has fallen in alternatives to private road travel.

20. Major subsidies for deployment of some energy supply technologies, notably nuclear power, dwarf the sums allocated to supporting energy efficiency, despite being less effective. Even within research budgets, there have been some poor choices, such as the decision to fund two doctoral training centres in nuclear energy, but only one for buildings. There is no good rationale for this, and a rebalancing of effort towards changing energy demand would provide greater social and economic benefit.

What role should the Government play in providing financial support and sharing risks for new energy infrastructure? Are existing financing mechanisms, notably the Contracts for Difference, fit for purpose? Are there any practical issues, or potential unintended consequences, that could affect the feasibility of implementing alternative support models (such as a Regulated Asset Base)?

21. In the buildings sector, energy demand is falling, but there has been a reduction in ambition for both the energy performance on new buildings and the rate of renovation of the existing stock. The latter is arguably the tougher challenge, but both need to be addressed, in both housing and non-domestic buildings. This will need a range of interventions, including tighter standards, better enforcement and incentives. One critical aspect of delivery will be to re-skill the workforce to meet the task of delivering buildings that are high performing in practice, not just on paper. This is likely to prove impossible without tackling the structure of the construction industry, in particular very heavy reliance on sub-contracting, which makes it almost impossible to develop and operate technically focused, knowledge-based businesses in this sector.
22. The longer-term challenge in buildings is the complete decarbonisation of heating. This is probably the biggest single challenge in moving to a low carbon economy. Whichever options are deployed (e.g. heat pumps, hydrogen and/or heat networks) will require massive investment and, in some cases, changes to user practices. Government could accelerate this transition by extending its support for industry innovation, ensuring the availability of low-cost capital for new infrastructure and with policies to enable the market for new energy-using technologies.
23. In the transport sector, there are many similar challenges in ensuring the continued improvement of vehicle efficiency. Again, poor enforcement has limited progress. There are clear signs of the early stages of light vehicle electrification; this is welcome although it clearly raises new challenges for electricity generation and distribution. Addressing emissions from freight transport and shipping remains more difficult. Decarbonisation of long haul aviation appears currently to be technically impossible.
24. In transport, there is also very large potential for reducing demand by changing the patterns of land use and by modal shift. This is frequently neglected in discussions about transport and energy

demand, and this deficiency needs to be addressed. Investment in electrified mass transit will be important, but so will raising the rate of cycling and walking for shorter trips to the levels already achieved elsewhere in northern Europe.

25. In industry there remains significant scope for technical efficiency improvement, although less so than in the energy intensive sub-sectors. There are two particular issues to consider. The first is the role of energy intensive materials and products in modern society – how they are used, reused and recycled, and the extent to which they can be substituted by lower energy alternatives. The second is the development of different process technologies, using electricity and/or other decarbonised vectors to replace fossil fuels. Both these strategies need policy support.

What further steps should the Government take to increase investor confidence in the UK energy sector?

26. It is not confidence in the conventional energy sector that is the critical issue, but rather confidence in the new technologies of clean supply and efficient, flexible demand. There are two critical issues for Government in ensuring investor confidence. The first is clarity about the direction of travel, i.e. that it is these technologies that will be supported. The second is that many of these technologies are mass market, small scale and distributed.
27. Government accepts the case for a stable framework for low carbon energy sources in order to reduce investment risk. The case for similar support for energy efficiency is even stronger and the non-financial barriers to investment are often larger. If ambitious targets are to be achieved, the recent weakening of policy needs to be reversed, through comprehensive policy intervention. A first step would be to set out a comprehensive long-term vision. We welcome the commitments to ending the sale of petrol and diesel vehicles. There are other areas where Government could take a similar lead. These are, for example: requiring net-zero carbon new build before 2025; ambitious goals for high-performance building renovation; targets for reduced road vehicle use in urban centres; and goals for reducing the use of carbon intensive materials.
28. For small-scale technologies, including efficient and flexible demand, investment support is not about delivering mega-projects, it is about support for mass-market clean technologies, and for the supply chains needed to deliver them. Asset ownership will be widely distributed, and policy needs to be designed accordingly. There is experience on which we can build, in the UK and elsewhere. Strong standards for products, vehicles and buildings will continue to be of central importance. It is also important that standards are enforced, which has not historically been the case, as evidenced in the Dieselgate scandal. Deployment can be encouraged by policy instruments such as feed-in tariffs, supplier obligations and fiscal incentives, all of which have been used successfully, either in the UK or elsewhere. Critically, these policy instruments need to be deployed in the context of a long-term political commitment to the means of delivering carbon emissions reduction.