BEIS Select Committee Super Inquiry:

Post-Pandemic Economic Growth

UK Energy Research Centre Response

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August 2020

Introduction to UKERC

The UK Energy Research Centre (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 the UK Research and Innovation Energy Programme.

Currently in its fourth phase running from 2019-2024, UKERC delivers an ambitious programme of research on the challenges and opportunities for delivering the transition to a net zero energy system and economy. The programme brings together engineers, natural scientists and social scientists to generate evidence that informs real-world decisions.

Our research programme encompasses major themes on global energy challenges and their implications for the UK; the role of local and regional energy systems; interdependencies between energy systems and the environment; decarbonisation of specific sectors including transport, heat and industry; and transitions in energy infrastructures.

The programme is complemented by a set of national capabilities. These will carry out systematic evidence reviews, host and curate energy data, map and monitor public engagement with energy systems, and improve the transparency and understanding of energy models. UKERC also supports the wider energy research community in the UK by promoting engagement with other stakeholders, supporting career development and capacity building, and enhancing international collaboration.

Introduction and key points

The UK Energy Research Centre (UKERC) has provided independent research and analysis across the whole energy system since 2004, with funding provided by the Research Councils through a succession of five year phases. Our whole systems research programme addresses the challenges and opportunities presented by the transition to a net zero energy system and economy. Our research themes include decarbonisation of heat and industry, mobility, and local governance. We also have a theme focused on the relationships between energy, environment and landscapes. UKERC has a long track record of engaging with the BEIS Committee and predecessors and we would be very happy to provide follow up information or to assist the Committee Secretariat in working through these substantial topics.

In this submission we address five of the inquiry questions where UKERC evidence and analysis provides us with relevant insights[1]. We draw upon UKERC reports and the wider literature in order to provide evidence based answers to a number of the Committee's core questions. Key points include:

Trade-offs and co-benefits need to be actively managed if multiple environmental objectives are to be achieved and the low carbon transition is to enhance the natural ecosystems that are essential to prosperity and well-being. UKERC's research on environmental goals informs the answer to Q1.

Energy efficiency and heat system retrofit in buildings offers an immediate 'triple-win' in terms of economic stimulus, societal benefits and environmental goals. A strong long-term economic case can also be made to boost investment in all of those areas where the UK will need to build infrastructure and capacity in order to meet decarbonisation objectives. UKERC has examined the evidence on green jobs. We explore this in more detail in our answer to Q2.

There are already skills gaps in the sectors relevant to energy efficiency retrofit and it is important to invest in addressing these, as we explain in the answer to Q3.

Further action is needed to strengthen the industrial strategy. Ambition needs to go well beyond the aim to decarbonise one (or even all) of the UK's industrial clusters. Decarbonising all of industry will require research, development and demonstration support for breakthrough technologies and wider low-carbon infrastructure; market creation for products made via low carbon production processes; and promotion of resource efficiency and circular economy approaches. UKERC has published a number of reports highlighting where further action is needed, as detailed in Q4.

Our research shows widespread low carbon ambition in local authorities but significant challenges in converting this to action. To change this, government could establish a new policy mandate for net zero carbon localities, institutionalise

[1] Note we have numbered our question responses 1 to 5 but we start with the 4th question in the list published by the Committee in the Call for Evidence

local net zero carbon planning and implementation through a new statutory power and devolved resources, and invest in local authority net zero teams. Q5 reviews a range of evidence on the role of local government.

In what follows we provide short answers to the following questions:

1. Whether the government should give a higher priority to environmental goals in future support?
2. Whether the Government should prioritise certain sectors within its recovery package, and if so, what criteria should it use when making such decisions? What conditions, if any, should it attach to future support?
3. How can the Government best retain key skills and reskill and upskill the UK workforce to support the recovery and sustainable growth?
4. Is the Industrial Strategy still a relevant and appropriate vehicle through which to deliver post pandemic growth?
5. How should regional and local government in England, (including the role of powerhouses, LEPs and growth hubs, mayoralties, and councils) be reformed and better equipped to deliver growth locally? The references provide greater detail, but we are happy to elaborate further or facilitate interaction with relevant experts on these topics.

1. Whether the government should give a higher priority to environmental goals in future support?

Our research indicates that the government does indeed need to place more priority on environmental goals. It is also important to recognise and actively manage potential trade-offs between different environmental objectives. A first challenge is to ensure that stimulus policies do not detract from the net zero aspiration, the second is to actively manage multiple environmental objectives and maximise co-benefits. There is compelling evidence that natural ecosystems are key to maintaining human prosperity (Stebbings et al., 2020) and wellbeing (DEFRA, 2020), particularly with regard to providing resilience to uncertain futures (Martin and Watson, 2016). These benefits have been embraced by the UK government, as exemplified by the commitment to net zero in 2050 and the 25 Year Environment Plan. However, despite recognition by the UK Chancellor and the UK Committee on Climate Change (CCC) that post-pandemic public spending should deliver on both economic recovery and environmental/net zero commitments (CCC, 2020), there is still a risk that environmental issues will slip from the agenda as governments focus on economic recovery.

Economic recovery presents an opportunity to build back greener, with benefits for environment, society and the economy. For example, a recent World Economic Forum report (WEF, 2020) details 15 systemic post-Covid19 transitions, including people- and nature-positive developments. These would result in annual business opportunities worth $10 trillion and could create 395 million jobs by 2030. Through the positive incorporation of nature and people into these systems, additional resilience to

future shocks is also built in. A nature-positive (or green) energy transition is included as one of these 15 transitions, and as such prioritising an energy future which is environmentally positive is considered critical, not just for the environment but for the economy and society as a whole.

Achieving net zero and ensuring a green recovery post Covid19 will require a continuation and strengthening of the recent progress in decarbonising parts of the UK energy system. However whilst there are many 'shovel ready' options available for implementation and continuation, care must be taken if undesirable consequences are to be avoided. Achieving net zero will require immense institutional, societal, and environmental transition with potential for both positive and negative secondary consequences for the natural environment (Hernandez et al., 2019). A holistic approach will be necessary to ensure that the benefits of a low-carbon energy transition are not outweighed with negatives (Armstrong et al., 2014), including exchanging the climate crisis for alternate environmental crises (Papathanasopoulou et al., 2015). For example, the development of renewable energy is a key action in achieving net zero, necessitating expansive land, river and marine use change, but also risks biodiversity loss (Holland et al., 2019) and land degradation (UKERC, 2019). Equally decisions that we make have international implications and what may offer environmental benefits in the UK could result in substantial overseas impacts for the environment and society (Holland et al., 2015; Holland et al., 2019).

To secure a sustainable energy future for the UK, the implementation of a radical energy transition must be harmonised with broader environmental and social goals. Trade-offs must be evaluated, negative impacts minimised and co-benefits fully exploited (Holland et al., 2018; Randle-Boggis et al., 2020). If the approach includes social, environmental and natural capital implications, the benefits of a green energy future would help ensure positive impacts on the environment more generally, with associated societal and economic gains (Donnison et al., 2020).

UKERC research demonstrates the importance of linking climate and wider environmental issues in energy system scenarios in order to ensure a more resilient and sustainable energy future (Hooper et al., 2018). Judicious management of the energy transition could enable win-win outcomes, maximising ecological co-benefits of energy system decarbonisation, alleviating pressures on natural resources, and providing long-term societal and economic resilience.

References to Q1

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Stebbings, E., Papathanasopoulou, E., Hooper, T., Austen, M. and Xiaoyu, Y., 2020. The marine economy of the United Kingdom. Marine Policy Volume 116, June 2020, 103905 Access here

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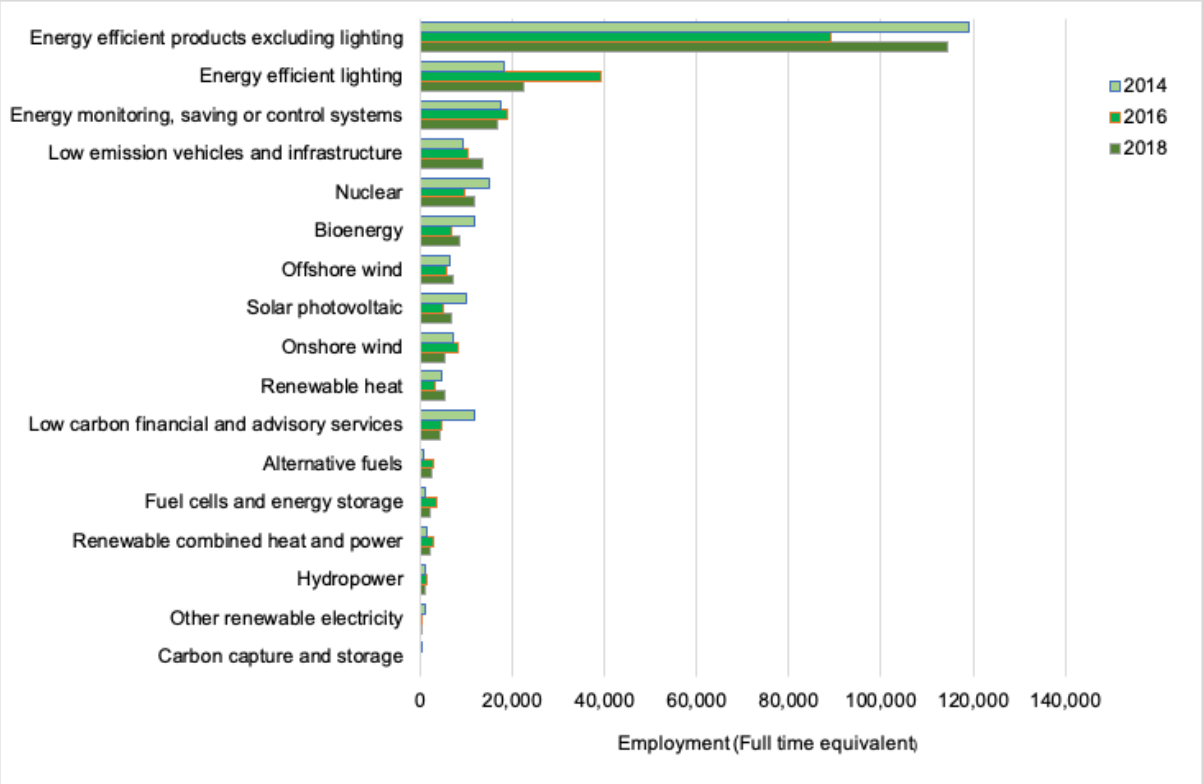
2. Whether the Government should prioritise certain sectors within its recovery package, and if so, what criteria should it use when making such decisions? What conditions, if any, should it attach to future support?

Our answer to this question starts from the premise that the key challenge is to continue to make progress with energy system decarbonisation whilst providing immediate support and stimulus to help the economy recover from the impacts of COVID-19. UKERC has two current strands of research relevant to this topic; we have ongoing research on energy and economic growth and we have embarked upon a new review of the evidence for net job creation from policy support for energy efficiency and renewable energy. This updates a systematic review UKERC produced on this topic in 2014 (Blyth et al, 2014). This work is at an early stage and we would welcome engagement with the Committee as we take it forward. However, some findings from our preliminary research and earlier work are salient to the enquiry and we briefly review them here.

The Treasury has estimated that the Green Homes Grant, spent over one year, could support more than 100,000 jobs (HM Treasury, 2020). Energy efficiency products and services, including lighting, currently comprise around 150,000 jobs in the UK (see Fig. 1, below): this equates to over two thirds of UK employment in low carbon and renewable energy businesses, according to a survey carried out by the Office for National Statistics (ONS, 2020).

There are good reasons to prioritise energy efficient refurbishment. The UK has one of the oldest, most poorly insulated and draughty housing stocks in Europe (ACE, 2015). Space and water heating in buildings contributes around 40% of UK energy consumption and 20% of UK greenhouse gas emissions (CCC, 2016). Several reports have been published recently, for example by the Energy Efficiency Infrastructure Group (EEIG, 2020) and the Institute for Public Policy Research (IPPR, 2020), which make a strong case for the co-benefits of investing in home energy refurbishments. Properly insulating UK homes and replacing fossil fuel boilers with heat pumps can help to alleviate fuel poverty, meet the UK's longer-term net zero climate target, and support a just transition. It can also create jobs in a distributed way around the country, including "levelling up" in regions most affected by unemployment and lack of investment. Employment in various low carbon sectors is shown in Figure 1 (below) and this indicates that the energy efficiency sectors already provide the largest numbers of jobs in the low carbon arena.

Fig. 1: Low carbon and renewable energy economy employment estimates by sector in the UK, 2014 to 2018



Source: ONS, 2020

Notes to Fig. 1

1. *Employment is measured in full-time equivalents (FTEs) and is rounded to the nearest 100.*
2. *For carbon capture and storage in 2016 and 2018, employment was estimated to be less than 100 and is not shown in the chart.*
3. *All employment estimates are subject to uncertainty ranges not shown in the chart: coefficients of variation and 95% confidence intervals.*

The above data and analysis helps support a focus on household energy efficiency as a priority for stimulus spending linked to decarbonisation. UKERC's work also provides some wider insights that the Committee may wish to consider in their evaluation of this topic.

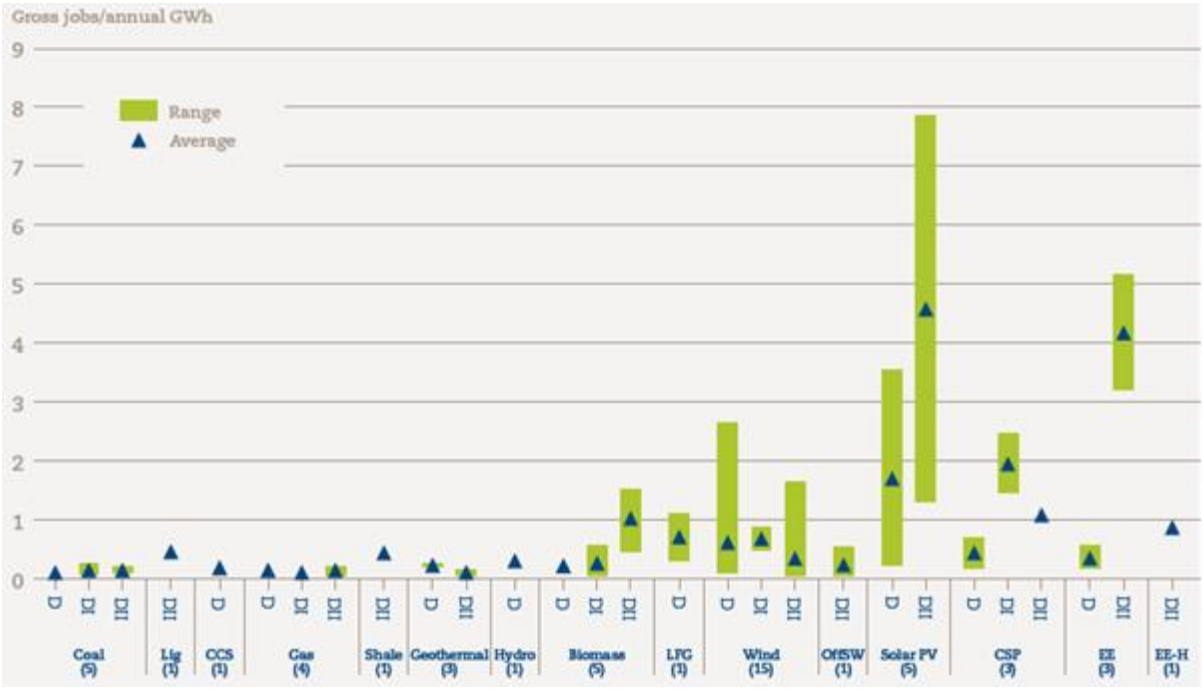
Blyth et al. (2014) reviewed the pros and cons of methodologies used to estimate job impacts. Studies often include the wider ripple-through indirect effects of increased demand in the supply chain, as well as the induced effect of higher spending potential for those households that have benefitted from the higher employment rates. The most common analytical approach for these wider effects is input-output modelling. Studies also address wider macro-economic impacts through computable general equilibrium (CGE) modelling, or macro-econometric approaches.

The quantitative evidence base comes from a systematic review of two main different types of literature. The first (comprising the majority of the literature surveyed) are studies where authors provide estimates of gross job impacts of individual projects for

specific types of energy generation. To get an approximate estimate of net job impacts, Blyth et al. (2014) compared the gross job impacts of investing in renewable energy and energy efficiency with the gross job impacts of investing in fossil fuel plant. In the second type of literature, authors explicitly calculate the net job impacts of renewables and energy efficiency compared to fossil fuels, giving a direct indication of the net impacts. This was a smaller set of literature, but produced a roughly similar result to the first set of literature, giving some additional confidence in the overall conclusion.

Based on a systematic review of this literature, there is good evidence that in general, renewable energy and energy efficiency are more labour-intensive in terms of electricity produced than either coal- or gas-fired power plant, as illustrated in Figure. 2 below.

Fig 2. Gross jobs per annual GWh generated (Blyth 2014)



Key: D: direct jobs; DI: indirect jobs; DII: induced jobs; CCS: carbon capture and storage; LFG: land-fill gas; OffSW: offshore wind; CSP: concentrated solar power; EE: energy efficiency; EE-H: energy efficiency in households (number of studies in brackets).

This implies that at least in the short-term, building new renewable generation capacity or investing in greater energy efficiency to avoid the need for new generation would create more jobs than investing in an equivalent level of fossil fuel-fired generation.

Whilst the evidence reviewed by Blyth et al. (2014) seems reasonably robust that renewables and energy efficiency are in general more labour-intensive than fossil fuels, this does not automatically mean that preferential investment in these technologies will lead to higher employment in the economy as a whole in the long-term. In a depressed economy in which aggregate demand is low compared to potential supply of goods and services (creating a so-called 'Keynesian output gap'),

then stimulating additional employment in particular sectors is very likely to lead to higher overall employment, and it makes sense to focus such efforts on more labour-intensive options (Blyth et al 2014).

However, policies have economic and societal impacts beyond their initial stimulus impacts. This is particularly true for decisions that concern long-lived strategic infrastructure. In these cases, it is important to assess the balance of costs and benefits to the economy in terms of the impact on growth potential. When designing stimulus programmes, it makes sense to support technologies and projects that support technological progress in the long-term, because if they have a persistent impact on the economy beyond the timeframe of the direct stimulus effects, they should also help contribute to long-term growth. In this longer-term context, labour intensity is not in and of itself economically advantageous. If it implies lower levels of labour productivity (economic output per worker), then it could adversely affect prospects for long-term economic growth. Therefore, the employment characteristics that matter in the long-run are not jobs per unit of investment, but whether or not the investment contributes to an economically efficient transition towards the country's strategic goals, taking account of environmental impacts and energy security considerations. Since the UK has far reaching ambitions to create a low carbon economy it makes sense to look beyond short-term job creation to consider the options that will provide affordable and resilient energy services.

It may appear a little trite to suggest that the response to COVID19 is simply to do everything that is already in the Clean Growth Strategy and more. However, a strong economic case can be made to boost investment in all of those areas where we know we will need to build infrastructure and capacity in order to meet decarbonisation objectives. This is particularly true where there are co-benefits such as improved air-quality, more comfortable homes, resilient energy supplies, or reduced congestion. As the UK pursues a more active industrial policy (discussed in response to Q4) the Clean Growth agenda can also help create new industrial sectors with export potential, particularly if this can be done in less-prosperous regions or where fossil fuel supplies chains could be partially repurposed (for example in the North Sea). Hence, irrespective of the immediate employment impacts it makes sense to invest in electricity system infrastructure to enable electrification in heat and transport, expanding renewable energy and other low carbon power sources, as well as ambitious energy efficiency improvements.

References to Q2

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IPPR (2020) Transforming the economy after Covid–19. Access here

ONS (2020) Low carbon and renewable energy economy, UK: 2018. Access here

3. How can the Government best retain key skills and reskill and upskill the UK workforce to support the recovery and sustainable growth?

For the reasons discussed in our answer to Q2 we focus the answer to this question on building retrofit. Each Home Counts (Bonfield, 2016) identified specific roles for successful retrofitting, including: training and accreditation; advising; assessment; installing; coordination or design; inspection and enforcement; and consumer protection.

There are significant gaps in recent trainees in the wood trades and bricklaying (ConstructionSkills, 2015). Future low carbon jobs projections for England estimate that, by 2030, roughly 160,000 jobs will be in low carbon heat, and another 145,000 will be in energy efficiency products, including insulation, lighting and control systems (LGA, 2020). A key near-term (2020-2025) skills gap has been identified in the design, specification and installation of heat pumps (LGA, 2020). There is an immediate need to establish high quality apprenticeships and training programmes to fill these gaps.

Delivering new skills for retrofitting will require a rapid shift in the UK's provision of existing vocational qualifications. The complex processes involved in energy retrofitting require 'energy literacy' across all construction roles (Clarke, Gleeson & Winch, 2017), and the related occupations listed above. In particular, design and construction teams need to be aware of the implications of their decisions on others' work (Owen, Janda & Simpson, 2019). If government is to invest in energy efficiency retrofit as part of the post-COVID19 package then there is an opportunity to develop new structures for the provision of training. This must include general knowledge of low energy construction and skills in understanding the 'whole house' needs, alongside tailoring to specific skills for the trade or role.

References to Q3

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4. Is the Industrial Strategy still a relevant and appropriate vehicle through which to deliver post pandemic growth?

The industrial strategy aims to boost the productivity and earning power of people throughout the UK (BEIS, 2019a). It sets out a number of "Grand Challenges" that present significant opportunities to improve people's lives and the country's productivity. Two of these, on clean growth and the future of mobility, are of particular relevance to the work of UKERC and therefore the focus of our response to this question (see Table 1 below).

Table 1: Selected Grand Challenges and Missions under the Industrial Strategy

Grand Challenge	Aim and missions
Clean Growth	Maximise the advantages for UK industry from the global shift to clean growth – through leading the world in the development, manufacture and use of low carbon technologies, systems and services that cost less than high carbon alternatives. • At least halve the energy use of new buildings by 2030 • Establish the world's first net-zero carbon industrial cluster by 2040 and at least 1 low-carbon cluster by 2030
Future of mobility	Become a world leader in shaping the future of mobility. • Put the UK at the forefront of the design and manufacturing of zero emission vehicles, with all new cars and vans effectively zero emission by 2040.[2]

Source: Department of Business, Energy and Industrial Strategy, 2019b

We believe the mission-oriented approach of the industrial strategy continues to be relevant and appropriate to delivering post-pandemic growth. This approach puts the "*focus on problems, and new types of collaborations between public and private actors to solve them [and] creates the potential for greater spillovers than a sectoral approach*" (UCL, no date). However, the scope and ambition relating to both clean growth and the future of mobility needs to be dramatically scaled up to be in line with the UK's net-zero carbon ambitions. The significant fiscal recovery package that the Government will need to implement as a response to the pandemic provides a perfect opportunity to accelerate progress replacing the current fossil-fuel-intensive economic system with one that is both more environmentally sustainable and fairer (CCC, 2020).

To achieve this the CCC has highlighted a number of principles that should guide any recovery, including using climate investments to support economic recovery and jobs, embedding fairness as a core principle and ensuring the recovery does not lock-in greenhouse gas emissions or increased risk. Key areas for investment that have high potential on both economic multiplier and climate impact metrics include: clean physical infrastructure, building efficiency retrofits and clean research and development (Hepburn el al., 2020).

UKERC has published a number of reports highlighting where further action is needed to strengthen the industrial strategy. In its 2019 Review of Energy Policy, UKERC welcomed the increased funding being directed at industrial decarbonisation, but noted that the ambition needs to go well beyond the aim to decarbonise one (or even all) of the UK's industrial clusters (UKERC, 2019). Currently, the six largest clusters in the UK are responsible for around 40 $MtCO_2$ out of a total industrial emissions of 105 $MtCO_2$ (including manufacturing, fossil fuel production and refining). Decarbonising all of industry will require measures including:

(i) Research, development and demonstration support for breakthrough technologies and wider low-carbon infrastructure;

(ii) Market creation for products made via low carbon production processes; and

(iii) Promotion of resource efficiency and circular economy approaches.

This will need to be delivered in such a way that it does not induce carbon leakage or damage the competitiveness of UK exports of goods and products.

Turning to energy use in buildings, we believe that a dedicated mission is needed focusing on existing buildings. Currently new-build accounts for less than 1% of the total stock, so delivering net zero will require major reductions in energy demand through the retrofit of existing buildings (UKERC, 2019b). The Clean Growth Strategy (CGS) does contain targets relating to retrofit of existing buildings: for homes to be upgraded to band C by 2030, and non-domestic properties to improve energy productivity by 20% by 2030. Analysis of the impact of both the clean growth mission to halve the energy use of new buildings, and the CGS retrofit target for reducing energy use in existing buildings found that compared to a baseline scenario with no

action, building energy demand could be reduced by up to 25% in 2030, with a GDP multiplier on investment of around 1.5 and up to 70,000 jobs created annually (Nieto et al. 2019). While the announcement of the Green Homes Grant scheme is welcome, further action is needed to both deliver the existing targets and go further to meet the 95% emissions reduction for buildings seen in the CCC's net-zero scenario (CCC, 2019).

Of relevance to the mobility mission is UKERC's work to analyse the impact of the Government's target to phase out conventional petrol and diesel vehicles (Brand et al. 2020). This found that existing policies[3] may neither hit carbon reduction targets nor make the early gains needed for a Paris-compliant trajectory. Deeper and earlier reductions in carbon and air quality emissions could be achieved by a more ambitious but largely non-disruptive 2030 phase out that includes plug-in hybrids. The earlier phase outs combined with lower demand for mobility and car ownership would make significant contributions to an emissions pathway that is both Paris compliant and meets urban air quality goals.

References to Q4

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[3] Based on the 2040 phase out date.

5. How should regional and local government in England, (including the role of powerhouses, LEPs and growth hubs, mayoralties, and councils) be reformed and better equipped to deliver growth locally?

The UK Chancellor and UK Committee on Climate Change (2020) have indicated that post-pandemic public spending must deliver economic recovery (including jobs), alongside commitments to net zero greenhouse gas emissions. English regional and local governments are well-placed to contribute to both, while simultaneously improving the resilience of localities.

UKERC research shows the widespread ambition of local governments to act on clean energy and climate protection (Webb et al, 2017), but constraints on public finances, and lack of clear strategic direction from UK government, has limited their ability to plan and invest. Nevertheless, valuable local expertise has accumulated, with some councils integrating energy into local plans, particularly for clean heat and energy efficiency in buildings (*Local Energy in UK Energy Systems*). A notable example is Gateshead District Energy set up by the local authority and providing affordable local heat and power, flexibility services to the grid, and town centre regeneration. Innovative local energy developments can often act on the hardest decarbonisation targets for central governments to tackle.

Our forthcoming report *Net Zero Localities: Ambition & Value in UK Local Authority Investment* (Tingey and Webb, forthcoming) updates earlier research, demonstrating the multiplier effect of affordable, systematic public investment in local and regional authorities for an economic recovery geared to net zero emissions in buildings, heating and transport.

Key points are:

Current local investments across housing, public and commercial buildings, transport and industry are failing to capture major cost-effective carbon savings[4].

Decarbonising heat, through low regrets options such as heat networks, offers considerable opportunity for immediate progress. Using very conservative estimates, if every local authority developed one average sized heat network in an area of high heat density and diversity of demand, this would represent an investment of over £5 billion in low carbon heat supply.

Investing in skills and expertise in local and regional governments accelerates net zero carbon programmes. European 'technical assistance' programmes provided funds to establish very successful local authority energy teams: in the UK every €1 in grant aid

[4] See for example https://www.leedsclimate.org.uk/sites/default/files/6660%20Leeds%20mini-stern%20exec%20summary_v3.pdf

has delivered about €37 investment[5]. On this basis, £1 million technical assistance funding to every English local authority could lead to over £12.5 billion in local energy investment.

Regional funds, such as the Mayor of London's Energy Efficiency Fund, have brought institutional investors on-board, combining public and commercial finance. Their collaboration has created 'the UK's largest ever dedicated investment fund for urban energy efficiency measures' (GLA, 2018) and is catalysing major local energy developments such as *Energetik*. Regional funds such as this have the potential to be replicated across English authorities.

To date UK government has provided only partial and intermittent strategic direction for local and regional government to contribute to energy decarbonisation; the situation differs in Scotland and Wales, with some divergence in policies, and opportunities for mutual learning. Systematic policy is now needed to step up from a few local authority 'energy leaders' to many. Existing initiatives signal the major potential for local net zero emissions' investment, with relatively minor changes in public policy to create local statutory powers and resources.

Our research concludes that the following reforms are necessary:

Establish a new policy mandate for net zero carbon localities to convert local authority ambition into action, and establish coordination between UK and English regional and local governments. Critically this will reduce uncertainties for businesses, investors and communities.

Institutionalise local net zero carbon planning and implementation through a new statutory power and devolved resources to secure long-term benefits from supply chain innovations, reskilling, high value local jobs, better health and improved housing.

Invest in local authority net zero teams. Provide technical assistance funding to develop and implement area-wide net zero carbon plans. Combine projects into regional programmes to attract long term finance on affordable terms, and prevent short-term 'cherry picking'. Back this up with regional and national coordination and support functions, building on the work of the Local Energy Hubs. In consultation with English local authorities, LEPs and key businesses such as gas and electricity DNOs, UK Government now needs to establish the long-term net zero remit of the Local Energy Hubs in accelerating local and regional scale action. Hub projects at 'shovel ready' stage can be immediately integrated into economic recovery.

Evaluate all local and regional public expenditure against net zero principles. This requires new cost-benefit analysis metrics to institutionalise net zero carbon

[5] Results reported in Tingey, M. and Webb, J. (forthcoming). Data extracted and compiled from individual local Elena programme factsheets published by EIB: European Investment Bank. 2020a. ELENA – On-going Projects Factsheets; European Investment Bank. 2020b. ELENA – Closed Project Factsheets

investment across local authority finance, procurement, land use planning, services and spending.

References to Q5

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