Proposal: The UK post-2050: looking beyond the net zero horizon to inform the path to decarbonisation and international leadership

Introduction:

The overwhelming focus of the climate policy debate in the UK is on mitigation, through decarbonisation, to reach net zero emissions in 2050. In the pursuit of a just transition, this target must be balanced alongside the UK's broader long-term social, economic and environmental goals. This is especially relevant to young people, for whom the second half of the 21st Century will be a significant period of their lifetime. It is therefore vital to scrutinise the net zero strategies under development against their long-term consequences. This network briefing seeks to provide a preliminary analysis of the challenges and opportunities the next generation will face post-2050, and to make recommendations for their consideration in current policy design.

The briefing aims to go to the heart of the issue, first assessing the extent to which long-term factors are considered in UK policymaking and how this can be improved for the net zero context. Three policy areas - energy systems, carbon removal, and biodiversity and ecosystems - will then be analysed in light of their potential long-term consequences. The necessity to address these in the short-term will also be underlined. Finally, the briefing seeks to understand how best to ensure the UK's continued position as leader in climate policy beyond 2050, once it is no longer directly contributing to climate change itself.

The breadth of this briefing should make its findings and recommendations relevant to a wide range of actors both within and outside of government. The prominent role of the Department for Business, Energy and Industrial Strategy in determining the UK's path to net zero makes it the primary audience, although this will not shape the briefing's direction.

The very nature of the post-2050 landscape is uncertain. Any analysis will require large assumptions and a degree of speculation; however, the inherent path dependency of energy and climate policy necessitates that a long-term perspective is taken now and continues to inform policy design. The findings and recommendations of this briefing will remain in line with the core mission: *enhancing* climate ambition and delivering decarbonisation. Therefore, it intends to guide the route that decarbonisation takes but to in no way delay or hinder it.

The research directions outlined in this proposal indicate those identified as relevant to the scope of this briefing. Through the course of the research process this may be refined further to maximise impact and relevance.

Integrating a long-term perspective into policymaking:

The difficulty of designing and implementing policy to address long-term challenges are well-known to countries with regular electoral cycles. The Well-being of Future Generations Act (2005) in Wales is one attempt to combat this and scrutinise policymaking from a long-term perspective. The work of the All Party Parliamentary Group for Future Generations is also conducting research in this area, but with a whole-UK policy focus. Where this work (and that done by academics, NGOs and think-tanks) relates to climate change, it tends to treat climate policy as an example of long-term policymaking. However, the urgency of policymaking required to meet the 2050 net zero target brings climate policy into the present. Therefore, it is necessary that the net zero policymaking process continually considers long-term consequences and that policies enacted be scrutinised from a long-term perspective. This is in addition to the need to consider the long-term climate change and decarbonisation impacts of *all* UK policy.
This section seeks to review the current mechanisms for assessing the long-term consequences of policy and to make recommendations for how policymaking relevant to reaching net zero can better consider these during policy design.

Research directions:

1. How is net zero policy currently developed? Are long-term impacts factored into policy design?
    - The APPG for Future Generations is currently conducting an inquiry into how UK policymaking considers the long term.
    - The subsequent sections of this briefing identify key areas of net zero policy that potentially have negative long-term impacts.
    - The incorporation of long-term analysis into policy making must go beyond considering net zero policy as inevitably long-term in nature; the evaluation of net zero policy options should consider their impact beyond 2050.
2. What mechanisms globally, and within the UK, are currently being employed to infuse long-term thinking into policymaking?
    - Jones, O'Brien, and Ryan (2018) and Anderson (2018) review methods for long-term policymaking from multiple countries.
    - Gonzalez-Ricoy and Rey (2019) review methods specifically within the climate policy context.
3. How can net zero policymaking best be aligned with long-term goals?
    - What forms of oversight are best suited to this task e.g a Select (sub-) Committee
    - Which are politically feasible?

Preliminary analysis of UK net zero policy:

Energy Systems:

As one of the biggest contributors to emissions in the UK and worldwide, the energy sector features prominently in the net zero roadmap. The UK's NDC under the Paris Agreement necessitates an overarching change in the sector, making significant long-term consequences inevitable.

The development of low carbon energy systems has been greatly accelerated since 2010 (Ritchie and Roser 2020), but looking beyond 2050 or even 2040, the proposed roll-out rate of these systems generates concerns over decommissioning and retirement of these devices. The rapid deployment of renewables is unarguably essential to minimize the long-term consequences of climate change but it is also essential to consider the full lifetimes of these renewable devices, which lie in the 20-30 year range (NREL).

Energy security is an important strategic pillar of the energy transition. It is vital for UK prosperity and to demonstrate climate leadership that an energy sector is developed in a sustainable and secure way. The analysis presented below aims to identify some of the long-term impacts that the energy system can have which might jeopardize energy security.

Research Directions :

1. **Depletion of limited natural resources:**
    - **What are the long term consequences for energy security?**
        - Renewable energy systems rely on certain natural resources.
        - In the UK context the challenge will be securing stable supply chains to ensure energy security is not threatened. This becomes a geopolitical problem.
        - The availability of certain resources are limited and it is essential to utilize them in a sustainable way and secure their supply.
            - For example, the demand for batteries is projected to increase exponentially with the roll out of electric vehicles (EVs). Currently, the most developed designs are lithium ion batteries but there are concerns over the limited availability of (mined) lithium (Runkevicius 2020). Current projections show that the lithium demand will far outgrow all known lithium mining projects. This puts the decarbonisation plans for the transport sector at risk.
            - The future energy sector will also rely heavily on rare earth metals for renewable technologies and batteries for storing electricity to meet demand instantaneously.
            - Solar PV: How critical are the rare natural materials used to produce solar panels? Does their supply threaten energy security or pose environmental concerns in the UK?
    - **How can we mitigate the dependency on certain limited resources?**

    - How can circular economy concepts become part of the solution?
    - Diversifying the energy mix
    - Encouraging development of new battery technologies to allow recycling or re-use.

2. **Decommissioning of renewable energy systems**
    - **Environmental impacts**
        - Current policy in the wind sector: how effective are the current UK decommissioning recommendations? (Energy Act 2004)
            - The wind industry follows United Nations Convention on the Law of the Sea guidelines for decommissioning.
            - The UK has additional national measures that were inscribed into the Energy Act in 2004. There are separate guidelines for England, Wales and Scotland (See section on Environmental impacts of decommissioning offshore wind turbine structures in Biodiversity and Ecosystems)
            - Are these the most recent measures? Should the guidelines be reviewed with 15 year hindsight and how can policy be better adapted to reflect how the environment could be impacted long-term?
        - What are the potential impacts of turbine foundations, especially offshore?

3. **Post-decommissioning waste**
    - **Wind Industry**
        - The UK has become increasingly dependent on low cost wind power, but is now left with an ageing fleet**.** This has brought the challenges associated with wind farm decommissioning to the fore. It indicates a significant problem for the post-2050 period when newly commissioned projects reach the end of their lifetime.
            - The UK plans to quadruple offshore wind capacity by 2030; this will generate escalating waste as existing devices are retired or upgraded.
        - Turbine blades are the main components that cannot be recycled and are currently disposed of in landfill.
        - This issue is gaining increasing attention with authoritative sources, such as Bloomberg (Martin 2020) and the FT (Slade 2019, McCormick 2019), recently publishing articles on the inevitable problem posed by accumulating used blades.
        - What strategy is best suited for dealing with waste blades?
        - Tackling the problem may incorporate **circular economy** concepts into the renewable energy sector. Current examples:
            - Vestas currently has a specific CETEC (Circular economy for Thermosets Epoxy Composites) program which aims to develop a technique to recycle blade composite materials (Durakovic 2021).
            - Blade recycling has been identified as a key area of impact for the EU Innovation Fund (Wind Europe 2019).

        - Zero Waste Scotland's Circular Economy Investment Fund awarded funding to Renewable Parts, a company helping increase recycling in the wind industry (Zero Waste Scotland).
    - The UK's goal of becoming an international leader in wind energy.
        - Opportunity to develop policy that can be transferred internationally.
        - Encourage other countries to think about the problem by leading by example.
- **Storage**
    - *What are the long term impacts of energy storage technologies?*
    - Due to the intermittent nature of renewables, batteries are likely to play a key role in meeting the instantaneous demand. Battery use in the transport industry is also increasing, with both resulting in increased battery waste.
    - Currently the design of battery technology makes them difficult to re-use or recycle.
        - The literature discusses incorporating circular economy concepts into the energy transition (Fall 2020, Morse 2021**).**
    - Current grid inefficiencies lead to energy loss, curtailment and payouts and increased need for flexibility via storage. Upgrading the grid is a long-term challenge.
        - For example, surges in wind lead to payouts due to lack of storage options (Ambrose, 2019).

4. **Social impacts of the energy transition**
    - **What are the social impacts of a completely new energy system?**
        - What are the social consequences of decentralised systems?
5. **Potential policy recommendations:**
    - Auctions for offshore licences which are awarded to projects with an innovative environmental focus. For example, a similar structure to the Dutch Government's auctions for offshore licences.
    - Increasing investment and allocations for R&D into recycling of existing turbine blades.
    - Providing comprehensive and transparent decommissioning policies that can potentially be adopted internationally.

Carbon Removal:

As human activity undermines the resource base on which it depends, innovating, developing and deploying new technologies in the pursuit of net-zero has become an increasingly necessary task (Steffen *et al.*, 2015). Net-zero implies a global balance between CO2 emissions and CO2 removal, also known as 'carbon neutrality'. Negative emissions technologies and other methods of greenhouse gas removal have thus become ubiquitous in the strategies for meeting the Paris agreement goals (Burke, 2020). Carbon removals are both natural and technological strategies that remove carbon dioxide from the atmosphere and store it through various means, such as in trees, plants and soils, or underground reservoirs, rocks, and the ocean. As emphasised by the Intergovernmental Panel on Climate Change (IPCC), to achieve the ambitions of the Paris Agreement and limit future

temperature increases to 1.5 degrees, we must do more than just increase efforts to reduce emissions, but actively remove it from the atmosphere. Indeed, research underlines a need to remove 10 GtCO2 per year by 2050 and 20 GtCO2 per year by 2100 (WRI, 2021).

It is important to consider the potential impacts of these methods post-net zero, as well as how they interact with other policy problems, such as decreasing biodiversity. The uncertainty in the effect of climate change on natural carbon sequestration (e.g Jones *et al.*, 2013; Seddon *et al.*, 2020); the potential leakage of CO_2 from geological storage (García and Torvanger, 2019), and the impact new technology may have on hard-to-abate sectors (Bataille *et al.*, 2018), underlines the relevance of carbon removal and storage beyond 2050.

The UK has approached carbon capture from both a natural and technological angle. The Government has underlined its desire to advance the rollout of carbon capture, utilisation and storage (CCUS) in it's 10 Point Plan (Point 8) and Clean Growth Strategy, while the March 2020 Budget created a £1bn Carbon Capture and Storage Infrastructure Fund. Meanwhile the Committee for Climate Change has underlined the need for a shift in land use, leveraging UK farmland as a site of carbon sequestration, which is financially backed by the Sustainable Farming Incentive, Local Nature Recovery and Landscape Recovery schemes. Taken together, the UK sits at a critical juncture in the direction it takes and policies it promotes to remove carbon. This section seeks to underline the long-term issues associated with this active policy landscape.

Research Directions :

1. **Long-Term Storage**
    - **Capture and Storage in Geological Formations**
        - Ensuring the viability, in the long-term, of removal initiatives demands an exploration of the extent leakage may undermine long-term carbon sequestration (cf. Deng *et al.*, 2017).
        - Finding suitable carbon stores to ensure long-term viability is both central to its success and carries significant political, legal, social and ecological considerations, particularly when operated at scale.
            - Policy recommendations might highlight the potential of the geological stores in the North Sea, underlining the chance to build relations with Scandinavian region to develop a global hub.

    - **Soil Sequestration**
        - What are the long-term consequences of land-use change?
        - Releasing land out of traditional agricultural production for long-term carbon sequestration has consequences for food production, which may demand changes in other areas, such as diet and reducing food waste, to facilitate expanded forest cover.
            - Policy recommendations might focus on drawing synergies with public behavioural nudges; the development of alternative food sources such as lab-grown meat which serve to lower agricultural demand; and/or GMOs.

    - **Biodiversity impacts**
        - The impacts of carbon removal on ecosystem functioning and biodiversity need to be at the forefront of decision-making. These issues are discussed in more detail in Biodiversity and Ecosystems, Section 4.
2. **Monitoring and Maintenance**
    - **Evaluating Methods**

        - Nature provides the simplest carbon removal solution, yet deciding on how best to use the land is context dependent (Hepburn, 2021). Understanding what policy best suits different regions of the UK requires broad and deep research into what contexts produce environmentally effective capture initiatives.
        - Enhanced rock weathering, Biochar, Perennial bioenergy crops, Peatland restoration, Large-scale tree planting among other methods all deserve more research underlining which contexts and climates they operate best in.
            - Suggested policy recommendations are likely to underline the £30m project funded by UK Research and Innovation which will test ways to capture carbon effectively and affordably on over 100 hectares (247 acres) of land. Trials such as these should be repeated and expanded to develop the monitoring, reporting and verification frameworks to ensure that removals are a genuine solution to climate change (Carrington, 2021).
    - **Future proofing**
        - Robust monitoring and evaluation systems that set both short- and long-term goals are crucial for providing constant evaluation needed to understand whether programs are maintaining their cost-effectiveness over longer time horizons.
            - Policy recommendations might suggest longer-term thinking built into the Government's Environmental Impact Assessment Scoping the environmental impacts of Carbon Capture, Transport and Storage
    - **Social, legal and ethical issues related to carbon removal.**
        - *To what extent have these been reiterated at each stage of the planning process and over what time horizons?*
3. **Synergies**
    - **To what extent might social goals be achieved through carbon removal**
        - As we rebuild societies and economies following COVID-19, we have an opportunity to orient ourselves towards the green jobs and industries of the future (Hepburn, 2021). The carbon removals sector has the potential to render a highly skilled sector of works, should it be adequately supported through green job sector growth, training and investment
            - Policy Suggestion: Creating more green specialised training positions and departments across the country.
        - The carbon removal sector has the potential to reorientate the direction of UK Growth. For example the development of Teesside stands to boost the wider Northern economy, delivering social and economic goals away from the nation's capital.

    - **Other emissions**
        - To what extent can carbon removal tech be leveraged across sectors?
        - The carbon removal sector, particularly technologically ground solutions may open routes for emissions reductions of equally pernicious substances.
        - Alternatives should be considered on the basis of the time they persist in the atmosphere, their warming impact and feasibility among other factors.
            - A suggested policy recommendation might emphasise the need for technology transfer across heavy industry sectors to deal with gasses such as methane (Lackner, 2020).

- **Facilitating Business As Usual**
    - Analysis of the extent to which carbon removal may justify business as usual scenarios and the negative impacts of such.
    - Carbon removal initiatives have been widely criticised on the basis that they facilitate greenwashing (Wennersten *et al.*, 2015), and business as usual. To what extent can these critiques be substantiated and what are the policy implications?
        - Policy recommendation likely to suggest an emphasis on carbon removal as a constituent link in a policy mix to achieve net-zero. Building on Herzog's (2018) assertion that "the best way to keep carbon dioxide out of the atmosphere is not putting it there in the first place." Linked to recommendations made in part 2.a. establishing an independent monitoring body might provide guidance and guidelines.

Biodiversity and Ecosystems:

Reducing greenhouse gas emissions to avert climate change is just one challenge in maintaining the earth system's integrity. Preventing global biodiversity collapse and preserving ecosystems (HM Government, 2018), while promoting and respecting human rights (UNFCCC, 2015), are equally fundamental to effective climate action on the road to net zero by 2050 and beyond. The importance of safeguarding the UK's landscapes and restoring habitat for wildlife in order to combat biodiversity loss and adapt to climate change is recognised in the UK Government's 10 Point Plan for a Green Industrial Revolution (2020). Similarly, the 25 Year Environment Plan (2018) recognizes that the 'natural world underpins our nation's prosperity and wellbeing' while acknowledging that 'long term action is needed' for the proposed 'new approach to managing the environment' (HM Government, 2018). Subsequently, Nature-based solutions (NbS) for climate change in the UK are gaining increasing political salience (see Howard-Boyd, 2021) and have received significant funding in the Government's 2020 Budget. However, while it is undeniably promising to see the policymakers, government officials and stakeholders recognise the importance of protecting nature in mitigating and adapting to climate change (Mace, 2014), policy target milestones and plans for NbS rarely go beyond 2050. Further, there is a contradiction in the UK's mitigation policies in that, while renewable energy developments are recognised as essential in achieving the UK's target to rapidly phase-out fossil fuels by 2050, very little has been said about the potential long-term environmental trade-offs of on- and offshore wind farm developments and their impact on ecosystems. Similarly, even if Carbon Removal Strategies are undeniably an important strategy for reducing greenhouse gas (GHG) emissions and achieving the UK's climate mitigation goals, their potential adverse future effects on biodiversity and ecosystem integrity needs to be considered in long-term policy planning, as this section will discuss.

This section provides an outline of the UK's unique natural habitats in light of their vital importance in preventing biodiversity loss and maintaining long-term ecosystem integrity. It assesses the UK's current environmental policies and analyses the extent to which the potential long-term environmental impacts of climate mitigation strategies are factored into policy design. Arguing that biodiversity and ecosystems should be prioritised beyond nature-based solutions to climate change, concrete policy recommendations will be made to inform the path to an environmentally and socially 'just transition' beyond 2050.

Research Directions:

1. **Importance of the UK's unique biodiversity and ecosystems to ensure effective climate mitigation on the road to net zero by 2050 and beyond**

    - The importance of safeguarding the UK's landscapes and restoring habitat for wildlife in order to combat biodiversity loss and adapt to climate change is recognised in the UK Government's 10 Point Plan for a Green Industrial Revolution (2020).

    - The 25 Year Environment Plan (2018) recognizes that the 'natural world underpins our nation's prosperity and wellbeing' while acknowledging that 'long term action is needed' for the proposed 'new approach to managing the environment' (HM Government, 2018).

    - Drawing on these policy documents, this subsection will outline the importance of the UK's unique biodiversity and ecosystems to ensure effective climate mitigation on the road to net zero by 2050 and beyond.

2. **Ecosystem preservation and biodiversity protection in climate mitigation policy design**
    - In what ways is safeguarding the UK's landscapes and restoring habitat for wildlife in order to combat biodiversity loss and adapting to climate change recognised in climate mitigation policy design and to what extent do policy milestones go beyond 2050?

        - Drawing on the following:
            - 10 Point Plan for a Green Industrial Revolution
            - Natural Environment and Rural Communities Act
            - 25 Year Environment Plan (2018)

            - Preliminary analysis:
                - Policy target milestones and plans for NbS and ecosystem/biodiversity protection rarely go beyond 2050
                - NbS that feature in these policies rarely consider the conflicting environmental impacts of climate change mitigation developments such as wind farms or Carbon Removal Strategies.

3. **Environmental impact of renewable energy developments such as on- and offshore wind farms on the UK's ecosystems and biodiversity**
    - Building on Section 2: Energy, this subsection will assess the extent to which the environmental impacts of the wind industry are addressed in the UK's climate mitigation policies. What is the importance of addressing the environmental trade-offs of on- and offshore wind developments in long-term policy design beyond 2050?

- Onshore wind energy development: Impacts on peatland
    - Outline of the importance of the UK's Peatlands in mitigating and adapting to our changing planet.
    - Why should peatland preservation and restoration be considered in long-term policy design?
        - Peatlands are the UK's largest terrestrial carbon store, storing around 3 billion tonnes of carbon in the UK. (IUCN, 2017, RSPB). Organic or peat soils make up 11% of England's total land area, over 70% of which are drained or in poor condition (25 Year Environment Plan 2018). As a result of such drainage and degradation, peatlands are emitting an estimated 23 million tonnes of carbon dioxide equivalent (CO_2e) annually, comprising around 5% of UK emissions (Evans et al, 2017). Restoration of peatlands beyond 2050 must therefore be considered in net zero policy design.
    - What are the **environmental impacts** of wind farm developments on **peatlands** in the UK? Are these addressed in the UK's current climate mitigation policies? What is the importance of addressing environmental trade-offs of onshore wind in long-term policy design beyond 2050? What tools and mechanisms can be put in place to ensure the long-term preservation of peatlands alongside wind energy developments and other climate mitigation policies?
        - Most wind farms in Scotland are located within blanket mire landscapes, partly because the landform and wind characteristics of these landscapes are favorable, but also because such areas are generally less economically productive and located away from human settlements (Wawrzyczek et al, 2018).
        - However, these **wind energy projects** mostly fail to consider ecosystem-level impacts on **peatland.**
        - Draw on Wawrzyczek et al, 2018's review on environmental impact assessments of onshore wind farms in Scotland. Findings indicate that assessed impacts on peatland ecosystems is not currently taken into consideration within the EcIAs
    - What tools and mechanisms can be put in place to ensure the long-term preservation of peatlands alongside wind energy developments and other climate mitigation policies beyond the net zero horizon?

- Environmental impacts of decommissioning offshore wind turbine structures

- Outline of the importance of considering environmental impacts of decommissioning in long-term wind energy policy design.
- To what extent are such impacts currently considered in wind development policies and legislations? What policies are currently in place to ensure Environmental Impact Assessments adequately consider future implications of offshore wind farms?
    - The lifetime of offshore wind energy projects is estimated to be between 20-25 years (Welstead et al., 2013).
    - The construction and operation of wind farms are meticulously planned, but decommissioning and its potential environmental impacts receive little attention, particularly during early stages of windfarm development (Topham and McMillan, 2017; Welstead et al., 2013).
    - Offshore wind energy developers are expected to follow legal guidelines such as the United Nations Convention on the Law of the Sea (UNCOS) and Decommissioning guidelines under the UK Energy Act for England and Wales and Scotland, with the aim of reducing the environmental impact of installing offshore wind farms on a local marine environment.
    - Nonetheless, there is still a lack of well-defined guidelines and standards on how to reduce the impact of wind energy developments on marine ecosystems.
    - The ecological impact of removing offshore structures at the end of life is still not investigated nor predicted thoroughly enough in Environmental Impact Assessments (Hall et. al 2020).
- How can the wind industry improve understanding of the potential implications of full or partial removal of marine wind turbine structures, or alternatives to decommissioning? How can it be ensured that appropriate decommissioning measures are considered at an early stage by both developer and consenting authorities to mitigate adverse long-term impacts?

4. **The long-term impacts of Carbon Removal Strategies**
    - Building on Section 3 above, this subsection will outline environmental issues related to Carbon removal. It will analyse the extent to which long-term ecosystem health and biodiversity preservation is considered in related policies, arguing that the impacts of carbon removal on ecosystem functioning and biodiversity need to be at the forefront of decision-making.

- Environmental consequences and long-term impacts of Carbon removal strategies on soil and peatland health:
    - Analysis of the integral value of soils and peatlands to ensure effective climate mitigation beyond 2050:
        - 'Improving soil health and restoring and protecting our peatlands' is an integral focus of the 25 Year Environment Plan (2018)
        - Soils provide a wide range of other ecosystem services such as filtration of nutrients and contaminants and storage of carbon and regulation of greenhouse gases (Dominati et al. 2014).

- Environmental consequences and long-term impacts of large-scale tree planting as a Carbon removal strategy
    - The UK"s forests currently store 1.09 billion tonnes of carbon and sequester about 4.6% of the country's total emissions (British Ecological Society, 2021).
    - The UK has committed to planting 30,000 extra hectares of woodland annually by 2025 to ensure carbon sequestration and mitigate climate change (British Ecological Society, 2021).
    - However, afforestation can also have disastrous consequences on nature (Carrington, 2021) if pursued inadequately. For example, non-native planting conifers can counteract climate benefits (Luyssaert et al, 2018; Naudts et al, 2016) and afforestation on peatland can have adverse consequences on soil (Matthews et al, 2020). Further examples and environmental trade-offs of large-scale tree planting will be considered in this section.

- Potential scope for further analysis: environmental consequences and long-term impacts of enhanced rock weathering, Biochar and Perennial bioenergy crops.

- Understanding the potential biodiversity impacts of operating carbon removal strategies at scale is crucial to inform policy-making, especially over longer-time scales (Dooley *et al.*, 2020).
    - Analysis of geological stores point to an abundant and safe sink (Dunne, 2018), yet storing it in soil systems, weather rock or other removal systems point to more profound land-use shifts.
    - Potential policy recommendations will likely emphasise strong and effective governance frameworks in cases where biodiversity impacts are dependent on the implementation method (Dooley *et al.*, 2020).

Securing long-term UK leadership in climate and energy policy:

The sixth Carbon Budget sets out the goal for the UK to be an international leader in climate policy. As the UK's carbon footprint is reduced, the less direct impact it's domestic actions have for global climate change mitigation. Therefore, if the UK seeks to lead on climate change action it must develop capabilities to influence policy beyond its borders. This section seeks to assess how best this can be achieved.

Research Directions:

1. Direct influence through climate diplomacy
    - How strong is the FCDO in this area?
        - There have been recent cuts to staff working on climate and energy within the FCDO (E3G, 2020), is this disadvantageous?
        - How can COP26 be leveraged to create a legacy of influence?
    - What capabilities are most impactful?
        - The role of aid and other finance flows (e.g funding research).
    - How can the UK maximise its strength in this area?
    - This is currently under research by the Foreign Policy Select Committee inquiry into UK environmental diplomacy.
2. Direct influence through striving to achieve net zero for all UK consumption
    - Minimising the UK's contribution to climate change must extend beyond emissions directly attributable to the UK economy and include those caused by UK-based demand.
    - What methods could be used to encourage imported goods and services to also be net zero?
    - Proposed legislation to ensure deforestation-free supply chains offers a starting point.
3. Indirect influence through international policy transfer
    - Successful policies could be replicated elsewhere and indirectly contribute to climate change mitigation.
    - The literature on policy transfer is substantial (e.g Bößner et al 2020, Stone et al 2020), with the German Feed-in Tariff design offering an excellent example (Busch and Jörgens 2007).
    - How can the UK facilitate this process?
        - Incorporating 'transferability' into the policy design process, as advocated by Cullenward and Victor (2020).
        - Actively aiding transfer of established policy to other countries.