Net Zero Review: Call for evidence

Response from UCL Institute for Sustainable Resources

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The UCL Institute for Sustainable Resources delivers world-leading research, teaching, and enterprise in the sustainable use of global resources.

We welcome the opportunity to present evidence to this review. We have chosen to answer the first section on Overarching questions.

We would be delighted to discuss this consultation, or any of our other work. Please contact Katherine.page@ucl.ac.uk

Overarching questions

1. **How does net zero enable us to meet our economic growth target of 2.5% a year?**

While we cannot comment on role of net zero in relation to any specific growth target (or the feasibility of any particular economic growth target), we can make three broad observations regarding net zero and economic growth.

First, climate change itself imposes damages on UK welfare and the UK economy. This is illustrated by the floods and the extreme summer heat this year leading to excess deaths and loss of productivity. Damages are driven by global emissions, but action by the UK is crucial in the global context for multiple reasons. These include disproportionate historical emissions; the world's first binding Climate Change Act and a key precedent for net zero emissions targets that have spread more widely; co-chair role of the IPCC Sixth Assessment Mitigation Report; host of the Glasgow COP26; leadership in some key technology areas (e.g. offshore wind); and more.

The IPCC Sixth Assessment surveyed the literature on cost-benefit appraisal of global mitigation and concluded that most such assessments now indicate that the global goals adopted in the Paris Agreement yield net economic benefits, even if extreme risks from climate change are set aside. Reaching net zero emissions is fundamental to achieving these goals.

Second, the past decade in particular has demonstrated the potential for net economic gains arising from well-designed mitigation efforts. Already before the energy crisis, renewables including the most recent round of offshore wind auctions, were becoming cheaper than fossil-fuel generated electricity. In the midst of the energy crisis, this now results in an extraordinary degree of 'cost inversion' in the electricity system – the price of Round 4 Contracts for Difference (CfD)[1] for offshore was about a quarter of the average wholesale electricity

[1] https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-4-results

price last winter. Discussion, data and projections are set out in our Working Paper series on *Navigating the energy – climate crises*.[2]

Similar degrees of cost-reducing innovation have been seen in electric vehicles - which most assessments now indicate are cheaper than internal combustion engine cars on a life-cycle basis, again, even before the recent increases of international oil prices. This is part of a wider understanding of the potential for innovation and transition which has been inadequately represented in traditional economic thinking.[3]

Low carbon technology-industries consequently offer potential economic opportunities. The Aldersgate Group argued recently that the UK is already benefitting from the economic opportunities of having ambitious environmental and climate change policies.[4] They state that in 2020, business involved in low carbon and renewable energy sectors generated over £40bn in turnover and directly employed over 200,000 people. Other estimates on the economic impact of net zero for the UK include the Cambridge Econometrics (CE, 2020)[5] study for the Climate Change Committee (CCC) which states that GDP would be 2-3% higher over the period 2020-2050 and a net increase of 300,000 jobs. This occurs due to a combination of falling costs, utilising spare capacity, reduced oil and gas imports, and a move towards capital-intensive rather than energy-intensive investments. However, both the CCC's own costs and the Cambridge Econometrics report omit other significant aspects of co-benefits such as health improvements from improved air quality and active transport and they do not include avoided climate damages, therefore likely underestimating the economic benefits to society.

Third, there is obvious potential for economic gain from enhanced energy efficiency. The CCC has underlined the collapse of investment in energy-efficient homes following policy changes in 2012. This has consequences in the current crisis because many households are paying higher heating bills than they would have done if levels of investment had remained at their pre-2012 levels over the past decade. Recent analysis underlines that the UK is substantially lagging in domestic energy efficiency compared to many other European countries, leaving us with higher energy bills.[6]

Finally, not unrelated, the energy crisis has yet again (as in the 1970s, and in the late 2000s) revealed the macroeconomic risks arising from instability in global fossil fuel markets: aside from absolute prices, the shocks themselves have macroeconomic consequences, and have exposed security dimensions. The recent crisis has been focused around Russia, but instability from the Middle East, and the leverage that global oil and markets give to regimes in that region, cannot be ignored.

2. What challenges and obstacles have you identified to decarbonisation?

Some sectors, such as the power sector, have made great progress towards decarbonisation. This is in large part due to consistent policy incentives over the medium-long term, and sustained government support e.g. in terms of subsidies, market reforms, incentives and planning. There is significant scope to learn lessons

[2] https://www.ucl.ac.uk/bartlett/sustainable/research-projects/2022/sep/reforming-electricity-markets-low-cost-and-low-carbon-power
[3] An exposition of evidence base and theoretical context, grounded in five case studies (including electric vehicles), is given in M.Grubb et al (2021), *The New Economics of Innovation and Transition: Evaluating Opportunities and Risks*, available at https://eeist.co.uk/eeist-reports/
[4] Aldersgate Group (2022) The Green Line: A Route out of the Crisis and Towards Prosperity. Aldersgate Group; https://www.aldersgategroup.org.uk/content/uploads/2022/09/The-green-line-a-route-out-of-crisis-and-towards-prosperity-an-Aldersgate-Group-manifesto.pdf
[5] https://www.theccc.org.uk/wp-content/uploads/2020/12/Cambridge-Econometrics-Economic-Impact-of-the-Sixth-Carbon-Budget.pdf
[6] For example: https://eciu.net/insights/2021/uk-left-out-in-the-cold-as-europe-storms-ahead-on-efficient-homes

from success with the power sector (see our response to Q1 above). These lessons can help to inform the design of policies to drive similar cost reduction dynamics in other sectors such as transport, industry and buildings. With respect to challenges, we would highlight two overarching points.

First, any perceived instability in commitment to the net zero goal and the trajectories laid out under the Climate Change Act, and/or associated policies. We repeatedly learn from industry that what they most need to enable efficient investment and effective innovation is stability in the policy landscape. Every time the net zero goal is questioned; every wavering in low carbon policies; and every assessment by the CCC that policies remain substantially insufficient, lessens industry confidence in the direction of travel and raises the perceived risk of low carbon investment. This is not just concerning 'big ticket' investment items. The cost of a stop-start approach to energy efficiency, which have caused the repeated build-up and collapse of the skills base for delivering energy efficiency, has been obviously detrimental to both UK value-added in the construction sector, as well as to our national and household energy bills.

Second, we suggest that an obstacle, historically at least, has been an element of economic (and sometimes political) ideology. Markets have a very important role, but they cannot themselves drive the scale of investment needed in either energy efficiency – which is replete with numerous barriers and endemic 'market failures' – or in innovation. Innovation requires sustained and direct government support to facilitate large-scale investment, learning-by-doing, and scale economies all ultimately leading to the low-cost and efficient finance that we now see for e.g. offshore wind. Our own research leads to the conclusion that many of the most valuable developments have occurred despite, not because of, the mainstream economic advice of the time.[7] The challenge is to coordinate policies for efficiency and industrial strategy *along with* appropriate developments of market structures and carbon pricing, as also implicit in the findings of the IPCC Sixth Assessment.

Other perceived challenges include the apparent disconnection between the central government decarbonisation agenda and Local Authority agendas and priorities; decarbonisation led by top-down approaches mainly focusing on large infrastructure, with very little, if any, action and engagement on the demand side and consumer led/ community scale interventions. There is also a risk that the focus on decarbonisation ignores trade-offs and co-benefits with other priorities, e.g. the natural environment.

Decarbonisation can imply producing the same outputs with lower, or mitigated, environmental impacts. But it can also imply doing things differently. Taking a whole systems approach that recognises the intrinsic links between sectors would be most efficient for long-term system change. This however means that the message given by policy across the system needs to be unequivocal and robust in the long term.

3. What opportunities are there for new/amended measures to stimulate or facilitate the transition to net zero in a way that is pro-growth and/or pro-business?

Economic growth comes about through two main routes: investment and productivity improvement, with the latter often being driven by the former. The UK's net-zero strategy needs to include clear incentives to drive investment in low-carbon technologies and infrastructures – and those incentives need to be durable and long-term. Government has a critical role in providing or stimulating the private sector to provide, investment in such areas as EV charging, power transmission and distribution infrastructure, electricity storage and carbon sequestration in agriculture. As we note in our response to Q1, the Contracts for Difference for electricity generation have been an exemplary success. However, this is not a reason for complacency. The Aldersgate Group has argued recently that UK government policies are lagging behind business ambitions for investment in areas such as home energy efficiency and low carbon power in general.[4] Furthermore, multiple short-term changes in policy – especially where they are not predictable – make it very difficult for businesses to make the longer-term plans and investment decisions that are required to meet UK carbon budgets and targets.

[7] See in particular the two main reports available at www.eeist.co.uk

There are many areas which are 'win win' i.e. good for emissions reductions and growth. These include large-scale programmes to upgrade homes, which could have huge economic benefits for supply chains and households themselves (via lower energy bills); ensuring we meet targets for phasing out fossil (ICE) vehicles, which would benefit substantial UK-based supply chain for electric vehicles and charging infrastructure; and future proofing our remaining industrial clusters by implementing plans for decarbonisation.

A more distributed, flexible, and diversified energy supply including both centralised generation and locally distributed renewables will also help us to quickly recover in the face of shocks and disruptions to society (climate related events as well as global conflicts). By accelerating technological development, diversifying investment including towards renewables, and skills re-training, the UK's security and resilience can be strengthened (see Q6 below). As the BEIS public attitude tracker shows there is very significant concern by the UK public over climate change,[8]. Leaders and organisations supporting transitions that benefit both industries and communities are also likely to enjoy a greater mandate from the public.

4. What more could government do to support businesses, consumers and other actors to decarbonise?

The UK is in a strong scientific and technological position to decarbonise across society, however, there is scope to strengthen the institutional environment and culture for transformation. All actors across society, whether business, consumers, trade associations, workers unions, investors, or communities, require a clear, coherent and robust strategic plan to collaborate on and follow, as well as the conditions that support action. While the pathway to decarbonisation is outlined in government strategies (including the Net Zero Strategy that was published a year ago), the specific drivers for action are sometimes opaque and uncertain – causing confusion, delays and inaction. Government support can be strengthened through a bipartisan commitment to providing certainty and incentives that ensure low carbon investments are favoured over fossil fuels.

First, certainty in respect of net zero – providing fairness and transparency[9] – is essential for actors to invest and grow in times of uncertainty (e.g., energy crisis, climate change, Ukraine war). For business, regulatory certainty, for example, allows them to plan appropriately (e.g., resource generation and allocation (financial and employee), research and development, innovation) and generate insights into potential return on investment of new technologies and revenue streams because they understand the parameters of action. Providing stability and a sense that the rules of engagement will not be changed in a couple of years strengthens strategic planning exercises and sets a minimum standard of legal compliance for business to meet. Reducing certainty increases precautionary or wait-and-see behaviour.

Second, incentivise key intermediaries to innovate and upskill to facilitate decarbonisation. For example, plumbers have a key role to play in facilitating the roll out of heat pumps to replace traditional gas boilers. Plumbers not only install the technology, but also, often influence the decision making of consumers by providing them with information about their potential purchase. The right set of incentives can motivate plumbers to transform their business model. Government may offer free training on how to install and maintain heat pumps, and/or % return or tax reduction on heat pump installation. The CMA is currently running a call for information on consumer protection in the green heating and insulation sector.[10]

[8] https://www.gov.uk/government/statistics/beis-public-attitudes-tracker-summer-2022

[9] A greater emphasis on what transparency means has the potential to reduce greenwashing, which is persistent and growing. Current name and shame pressures maybe leading to businesses greenhushing (South Pole. 2022. https://www.southpole.com/publications/net-zero-and-beyond), where they do not talk about their climate activities. Providing businesses with the tools to be transparent, and stakeholders with the knowledge to understand how to use information shared, can begin to reduce cases of misinterpretation/understanding.

[10] https://www.gov.uk/government/consultations/consumer-protection-in-green-heating-and-insulation-sector-a-call-for-information

From a purely behavioural perspective, the government should focus on creating an enabling environment (facilitating default options for instance and making sustainable choices easier and quicker). At the same time, it is key to work on citizens' choices through behavioural interventions and nudges: in terms of specific fields of action, decades of literature show significant results in terms of reducing households' energy consumption, improving recycling, or shifting towards a more sustainable diet. The last IPCC report[11] shows how socio-cultural factors could play the most important role when we consider nutrition, with a potential reduction of several gigatons of CO_2 per year.

Finally, policies are needed that target energy demand reduction in a consistent way across all sectors of the economy. Reaching net zero without energy demand reduction is very difficult and relies on currently unproven and complex technologies. The easiest and most cost-effective energy-use to decarbonise is the one that does not occur in the first place. Both UK research and past UK experience show, that sustained residential energy efficiency programmes offer a cost-effective way of decarbonising household energy consumption in the immediate and short-term. This can go much further when applied to the whole energy system. Avoiding waste, shifting to different modes of service delivery, and improving the way that end use energy services are delivered could mean that the UK delivers all the services its citizens need in 2050, without affecting quality of life, all the while using half the energy that it uses today. [12] This is not possible without the long-term, bipartisan, and transformative approach set out above, but taking such an approach would make the UK truly world leading.

5. Where and in what areas of policy focus could net zero be achieved in a more economically efficient manner?

In terms of policy, there is no 'magic bullet' that will ensure decarbonisation with maximum economic efficiency. The appropriate policy instrument, or combination of instruments, for each context needs to be assessed separately. That said, it is possible to draw some general conclusions from past experience:

- In principle, carbon pricing across the economy could be effective in a wide range of contexts, and raises public revenue rather than expenditure. In practice, pure carbon pricing has been difficult to implement. Instead, proxies such as contracts for difference for low carbon electricity have been much more practical and effective to introduce.
- Current energy prices offer opportunities[13] to some households (especially those in the higher income deciles) and businesses to cost-effectively reduce gas use through energy efficiency measures and renewable technologies. It is important to note that many households on low and modest incomes will find it very difficult to meet their basic energy needs this winter. Therefore, the effectiveness of high prices as a driver of energy efficiency will be extremely limited for these households. Instead, they will require government help to make the investments that are required to help them reduce their bills over the medium-term. If and when energy prices fall, a carbon tax could maintain this incentive for decarbonisation and more efficient energy use.
- Regulation has been effective, especially in respect of energy efficiency in contexts that are not responsive to prices.[14] But regulations (e.g. on building energy efficiency) need to be enforced if they are to be effective. Support for innovation and for innovative businesses in a range of economic sectors will be critical to achieving decarbonisation and is likely to be positive in terms of economic growth as well. Governments will need to ensure that infrastructure is available in advance of when it

[11] https://www.ipcc.ch/report/ar6/wg2/
[12] https://www.nature.com/articles/s41560-022-01057-y
[13] https://www.iea.org/commentaries/accelerating-energy-efficiency-what-governments-can-do-now-to-deliver-energy-savings
[14] Lees, E. and Eyre, N. 2021 Thirty years of climate mitigation: lessons from the 1989 options appraisal for the UK, Energy Efficiency, 14: 37, https://doi.org/10.1007/s12053-021-09951-2

is needed: e.g. charging infrastructure for EVs; power transmission and distribution for both centralised and distributed renewables; electricity storage, through batteries and hydrogen, the latter making use of renewable electricity at times when it is surplus to demand.

6. **How should we balance our priorities to maintaining energy security with our commitments to delivering net zero by 2050?**

Energy security is higher on the agenda now than it has been for several decades. Russia's invasion of Ukraine and the high oil and gas prices have brought this issue back on to the agenda. Whilst the UK is less dependent on Russia than many other European countries – particularly for gas – it is clear that we are not immune from the impacts of high prices or the knock-on effects of efforts by other countries to reduce their dependency on Russia.

However, the context today is very different to that of the past. When the pursuit of decarbonisation first became an emerging priority in the UK in the early 2000s, it was sometimes viewed as being in conflict with increasing energy security and energy affordability/equity. This three-way conflict was commonly dubbed the 'energy trilemma'. When most key technologies required to achieve decarbonisation were immature and expensive with respect to existing stock (e.g. solar and wind vs natural gas power; electric vehicles vs internal combustion engine vehicles), trade-offs appeared strong. A notable exception was measures to cost-effectively improve energy efficiency across the economy.

However, the rapid and sustained reduction in the costs of key low-carbon technologies, delivered mainly through innovation and learning induced by subsidy-supported early deployment,[15] have reduced these trade-offs. Much stronger synergies between the three points of the energy trilemma have emerged. For example, before the onset of the energy crisis new solar PV, onshore wind and offshore wind capacity either were estimated to have average costs at or below the prevailing wholesale electricity market prices. With the rapid rise in gas and subsequently electricity prices since early 2021, new renewable technologies have become even more economically attractive. For example, new offshore wind contracts under the Allocation Round 4 (AR4) of the Contracts-for-Difference (CfD) mechanism in early 2022 were awarded prices at around nine times lower than the cost of electricity generated from existing gas power plant. Due to the characteristics of the Great Britain's electricity generation capacity, and an electricity market based on marginal costs and an associated 'merit order' of generation, each unit of renewable electricity generation almost directly offsets a unit of electricity generated by natural gas combustion. This reduces emissions and system costs and enhances energy security through a reduction in natural gas demand and imports. New renewable technologies, and particularly onshore wind and solar PV, can be built much more rapidly than other forms of capacity if incentives and planning regulations allow.

The costs of other key low-carbon technologies, such as electric vehicles and electrically powered heat pumps, have also reduced rapidly in recent years and likely to continue decreasing.[3] Although the capital costs of these technologies typically remain higher than their fossil fuel-based counterparts, their significantly higher efficiency means that often their total costs are comparable, or lower. Coupled with increasing proportions of low-cost renewable electricity generation, their deployment also simultaneously reduces emissions and costs, and reduces demand for (largely imported) fossil fuels and their derivatives.

Although the British electricity system is to reach net-zero emissions by 2035, some natural gas generation capacity will still be required to occasionally balance the system, and natural gas will be required for at least some space and water heating and in industrial processes for many years to come. The same applies to the use of oil-derived products in transport. A secure and affordable supply of natural gas, oil and its derivatives, will thus remain important, even with rapidly falling demand.

[15] Anadon, Jones, Peñasco et al, Ten principles for policy making in the energy transition: Lessons from experience, Economics of Energy Innovation Systems Transition (EEIST) https://eeist.co.uk/eeist-reports/

Therefore, it will be essential for the UK to manage the security and resilience of natural gas use during the transition to net-zero. That means doing everything we can to reduce gas demand, particularly by revitalising household energy efficiency programmes, and replacing gas boilers with heat pumps where this is feasible. It also means considering whether the UK might need more gas storage and ensuring that gas is sourced from a diverse range of sources – and via a diverse range of supply routes.

Although the low-carbon transition now largely contributes to energy security and affordability, the transition must also be managed to minimise new risks. An electricity system based on intermittent renewables requires a high degree of geographic distribution, significant increases in transmission infrastructure, and substantial deployment of energy storage (i.e. batteries and other longer duration storage) and new interconnector capacity. This transformation will require new market, legislative and policy structures that facilitate, drive and co-ordinate this transformation, and which connect supply to more actively engaged consumers, as end-use sectors become increasingly electrified.

Transitioning to this more complex system may create new risks to energy security and affordability both foreseen and unforeseen. Key low-carbon technologies also require greater use of critical minerals such as lithium, cobalt, nickel and rare earth elements, which may create new dependencies on regions of geopolitical instability, and dependencies on those with fossil fuel reserves decline. That means paying attention to the diversity of sources and supply routes for such minerals, in the same way traditional energy security has been concerned with the diversity of fossil fuel supplies, and to give much greater attention to 'circular economy' ideas concerning the durability, re-use, re-manufacturing and recycling of the products than has occurred in the past. Both types of risk –intermittency and critical mineral availability - will require close monitoring by Government to plan for, mitigate and adapt as necessary to these risks and potential impacts, as the net-zero transition progresses.

7. What export opportunities does the transition to net zero present for the UK economy or UK businesses?

As 91% of global GDP now occurs in countries that have net zero targets there is substantial global demand for low-carbon products and services which will likely only grow internationally over the coming decades.[16] BEIS has previously carried out a significant amount of analysis of the export opportunities for a range of low carbon technologies that are essential for reaching net-zero – both in the UK and abroad.[17] The most recent round of these Energy Innovation Needs Assessments (EINAs) were published in 2019. This process prioritised 600 innovations that had a strong case for government investment, based on the potential economic benefits to the UK (for example, by lowering the costs of meeting climate change targets) and larger export markets.

We recommend that this evidence base is used as a starting point for any further analysis by the current government, which can help to target support for R&D, demonstration and deployment of the technologies and infrastructures required to meet net-zero. In addition to this, we agree with the Aldersgate Group, that any updated set of priorities should be integrated into the UK's priorities for international trade.[4]

Offshore wind is a good example where stable government support has driven down technology costs and supported the growth of an industry. Although many of the leading offshore wind farm developers working in the UK are not UK businesses, export opportunities exist for UK supply chain companies and associated knowledge, consulting and financing expertise. In a future European electricity system with a high proportion of renewables, balancing electricity supply and demand across the continent is very cost-effective - the UK's

[16] https://zerotracker.net/
[17] Vivid Economics (2019) Energy Innovation Needs Assessment: Overview Report. Report commissioned by BEIS from Vivid Economics and a consortium of partners; https://www.gov.uk/government/publications/energy-innovation-needs-assessments

offshore wind, in particular, will provide export opportunities in that context. Access to low-cost renewables, particularly offshore wind, also opens up the potential to lead the way in green hydrogen production and techniques to store it long term (e.g. in salt caverns).