INDEPENDENT REVIEW OF NET ZERO

About E3G

E3G is an independent, not-for-profit climate change think tank. E3G has been a leading expert voice for over 15 years on areas including green and sustainable finance, energy efficiency and zero carbon heat, and energy system decarbonisation, as well as on the political economy and governance of climate policy. Evidence submitted reflects these areas of specialisation. E3G provides secretariat support for the Transition Plan Taskforce, the Green Finance Institute's Coalition for the Energy Efficiency of Buildings, the Energy Efficiency Infrastructure Group, the Electrify Heat Coalition, and the Taskforce on Climate-related Financial Disclosures.

Executive summary

The transition to net zero and economic growth are complementary trends. The global economic story of the 21st century will be dominated by the investments, innovation and consequent transformations in productivity that decarbonisation entails. Renewables, electrification, energy system digitalisation and efficiency all enjoy significant economies of scale, unlike fossil fuel-based energy systems. Recent research from Oxford University found that, given significant improvements in renewables energy cost and deployment rates in recent years, transitioning to a net zero energy system by 2050 is economically beneficial even without accounting for climate damages or climate policy co-benefits.[1] The net present saving of transitioning to net zero energy globally is between $5 and $12 trillion, using the range of widely accepted reasonable discount rates.[2] Soaring oil and gas prices, geopolitical tensions, and the likelihood of continued volatility serve to underline that transitioning to net zero is also an energy security imperative.

Accounting for climate damages makes the cost-benefit picture even more stark. Recent events have shown how serious the impacts of the damages the UK is exposed to can be. European floods in July 2021 cost Germany, Belgium and the Netherlands $43bn in damages.[3] The total costs of climate damages are projected under current policies to increase to 3.3% of UK GDP by 2050 and

[1] **Way R., Ives M., Mealy P., Doyne Farmer J., Joule Volume 6 Issue 9, 13 September 2022, Empirically grounded technology forecasts and the energy transition**

[2] **Way R., Ives M., Mealy P., Doyne Farmer J., Joule Volume 6 Issue 9, 13 September 2022, Empirically grounded technology forecasts and the energy transition**

[3] **Barclays, 4 May 2022, Gloomy forecast: The economic costs of extreme weather**

7.4% by 2100.[4] HM Treasury projections must include these costs in order to take sensible, pro-growth and pro-net zero decisions in the years ahead.

The fundamental ingredients that drive economic growth – reducing energy inputs costs, using resources more efficiently, making productive investments, encouraging innovation, digitalisation, upskilling, and creating export opportunities – are at the core of the net zero transition.

The UK has comparative advantage in several key sectors, including in the professional services and financial industries that will be essential as countries and companies across the world re-allocate their investments, and as global capital expenditure flows into clean energy infrastructure. Our North Sea wind resources could be an engine of future economic activity, as a source of domestic energy and exports and through developing world-leading expertise in renewables. The UK's leading universities and science and tech centres will give the country an edge in many of the new technologies and services that net zero will generate. Moreover, supplying the goods and services for the global net zero transition could be worth over £1 trillion to UK businesses by 2030 – with high growth opportunities for the City of London such as in commercial (re)insurance and rapidly scaling green bond markets.[5]

Energy efficiency is a critical piece of the economic, energy security and climate case for net zero. Reducing final energy demand in homes would raise household disposable incomes, shrink the UK's trade deficit - increasing the value of the pound - and bolster our energy security. There are also domestic manufacturing opportunities and the potential for hundreds of thousands of skilled jobs across the country in sectors like home decarbonisation, in addition to productivity-boosting health co-benefits.

This submission focuses on three areas where the UK has an important opportunity, and where successful UK leadership could have the biggest impact on economic growth:

> **Finance:** The UK has an opportunity to secure its status as the world's leading global financial hub by delivering an ambitious Net Zero Financial Centre. The UK could become the main provider of financial and related professional services for the global net zero capital reallocation process, and lead in setting standards and norms for sustainable investment.

[4] **Grantham Research Institute, 30 May 2022, What will climate change cost the UK? Risks, impacts and mitigation for the net-zero transition**

[5] **Climate Bonds Initiative, 20 October 2022, Green Bond Market Hits USD2tn Milestone at end of Q3 2022**

- **Energy and power:** Massively increasing renewable generation, decarbonising the power sector and electrifying as much of the economy as possible is the core task of the net zero transition worldwide. The UK has made huge progress decarbonising its power sector. With the right regulation and market structures in place to attract investment in generation, transmission and digital technologies, UK consumers and businesses can be among the first in the world to benefit from the net zero promise of clean, abundant and cheap energy.
- **Homes and buildings:** The gas crisis has underlined the need to waste less energy in inefficient buildings and to protect consumers and businesses from unaffordable prices. The built environment is also the source of around one-fifth of UK emissions. If the UK acts decisively to decarbonise the buildings, households and businesses will save money, the government will be less exposed to volatile gas prices – which pose a significant threat to fiscal credibility while its energy support schemes are in place – and our energy security will be improved.

Recommendations

Finance

- **Net Zero Investment Plan:** Thirty major private sector firms across finance and the real economy, representing £3 trillion in assets under management, recently called for the government to include a Net Zero Investment Plan (NZIP) within the Green Finance Strategy to leverage in the maximum level of private sector investment into the net zero economy. This should be underpinned with an independent unit to monitor public and private financial flows in support of net zero, assess the net-zero investment gap and advise how this can be filled in a way which maximises benefits for the UK economy.[6]
- **UK Infrastructure Bank (UKIB) mobilises investment at scale for net zero and resilience:** The UKIB should take proactive action to mobilise investment in key sectors like the built environment and nature, taking proactive action to tackle market barriers. Government should strengthen the Bank's mandate to mobilise investment towards net zero, and increase the capitalisation of the Bank over time commensurate with need. The Green Finance Strategy should also set out the relationship between UKIB and other sources of public investment and finance for net zero.
- **Account for the reality of climate impacts in policy-making forecasts:** UK fiscal credibility and its ability to make long-term decisions rest on facing up to reality, whether on economic forecasts or climate change. The Treasury must incorporate climate impact projections into its

[6] **E3G, 19 October 2022, Investors managing £3 trillion in assets call on UK government to deliver Net Zero Investment Plan**

economic forecasts, rather than assuming business-as-usual conditions which will bear increasingly little relationship to reality, so it can make decisions based on accurate information.

> **Gold-standard UK Green Taxonomy**: A credible, science-based green taxonomy to define sustainable economic activity is a baseline requirement for a flourishing green finance sector. To have integrity, the taxonomy must not include gas as a sustainable investment activity.[7]

Clear, consistent, and competitive financial regulation: The UK can set international norms by including a net zero emissions target within the statutory responsibility for financial regulators. This includes setting a gold standard for transition planning for financial institutions and companies that is backed by a science-based green taxonomy.

Energy and power

> **Remove planning restrictions that get in the way of onshore wind and solar projects:** Onshore wind and solar power are quick and effective routes to cheaper electricity, greater energy security and economic growth. Removing the de facto ban on onshore wind and ruling out further restrictions on solar would be no-regret, cost-free and immediately actionable.

> **Create an independent system operator and planner (ISOP):** An ISOP should be created to advise government and Ofgem on energy infrastructure investment decisions, including demand-side and digital assets, based on up-to-date, independent assumptions and analysis.

> **Digitalise the grid and support investment in flexibility:** The network price control review process and market review must contribute to the goal of a digitalised energy system fit for the 21st century, which is needed to decarbonise power at least cost and maximum benefit.

> **Take advantage of power export opportunities:** The UK should become a proactive partner in the North Seas Energy Co-operation to build an integrated North Sea grid and take advantage of £25bn in system benefit driven by energy trading.

Homes and buildings

> **Boost investment in energy efficiency to improve energy security and maximise savings, setting a target to cut energy demand in homes by 25% by 2030:** A target of 25% demand-reduction by 2030 is feasible and in line with the Climate Change Committee's 6th Carbon

[7] **E3G, 1 June 2022, United call for a gold-standard green taxonomy**

Budget "Tailwinds" scenario.[8] This would significantly reduce our import dependency, which would also reduce inflationary pressures in the UK economy. Action on energy and product efficiency would translate into higher consumer demand through household savings.

- **Clear regulatory signals to drive investment:** Clear, long-dated regulatory signals can have a transformative effect on business investment. The UK should legislate for a phase-out of gas boilers from the early 2030s, implement stronger efficiency standards in the private rented sector, and make clear that electrification will be the core technology for heat decarbonisation.
- **Renewed focus on skills and supply chain development with an "Olympic-style" academy:** The UK should learn the lessons from previous large infrastructure projects to ensure we have the skilled workforce we need to match the demands of decarbonising the built environment.
- **A smarter approach to subsidy and finance:** Where subsidy is required, government should aim for dynamic levels that can flex to match market development and demand and should explore household-level blended or concessional finance to help retrofit homes.
- **Dedicated and independent consumer advice:** Improving the consumer journey for retrofits is essential. Independent advice services have been shown to boost demand and cut emissions.

[8] **Climate Change Committee, 9 December 2020, Sixth Carbon Budget Report**

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

The UK's growth and climate targets go hand in hand. The global growth story for the next several decades will be driven by the transition to a low-carbon economy. The UK showed leadership by establishing its net zero greenhouse gas emissions target in law in 2019 and much of the rest of the world has followed suit. Net zero targets cover 90% of global GDP, with most peer countries in the developed world (including the United States) aiming for 2050 or sooner. More than one-in-three of the world's largest publicly traded companies have net zero targets.[9] The Glasgow Financial Alliance for Net Zero, launched at COP26, contains more than 500 firms representing $130 trillion of private capital committed to net zero by 2050.[10] Meanwhile, the costs of climate change are having significant economic and social impacts around the world. The total costs of climate damages in the UK are projected under current policies to increase to 3.3% of GDP by 2050 and 7.4% by 2100.[11]

The direction of travel is clear, and competition is getting fiercer in the emerging clean industries of the 21st century. The energy price crisis currently gripping much of the world has brought new urgency to the shift to clean energy. But the UK is still in a strong position to benefit as an early mover and to build the kind of modern, internationally competitive and attractive net zero economy that is a pre-requisite for 2.5% growth.

The transition to net zero emissions in the UK and around the world will create huge opportunities for British businesses, particularly in areas where the UK already enjoys competitive advantages. The UK is a global leader in financial, professional, and technical services, all of which will be in high demand for the capital investment intensive processes required for the energy transition. The UK has a growing tech industry, world-leading universities and scientific capacity, and a history of energy sector innovation and expertise in renewables like offshore wind. The transition to net zero in people's daily lives, notably in their homes and wider built environment, has the potential to deliver significant cost savings, health benefits and greater comfort and convenience. The process of decarbonising the built environment will also lead to investment and job creation in every part of the country and create manufacturing supply chains with strong export potential.

[9] **Net Zero Tracker, 13 June 2022, Net Zero Stocktake 2022**

[10] **Glasgow Financial Alliance for Net Zero, 3 November 2021, Amount of finance committed to achieving 1.5 now at scale needed to deliver the transition**

[11] **Grantham Research Institute, 30 May 2022, What will climate change cost the UK? Risks, impacts and mitigation for the net-zero transition**

Global economic uncertainty makes the case for investment in renewables and energy efficiency even stronger. Focusing on cheap and secure domestic renewables will reduce our exposure to global supply shocks. Investments in renewables and energy efficiency will lead to productivity gains and can act as a disinflationary force. This is because, unlike fossil fuels which generally experience diminishing returns to scale, renewables technologies have positive economies of scale and accelerating cycles of innovation.[12] These productivity and reliability gains are not conditional on external macroeconomic scenarios, making them a safe and prudent investment at any time. Recent Oxford University research shows that the global transition to a net zero energy system will be beneficial even without accounting for the climate benefits of acting or disbenefits of failing to act, with net present savings of between $5 and $12 trillion by 2050.[13]

Net zero will mean different things to different sectors of the economy, but several principles will hold for all sectors. Net zero will mean greater **efficiency**, turning our economic inputs – energy, capital and labour – into our desired outputs more effectively. Moving away from fossil fuels will reduce the input cost of energy to the economy, and a flexible and renewables-dominated energy system will create new opportunities related to periods of zero-marginal-cost energy generation. Net zero will also mean significant capital **investment**, mostly from the private sector, which is a key driver of productivity. The transition will create new, **high-skilled jobs** across a range of industries, and will drive **innovation** in business models and technologies which are likely to create spill overs across the economy. The co-benefits of the transition, most notably in the health impacts associated with reduced air pollution, will also contribute to productivity growth.

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

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?

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

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

[12] **Grantham Research Institute, July 2022, Policies for investing in sustainable growth: risks and opportunities in the current macroeconomic environment**

[13] **Way R., Ives M., Mealy P., Doyne Farmer J., Joule Volume 6 Issue 9, 13 September 2022, Empirically grounded technology forecasts and the energy transition**

To achieve net zero while maximising the benefits and minimising the costs, the UK needs a stable, clear, and competitive investment environment. These are also the conditions necessary for meaningful growth and an efficient economy. The absence of clear and consistent policy and long-term structures that give investors confidence is the biggest obstacle the UK faces to decarbonisation.

This answer will take the finance, energy and power, and built environment sectors in turn. It will set out the economic opportunities presented by net zero in each sector and recommend areas of policy focus that would help overcome obstacles to investment and help businesses and consumers to decarbonise.

Finance

The net zero transition is an unparalleled investment opportunity. As new markets, products and services are created to meet the growing demand for green finance, the UK has an opportunity to become the global centre for organising and servicing the capital investment the world needs to decarbonise. The UK is already a leading financial services export provider[14], the world's largest centre for international debt issuance, commercial insurance and reinsurance and foreign exchange trading, boasts the most globally connected banking sector, and is an increasingly attractive centre for asset management.[15] The growth of green finance therefore represents an opportunity to cement the financial services industry's role as a leading source of growth and exports in the UK economy, and to efficiently and effectively allocate the capital the rest of the UK economy needs to take advantage of the net zero transition.

New markets are emerging to meet increasing demand for green finance to provide the capital needed for the global net zero transition. The UK has an opportunity to cement its status as the primary global home of green finance, bringing huge economic and export opportunities as well as smoothing the transition at home and abroad. Supplying the goods and services to enable the global net zero transition is estimated to be worth £1 trillion to UK businesses by 2030, and low carbon financial services could generate an export opportunity of up £7.5 bn per year in 2030, rising to £17 bn per year by 2050.[16]

[14] **The City UK, 8 December 2020, US overtakes EU as leading destination for UK financial services exports**. When looking at financial services trade surpluses, the UK overwhelmingly remains the clear global leader. The UK financial services trade surplus in 2020 was $80.6bn, almost as much as the next two leading net exporters, the US ($66.9) and Singapore ($24.8), combined.

[15] **City of London Corporation, 27 January 2022, Our global offer to business: London and the UK's competitive strength in a critical time**

[16] **Social Market Foundation, May 2022, Financial services and net zero: Seizing the opportunity**

But to fully grasp this opportunity, the UK should establish:

- **Net Zero Investment Plan:** The private sector is ready to invest at scale, but it needs strong and consistent science-based market signals and transparent policies. 30 major financial institutions and real economy actors poised to lead the net zero transition, representing £3 trillion in assets under management, have recently called for the government to provide a "Net Zero Investment Plan" as part of the upcoming Green Finance Strategy to provide these signals.[17]

  Recent research from E3G and Frontier Economics assessing the size of the investment required this decade to stay on track for net zero found an "investment gap" of £81–111bn.[18] This is equivalent to 25–34% of the total investment required. Private finance is expected to cover at least 70% of the investment gap to reach our net zero targets.[19] This private investment will only be delivered at the speed and scale required if the government has in place a clear Net Zero Investment Plan delivered under a mandate to scale up private investment and capture the growing net zero investment opportunities.

> The Net Zero Investment Plan would:

  > **Assess and monitor public and private financial flows in support of net zero**, enabling a rapid and dynamic **feedback loop between policymakers and markets.**[20] It would **assess the investment needs of different economic sectors for decarbonisation, identify the net-zero investment gap** and set out how any investment gap would be bridged.

  > Be backed up by an independent body which would **give ongoing regular advice to the government** on net zero financial flows, monitor how successfully the gaps were being filled and provide further advice on filling them as economic circumstances change.

> **Gold-standard UK Green Taxonomy:** Directing investment capital to where it is most needed is a key challenge for the net zero transition. A well-designed UK green taxonomy that objectively sets out the economic activities that can be described as sustainable will be essential to this task. The taxonomy under development by the UK government is an

[17] **E3G, 19 October 2022, Investors managing £3 trillion in assets call on UK government to deliver Net Zero Investment Plan**

[18] Frontier Economics and E3G, 2022 [forthcoming], The UK's Net Zero Investment Gaps

[19] **The City UK, 2022, Enabling the net zero transition: the role of financial and related professional services**

[20] Frontier Economics and E3G, 2022 [forthcoming], The UK's Net Zero Investment Gaps

opportunity to set the leading global standard, including in areas where the UK is committed to faster climate action than the EU, which has recently completed a taxonomy process.[21]

  - For the taxonomy to be credible and compatible with limiting global temperature rises to 1.5 °C, it must **exclude fossil gas as a sustainable activity**. This would not preclude such investments from being made – it would simply stop them from being listed as sustainable. Failure to do so would undermine the integrity of the taxonomy and the UK's ability to forge a leadership role in green finance. The call to exclude fossil gas has recently been made by three major bodies representing investors including pension funds, banks and investment managers managing trillions in assets under management – the Institutional Investors Group on Climate Change, the Principles for Responsible Investment, and the UK Sustainable Finance Association.[22]

- **Account for the reality of climate impacts in policy-making forecasts:** The Treasury must incorporate climate impact projections into its economic forecasts, rather than assuming business-as-usual conditions which will bear increasingly little relationship to reality, so it can make decisions based on accurate information. Climate change is projected to cost the UK economy up to £20bn per year by 2050 on the current warming trajectory.[23]

- **Clear and consistent regulation:** Financial regulation reform in the UK should be seen as an opportunity to boost the sector's competitiveness in green finance. The UK is well placed to set international norms that will enable UK business to gain global market share and attract investment to the UK, and to tackle greenwashing and promote transparency in the green finance sector. Regulators need to be active participants in the green finance space for this to happen, to ensure innovation in green financial products and services is incentivised and rewarded. The upcoming Financial Services and Markets Bill (FSMB) is instrumental to align the UK's financial sector to net zero emissions targets. The recent Bill amendment document indicates that regulators should act in a way which is compatible with both the competitiveness and growth objective and the government's climate commitments set out at COP26.[24] Upholding climate as a statutory objective for regulators as the FSMB becomes law will be key in delivering the world's first net zero aligned financial centre.

[21] **Green Technical Advisory Group and Green Finance Institute, October 2022, Advice on the development of a UK Green Taxonomy**

[22] **UK Sustainable Investment and Finance Association, 21 June 2022, UKSIF, IIGCC and PRI open letter to government: future of UK's green taxonomy**

[23] **The Times, 17 January 2022, Climate change to cost UK economy up to £20bn a year by 2050**

[24] **House of Commons, October 2022, Financial Services and Markets Bill Amendment Paper**

Energy and power

Moving away from volatile, increasingly expensive and climate-damaging fossil fuels by decarbonising our power system, electrifying as much of the economy as possible, and finding new energy carriers like hydrogen to cover the areas where direct electrification is impossible, is the core of the net zero proposition. Reducing our dependence on imported fossil fuels is the right decision for our energy and geopolitical security, and for our economy – a renewable, digitalised, efficient and flexible energy system will permanently reduce the energy cost base of the economy.

The UK has made huge progress in this area. In 2020 renewables accounted for more than 43.1% of total electricity generated, outstripping fossil fuels.[25] Successful policy and private sector innovation in the UK has contributed to the costs of offshore wind falling significantly, such that it is now nine times cheaper than gas.[26] The UK now needs to build on this success.

Delivering a decarbonised grid will involve scaling up generation capacity, investing in infrastructure ahead of time to handle the doubling of electricity demand, and delivering the other features a renewables-dominated system will need to deliver cheap, reliable electricity: storage and digitally-enabled flexibility services. A fully flexible energy system has the potential to deliver net savings of between £9.6bn and £16.7bn per year in 2050.[27] This will require planning, market and regulatory design that incentivises investment in the right technologies and infrastructure in the right places.

To overcome the obstacles to creating a net zero energy system in the next 12 years, infrastructure asset investors need independent and transparent decision making to inform a coherent planning and regulatory system, they need investable models for providing flexibility services, and they need a strong investment environment for digitalisation. The system must be set up to make the most of competition and innovation, deliver maximum benefit for customers, fulfil the renewable promise of clean, abundant energy and provide as much consumer choice as shared infrastructure systems can allow. To achieve these overlapping aims, we recommend:

> **Remove barriers to the deployment of solar generation and onshore wind:** The government recently indicated that it would remove the de facto ban on onshore wind. The number of onshore wind developments granted planning permission between 2016 and 2021 was 97% lower than between 2009 and 2014.[28] Reversing this trend would be a no-regrets option,

[25] **National Grid, 2022, How much of the UK's energy is renewable?**

[26] **Carbon Brief, 8 July 2022, Analysis: Record-low price for UK offshore wind is nine times cheaper than gas**

[27] **Carbon Trust, 2022, Flexibility in Great Britain**

[28] **UWE Bristol, 14 March 2022, National planning policy limiting creation of new onshore wind farms in England, research finds**

lowering energy bills and increasing the UK's energy security. The government should also resolve to get out of the way of investment in solar power, the cheapest available electricity generation technology in the world. Solar panels cover less than 0.1% of land, and under government plans coverage will remain less than 0.3%. Fields with solar panels can still be used to produce food with little to no negative impact on yields. Recent analysis has shown that in the last 12 years only 0.6% of the best and most versatile arable land was developed for non-farming purposes. Of this small proportion, 10% went to renewable energy developments, while 55% went to housing.[29] Ground-mounted solar panels pose no threat to UK agriculture, and instead provide huge opportunities for UK investment and energy security.

> **Create an independent system operator and planner (ISOP)** to advise government and Ofgem on the infrastructure investment decisions that are required. Critically, relevant energy infrastructures go beyond large upstream and transport assets and must include those which directly open-up opportunities for consumers and the innovators serving them. This includes investments to improve the efficiency of buildings which provide consumers with new choices about how to heat their homes. It also includes investments in digital infrastructure.

> An ISOP proposal was included in the recent Energy Security Bill, the progress of which has now been paused. It is vital that legislation to establish the ISOP is brought back to Parliament and passed as soon as possible. The ISOP should be mandated to maintain latest, best views on how technology costs and deployment potentials are evolving. Infrastructure investments should be made to provide future consumers with access to those products and services that are likely to provide best value to them as individuals and to the whole energy system. ISOP should have a statutory mandate to ensure investment decisions give access to products and services that provide best value and choice to consumers and ensure least-cost dispatch using digital technology.

> **Include stretching grid digitalisation goals as part of the network price control review process:** Digitalisation of the energy system will ensure that the demand-flexibility that will be necessary to make the most of cheap domestic renewables is consumer-focused, seamless, and drives innovation. This means digitalisation of the grid as well as of electrical devices in homes and businesses. But progress to date has been very slow, and digitalisation has not been prioritised in either BEIS or Ofgem. Network companies and system operators must be given clear and challenging objectives to upgrade the system for the digital age, so that they upskill their workforce and change procurement practises to embrace digital innovators.[30]

[29] **Carbon Brief, 25 August 2022, Factcheck: Is solar power a 'threat' to UK farmland?**

[30] **E3G, 17 May 2022, Digital innovation for a net zero electricity grid**

> **Use the Review of Energy Market Arrangements (REMA) to set a long-term goal for a fully digitalised energy system**: The ongoing REMA process is an opportunity to set the energy system on a digitalised pathway and deliver stable, secure, cheap, and convenient electricity supplies to consumers. Demand flexibility will be essential to ensure the UK makes the most of its renewable energy resources. Focusing exclusively on large power generators to the detriment of opportunities for demand flexibility will lead to higher bills – instead, the government must ensure the electricity market supports least-cost use of resources at an investment and operational level.

  Digitalising the grid and electrical devices in homes and businesses will ensure that this happens in a way that is consumer-focused, innovative, and cost-effective. It will sweep away current constraints on system operation and allow innovators to find products and services that make consumer lives better. Done effectively, it will provide a virtual guarantee that electricity will be available to electrical devices when needed and avoid consumption when it is not required and when prices are high.

  The government should therefore commit to a programme of market reform that creates and incentivises a digitalised and renewables-based energy system. This reform must be viewed as an ongoing process and incorporate a 'digital spine' for the energy system. Markets must evolve to meet the continually changing opportunities for, and needs of, system operators and system users. The market arrangements must support the system operator to balance supply and demand at least cost with decentralised renewable energy and millions of connected devices, while allowing innovators to offer new products and services to consumers.

> **The government must ensure markets deliver efficient investment in assets (including digital assets) that support the rapid decarbonisation of the power system:** Investment in renewable electricity and supporting technologies to decarbonise the power sector will boost the economy and our energy security by eliminating our dependence on gas and driving down the economy's energy input costs. But consumers' money must not be wasted on assets that end up not being needed. Independent, science-based processes should be used to identify the minimum asset deployments required to remain on-track. Support mechanisms should then be designed to ensure these asset investments can be efficiently financed whilst retaining appropriate incentives to maintain operational efficiency. Support should be allocated via processes that harness competition, ensuring cost-efficiencies are passed on to consumers. Key assets must include the deployment of the instrumentation, control and predictive technologies that will support demand flexibility.

> **The government should ensure that the market reveals accurate, granular marginal prices whilst protecting consumers from high prices through a combination of smart technology,**

recycling revenues from renewables contracts, and guarantees within network connection agreements: Consumers must not be exposed to excessive costs to meet their basic energy needs. There are currently insufficient cheap renewables available to offset the high costs of gas generators for all consumers. Earnings for renewable projects should be set by long-term contracts that return earnings to consumers when wholesale power prices are high. Governments should be free to choose how this revenue is used to reduce bills and which consumers should benefit. As smart devices are deployed and innovative supply contracts emerge, consumers will be able to manage their usage to avoid high costs, and it is important that prices accurately reflect the marginal cost of their consumption. As gas prices reduce, and/or the volume of gas generation dwindles, higher prices could arise through grid congestion. In these circumstances, network connection agreements – whereby network companies must agree to new connections with upfront charges and direct compensation if local prices escalate due to temporary constraints – will provide a more effective vehicle for protecting consumers from high prices.

Homes and buildings

In the face of huge bills to heat the nation's homes – whether the costs are borne by households or by the state – the need to use energy more efficiently and end our reliance on fossil fuels for warmth has never been stronger. Even with the Energy Price Guarantee in place, the fuel poverty charity National Energy Acton predict that 6.7 million households are in fuel poverty as of October.[31] NEA estimates that on average almost 10,000 people die each year due to living in a cold home, with many more suffering from associated poor health. The health, security, and economic case for a concerted effort to retrofit homes and move off gas is overwhelming, and the climate case is clear too: emissions from heating buildings make up around 21% of all UK emissions.[32] Investing to get on track for the Climate Change Committee's "Tailwinds" scenario for buildings would mean saving 25% of final energy demand in homes and eliminating half of our total gas imports by 2030.[33]

The UK has the least energy efficient housing stock in Western Europe, with British homes losing three times as much heat through their walls, windows, and roofs in a five-hour period than the equivalent German homes.[34] Around 85% of our homes rely on gas for their heating, and most of the rest use another expensive fossil fuel like oil or LPG. These two factors leave British

[31] **National Energy Action, 2022, What is Fuel Poverty**

[32] **HM Government, October 2021, Net Zero Strategy: Build Back Greener**

[33] **E3G, 3 April 2022, UK can cut its gas demand by a quarter by 2030**

[34] **TADO, 20 February 2022, UK homes losing heat up to three times faster than European neighbours**

households particularly exposed to the painful volatility of the international gas market, regardless of where our fuel is sourced.

Fortunately, the benefits of a long-term plan to boost the energy efficiency of our building stock and switch to clean heat technologies like electric heat pumps are significant. Energy efficiency upgrades deliver savings that recur annually and put money that is otherwise entirely wasted back into local economies. The savings available for homes moving to at least an Energy Performance Certificate of C amount to hundreds of pounds per year. Under current prices, the average household with an EPC rating of D or below would need to pay around £1000 per year more than a household in an EPC C rated home to receive the government definition of adequate heating.[35]

For the economy as a whole, upgrading the 15.3 million homes rated below EPC C would mean aggregate savings of £17.1bn each and every year.[36] Even accounting for the inherent unpredictability of energy prices beyond the medium-term, the amount of money returned to the economy as consumer spending power would run into the hundreds of billions between now and 2050. The productivity and health benefits of upgrading our homes are also vital. The impact of poor housing on health was estimated to cost the NHS at least £1.4bn per year in 2020 – and the sharp rise in fuel poverty since that time will unfortunately have increased that figure. A recent independent report found that spending £10bn just on the poorest quality housing over the next decade would save the NHS £14bn over the same period.[37] Given the impact long-term ill health has had on the labour force in the past years, we should not underestimate the economic benefits of preventive steps like energy efficiency improvements.

The UK already has significant manufacturing capacity in heating appliances, which makes us well-positioned to manufacture heat pumps for UK homes and for export. A study for BEIS from 2020 suggested that manufacturers would be able to respond and supply under high-ambition heat pump deployment scenarios.[38] Following recent government announcements on clean heat, leading manufacturers including Vaillant and Kensa have already made investments in new facilities. They are joined by energy companies including Octopus, OVO and EDF who are making major investments in the electrification of heat. These investments will lead to skilled jobs in heat

[35] **E3G, 26 August 2022, UK government must launch retrofit revolution to save leaky homes £1000**

[36] E3G modelled estimates using English Housing Survey 2019/20 fuel poverty data.

[37] **Brown, D. and Bailey, T., October 2022, Cheaper Bills, Warmer Homes**

[38] **BEIS, November 2020, Heat Pump Manufacturing Supply Chain Research Project**

installation, energy efficiency installation, and related trades across the country, with some estimates that 190,000 jobs across a range of trades could be created to 2030.[39]

The government has also already made welcome investments in heat pump innovation, including through the Heat Pump Ready Programme, which is enabling innovative firms like Kensa to develop highly flexible heat pump storage technology.[40] The system-wide flexibility benefits of heat pumps on a digitalised grid are significant, and analogous to the system benefits of widespread use of electric vehicles.

For all the benefits of energy efficiency and clean heat, several barriers and market failures exist which have made it harder for the built environment to attract the investment it needs to decarbonise. The rise in energy prices has made the case for investment stronger than ever, but it remains the case that capital costs generally fall on private households even though a great deal of value is accrued to the system. This creates an incentive problem, whereby a public good is treated as wholly private. Even where a private household is motivated to take action – and given current energy prices, the payback period for many interventions is very short – upfront costs, a lack of trusted information and frequently weak supply chains can make the process difficult.

These barriers are all solvable with a stable investment environment, long-dated regulatory signals, smart subsidy models to incubate and grow the supply chain, and private sector innovation, particularly in new service models. To deliver this, we recommend:

> **Clear regulatory signals with no ambiguity or backsliding:** Clear regulation that gives industry and consumers time to prepare and investors certainty on the direction of travel can have a transformative impact on business investment. We have seen the impact of reducing uncertainty in several technologies, most notably with the UK's phase-out date for internal combustion engine cars, which has prompted preparation throughout the vehicle sales supply chain, primed consumers for change, and contributed to falling costs and rising investment. Staying on course for the regulations proposed in the Heat and Buildings Strategy, such as the phase-out of new fossil fuel heating systems in off-gas grid homes from 2026, is important – but the government should also go further by:

  - **Legislating for a phase-out of gas boilers from the early 2030s:** This would be a clear signal to businesses to invest in heat pump supply chains and relevant training.

[39] **Energy Efficiency Infrastructure Group, September 2021, Better Buildings Investment Plan**

[40] **Kensa, 27 September 2022, Government funding means revolutionary new British-manufactured heat pump could be saving homeowners money, sooner**

- **Implementing planned minimum energy efficiency standards in the private rented sector:** The government concluded a consultation last year on raising the minimum level of energy efficiency landlords are required to provide their tenants. This has become even more urgent in the cost-of-living crisis, as tenants are particularly powerless against energy price rises. The government's proposals, for homes to reach EPC C by 2025 for new tenancies and by 2028 for existing tenancies, were a strong statement of intent. Many responsible landlords have started to invest ahead of time. However, no efforts have yet been made to put these regulations in law, and further delay to legislation risks delaying investment.

- **Bring forward the decision on hydrogen for heating and make it clear that hydrogen will not play a significant role in our future heating mix:** Numerous independent studies have shown that hydrogen does not have any strategic value as a domestic heating solution.[41] Hydrogen will be an important energy carrier for certain hard to decarbonise sectors, but no credible independent expert thinks we will be able to generate the volume of hydrogen required for domestic heating, and that if we did the costs would be prohibitive not just to consumers but for the energy system as a whole, as the network would face expensive repurposing costs. The economic and physical qualities of hydrogen mean that we will not see it used for domestic heating at any meaningful scale – but the delayed regulatory decision on hydrogen, due in 2026, is holding back investment now from heating manufacturers who could be investing in heat pumps and risks misleading consumers.

> **A smarter approach to subsidy and concessional finance:** To achieve the pace and scale of transformation needed in the built environment, some degree of subsidy will be required for energy efficiency and clean heat as the supply chain develops and the market becomes self-sustaining. The government should explore options which include dynamic subsidy levels that can flex to match market development and consumer demand, as proposed recently by several leading energy companies and energy efficiency suppliers.[42] The new £1bn investment announced at the mini budget was a welcome step, but it fell short of the £3bn that industry said their supply chains could readily absorb in the remainder of this Parliament.[43] The government should also link subsidy to concessional finance. The German KfW public infrastructure bank gives out ultra-low interest rate loans for home upgrades and has been central to improving the energy performance of German homes. This is a model that the UK could look to emulate through the UK Infrastructure Bank.

[41] **Rosenow, J., Joule Volume 6 Issue 10, 19 October 2022, Is heating homes with hydrogen all but a pipe dream? An evidence review**

[42] **Energy UK, September 2022, ECO+: The energy industry's proposal for powering up the domestic energy efficiency market**

[43] **Gemserv, 12 July 2022, Proposed Energy Efficiency Scheme (ECO Plus) – Supply Chain Market Research Findings**

- **Renewed focus on skills and supply chain development with an "Olympic-style" academy:** The UK does not currently have enough skilled installers of either heat pumps or insulation to match projected demand for the net zero transition. Addressing the skills and jobs gap will require building on the skill set of the current workforce, as well as encouraging new entrants into the workforce. Leading companies are already investing in skills and supply chains. For example, EDF recently partnered with CB Heating, funding a New Heat Pump Installers Network Academy to help upskill engineers across the country. The Academy has the potential to train up to 4,000 new installers from 2022.[44] But more needs to be done to align professional standards, training opportunities, and further education offers, and to tackle training costs for SMEs and sole traders.

- Industry groups have recently called for an "Olympic-style" retrofit training academy to reform the skills landscape for buildings decarbonisation and create a national centre of excellence.[45] This would be modelled on previous skills academies which have been set up to fill workforce gaps for specific infrastructure gaps, such as the 2012 Olympics, or Crossrail and HS2. A retrofit training academy would bring together the private sector, expert stakeholders, and government to understand the labour market need at an occupational level, develop course content for apprenticeships and upskilling, work with the Further Education sector to standardise content and delivery, promote supply chain innovation and act as a brokerage to ensure opportunities for those undergoing training with a network of engaged and accredited installation companies.

- **Dedicated and independent consumer advice:** Making home retrofits straightforward will be critical to drive demand and underpin a successful market. Understanding what energy efficiency measures are appropriate for a given home can be confusing for households, and this relative lack of consumer familiarity with energy efficiency and alternatives to gas heating is a barrier to increased demand. Supporting a nationwide information campaign, with a parallel roll-out of a trusted advice services with local provision across the country, would be a relatively low-cost, high-impact way for the government to spur demand and increase awareness of measures and financing options, complementing existing support services. As many measures households can take to save money can be put into action without any cost implications, this would also help boost the UK's energy security. The UK has a model for an advice service, with the Scottish government supporting "Home Energy Scotland", which is run by the Energy Saving Trust. They estimate that expanding the Home Energy Scotland model to England could result in over £1bn in total lifetime savings each year (calculated before the

[44] **EDF, 16 May 2022, EDF announces investment and partnership with Heat Pump installer, CB Heating**

[45] **E3G, 7 June 2022, Home energy security strategy: the permanent solution for lower bills**

current price crisis). Evidence from Scotland found that 69% of total savings achieved by customers can be directly attributed to the advice received, with an average lifetime saving of 4.3 tonnes CO_2 (and £1,600 financial saving) per customer advised.[46]

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

Delivering net zero will enhance UK energy security, by reducing our reliance on imported fossil fuels whose price we cannot meaningfully affect in favour of cheap, domestic renewables. Investments in energy efficiency, vital for a least-cost transition to net zero, also have immediate energy security benefits under our current energy mix. By contrast, new domestic oil and gas production cannot play a meaningful role either in lowering prices on increasing UK energy security this decade given their outputs are an internationally traded commodity and they can take years – and sometimes decades – to come on stream. The International Energy Agency and International Institute for Sustainable Development have both issued comprehensive analysis this year showing that approvals for new oil and gas fields are incompatible with the 1.5 °C Paris Agreement target.[47]

System flexibility, digitalisation and new approaches to demand-side response will all be important features of a reliable, secure, and affordable decarbonised energy system. Importantly, as with efficiency, they all provide benefits immediately. With digitalisation and a convenient, smooth approach to demand-side flexibility, we also have an opportunity to productively decentralise and democratise elements of the energy system. As National Grid's warning of possible blackouts this winter have shown, absolute energy security entails essentially infinite costs and is not practically achievable – but today, if we find ourselves in a position of energy insecurity, we have no choice but to indiscriminately curtail demand.[48] By instead creating a digitalised and more flexible system, we would be able to differentiate between different sources of demand and allow people to almost guarantee they receive electricity when they need it whilst also avoiding high prices – or even being compensated – when they do not. This would bring significant benefits both to individuals and to the system.

[46] **Energy Saving Trust, January 2022, Home energy programmes delivered by Energy Saving Trust on behalf of the Scottish Government**

[47] **Carbon Brief, 23 October 2022, New fossil fuels "incompatible" with 1.5C goal, comprehensive analysis finds**

[48] **Sky News, 18 October 2022, Blackouts may be imposed on cold weekday evenings, National Grid chief warns**

Creating the right market and regulatory conditions for investment in digitalisation and flexibility will make a significant difference to affordability and reliability, with a flexible system reducing system costs by £30–70bn versus the counterfactual to 2050.[49] By 2050, Carbon Trust has calculated a fully flexible energy system could deliver material net savings of between £9.6bn and £16.7bn per year.[50]

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

Net zero represents significant export opportunities for the UK, in both goods and services. Many UK industries are well positioned and are already sought-after exporters. One government estimate puts likely low-carbon economy export sales at £170bn by 2030.[51] Meanwhile, McKinsey has estimated that the global market opportunity for UK companies producing the goods and services to feed the "green capex revolution" could be worth more than £1 trillion in revenues by 2030.[52] Financial and professional services, information and communication, manufacturing, and construction firms, mostly in the business-to-business category, are the key beneficiaries.

However, it will only be possible to secure these benefits from the global transition if the UK remains at the cutting-edge of the net zero transition domestically, to retain the innovation and sector-expertise leads that translate to comparative advantage in the global marketplace. For example, the UK has a significant manufacturing base in the midlands in heating appliances. With government support – for example by sending much stronger market signals that the future of UK heat will be dominated by heat pumps – these firms could readily switch their production lines to focus more on heat pumps and start to export to Europe at scale. Indeed, many of the companies in question have parent companies around the world with existing strengths in heat pumps. The market in Europe is growing rapidly this year, where supply chains are struggling to keep up with booming demand in Germany, France, Italy and Poland. The Commission's REPowerEU plan is targeting 20 million heat pump installations by 2026 and nearly 60 million by 2030.[53] Supplying this growing market should be viewed as a key opportunity for the sector.

[49] **BEIS, UKRI and Ofgem, July 2021, Digitalising our energy system for net zero**

[50] **BEIS, UKRI and Ofgem, July 2021, Digitalising our energy system for net zero**

[51] **UK Export Finance, 3 November 2021, COP26: UK government launches call to action for exporters to go green**

[52] **McKinsey, 21 October 2021, Opportunities for UK businesses in the net-zero transition**

[53] **Electrify Heat, June 2022, Getting off gas: learnings for the UK to get ahead in the global race to clean heat**

The UK also has inherent advantages in energy supply that can be leveraged to drive exports. The shallow, windy North Sea provides a huge potential resource of cheap electricity produced by offshore wind (and, in the future, other potential sources of renewable power). This not only has the potential to meet our domestic requirements for electricity, but can be exported to countries in Europe without direct access to these low-cost resources. The physical integration of the power grid in the North Sea linking the UK and Europe creates the opportunity to strike long-term reciprocal supply agreements. This will not only deliver a net trade benefit to the UK economy, but it also provides a cost-effective way to maximise the use of renewable resources without building expensive and poorly utilised infrastructure such as power network or hydrogen electrolysers, thereby further reducing their cost. The value of electricity trading with the EU could be around £25bn to 2050.[54]

The UK also has a long-standing reputation of operating at the vanguard of energy market and regulatory design. This has driven a huge dividend for technology and services industries in export markets around the world. To preserve and develop these export opportunities, the UK must take the lead in energy system digitalisation, which will define the next stage of regulatory and market developments. REMA and other regulatory developments should be aligned with latest technological opportunities to maintain this advantage.

To meet these export opportunities, in addition to our answer to questions 2–4, we recommend:

> **Implement a high-ambition market-based mechanism for low-carbon heat:** The government's Heat and Buildings Strategy proposed an innovative new market-based mechanism designed to support the transition to clean heat manufacturing in the UK via an obligation and tradeable credit system. Alongside the other market signals on heating recommended in our answers to questions 2–4, this is precisely the kind of investment signal that will be so crucial to attracting the timely investment that will enable UK homes to decarbonise *and* UK firms to seize the benefits of the transition overseas. The government must now bring forward ambitious final proposals on the design of the mechanism to ensure that it drives investment at the scale required.

> **Become a proactive partner in the North Seas Energy Co-operation (NSEC):** The UK must become a proactive partner in the North Seas Energy Co-operation (NSEC), working with other North Seas countries to build an integrated grid that maximises opportunities to exploit renewable resources whilst minimising adverse impacts on coastal environments. Co-

[54] **E3G, 12 March 2021, Offshore Wind in the North Seas**

ordinated offshore connection to hubs in the North Sea could also save £23–45bn while maintaining the rate of renewables deployment needed versus individual connections.[55]

> **Reset UK–EU relations on climate and energy to unlock co-ordination and commercial opportunities:** To achieve the full benefits of NSEC co-operation, the UK needs to reset its relationship with the EU on climate and energy. The lack of finalised electricity trading arrangements between the UK and EU is costing British households "hundreds of millions a year" according to the UK energy industry.[56] As part of resetting relations, the government should progress UK–EU Emissions Trading Scheme linking. UK–EU ETS linking would not involve signing up to any EU law. Instead, linking allows businesses to trade between carbon markets and therefore benefit from greater liquidity for cost-effective decarbonisation. ETS linking would also give the UK an exemption from the EU's planned Carbon Border Adjustment mechanism, which would otherwise place a regulatory burden on UK business and present significant complexities under the Northern Ireland Protocol.

24. What are the biggest barriers [local authorities] face in decarbonising / enabling communities and areas to decarbonise?

While many key decisions to create a strong investment environment we need to reach net zero will be taken at a national level, much of the delivery of the transition will take place at a local level, through collaboration between the private sector, local authorities, and infrastructure operators. The UK lacks a coherent policy framework to enable this vital local delivery. The detailed decisions on planning, investment, local growth strategies and the built environment – needed in every part of the country to reach net zero – cannot be taken exclusively in Whitehall.

Four out of five local authorities have net zero delivery plans, but with huge variations in sophistication, scope, deliverability, and attractiveness to investors. This means 20% have no plan at all. Thirty-nine per cent of the UK's 434 local authorities were known to be actively delivering clean energy transitions in 2020. They are spread across the country, and many have been taking forward local energy efficiency schemes independent of UK and devolved government support.[57] They often work with, and are supported by, expert managing agents. They can form the backbone of coordinating accelerated delivery on the ground.

[55] **E3G, 12 March 2021, Offshore Wind in the North Seas**

[56] **Politico, 20 September 2022, Britain blames Brussels for driving up UK energy bills in explosive new Brexit row**

[57] **Tingey, M. Energy Policy Volume 138, March 2020, Governance institutions and prospects for local energy innovation: laggards and leaders among UK local authorities**

Many leading and combined authorities assist their neighbours in tackling energy efficiency, heat decarbonisation and fuel poverty, increasing their capabilities. City regions are ready to play this role. The Mayors of the Manchester and Liverpool city region have called for a programme to retrofit homes with renewable energy technology to reboot the economy and create jobs.[58] A range of local partnerships, combined authorities, county councils and energy agencies have developed joint 'statements of intent' outlining their proposals to assist energy companies in targeting their ECO3 funding under the scheme's flexible household eligibility mechanism, which – capped at 25% of ECO delivery – was over-subscribed. In response to this, the government increased the cap for 'Flex' to 50% under ECO4.

Supporting this and other local energy investment plans, BEIS has set up a network of regional Net Zero Hubs in England, offering funding to all Local Enterprise Partnerships (LEPs) to develop energy and low carbon strategies. These plans provide a roadmap net zero investment that bolsters local jobs and supply chains – including in regions facing high occurrences of unemployment and fuel poverty.

However, no-one is responsible for producing coordinated regional spatial plans that ensure local deployment and social initiatives march in-step with energy network developments and national policy. The aim must be to work with the grain of delivery capabilities already in place around the country, and build it up to de-risk delivery and maximise the benefits of the transition. We recommend:

> **New statutory mandates for co-ordinated regional spatial energy planning**: The government must find a way to ensure all local environments are decarbonised in line with net zero targets, and that local actions link efficiently with regional and national infrastructure such as energy networks. This might be achieved through structured support to local areas but could require new statutory mandates. For example, mandates could be placed on local authorities to establish net zero delivery plans as part of a co-ordinated regional spatial plan. Energy regulator Ofgem and network operators could also be mandated to develop regional spatial plans and deliver the required network infrastructure. Research from the Energy System Catapult funded by UK Research and Innovation on Local Area Energy Planning shows promise as a methodology.

  The current energy infrastructure system can frustrate local industrial regeneration by preventing timely network upgrades and connections. A new system would allow for more meaningful local industrial strategies and attract inward investment. They would give areas the

[58] **The Guardian, 1 April 2020, Northern mayors call for economic rethink after coronavirus**

ability to plan industrial hubs, supported by national energy infrastructure. A new system of co-ordinated regional and local energy planning would stop energy infrastructure limiting local areas' ambition on economic growth and development. Greater control over energy planning, and a requirement for networks and other relevant stakeholders to work with local plan, would also make it easier for areas to leverage in private finance to their project pipelines. Better co-ordinated planning would provide investor certainty and allow the private sector to invest more in local energy systems and economies than would otherwise be the case, reducing the government's responsibility and exposure.

> **Technical and financial support for local authorities to create robust local decarbonisation plans:** Local authorities are already operating under tight budget constraints. They need additional resources and dedicated expertise. A "one-stop-shop" should be created, which provides the technical and financial advice that local authorities need to fulfil new duties. This would avoid costly consultancy spending and ensure that a consistent set of technology and behavioural assumptions would be used across all regional planning processes. Monitoring progress would enable lessons to be learnt and rapidly shared with all stakeholders. This would avoid replicating mistakes and allow authorities to focus innovation investments on solving challenges that repeatedly arise. Other countries in Europe are adopting this approach to similar challenges. For example, the Dutch government is introducing legislation that requires all 355 municipalities to draw up a heat transition plan that will sit at the core of local net zero delivery. These plans must be consistent with the regional energy strategy.

> **The UK Infrastructure Bank must work closely with local authorities on net zero, providing technical assistance and project development support in addition to financing and investment:** To accelerate net zero investment in the UK, the Bank's advisory function needs to be built and implemented as quickly as possible. This service must be serviced and structured to meet the needs of places and investors, as local authority capacity is one of the most frequently referenced barriers to delivering investment for place-based impact[5]. Functions should include technical assistance and project development support, and the Bank should work with Net Zero Hubs to scale up critical new markets for decarbonisation and resilience such as the built environment and nature.[59]

[59] **UK:100, May 2022, Insight Briefing: UKIB Local Authority Lending and Advisory Service**