THE ENVIRONMENT STRATEGY FOR SCOTLAND

DELIVERING THE ENVIRONMENT STRATEGY OUTCOME ON SCOTLAND'S ECONOMY: EVIDENCE BASE AND POLICY LEVERS

Independent report by the New Economics Foundation

NEF CONSULTING

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Riaghaltas na h-Alba

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Disclaimers

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1. Executive Summary

The world faces unprecedented crises of climate breakdown and biodiversity loss, driven by the ways in which our economies have developed. Limiting global heating and its impacts will require a rapid and systematic reduction of the greenhouse gas emissions of all parts of our economies. Creating a nature positive world, where biodiversity loss is halted and reversed, will require substantial changes to the aspects of our economies that are currently putting unsustainable pressure on nature. Circular economy approaches remain underused, with many economic sectors continuing to operate linear, extractive models that deplete our finite natural resources. The prevailing economic model, with its focus on growth and GDP as measures of success, has not adequately responded to these challenges. A change in approach to prioritise more meaningful measures such as wellbeing is long overdue.

In its 2023 Global Risks Report, the World Economic Forum warned that the four most severe risks facing humanity over the next decade are environmental, including climate change and biodiversity loss.[1] The intergovernmental science bodies on climate and nature advise that tackling these crises will rely on urgent, transformative economic and societal change, particularly in developed countries.[2] **The Environment Strategy for Scotland sets out the Scottish Government's commitment to ensuring Scotland plays its full role in tackling the climate and nature emergencies.** It acknowledges that this will require transformative changes across Scotland's economy and society. In turn, these transformations can help to 'transform Scotland for the better' by improving people's health and wellbeing, tackling inequalities, and supporting new opportunities for green jobs and businesses.

This research project was undertaken to support the evidence base for informing the development of a 'pathway' for achieving one of the outcomes of Scotland's Environment Strategy, looking at the transformations in Scotland's economy needed to play its part in tackling the global climate and nature emergencies. This pathway, and the content of the research, focuses on the functioning of the domestic economy within Scotland and the features and functions of key sectors of the Scottish economy.[3] The 'economy' outcome within the strategy focuses, in particular, on the goal of **a just transition to a net zero, nature positive, circular economy.** This outcome directly aligns with the National Strategy for Economic Transformation's ambition for a 'greener economy'. It is also integral to the Scottish Government's vision for a wellbeing economy,[4] defined as an economic system, within safe environmental limits, which serves and prioritises the collective wellbeing of current and future generations. The Scottish Government's Programme for Government (2023-24) describes a wellbeing economy as "an economy which meets the needs and aspirations of people

and provides opportunities for all", and commits to "use every lever at its disposal to deliver a wellbeing economy that is fair, green and growing".

Section A of the report begins with an assessment of current progress in Scotland towards a net zero, nature positive, circular economy. In summary:

- In the transition to **net zero**, Scotland has set ambitious targets and has made some progress in sectors such as electricity generation, but many other key sectors require a faster pace of emissions reduction to meet 2030 and 2045 milestones. These areas for further action include emissions from buildings, car transport, aviation, low-carbon agriculture, peatland restoration, tree planting, industry and engineered removals.
- Progress towards a **nature positive economy** cannot be assessed with the same precision, but broad indicators of biodiversity and the economic factors driving its loss can be assessed. Scotland's biodiversity intactness is among the bottom 25% globally and its land and freshwater species abundance declined by 15% between 1994 and 2020. While some improvements have been observed in forest cover, air pollution levels and the tentative recovery of some commercial fish stocks, economic factors including the intensification of agriculture and overexploitation of fish stocks have harmed biodiversity over the past several decades. Two other direct drivers of biodiversity loss, climate change and invasive non-native species, are increasing and working in synergy. The combined evidence available suggests that a significant transformation across many sectors will be needed to achieve a nature positive economy in Scotland.
- Scotland's economy was estimated to be 1.3% **circular** in terms of its resource use in 2022, below the level of circularity estimated for the global economy (8.6%) and the leading economy, the Netherlands (24.5%). Waste management and reduction targets are ambitious, but further system change will be needed to meet them and to reduce the per capita rate of domestic resource extraction to match other similar economies and ultimately to reach sustainable levels.

Section A continues with a review of the Scottish Government's existing use of the available policy levers for driving the just transition to a net zero, nature positive, circular economy. This finds that, although there have been pockets of success, overall progress has been limited on creating a **nature positive** and a **circular** economy, where bold targets have been set but the necessary legislation, policies and implementation are still in train. On **net zero economy**, the Climate Change Committee advises that the levers currently in place are not yet sufficient to meet climate targets, particularly in sectors like transport, agriculture and domestic heating. Our analysis shows that **public investment** is the most effective lever in the Government's toolkit, particularly when deployed with the express aim to leverage greater levels of private

finance, but that levels of public investment will need to increase. **Private investment** will also be needed to transform the economy but will need to be considered carefully and applied where it is most appropriate to ensure it is compatible with a just transition. There has been limited impact and effectiveness from Scotland's current use of some other economic policy levers such as **tax, regulation** and **public procurement**. This is explained partly by the fact that key regulatory and tax powers are reserved to the UK Government (UKG hereafter) and challenges in implementing diverging regulations in areas such as the Future Homes Standard and the deposit return scheme. Action at the UKG level will be needed in alignment with renewed ambition in the use of devolved powers.

In **Section B**, a Theory of Change approach is undertaken to map out the key intermediate outcomes on the pathway to a net zero, nature positive, circular economy, and to identify how existing policy levers could go further, or new policy levers could be adopted, to steer the economy of Scotland onto a more direct path to achieving these goals. Two Theory of Change diagrams, which draw on key net zero research from the Climate Change Committee and the international literature on best practice for nature positive economies, illustrate the wide variety of outcomes and levers required to progress towards long-term net zero and nature positive goals.[5]

Finally, **Section C** makes extensive recommendations for how the set of available policy levers can be applied more effectively to move towards a net zero, nature positive, circular economy. These can be found in full on pages 95-118 presented by type of lever and economic sector. For illustrative purposes, broad areas addressed within the recommendations include:

Net zero economy:

- **Electricity:** maximising the **social value** (e.g. jobs and local supply chains) from private investment in renewables; scaling up development of **community energy** projects; and advocating to UKG for improved electricity **market design**.
- **Buildings:** supporting the Heat in Buildings Strategy through **public investment, delivery plans and legislation**; extending the policy focus to include **non fuel-poor households**; and adopting an **area-based approach**, centred on communities and local authorities.
- **Transport:** strengthening measures to promote **reduced car-use,** including **re-prioritising transport spend** towards public transport and 20 minute neighbourhoods; franchising **public transport** and delivering an integrated nationwide fare structure; accelerating introduction of **road user demand management schemes**; and providing transition support ahead of **LEZ enforcement**. Additionally, strengthening measures to reduce aviation and shipping emissions, including adopting a **2030 aviation demand reduction target**; using powers under the **Air Departure Tax** to disincentivise

unnecessary air travel in a just way; and investing in **shipping decarbonisation**.

- **Industry:** working to secure **increased funding** for decarbonisation through the UKG's cluster approach; focusing on immediate actions to promote **energy and resource efficiency, fuel switching** and **low-carbon materials**, alongside longer-term goals on hydrogen and carbon capture; and implementing **whole life carbon policies** in construction.

Nature positive economy:

Increasing public funding for **nature conservation and restoration** and using **public investment** and **regulatory** levers to support the transition to regenerative land and marine-based industries:

- **Agriculture:** ensuring **post-CAP payments** are heavily conditional on nature positive activities (not just reduction of biodiversity impact); and undertaking a **national land use assessment** to explore the optimal mix of land uses for meeting nature positive, net zero and sustainable food production goals.
- **Forestry:** increasing Forestry and Land Scotland funding to accelerate **land acquisition** for forestry and nature restoration; and increasing support to **community-led** forestry projects.
- **Fisheries:** reviewing the biodiversity impact of **subsidies**; increasing public investment in **Marine Protected Areas**; and implementing increased spatial restrictions on **bottom-contact fishing** across a wider area of Scotland's seas.
- **Aquaculture:** strengthening **evidence** on the biodiversity impacts of the sector and directing funding to **lower-impact** forms of aquaculture.
- In addition, the report includes recommendations on how the following wider policy levers can be used to drive progress towards a nature positive economy:
- **Mainstreaming biodiversity, including in national measures of success:** introducing mechanisms for **mainstreaming** biodiversity across SG policies (e.g. via Natural Environment Bill targets and cross-portfolio coordination and monitoring); applying **green budgeting** approaches to understand and improve the biodiversity impacts of SG budget decisions; and continuing to improve the **Natural Capital Asset Index** as a National Performance Framework indicator.
- **Taxation:** exploring options for taxes on **pesticides** and **fertilisers** to reduce their use in agriculture, forestry and aquaculture.
- **Private finance:** generating a clearer picture of i) the **finance gap** for nature investment, ii) the range of funding options for addressing this gap

(including from taxation) and iii) the scenarios where private investment is more or less suitable; ensuring private investment is governed by **binding criteria** for social and environmental benefit; and that blended finance is subject to **public scrutiny**.

- **Business disclosures and financial regulation:** including nature positive economy in the missions of the **Scottish National Investment Bank** (SNIB); promoting **voluntary disclosure** of nature-related risks and impacts by businesses; and working with UKG to explore **regulatory options**.

Circular economy:

- Fully integrating Scotland's **climate change plans** with the upcoming circular economy strategy to ensure targets, policies, governance and delivery are aligned, including on **consumption-based emissions**.
- Adopting a **net zero-style governance** approach to meeting circular economy outcomes by requiring and tracking contributions from different SG portfolios.
- Signalling intent by setting a clear **target** for reduction of per capita material use and intensity.
- Advocating to UKG for **fiscal incentives** (e.g. tax breaks) for businesses to reduce their material footprint by investing in circular product and process standards.
- Exploring incentives for consumers and businesses to promote the **product-as-service** model.
- Exploring how **Extended Producer Responsibility**, which exists in sectors such as plastic packaging, could be extended to the textile sector.

Cross-cutting policy levers:

The report also sets out recommendations for using a range of cross-cutting policy levers for achieving net zero, nature positive and circular economy goals. For example:

- **Skills and advice:** producing a **10 year timeline** with actions for meeting the skills needs for a net zero, nature positive, circular economy; working with all **relevant agencies** (including Skills Development Scotland, the Scottish Funding Council and the Scottish Cities Alliance) to address skills needs in specific sectors; encouraging more students into STEM subjects throughout primary and secondary **education**; and providing **careers advice** on the green economy.
- **Innovation and R&D:** setting a **prioritised framework** to signal to business and research institutions the strategic areas in which the SG will support and encourage new R&D, with a focus on net zero, nature positive and

circular economy goals; and ensuring increased support is available for businesses investing in **first-mover innovation** (overcoming the challenges of path dependency).

- **Development planning:** assessing opportunities for **local authorities** to take a more **proactive role** in planning and developing places that support net zero, nature positive and circular economy goals e.g. via Compulsory Purchase Order powers, SNIB funding, and legislative changes to enable the public to capture more land value uplift from development.
- **Procurement:** switching **food procurement** to vegetarian across SG catering; implementing a plan to increase the proportion of **circular economy suppliers** to SG; assessing the potential to procure from **product-as-service** systems; and developing **new contracting guidance** for public procurement to support net zero, nature positive and circular economy goals, including for transport and buildings.
- **Consumer information:** considering options for **food labelling schemes** to inform consumers on the emissions and nature impact of foods; and continuing to work with sectoral organisations to improve consistency of practice and labelling on **shelf-life.**

Finally, the report reflects on how the **wider economic model** and policy framework affects Scotland's ability to achieve the just transition to a net zero, nature positive, circular economy. Broad recommendations arising from this discussion include:

- Shifting to an economic system that is **growth-agnostic**, targeting improvements in **wellbeing** rather than GDP.
- Recognising that, while the just transition to a net zero, nature positive, circular economy creates many economic opportunities, **it will not be sufficient to focus only on the subset of green interventions that are profitable** – a truly sustainable economy is one that consciously limits its demands on nature to ensure they do not exceed what nature can sustainably supply.
- Exploring policy options that **more fully incorporate nature and climate-related costs and benefits into economic decision-making** (as addressed in some of this report's recommendations).
- Carefully considering the **roles of public and private delivery models** in order to ensure a **just transition** – recognising that an approach based predominantly on promoting private investment risks directing both the decision-making power over what kind of transition occurs, and the financial returns from the subsequent investments, to a small number of investors rather than the public at large.

The full list of recommendations provides our assessment, based on evidence of best practice elsewhere and the approaches available, of directions the

Scottish Government should take when seeking to align its economic policy for a just transition at the scale required to address the nature and climate crises it faces. The process of transforming the economy to decarbonise, restore biodiversity and maximise circular material flows presents an opportunity to put wellbeing first, to create a wide range of co-benefits from health to employment, and to bring Scotland onto a sustainable path for the long term.

2. Introduction

2.1 Context

This research project was undertaken to support the evidence base for informing the development of a 'pathway' for achieving one of the outcomes of Scotland's Environment Strategy. The outcome focuses on the transformations in Scotland's economy needed to play Scotland's role in tackling the global climate and nature emergencies.

This pathway, and the content of the research, is therefore limited to the functioning of the domestic economy within Scotland and the features and functions of key sectors of the Scottish economy. Other Environment Strategy outcomes outside the scope of this research are focused on related areas, such as the transformations in Scotland's society (including lifestyles and social policies) needed to tackle the climate and nature emergencies; and the sustainability of Scotland's global footprint (including sustainable consumption and international trade).

The Environment Strategy for Scotland's vision, published in 2020, describes the country's ambitions for achieving net zero by 2045, restoring Scotland's natural environment, and playing Scotland's full role in tackling the climate and nature emergencies. It acknowledges that this will require transformative changes across Scotland's economy and society. In turn, these transformations can help to 'transform Scotland for the better' by improving people's health and wellbeing, tackling inequalities, and supporting new opportunities for green jobs and businesses.

The 'economy' outcome within the strategy focuses, in particular, on the goal of **a just transition to a net zero, nature positive, circular economy.** This outcome is integral to Scottish Government's vision for a wellbeing economy,[6] described as 'an economic system, within safe environmental limits, which serves and prioritises the collective wellbeing of current and future generations'. It also directly aligns with one of the three ambitions set out in the 2022 National Strategy for Economic Transformation,[7] to create a 'greener economy: demonstrating global leadership in delivering a just transition to a net zero, nature positive economy, and rebuilding natural capital'.

The Scottish Government (SG) is now developing a 'pathway' to identify actions and priorities across the breadth of government for driving progress towards the Environment Strategy 'economy' outcome.

2.2 Overview of approach

In order to identify evidence to support the development of this pathway, a comprehensive literature review was undertaken, assessing a series of strategy and policy documents that included, among others, the National Strategy for Economic Transformation, the draft Biodiversity Strategy, the Just Transition Planning Framework, the Infrastructure Investment Plan, the National Planning Framework 4 and the updated Climate Change Plan.

The research considers within each of these plans and strategies, how the Government is currently deploying, or planning to deploy, economic policy levers to achieve its targets and objectives and the research offers a qualitative assessment of their **effectiveness and sufficiency** in driving progress towards the Environment Strategy 'economy' outcome. When referring to the SG, the report also considers Government funded public sector organisations and private sector organisations that the Government can influence directly (e.g. investors and employers through regulation or public investment).

2.3 Methodology

In order to develop evidence for the pathway, the research project was undertaken with two overarching research questions, which were:

- **Research Question 1:** *What does existing evidence tell us about Scotland's current progress towards a just transition to a net zero, nature positive, circular economy?*
- **Research Question 2:** *How can the SG and its partners use the available policy levers most effectively to drive progress towards a just transition to a net zero, nature positive, circular economy?*

The research was also necessarily broad given the range of sectors within the Scottish economy requiring due consideration, and the breadth of policy areas which are relevant across these sectors and with environmental and economic implications.

It is important to note, that in many cases, detailed evidence or data, for example about sufficiency of policies for delivering objectives, is not always available, nor are targets and objectives always explicit in different areas about what would achieve the outcomes. Therefore, the research team has in many cases had to use its own judgement as to sufficiency in many areas. The team is aware that in assessing the sufficiency of policies already in place or in design, it is clearly not always possible to be scientific; hence in places

the assessment is necessarily based on framing (of the problem), belief (in paradigms, e.g. technological optimism, market forces), and judgement.

The researchers note the intention for the pathways, once developed, to be taken to public consultation. The evidence presented here is therefore not intended to be a final say on the challenges set out, but an informed and evidenced judgement.

2.4 Key definitions used

A number of key terms that are used throughout the report are defined as follows:

- **Just transition**: we draw on the definition used by the Just Transition Commission, who state that just transition policies are those designed "in a way that ensures the benefits of climate change action are shared widely, while the costs do not unfairly burden those least able to pay, or whose livelihoods are directly or indirectly at risk as the economy shifts and changes."8 This does not mean eliminating the costs of transition or a situation where nobody loses out from transition, but rather protecting the most vulnerable from their impacts. Importantly, when applying this definition in the report, we broaden its scope beyond climate change action alone, to refer more holistically to the just transition to a net zero, nature positive, circular economy.
- **Net zero economy**: in line with the SG's 2045 target, a net zero economy is one where the sum of the greenhouse gases created and greenhouse gases removed from the Scottish economy will be at or below zero.9
- **Nature positive economy**: for the purposes of this project, we have defined a nature positive economy to be one that halts biodiversity loss by 2030 and creates an increase in and restoration of biodiversity levels after that point, in line with its definition in the international literature.10 This matches the high-level outcomes proposed by the SG in the 2022 draft Scottish Biodiversity Strategy.11
- **Circular economy**: based on the approach used in the Circularity Gap report for Scotland, we define a circular economy as one that minimises resource extraction, ensures that remaining extraction is regenerative and minimises the dispersion and loss of materials. In practice, increasing circularity in an economy requires narrowing material flows by using less material in the making of products and the delivery of services, slowing material flows by using goods for longer, replacing inputs and materials with regenerative alternatives where possible, and maximising re-use of materials and products.

2.5 Structure of the report

The report is structured into three sections (A, B and C), which broadly follow a logical structure as follows:

Section A reviews existing and proposed policies across the three interlinked objectives that fall within the Environment Strategy 'economy' outcome i.e. 'net zero economy', 'nature positive economy' and 'circular economy'. For the purposes of this report, these objectives are described as 'missions'. For each of these areas, policies are reviewed as 'levers' that sit under overarching policy lever-domains. Where evidence and existing data allows, levers are reviewed for their sufficiency and effectiveness in supporting the three missions.

Section B undertakes a Theory of Change exercise for the 'net zero economy' and 'nature positive economy' missions. It takes the policy levers set out in Section A, adds additional levers identified in wider national and international literature, and tests them systematically across different sectors of the Scottish economy for formulations of the levers (existing or hypothetical) which could effectively contribute towards these missions over the short, medium and long term.

Section C then synthesises the research of Sections A and B to identify policy-lever recommendations, aligned to specific sectors within the Scottish economy (following the structure of Section B). These recommendations both identify new levers as well as proposing how existing levers could be improved or go further.

3. SECTION A: Evaluating Scotland's progress in driving a just transition to a net zero, nature positive and circular economy

3.1 Overview

There is no comprehensive source of evidence on how Scotland is performing towards achieving the goal of a just transition to a net zero, nature positive, circular economy. Scotland is not alone in this regard. It is not straightforward to make assessments about the sufficiency of individual or collective policies, due to the uncertain nature of the impact of policies, and constraints around the availability of data to track progress. Indeed, the formal evaluation process for many policy levers will not have started or may take years to be fully informed. Separately, many policy levers, such as within skills, may not directly be linked to environmental outcomes but provide ancillary effects to support or hinder the transition. Separately, in other fields, like biodiversity, there may be a lack of baseline data or accepted mechanisms for measuring change or the impact of individual policies.

Nonetheless, and noting the methodological challenges, this section of the research seeks to draw judgement-based conclusions on a range of policies

currently in place within Scotland's economy, with a view to making assessments on how well different components of the SG are considered to be performing towards achieving the Environment Strategy 'economy' outcome.

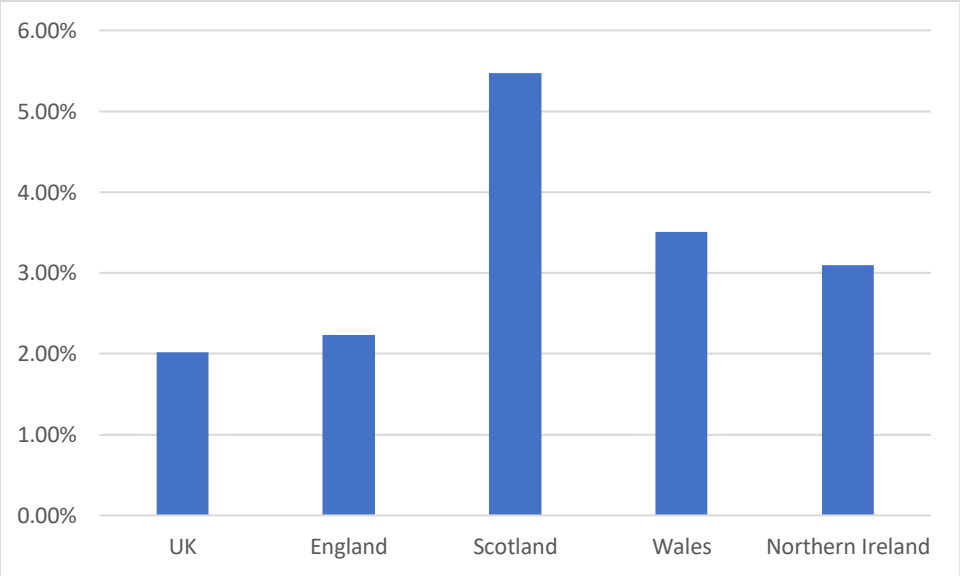
Given the breadth of the Scottish economy, and the range of policies which impact it, the assessments are necessarily high-level at this stage. Where evidence gaps exist and judgements are made, these shine a spotlight on areas in which the SG may wish to target monitoring and evaluation resource to develop better informed and better evidenced policies.

3.2 Overall performance summary towards a net zero, nature positive and circular economy

3.2.1 Net zero economy

Although significant further economic transformation is needed, the net zero economy is relatively strong in Scotland in comparison to other UK regions as nations,[12] (Figure 1). Based on a narrow definition focusing on low carbon and renewable energy, Scotland's net zero economy formed over 5% of the country's economy in 2021, generating £8.7bn in turnover and employing over 28,000 people across Scotland.[13] Scotland currently being ahead of other parts of the UK is required, given its target for reaching net zero greenhouse gas emissions five years earlier than the UK: in 2045 compared to 2050.

Figure 1: Size of Low Carbon and Renewable Energy Economy as % of total GDP (2021)



Source: Office for National Statistics, Low Carbon and Renewable Energy Economy Survey

Based on the size of its labour market, Scotland has the highest concentration of green jobs in the UK.[14] In 2022, 3.3% of all job adverts in Scotland were for jobs that have a positive impact on the environment, up from 1.7% in 2021.

This helped Scotland retain first place among 12 nations and regions of the UK in the Green Jobs Barometer developed by the consultancy PWC.[15]

Meeting the SG's target to reduce emissions by 75% by 2030 (and by 90% by 2040) requires annual reductions of 8% from 2021 onwards, which is over 3 times the rate from 1990-2020.

Greatest progress towards Scotland's net zero targets has so far been achieved in the energy sector. Emissions from **electricity** supply have fallen by almost 90% since 2010 due to a rapid rise in renewable generation which increased nearly threefold between 2009 and 2019. With ever higher generation of clean energy, new sub-sea links will channel excess supply from Scotland to England.

The emissions reduction pathway in Scotland's updated Climate Change Plan aims to achieve zero emissions from electricity supply by 2029, which is six years earlier than the rest of the UK. At the same time, Scotland's electricity supply will need to accommodate increased demand, particularly from heating (heat pumps), transport, or electrification in industry. Earlier this year, the SG published a Draft Energy Strategy and Just Transition Plan with more details on specific goals including the ambitions to deliver an additional 12 GW of installed onshore wind capacity and to achieve 8 to 11 GW of offshore wind capacity by 2030.[16] Specific targets are currently missing for renewable energy storage, albeit the pipeline of storage projects is robust.

The SG is aiming for the energy sector to spearhead a huge inward investment drive[17] with ambitions of creating an additional 20,000 jobs, increasing Scottish GDP by £4.2bn, boosting exports by £2.1bn, and adding up to £680m in additional government revenues per annum.[18] By 2050, nearly 80,000 are projected to be employed just in the low carbon energy sector as a result of the just energy transition.[19]

However, in its latest progress report, the Climate Change Committee (CCC) noted that, across a range of other areas largely devolved to SG – such as domestic heating, transport, land use and agriculture – Scotland has set relatively high ambition in cutting emissions but remains significantly off track from its own targets for the short and medium term, highlighting issues with policy delivery.[20] As summarised below, urgent, transformative action in these areas is required:

Domestic heating: The decarbonisation of heating is one of the most complex challenges facing the Government. Emissions from Scotland's buildings have fallen only slightly over the past decade, highlighting the slow pace of change vis-à-vis the energy sector. The emission reduction pathway in Scotland's updated Climate Change Plan sets out to reduce annual emissions from buildings to 2.6 MtCO2e by 2030, a 71% reduction on the sector's emission in 2021.

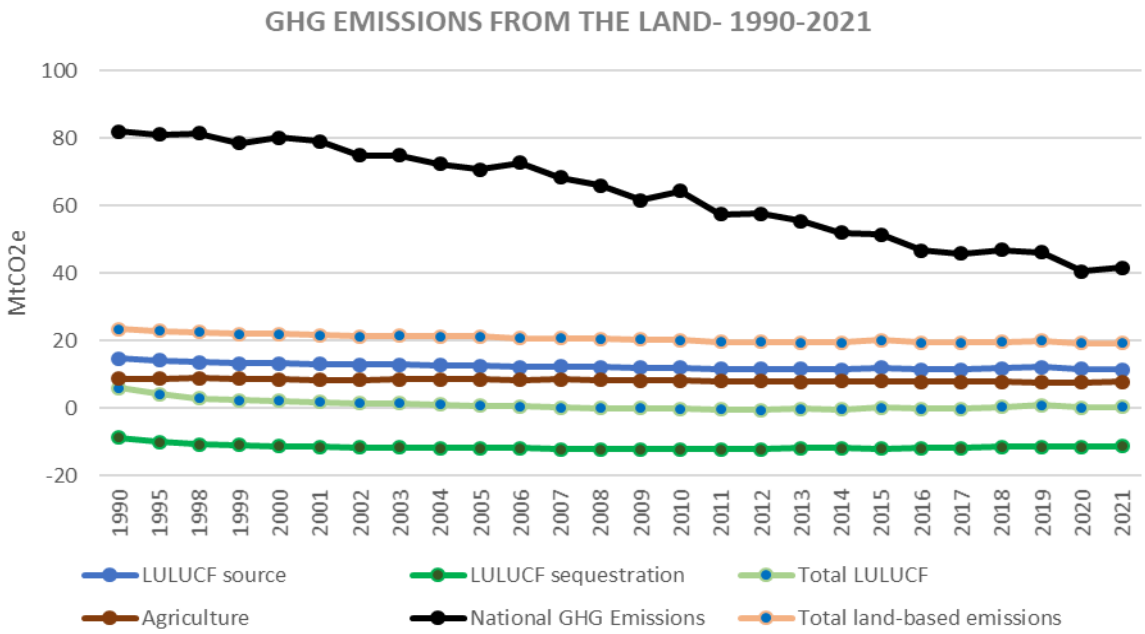
The Government has laid out specific goals to meet this ambition that includes a commitment to zero emissions heating systems in all new builds from 2024, zero emissions heating systems to account for 50% of new systems installed each year by 2025, and 50% of all buildings to be converted to a low or zero carbon heating system by 2030.[21]

Transport: Emissions from transport account for the largest share of Scotland's territorial emissions and are yet to start falling considerably over the last decade, reflecting a similar lack of progress relative to targets observed in the rest of the UK. Surface transport is the single biggest contributor to carbon emissions with a gradually increasing share from aviation and shipping. The emission reduction pathway in Scotland's updated Climate Change Plan projects annual emissions falling to 6.5 MtCO2e by 2030, a 44% reduction on the sector's emissions in 2021. Specific goals to meet this ambition include a 20% reduction on 2019 car kilometres, phasing out the need for petrol and diesel cars and vans by 2030 and petrol and diesel HGVs by 2035, ensuring that 30% of state owned ferries are low emission by 2032, decarbonisation of passenger rail by 2035 and the decarbonisation of flights within Scotland by 2040.

Land use and agriculture: Total net emissions in Scotland were 41.6 $MtCO_2e$ in 2021 and land-based emissions represented nearly half of this total, with agriculture at 7.8 $MtCO_2e$ and land use change and forestry at 12.3 $MtCO_2e$. As shown in Figure 2, while total net emissions have approximately halved since 1990, land-based emissions have remained relatively constant over this period, highlighting the scale of the challenge ahead in reducing emissions in this sector. Soil health and widespread nature restoration, including woodland creation and peatland restoration, are key priorities for creating a net zero and nature positive economy. Woodlands constitute 19% of Scotland's land area, which is higher than the UK average but lower than Europe at 37%.

Woodlands including commercial forestry and semi-natural woodlands sequestered 7.3 $MtCO_2e$ in 2021, including over 1.5 $MtCO_2e$ sequestered in broadleaved woodlands. Most woodlands in Scotland are commercial conifer plantations. New woodland creation is considerably off track to meet the SG's own targets for 2024/25 of 18,000 hectares annually. Similarly, peatlands are contributing to significant carbon emissions with 80% of Scottish peatlands damaged and emitting 6.6 $MtCO_2e$ a year based on 2020 data. Current restoration targets and delivery are well below what is necessary.

Figure 2: Land-based emissions (from the Agriculture and LULUCF source sectors) have remained more or less static since 1990



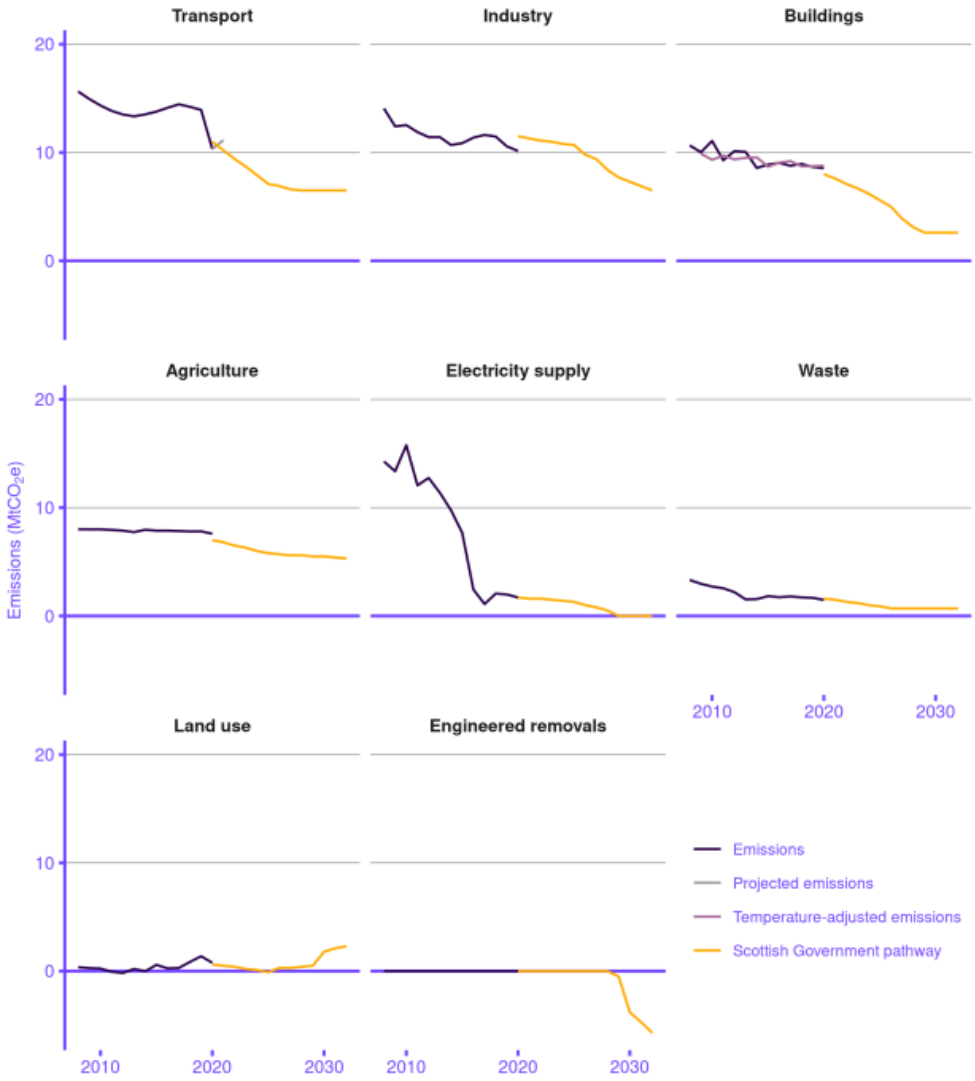
Source: NatureScot, using figures from the NAEI for England, Scotland, Wales and Northern Ireland, 2023.[22]

Sectors like cement, iron and steel, chemicals, and the extraction and refining of oil and gas, alongside fuel supply, contribute one fifth of Scotland's territorial emissions. The SG is aiming to reduce emissions from **industry** by 38% between 2020 and 2030, but policy in this area is largely reserved to Westminster. The CCC was not able to fully assess progress on decarbonisation of industry in its 2022 progress report for Scotland due to a lack of data, benchmarks and metrics, although there has been a slight improvement in energy efficiency over the past decade. Key gaps in reserved policy identified included a lack of medium to long-term plans from the UKG for industrial energy efficiency and electrification.

As shown in Figure 3, the Government is currently relying on **carbon removal technologies** to deliver its 2030 emission targets, particularly in industrial sectors, with an ambition of removing 3.7 $MtCO_2$ every year from 2030 or an equivalent of removing 1.7 million cars from the streets. If this scale of emissions removal does not materialise to offset continued positive emissions forecast for sectors such as industry, transport and agriculture, then Scotland will miss its net zero targets unless further emissions reductions are secured in the aforementioned sectors. The UKG has also set itself a bullish target of 20-30 $MtCO_2$ captured every year by the mid-2030s. Existing global capacity in carbon removal is currently far below the level expected to be needed by 2030 and beyond, meaning that the technologies are unproven at the required scale. Global commercial carbon capture capacity was just

45MtCO$_2$ in 2022.[23] Bioenergy with carbon capture and storage (BECCS) captured 2 MtCO$_2$ in 2022, of which less than half was stored,[24] while global direct air capture (DAC) capacity in the same year was just 0.008 MtCO$_2$ per annum.[25] It is worth noting that there are currently no carbon capture or removal sites in Scotland, though the geography and the existing industry offer considerable potential. Specific proposals currently under development are awaiting approval and funding, posing an inherent risk of achieving rapid scale in these technologies within a short span of time. These removal technologies will only be effective in helping to achieve net zero if combined with very large reductions in emissions across the economy.[26, 27]

Figure 3: Scotland's historical emissions (2008-2020) and the Government's proposed pathway (2020-2032) by sector



Source: Climate Change Committee, Progress in reducing emissions in Scotland 2022 report to Parliament.[28]

Just transition is a key objective for the SG and the recent budget allocated its first tranche of £20m towards projects in the North East and Moray as part of a £500m decade long Just Transition Fund. There is no universally agreed definition of a just transition but the Just Transition Committee (JTC), set up by the Government, is working with stakeholders across all economic sectors in better defining the concept of just transition and to inform practical policy design (their working definition is included in the 'Definitions' section, above). Although the JTC have so far focused primarily on the just transition to a net zero economy, these issues are also relevant to the transformations needed to achieve a nature positive and circular economy, and a holistic approach should be adopted when considering how to achieve these goals in a just way.

3.2.2 Nature positive economy

Nature positive refers to a world where species and ecosystems are being restored and regenerated rather than in decline. For the purposes of this project, we have defined a nature positive economy to be one that halts biodiversity loss by 2030 and creates an increase in and restoration of biodiversity levels after that point, in line with its definition in the international literature.[29]

The 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Global Assessment highlighted the scale and pace of global biodiversity loss, identifying five *direct drivers* of biodiversity loss: changes in land and sea use, direct exploitation, climate change, pollution, and invasive alien species. The report also highlighted that these direct drivers result from a range of demographic and economic *indirect drivers*, including unsustainable production and consumption patterns.[30]

The James Hutton Institute (JHI) has recently published a report on how these indirect drivers apply in Scotland, categorising drivers as **socio-cultural** (i.e. the values people hold and how that makes them behave), **demographic** (i.e. population growth, patterns of migration and urbanisation, and education and local knowledge relating to the environment), **political and institutional** (i.e. public investment and subsidies, taxation, property rights, the political system, inequality, and local and global coordination), **technological** (i.e. new technologies for energy and agriculture, the externalities of this, and traditional local knowledge) and **economic**.[31] Three of the economic indirect drivers are international (relating to global trade, remittances, and tax havens) and hence outside of the scope of this project.[32] Their recommendations for addressing the remaining economic indirect drivers include:

- reforming regulations and incentives in sectors that affect land use and nature such as farming, fishing and forestry;

- reducing inequality and poverty to allow more of society to benefit from sustainably produced food;
- moving towards a zero-waste society and a circular economy to reduce Scotland's global biodiversity footprint, including through certification schemes for Scottish produce;
- habitat restoration managed in a way that avoids exporting the negative biodiversity impacts via consumption of unsustainable alternatives (e.g. timber or food) from abroad, including by reducing overall material consumption in Scotland;
- ensuring that carbon markets contribute to improved biodiversity rather than worsening it; and
- adopting new indicators of sustainability and wellbeing instead of GDP.

While they do not assess Scotland's progress on biodiversity, JHI advise that substantial change in values, behaviours, education, investment, production and consumption will be needed to reverse biodiversity loss.

Evidence on Scotland's progress towards a nature positive economy is limited. It is more challenging to assess progress towards a nature positive economy than progress towards net zero, for several reasons. Biodiversity loss cannot be summarised as easily through a single indicator in the same way as greenhouse gas emissions. The evidence base can tell us which aspects of the economy negatively affect biodiversity, but it lacks the level of detail of the Climate Change Committee's net zero research. It does not give a clear picture of the contribution of each sector of the economy to the problem nor has a clear plan been produced for what a nature positive economy will look like and how to get there.

The SG intends to explore options for measuring progress towards a nature positive economy through the further development of the Environment Strategy monitoring framework. The Initial Monitoring Framework, published in 2021, sets out an initial set of indicators for tracking progress towards the 'economy' outcome – including the Natural Capital Asset Index and Natural Capital Accounts, as described below. However, it noted that these indicators alone are not sufficient, and that further work will be undertaken to identify 'meaningful and robust measure of progress towards this outcome'. It noted that this will include, for example, considering indicators relating to investment in natural assets, jobs in green industries and the scale of green finance.

In this section, we approach the task of evaluating Scotland's progress towards a nature positive economy by exploring evidence on the key pressures on biodiversity in Scotland and how these relate to specific sectors of the economy. Further work is needed to explore, in greater detail, what a nature positive economy will look like in practice in Scotland, and how to

measure progress towards this. However, the evaluation below provides a starting point for understanding Scotland's progress towards a nature positive economy, which the SG can build on when developing the pathway for the 'economy' outcome and exploring indicators for the monitoring framework.

- *Status of Scotland's biodiversity*

Existing evidence indicates that **global trends of biodiversity loss are mirrored in Scotland**. The 2019 State of Nature Scotland report concluded that there has been **'no let up' in the net loss of nature in recent decades**, with the 2023 version of the report confirming that **11% of species in Scotland are threatened with extinction**.[33] The draft Biodiversity Strategy summarises the evidence on 'Scotland's biodiversity crisis'.[34] For example, the Biodiversity Intactness Index indicates that Scotland has retained just under half of its historic land-based biodiversity, ranking in the bottom 25% of nations around the world.[35] Terrestrial and freshwater species abundance fell by 15% between 1994 and 2020 and saw a decline of 9% in the decade from 2010 to 2020.[36] The draft Biodiversity Strategy sets out ambitions for halting the loss of Scotland's biodiversity by 2030, and restoring and regenerating biodiversity (and hence becoming nature positive) by 2045. Scotland's consumption of imported commodities also has a significant impact on the natural environment overseas – this is the focus of a separate Environment Strategy outcome[37] and is not explored in detail through this project.

- *Key pressures on Scotland's biodiversity*

According to the State of Nature report, **key pressures on biodiversity in Scotland** include the impacts of **agriculture**, development of the **built environment**, **fishing**, **climate change** and **pollution**.[38] This indicates some of the key economic sectors where transformation is therefore needed. The paragraphs that follow give an assessment of the available evidence on the biodiversity impacts of the Scottish economy – focusing on the above areas, as well as other key issues including protection of areas of nature, peatland restoration, forest cover, and invasive non-native species.

i) Protection of areas for nature

Protecting and restoring areas of land and ocean for nature will be an essential part of any mission to restore biodiversity and create a nature positive economy.[39,40,41] This will require a set of interventions to stabilise and then reduce the impact of agriculture and fisheries on the country's land and oceans, and to increase the natural areas that are protected, restored and returned to nature.[42] Estimates of the proportion of land needing protection to achieve biodiversity goals vary, from the emerging consensus of conservation scientists to target protection of half of all land globally to other targets suggesting a minimum of 20% or 30% protection for a functioning landscape.[43,44, 45] It is also important to ensure that protected areas are well managed to realise the full benefits. There is a

substantial net benefit to protecting and restoring large areas for nature, in terms of nature positive and net zero missions and other social outcomes.[46]

The SG is aiming to protect 30% of Scotland's land and seas for nature by 2030 under the 30x30 goal,[47] which is one of 23 targets of the Kunming-Montreal Global Biodiversity Framework, adopted by 196 states at the COP15 conference in 2022.[48] In practical terms, Scotland's land area is 77,910km^2, of which 18% (c. 14,000 km^2) is currently protected and a further 5% (c. 3,900 km^2) is national parks.[49] Scotland's seas cover an area of 462,315 km^2 and Marine Protected Areas cover 37% of this (228,118 km^2)[50], albeit not all of these areas have the fisheries measures in place at present to ensure that they are well managed. This shows that a major increase is needed in the protected land area between now and 2030. The biodiversity impact of this protection will also depend on how effectively it is implemented; in marine areas, for example, biodiversity outcomes are still at low levels (albeit with some recovery) in spite of a higher rate of notional protection.

ii) Peatland restoration

Scotland's extensive peatlands are in particularly urgent need of restoration to meet both the net zero and nature positive missions. Their condition is poor, with 80% being degraded, and as a consequence they are a large source of emissions rather than being a net carbon sink.[51]

iii) Forestry

Scotland is among the most deforested countries in Europe[52] and had lost most of its woodland by 1800[53] or earlier,[54] but the country has also made significant progress in increasing forest cover in the past century, from 4.5% in 1905 to 19.1% in 2022.[55] Forest cover in Scotland remains substantially lower than many EU countries, where the average forest cover is 39% and 20 member states have forest cover greater than 29%.[56] Not all forest cover is of equal benefit to biodiversity. Certain types of mixed or semi-natural woodland are likely to be of high biodiversity value, whereas areas used for commercial forestry do not necessarily provide the same level of biodiversity benefit. Nonetheless, given the potential for forests to contribute to the nature positive mission, and to capture and store carbon for net zero,[57] there is a need for further ambition to restore forest cover in Scotland to move closer to the EU average.

iv) Agriculture

More than 70% of Scotland's land area is used for agriculture, making it the predominant land use in the country.[58] Of this agricultural land, 55% is used for rough grazing, 23% is grass, 10% is used for crops or fallow, 10% is woodland, and 2% is other land.[59] Around 85% of agricultural land in Scotland is in Less Favoured Areas, with lower productivity for agricultural

uses.[60] The capability of Scotland's land is an important constraint to what sort of agriculture is possible in different parts of the country: while arable land (8% of area) can support a wide range of crops and a further proportion of Scotland's land (20%) can support mixed agriculture with a moderate range of crops, the agricultural potential of large parts of the country is limited to rough grazing (51%) or improved grassland (18%).[61] Among the largest crops by area in Scottish agriculture, barley and wheat, the majority of output is used either for whisky production or animal feed.[62] Food production and supporting biodiversity are not mutually exclusive, but given the finite amount of land available for uses such as conservation and forestry in Scotland, a reduction in the land footprint of agricultural uses such as livestock and dairy and non-food production could allow more land to be used for biodiversity while maintaining a secure food supply.

Agriculture is one of the largest contributors to biodiversity loss, through its direct effects on nature (intensive use of soil and land, pollution via pesticides and fertilisers) and through the use of land that could otherwise support higher biodiversity, for example as semi-natural habitats or under conservation measures.[63,64] In particular, increasing intensification of agriculture has driven biodiversity losses in Scotland, a trend which had some forms of impact for more than a century but has been more pronounced in the past 50 years.[65] Certain forms of agriculture such as meat and dairy production have a particularly strong impact on emissions and land use requirements, as they are inherently less efficient at converting energy into calories.[66] On the other hand, certain lower intensity forms of farming can benefit biodiversity: for example, a certain amount of grazing in upland areas can prevent the negative biodiversity effects of undergrazing.[67] A 2011 study estimated that 40% of Scotland's agricultural land is used for 'High Nature Value' farming (i.e. where rough grazing occurs on more than 70% of the farmed area and livestock density per hectare of forage is below a certain threshold).[68] These forms of farming are more likely to support biodiversity, albeit it is unclear whether this is sufficient to achieve an increase in biodiversity relative to the status quo, as required for a nature positive economy. The same 2011 study estimated that livestock-focused forms of farming in Scotland (crofting, sheep systems, beef cattle systems, combined sheep and cattle systems) were likely to make up the bulk of the country's 'High Nature Value' farming whereas other forms (arable systems, dairy systems, mixed arable and horticulture systems, horticulture systems, pig systems, poultry systems) were unlikely to meet the 'High Nature Value' definition because they were managed very intensively in the vast majority of cases.[69]

Data from the Natural Capital Asset Index 2023 shows that fertiliser use in Scottish agriculture fell by 31% between 2000 and 2010, before remaining

roughly constant until 2019, and falling slightly further in 2020 and 2021.[70] In the same period, pesticide use in Scottish agriculture rose significantly during the 2000s, was on average 32% higher in the decade from 2008 to 2017 relative to its 2000 baseline, but has declined slightly to a level 23% above its 2000 baseline during the period from 2018 to 2020.[71] The abundance of farmland bird species in Scotland rose by 24% between 2000 and 2008, but has since fallen steadily and as of 2021 stood at a level 13% above its 2000 baseline.[72]

The complex relationship between Scottish farming and biodiversity poses a challenge for assessing the impact of the sector over recent decades and what a hypothetical nature positive agriculture sector would look like. There is clear evidence that intensive agriculture is a key driver of biodiversity loss in Scotland, and that management interventions such as agri-environment measures and regenerative farming approaches can mitigate some negative impacts on biodiversity. However, there is a need for further evidence on the impact of existing farming practices on biodiversity – and on the broader land use transformations needed to achieve multiple goals for climate, nature and food production – to give greater clarity to SG policies on the sector's contribution to the nature positive mission. The 2022 *Vision for Agriculture* sets an ambitious direction of travel and acknowledges the need for change in the sector, but frames farming almost exclusively in terms of its positive contribution to biodiversity.[73] The draft *Scottish Biodiversity Strategy* presents evidence of a substantial decline in biodiversity on land and the effects of agriculture as a driver of this,[74] and aims to achieve farmland practices that result "in a substantial regeneration in biodiversity, ecosystem and soil health and significantly reduced carbon emissions while sustaining high quality food production" by 2045.[75] However, it is unclear from reading the strategy as a whole whether the outcomes targeted will be sufficient to transform the agricultural sector's impact to the extent that biodiversity decline is effectively reversed. The post-Brexit replacement of the Common Agricultural Policy (CAP) will be a critical tool in putting Scotland on track to meeting its biodiversity goals.

v) Aquaculture

Aquaculture is an important primary sector of the Scottish economy, with farmed salmon making up over one third of national food exports in 2021 following strong growth in the previous decade.[76, 77] The sector has the potential to form an important source of sustainable food supply in a nature positive Scotland, with the caveat that it will have to overcome several issues with its current environmental impact.[78] In the salmon farming subsector these include disease management among farmed fish such as sea lice (which have been shown to have negative spillover effects on the adjacent marine ecosystems),[79] the use of pesticides and antibiotics with

knock-on effects to adjacent areas,[80] an increased risk of eutrophication arising from the nutrient input from fish farms,[81] sourcing sustainable feed for farmed fish that doesn't put further pressure on wild fish stocks or land use,[82] and pollution from the solid waste arising from farmed fish.[83] There appears to be an evidence gap on the environmental impact of finfish farming in Scotland (especially in light of the recent growth of the subsector).[84]

vi) Fisheries

As in many countries, Scotland's fisheries have been subject to overexploitation in past decades, leaving stocks at reduced levels[85] and having negative knock-on effects to the abundance of other marine species.[86] Scotland's Marine Assessment 2020 took a detailed look at the available data on different commercial fish stocks.[87] The proportion of key commercial stocks subject to overfishing (where mortality was above the level required for maximum sustainable yield (MSY)) was high, albeit it fell slightly from 54% in 2016 to 46% in 2018. There was substantial variation by species, however: while hake and herring stocks made some recovery in recent decades, stocks of whiting and cod stocks did not. Between 1985 and 2016 there was some recovery with increases in abundance among demersal species (using data that covers only the 9 to 11 most commercially important species) in the Greater North Sea and Celtic Seas, from a very low baseline. There were also increases in the abundance of pelagic fish species in the same seas over that period.[88] The National Performance Framework indicator for the proportion of commercial fish stocks that are being fished sustainably (an average of stock and fishing mortality metrics for certain commercially important fish species) has improved substantially since the 1990s, from an average of 33% for the period 1991-2000, to an average of 63% in the decade from 2011 to 2020, an average of 65% from 2016 to 2020, and a level of 72% in 2021. There is still much room for improvement, given that 28% of the most important commercial stocks were not being fished sustainably (i.e. were being overfished) in 2021.

It is important to note that the data referenced above focuses on a small number of economically important species. As noted in a recent survey of evidence on Scottish nature, "very little is known about the vast majority of unmonitored and unregulated fish populations."[89] The 2020 Marine Assessment found no trend changes in the diversity of deep-sea fish in the past two decades, albeit with substantial data gaps in certain areas.[90] The same assessment could not discern a trend for the wider fish community (a larger sample of 167 species including many non-commercial fish) due to lack of evidence, albeit the available data suggested an improvement in the proportion of large fish in Scottish waters and a reduction in species richness and diversity in offshore waters.[91]

An indicator of the mean numbers of 11 seabirds in Scotland has fallen sharply in recent decades, so that the breeding numbers in 2019 were at 49% of their 1986 level.[92] Fisheries are one of the key drivers of this change (together with climate change and invasive non-native species) and the reduction in prey due to fishing is considered to be a high threat to six of the 11 species measured by the data.[93]

vii) Pollution

Pollution can negatively impact biodiversity through chemicals and waste deposited in the natural environment and through air, light and noise pollution. The 2019 State of Nature report noted that the farming, transport, energy and industry sectors were key sources of pollution and that pollution continues to have an impact in Scotland, in spite of some progress since the 1990s.[94] While the levels of key air pollutants have fallen significantly in recent decades, there is continued pressure on nature from new agrochemical and pharmaceutical products, plastic pollution, and diffuse pollution arising from the forestry and agriculture sector, roads and urban areas.[95] Pollution has had an impact on the Scottish distributions of lichen, more than half of which have declined since 1980, albeit there has been some recovery from the high levels of sulphur deposition observed in the 1970s.[96] Monitoring by SEPA found that in 2020, 66% of Scotland's water environment was in good or better condition based on a combination of water quality, flows and levels, physical condition and barriers to fish migration, an improvement from a figure of 63% in 2015.[97] The proportion of river length classed as polluted declined from 7% in 1998 to 3% in 2018.[98]

viii) Invasive non-native species and climate change

According to Great Britain level indicators for Invasive and Non-Native Species (INNS) cited in the 2023 State of Nature report, there has been an increase in the spread of existing INNS and no reduction in the establishment rate of new INNS since the 1960s, meaning that the impact and threat from INNS is intensifying significantly in Scotland.[99] Climate change, which will continue to put direct pressure on biodiversity as it worsens on a global scale, is also reinforcing the negative impact of INNS in Scotland.[100]

Ultimately, transitioning to a nature positive economy will mean ensuring that the economy's demands on nature do not exceed its supply. The 2021 Dasgupta Review on the Economics of Biodiversity emphasised that the economy is embedded in nature i.e. it is fundamentally dependent on the resources and services nature provides, and its capacity to absorb wastes, including greenhouse gas emissions.[101] The Review concluded that humanity's demands on nature currently far outstrip its capacity to supply, eroding nature's capacity to meet people's needs into the future and to sustain other life. For example, globally, while produced capital per person

doubled between 1992 and 2014, the stock of natural capital per person declined by nearly 40%.

In Scotland, the Natural Capital Asset Index measures the capacity of Scotland's terrestrial ecosystems to provide benefits to people. Although the index has improved slightly over the past 20 years, a back-casting exercise highlighted that this followed a significant deterioration between the 1950s and 1990s.[102] The Environment Strategy monitoring framework therefore notes that 'natural capital in Scotland is at low levels when considering long term trends'.[103] The biggest declines in the NCAI between the 1950s and 1990s were in moorland, grassland, cropland and coastal ecosystems. A NatureScot study attributes these declines to a range of factors, including peatland drainage and bracken encroachment on moorland; afforestation of grassland; loss of hedgerows and excess nitrogen application on crop land; and pollution of coastal ecosystems.[104] To restore Scotland's natural capital and reverse past declines, significant economic transformation will be required – including investment in and sustainable management of Scotland's natural capital assets by land-based and marine industries. As noted above, Scotland's consumption of imported products also places unsustainable demands on natural capital in other countries, and this is a focal point of another Environment Strategy outcome.

There is growing understanding of the economic risks posed by the degradation of nature. In a 2020 study, the World Economic Forum and PwC estimated that $44 trillion of economic value generation – over half the world's total GDP – is moderately or highly dependent on nature and its services and, as a result, is exposed to risks from nature loss.[105] This estimate was updated to $58 trillion in a 2023 PwC analysis.[106] While in the broader sense, all economic value generation is ultimately dependent on nature, these studies highlight the reliance of a wide range of economic sectors on nature, and the material risks posed by its decline.

The importance of nature to Scotland's economy is illustrated by the 2023 Natural Capital Accounts, which estimate that Scotland's *stocks* of natural capital have an economic value of £230 billion and provide an annual *flow* of benefits to society worth £15 billion.[107] Drawing on this data, the Environment Strategy monitoring framework includes an indicator on the annual *flow* of benefits from Scotland's natural capital, *excluding fossil fuels:* estimated at £4.0 billion.[108] However, as emphasised in the Natural Capital Accounts, these estimates do not cover all services from nature, and should therefore be interpreted as a partial or minimum value of Scottish natural capital. The asset values are also not an absolute "value" of nature, since 'its collapse would precipitate our own, implying infinite value'.[109] It is important to recognise that natural capital stocks and flows may show different patterns in the short term, e.g. when a resource is being extracted at unsustainably high levels, creating a large temporary flow of value but a

reduction in the stock of natural capital and its capacity to produce flows of value in future years.

3.2.3 Circular economy

Recent estimates suggest that **Scotland's economy is only 1.3% circular** – meaning that only 1.3% of the resources that Scotland uses are circulated back into the economy after use, and Scotland's economy relies almost exclusively on virgin materials. By comparison, the global economy is 8.6% circular and the Netherlands' economy is 24.5% circular.[110]

Scotland's annual consumption of virgin materials (around 21.7 tonnes per capita), its material footprint, **is nearly double the global average**. The rate of domestic resource extraction per capita, at 22.8 tonnes, is more than four times the UK average - largely owing to the extraction of fossil fuels in the North Sea. Addressing the question of future North Sea oil and gas extraction is of significant import both at the national and international level. The 2023 Circularity Gap report for Scotland notes that 'while high per capita extraction and consumption rates are common for a high-income economy, Scotland rests near the top of this classification.'[111]

The report also highlights that, since Scotland represents 0.073% of the world's population, yet consumes 0.1% of the globe's virgin material use, 'the Scottish economy is largely driven by overconsumption'. Scotland's large material footprint stems from significant levels of waste generation; reliance on fossil fuels for transport and heating; and geographic, demographic and climatic factors, with Scotland's low population density meaning that materials needed for infrastructure, amenities and services are used less efficiently.

Scotland's large material footprint is strongly linked to Scotland's consumption of imported materials and finished products, which accounts for more than two-fifths of its total material consumption. This is also reflected in Scotland's consumption-based carbon footprint, which exceeds territorial emissions by 42%, meaning that much of Scotland's carbon footprint results from emissions embedded in imports.

Focusing specifically on waste management, the Government set a range of targets, including a 15% reduction of all waste by 2025 against 2011 levels; a 33% reduction of food waste by 2025 on 2013 levels; a minimum of 60% recycling of all household waste by 2020; a minimum of 70% recycling of all waste by 2025; a maximum allowance of 5% of all waste to reach landfill by 2025 and a ban on all biodegradable waste going to landfill by 2025. The Government is currently underperforming on all of these targets while missing the 2020 household waste recycling target, acknowledging that "it is unlikely that waste and recycling targets or emissions goals will be met in full without large-scale, and rapid system change".[112]

The recently published Circular Economy Bill will provide the necessary legislative underpinnings for the Government to implement more systemic solutions to the challenge. The Government has also published a 2025 route map document, laying out some of the key interventions and actions it is considering which have since been consulted upon.

Historically, measures such as the carrier bag charge and ban on plastic cotton buds have had a positive impact with a significant reduction in their reported use across the country. Scotland has also met its EU targets for limiting the amount of biodegradable waste going to landfill and enhanced recycling of construction and demolition waste. Furthermore, a £70m local authority recycling improvement fund to improve reuse and recycling practices; banning the supply and manufacturing of some of the most environmentally damaging single-use plastic items; a plastic packaging tax and other measures in reducing waste from sectors like textiles and construction have all been introduced in the past few years.

The initial consultation on the route map to 2025 highlighted several new measures across different packages, targeting specific areas ranging from household recycling to circular construction practices. The approaches suggested in the route map are comprehensive but governance and delivery will pose significant challenges – as is evident with the attempts to roll out the deposit return scheme which has already been deferred by several months.

3.2.4 Conclusion on performance towards a net zero, nature positive and circular economy

As demonstrated in the section above, **Scotland's progress towards a net zero economy is a mixed picture**, with some progress accompanied by several significant gaps. The country's net zero targets are ambitious relative to the rest of the UK. The evidence on progress by economic sector, drawing primarily on the more detailed assessment by the CCC, is as follows:

- Emissions from **electricity** supply are being sufficiently addressed, with a sharp reduction recorded since 2010.
- There has not been much reduction in emissions from **buildings** in the past decade, but a major fall in emissions will be required in the sector between now and 2030. Although there have been some encouraging policies in this sector, they are not yet sufficient to deliver the reduction in emissions needed according to the CCC's recent progress assessment.
- Scotland is falling behind on **transport** decarbonisation, especially when it comes to the distance travelled by cars and aviation, with more ambitious policies needed to achieve 2030 targets.

- More progress is needed in **agriculture** and **land-based sectors**, with the CCC identifying a particular need for low-carbon agriculture policy and a shift to healthier diets. Peatland restoration and tree planting are short of the targeted rates needed for net zero.
- There is a lack of data to give a clear picture of progress in decarbonising **industry**, but a significant further reduction in emissions will be needed by this sector, in which many important policy levers are reserved to the UKG.
- **Engineered removals** are forecast to play a substantial role in achieving net zero, but at present no removals are occurring in Scotland. Although this is largely a devolved policy area, there is a significant risk of not scaling up capacity quickly enough to meet net zero targets.

Progress towards a nature positive economy cannot be assessed with the same precision as in the case of net zero, but the evidence in the previous sections does allow us to make a broad assessment of whether the key drivers of biodiversity loss are being reduced and whether metrics of biodiversity are getting better or worse. This broad assessment suggests the following:

➢ *Biodiversity metrics*

- Nature in Scotland is starting from a depleted baseline, with **biodiversity intactness** being among the bottom 25% globally and half of Scotland's historic land-based biodiversity having already been lost. There have been some promising signs of modest improvement since the 1990s but some key drivers of biodiversity loss are still getting worse and significant transformation is needed across the economy to become nature positive.
- Indicators of **species abundance** continue to show a mostly negative trend. Terrestrial and freshwater species abundance fell by 15% between 1994 and 2020, with a decline of 9% in the past decade alone. There has been some improvement in farmland bird abundance since 2000, but this has varied significantly by species. There has been a large decline in the abundance of 11 seabird species, which fell by 51% between 1986 and 2019. As mentioned below, key commercial fish stocks exhibit a mixed picture, with some stocks having recovered since the 1990s and others remaining at very low levels.

➢ *Drivers of biodiversity loss (as defined by the 2019 IPBES Global Assessment)*

- In terms of **land and sea use** change, there has been a significant increase in forest cover over the past century but the present level is still well below EU average. Protected areas on land will need to increase

substantially (from 23% to 30% of Scotland's land area) to meet the 2030 target for biodiversity. Large areas of seas are designated as protected (38% of Scotland's territorial waters), but this hasn't always translated to better condition in these areas.

- Pressure from **resource use and exploitation** appears to remain high in key nature-related sectors. The impact of farming on biodiversity has worsened with intensification in the past 50 years, though the impact varies significantly between intensive farming (e.g. arable, dairy, horticulture, poultry, pig farming) and higher nature value forms of farming (low intensity livestock, primarily in areas of lower land capacity). Agricultural policies have become somewhat more aligned with biodiversity goals but this has been insufficient to halt biodiversity decline, suggesting that realignment measures to date have not been sufficiently ambitious. Fisheries have been subject to overexploitation in past decades. The proportion of key commercial stocks being overfished remained high at 28% in 2021, but has fallen substantially from 67% in the 1990s. There has been some recovery of abundance in commercially important fish species since the 1980s but key stocks such as cod and whiting remain very low relative to levels several decades earlier and discards of these species have not fallen.
- There has been some reduction in air **pollution** since the 1990s but pollution from agriculture and forestry (via pesticide and nutrient run-off), transport (contaminated drainage and acid pollutants in the air) and plastic pollution (including in seas and soils) are still present, and the condition of the water environment is improving only slowly. Since 2000, fertiliser use has fallen but pesticide use has risen.
- The remaining two direct drivers of biodiversity loss, **climate change** and **invasive and non-native species**, are increasing and working in synergy.

Evidence on progress towards a **circular economy** suggests significant further action is needed to move Scotland closer to its peers:

- Scotland's economy was estimated to be **1.3% circular** in terms of its resource use in 2022, well below the level of circularity estimated for the global economy (8.6%) and the leading economy, the Netherlands (24.5%).
- The rate of domestic **resource extraction** per capita, at 22.8 tonnes, is more than four times the UK average and relatively high among high-income economies, largely owing to the extraction of fossil fuels in the North Sea.

- **Waste** management and reduction targets are ambitious in Scotland but performance is behind on these and large-scale, rapid system change is needed to hit these targets.

3.3 Wider economic model and transformational change

Before reviewing the economic policy levers currently used by the SG to drive progress towards a net zero, nature positive and circular economy, it is necessary to reflect on the wider economic model and policymaking framework as they currently exist, and how these affect Scotland's ability to achieve these missions.

There are a number of features of the wider economic model that apply in Scotland and other advanced economies that will hinder efforts at rapid transformational change to reduce emissions and restore biodiversity. Permanent, continual growth in economic production is an embedded feature of capitalist economies and poses a challenge to addressing the aforementioned environmental crises. Economic output and similar measures such as GDP are highly correlated with energy, greenhouse gas emissions and material use and there is much debate over whether it will be possible to decouple these factors from growth to the extent that a net zero, nature positive and circular economy can be achieved while still continually growing the economy.[113, 114] This suggests that a move away from prioritising economic growth may be necessary to achieve the three missions, but this will be challenging to achieve in an economic system that is based on growth and where many interests benefit economically from continued growth without having to absorb its full costs yet. One approach to achieving this would involve shifting to an economic system that is growth-agnostic, targeting improvements in wellbeing rather than GDP. This could allow a just transition to achieve the three missions while enhancing people's wellbeing. An economy that is not shaped with growth alone as the goal can still be the kind of wellbeing economy that the SG aims to foster.[115]

The Dasgupta Review, commissioned by HM Treasury, emphasises that conventional economic thinking sees the environment as external to the economy, rather than framing the economy as embedded within the environment, and the former view can encourage suboptimal policies in response to environmental crises.[116] The Review emphasises that economies are underpinned by finite but regenerative natural resources and ecosystem services, so that a truly sustainable economy is one that fully accounts for its impacts on nature and consciously limits its demands on nature until they balance what nature can sustainably supply. The fact that the economy is embedded in the natural environment suggests that policies sufficient to achieve a net zero, nature positive and circular economy will need to prioritise these missions first and foremost: it will not be enough to focus

narrowly on the subset of green interventions that are profitable or where nobody loses out.

Climate and nature are typically not factored into market prices, meaning that decision-making that prioritises financial return does not take these factors into account. Neither do market prices capture the tipping points inherent in the natural environment that could create runaway negative impacts if reached,[117] such as changes to ocean currents or permafrost thawing.[118] This is one of the reasons why the existing economic model drives continued activity and even growth in a number of highly environmentally destructive economic activities that are profitable in a narrow financial sense and whose producers and consumers do not bear their full environmental costs, such as oil and gas extraction, fast fashion, disposable products and packaging and unnecessary air travel. Various policy responses to environmentally harmful economic activity are discussed in the sections that follow, including the use of more holistic natural capital accounting or eco-labelling to more fully incorporate these costs and benefits into decision-making, the use of taxation to discourage certain activities or the use of regulation to prohibit them. Similarly, our existing economic system and market mechanisms have proved incapable of reducing the damage of excessive consumption among the very wealthiest, with the top 0.1% of income earners worldwide being responsible for 6% of total global growth in carbon emissions between 1990 and 2015 and emitting 45 times as much per capita as the global average person in 2015.[119]

Within our present economic model, certain policy frameworks and paradigms have become dominant in recent decades, which also pose challenges to achieving a just transition to a net zero, nature positive and circular economy. The dominant neoliberal economic policy approach that emerged in the 1980s and has remained prominent tends to favour the market sphere of an economy, which is seen as efficient, over delivering economic activity in the public sector, which is characterised as inefficient. This has created a legacy of privatisation which has made it more difficult for the SG to exert direct control over aspects of the economy such as housing energy efficiency, public transport and power generation, even in cases where policies have recently been reversed such as Right to Buy and the nationalisation of ScotRail. Given the rapid transformation needed to respond to the climate and biodiversity crises and the lack of profitability of some of the investments needed, the public sector is likely to be required to take a more active role in the Scottish economy (in a configuration more similar to the mid-20th century economic model than the neoliberal model) to achieve the three missions. This may come into conflict with the prevailing ideas that have taken root under the neoliberal economic paradigm, such as the presumption that private firms should not be subject to significant regulation, that taxation should be kept low or that delivery of key economic services by

public sector organisations is inherently inefficient. Neoliberal economics has also created a deep-rooted presumption in many advanced economies that one of the primary functions of governments is to encourage private investment (through policy measures that subsidise these investors with public funds, socialise their investment risk or reduce the investors' social or environmental obligations). Allowing such an approach to dominate in the transition to net zero, nature positivity and circularity would put a just transition at risk, by directing both the decision-making power over what kind of transition occurs and the financial returns from the subsequent investments to a small number of investors rather than the public at large. While there are signs of this way of thinking being challenged in recent years through initiatives such as the Scottish National Investment Bank, the SG will need to carefully consider the roles of public and private delivery models in achieving a just transition and how the shortcomings of previous neoliberal economic policies can be avoided.

The policy levers covered by the subsequent assessment and recommendations are not on their own sufficient to transform every aspect of the economic system in Scotland. Nonetheless, if the recommendations are pursued they could have some impact in counterbalancing the tendencies within the current economic and policymaking systems that continue to contribute to the climate and biodiversity emergencies.

3.4 Reviewing and assessing policy levers

The economic transformations needed to tackle the climate and nature emergencies will require a whole-of-government approach, with strong alignment across a range of public policy levers. However, as a devolved nation, Scotland does not retain full control of its economic policy (e.g. tax, monetary policy, specific aspects of industrial policy which are retained competencies of UKG). Furthermore, since Brexit, the UKG has not matched the scale of public investment received by Scotland from the EU – in particular through the UK shared prosperity fund which is estimated to fall short by £337m over the next three years in comparison to the EU's structural funds.

Noting these constraints, this sub-section of the research provides a high-level overview and synthesis of a very broad range of policy levers currently deployed or proposed in Scotland. The synthesis of existing policies is valuable in itself by providing a clear mapping of the extensive and overlapping areas of public policy through which the economy and the environment link together.

Wherever existing data and evidence allow, the research goes further by presenting an assessment of the success or expected sufficiency of the policies set out. However, in many areas this is simply not feasible due to a lack of evidence, or indeed, mechanisms, for measuring success. In these

areas, the research team uses its own judgement to make assessments where reasonable. Where such assessments are not possible, the lack of evidence enables the SG to identify areas for further research and investigation – or indeed, consultation, where political or economic opinion may be an essential factor in policy making – for example, in areas of contention such as the ability for markets to solve problems, or the need to trade off pace of change considerations, or micro vs macro impacts on communities and the national economy.

Nonetheless, it is the view of the research team that delivering the Environment Strategy 'economy' outcome will require all of these levers to point in the same direction while matching the urgency of the climate and nature emergencies.

3.4.1 Policy lever domains

In the box below, we set out a list of policy lever 'domains' within which we group known policies relevant to the 'economy' outcome.

Policy lever domains

Below, we set out a list of policy lever 'domains' within which we group known policies relevant to the 'economy' outcome.

I. Public investment (including investment designed to leverage private investment)
II. Public procurement
III. Direct and indirect taxes
IV. Regulation and legislation
V. Industrial product and process standards
VI. National planning framework
VII. Research and innovation
VIII. Enhancing human capital through upskilling, retraining
IX. New forms of ownership to distribute economic value fairly

These levers are not exhaustive because of the aforementioned breadth of policies which impact both economy and environment, but capture some of the key, priority policy levers that the SG could deploy. In the analysis that follows we review existing policies under the headings of these domains for each of the three missions of net zero, nature positive, and circular economy. It is important to note, that not every domain sits under each of these missions.

As mentioned, where possible, we also evaluate these levers in terms of their efficacy and sufficiency in driving the transition to a **net zero**, **nature**

positive, **circular economy** i.e. whether they provide sufficient economic signals and impact to put Scotland on track to meeting its short and medium term targets. We also evaluate where possible how policy levers help to deliver the broader socioeconomic outcomes required of a **Just Transition**, such as green job creation, local economic development and fair distribution of costs and benefits.

A preliminary observation that can be made here is that a lot of these levers have been used more effectively towards climate mitigation and net zero with limited interventions so far on the nature positive and circular economy missions, albeit that new legislation and policy is currently under development in relation to the latter two missions.

3.5 Current use of levers for a net zero economy

With an ambitious target of reaching net zero by 2045, Scotland will require an economy-wide transformation. The aforementioned economic policy levers will need to be strongly aligned to trigger the necessary change in private investment and consumer behaviour whilst developing existing and building on emerging low carbon industries and sectors. In the following section, we discuss each of these levers that SG may be able to utilise. The recommendations in Section C then delve deeper into ways the Government can use these levers more effectively.

3.5.1 Public investment

➢ *Public investment and private finance*

The SG allocated £4.4bn (or 8% of the total budget) in December 2022 to the net zero, energy and transport portfolio.[120] Just over half of it, £2.5bn, is capital spending, with the rest largely contributing to the day-to-day expenditure of the Government. Extrapolating the CCC's recommendation of spending 1-2% of GDP on climate action, SG's investment would fit within that range: £4.4bn is equivalent to 2.1% of Scotland's estimated 2022 nominal GDP of £210.7bn.[121] However, some sectors like transport and buildings are under-funded, while energy faces a heavy reliance on private investment without significant imposition of additional conditionality obligations, such as investing in worker skills, local supply chains and/or in particular communities with the aim of securing wider socioeconomic outcomes.[122] ScotWind is a good example of an organisation that has conditionality imposed to its private investment to support local supply chains, but more could be done in future leasing rounds.

SG's own estimate reveals emissions of 8.8m tonnes of carbon dioxide equivalent (MtCO2e) that are attributable to the 2023-24 budget, based on the Government's Environmental Input-Output model.[123] The Fraser of

Allander institute has challenged some of the carbon impact assessment calculations and the Government has acknowledged the limited value of these estimates in informing public policy choices.[124] However, such attempts at calculating the environmental impact of budget decisions are useful and a SG and Parliament Joint Budget Review has been set up to improve the exercise.

Public investment is informed by the Government's Infrastructure Investment Plan (IIP) (2021-2026) which provides the strategic framework for the next 5 years' pipeline of projects and programmes – with expected value of around £32 billion over 5 years to attract inward investment. For instance, the Government has identified renewable hydrogen production as a new market opportunity with an ambition to make "Scotland a leading nation in the production of reliable, competitive and sustainable hydrogen".[125] The first tranche of investment focuses on driving technological progress and advancing innovation and cost reduction within the emerging sector. Concurrently, the Inward Investment and Capital Investment plans and Scotland's Green Investment Portfolio operate alongside the IIP with the primary aim of attracting private investment in sectors where Scotland has a competitive advantage (e.g. energy transition, transport decarbonisation).

The Government acknowledges the limitations of public investment in achieving its outcomes and is inviting greater amounts of private capital.[126] The Scottish National Investment Bank, for instance, is already playing a key role in crowding-in and leveraging private investment. Capitalised with £237m for 2023/2024, the bank is providing crucial capital to a variety of businesses, both small and large, alongside private funds managing natural assets in Scotland sustainably.[127] The bank has a clear mandate to offer capital to projects that carry risks which are beyond the appetite of private capital, in other words, which are not deemed to generate high returns in a short period of time. However, the investment portfolio remains relatively small, at £415m (alongside an additional £680m from third party investors), compared to the tens of billions required for achieving SG's goals for a net zero, nature positive, circular economy.

Public funding is useful in the early delivery of policy when private capital is harder to secure, and there are also scenarios and objectives where continued public investment is most appropriate. In that context, the SG has allocated comparatively (i.e. to the rest of the UK) higher amounts of public investment in growth areas such as electric vehicle charging, active travel infrastructure and natural capital markets. However, there are a few important areas where public investment is significantly lacking in Scotland, as outlined below.

➢ *Public investment in transport*

Emissions from transport account for the largest share of Scotland's territorial emissions and have fallen only very slightly in the past decade. In 2021, emissions from transport were 11.6 MtCO2e (27.9% of Scotland's territorial emissions), compared to 14.9 MtCO2e in 2009 (or 24.1% of Scotland's territorial emissions in 2009).[128] [129] The main sources of Scottish transport emissions include passenger road transportation (42%), heavy and light goods vehicles (25%), domestic maritime transport and shipping (14%), international aviation and shipping (14%), and domestic aviation (5%).[130]

The emission reduction pathway in Scotland's updated Climate Change Plan sets out to reduce annual emissions from transport to 6.5 MtCO2e by 2030, a 44% reduction on the sector's emission in 2021. Specific goals to meet this ambition include a 20% reduction on 2019 car kilometres, phasing out the need for new petrol and diesel cars and vans by 2030 and petrol and diesel HGV's by 2035, ensuring that 30% of state owned ferries are low emission by 2032, decarbonisation of passenger rail by 2035, and decarbonisation of flights within Scotland by 2040.[131]

Scotland has made significant investments per capita on active travel, buses and rail decarbonisation but is underestimating the associated behaviour change necessary in reducing personal vehicle mileage, thereby risking its ambitious 2030 target of reducing car kilometres by 20% against a 2019 baseline. Public transport in Scotland – and bus services in particular – has struggled with increasing passenger fares and declining patronage. Lack of reliable and affordable bus provision is forcing many to use cars and has negative distributional consequences. On the other hand, the Government has invested billions in road infrastructure that is not compatible with the Climate Change Plan targets.

The SG has made small but strategic investments in supporting the uptake of electric vehicles (EVs) with a mix of grants, interest free loans, match funding for public EV charging and funding bus operators to electrify their fleet. The Government is also investing billions in building new roads and upgrading existing road infrastructure with high direct and indirect emissions but there are no clear plans for mitigating them.

The SG has also made very little investment on micro-mobility, last-mile and shared transport options that could also contribute positively to decarbonisation. The latest National Transport Strategy commits to local pilots and to co-develop the legal framework with the UKG.

Transforming towns and cities – from active travel infrastructure to 20-minute neighbourhoods – will play an important part in reducing transport emissions. Concepts such as 20-minute neighbourhoods, where the majority of day-to-day services can be found within a 20-minute walk, cycle or public transport journey of home, have gained some traction in Scotland but there is no

public investment to back such proposals. For example, the latest National Planning Framework urges local development plans to incorporate 20-minute neighbourhoods but there is no meaningful capital outlay to develop and implement these proposals, or to retrofit existing car-dependent areas or areas typified by urban sprawl. Place-based intervention funding, such as community-led regeneration and reviving town centres, that could be used for such purposes has an inadequate budget of £50m a year.

Such city level transformations can be instrumental in reducing reliance on private transport while inducing wider co-benefits for public health, air quality, and access to social and economic opportunity. Similarly, while there has been investment in active travel infrastructure, the current scale of public investment in place-based transformation is incommensurable with the change required. The active travel budget is expected to rise to £320m in 2024/25, however, based on a commitment in the Programme for Government.

On aviation and shipping decarbonisation, progress has been slow with little emphasis on demand reduction, i.e. reducing passenger demand for flying. Significant investments are being made in the country's ferry services but clean shipping infrastructure targets are weak with no clear delivery strategy in place. The UKG has however committed £685m of R&D funding to support the development of low-emission aircraft technology via the Aerospace Technology Institute Programme over the next three years. In aviation specifically, ambitious targets such as creating the world's first zero aviation emission region have been set by the SG, in partnership with the Highlands and Islands Airport Limited (HIAL). However, they remain necessarily in the demonstration and pilot phase, funded by UK Research and Innovation (UKRI). The Government is yet to publish its aviation strategy following a consultation last year. As a potential future hub for hydrogen generation through excess renewables, shipping is a positive use case for these emerging technologies which Scotland could exploit.

- *Public investment in buildings*

The majority of buildings' operational emissions result from the use of fossil fuels for heating and hot water,[132] and they have fallen only slightly over the past decade. In 2021, emissions from buildings were 9.0 MtCO2e (21.6% of Scotland's territorial emissions), compared to 10 MtCO2e in 2009 (or 16.2% of Scotland's territorial emissions in 2009).[133] [134]

In relation to buildings and heat decarbonisation, the SG has made noticeable investments in tackling fuel poverty, in social housing & public sector decarbonisation, and in investing in heat networks. The investment for fuel poverty is £465m for a period of 5 years, an additional £200m for social housing and £200m for public sector decarbonisation to 2026. The SG recently committed to funding of £1.2m to enhance services for people

seeking advice on energy bill management and energy efficiency through agencies like Citizens Advice, Advice Direct Scotland and Home Energy Scotland.

Warmer Homes Scotland, the Government's flagship grant funded energy efficiency programme so far has benefited over 32,000 households. However, energy efficiency measures for the non-fuel poor housing stock are significantly behind with a lack of regulation or investment. Although loans and grants from Home Energy Scotland are available to homeowners to help to fund energy efficiency improvements,[135] the proportion of owner-occupied homes in EPC Band C or above is higher than for social or private-rented housing.[136] Emphasis is also lacking in the private rented sector where minimum standard led regulations remain the main driver of energy efficiency related private investment, despite the availability of loans to landlords for energy efficiency measures via Home Energy Scotland.

Specific targets for heat networks and for energy efficiency of multi tenure domestic and non-domestic buildings have been established but there is yet to be a coherent delivery strategy, particularly on low carbon heating, to reduce the building sector's emissions by 70% by 2030 upon 2020 levels. The SG has allocated £300m over five years as part of its Heat Network Fund to support the development and roll out of heat networks. The speed of delivery across all policy measures needs to increase, as Scotland has more ambitious targets than England.

Overall, the SG has committed £1.8 billion of public funding for low carbon heating and energy efficiency projects to 2026, just over half of what the CCC laid out in its investment pathway. With the deepening of the cost of living crisis and the subsequent rise in levels of fuel poverty, further funding might be necessary to ensure adequate levels of support.

- *Public investment in energy*

Emissions from electricity supply in Scotland have fallen dramatically in the past decade as renewable electricity generation increased nearly threefold between 2009 and 2019.[137] In 2021, emissions from electricity supply were 1.6 MtCO2e (3.8% of Scotland's territorial emissions), compared to 13.4 MtCO2e in 2009 (or 22% of Scotland's territorial emissions in 2009).[138] [139] The emissions reduction pathway in Scotland's updated Climate Change Plan aims to achieve zero emissions from electricity supply in 2029. At the same time, Scotland's electricity supply will need to accommodate increased demand, particularly from heating (heat pumps), transport, and electrification in industry. Earlier this year, The SG published a Draft Energy Strategy and Just Transition Plan[140] with more details on specific goals including the ambitions to deliver additional 12 GW of installed onshore wind capacity and to achieve 8 to 11 GW of offshore wind capacity by 2030.[141] Specific targets are currently missing for renewable energy storage.

A majority of the capital investment in this sector to-date has come from the private sector backed by the Contracts for Difference mechanism that guarantees developers long term revenues through competitive auctions. The high profitability of renewable energy compared to fossil fuels highlights future opportunities for further expansion on renewable energy generation in Scotland.

The SG set up the Energy Transition Fund capitalised with £75m to support businesses primarily in the fossil fuel sector to diversify their business model and help them transition to net zero.

Offshore wind is clearly a huge growth sector for the country but the Government acknowledged recently that the wider economic and social benefits have not been captured sufficiently.[142] The local content of Scotland's offshore wind sector (i.e. inputs coming via local supply chains based in Scotland) is currently at 44%, less than the rest of the UK; and less than 1% of non-Scottish wind projects are delivered through Scottish supply chains. This represents a missed opportunity and the need for better policy design and greater collaboration between industry and government. The Government has an ambition to secure investments of at least £1bn in the Scottish supply chain for each GW of new offshore wind capacity and there is an ongoing consultation by the UKG to achieving the wider socioeconomic outcomes through changes in the Contracts for Difference scheme.

The growth of renewables has so far not met its full social value potential in terms of local supply chain and job creation, and has not translated into cheaper electricity. This presents a strong case for the SG to take an active role in shaping how Scotland delivers the next generation of renewable energy and who will benefit from it. To this effect, recent offshore wind projects leasing through ScotWind have set out substantial supply chain commitments and the Draft Energy Strategy and the Just Transition Plan reflects the potential for increasing local content of energy projects, boosting domestic supply chains and increasing community ownership. However, it only includes a general commitment to continue engaging with the UKG on these issues.[143]

Bold targets for onshore & offshore wind and hydrogen are in place but no such targets exist for renewable energy storage, however there is a strong expectation of private capital to leverage the huge storage opportunity in Scotland.

- *Public investment in industrial transformation*

In 2021, emissions from industry were 9.6 MtCO2e (23% of Scotland's territorial emissions), compared to 12.4 MtCO2e in 2009 (or 23% of Scotland's territorial emissions in 2009).[144] [145] Following the Climate Change Commission reporting on Scottish emissions and methodology, emissions covered under industry

include emissions from the construction industry, manufacturing, and fuel supply. Some of the key subsectors include cement, iron and steel, chemicals, and the extraction and refining of oil and gas.[146]

The emission reduction pathway in Scotland's updated Climate Change Plan sets out to reduce annual emissions from industry to 7.3 MtCO2e by 2030, a 24% reduction on the sector's emissions in 2021. This target reflects relative difficulty in reducing emission from industry, with the majority of emission reduction expected to happen between 2030 and 2040.[147] The plan's vision for Scottish industry is heavily reliant on new technologies including carbon capture and storage, and the use of hydrogen in industry. The plan does not include specific goals around key factors underpinning Scotland's transition to a net zero industry, such as improved resource efficiency, embodied emissions in materials, energy efficiency, industrial fuel switching, or specific industrial processes.

Many relevant policy levers are currently significantly dependent on the UKG, limiting the scope for intervention. The cluster approach to industrial decarbonisation (i.e. sites with multiple high carbon point sources, which represent over half of UK's industrial carbon emissions) is appropriate but requires better coordination with Westminster and more urgent finance.[148] For instance, key decisions around financing the running costs of new industrial infrastructure such as hydrogen or carbon capture, utilisation and storage (CCUS), which are critical to industrial decarbonisation, fall largely within the powers of the UKG. The SG also cannot unilaterally decide to levy a charge on Scottish consumer energy bills to pay for long term operational costs of hydrogen infrastructure (an issue that is currently being debated as part of the Energy Bill going through UK Parliament).

Scotland aims to reduce emissions in the industrial sector by 24% by 2030 compared with 2021 levels. The only indicator showing good progress is hydrogen according to the Climate Change Committee, where there is a route map alongside extensive assessment and funding, but it highlights that ultimately the UKG has control over the business model. This business model will need to be established using support that can only be provided through reserved powers, such as long-term financial support provided though a contractual mechanism, the ability of the Government to act as a counterparty in hydrogen contracts, and the power to raise general revenue or a specific levy to fund hydrogen investment.[149] The decarbonisation challenge is more concentrated in specific sectors like oil and gas, chemicals and cement, which represent three quarters of the total industrial emissions in Scotland and more particularly within a 50km radius of Grangemouth. Decarbonising this cluster through CCUS will be critical not just from the perspective of meeting the Government's net zero targets but also to establish a new industry of the future and the associated jobs and economic

development. By 2027, the Grangemouth cluster is expected to sequester 1 million tonnes of carbon annually.

One of the main programmes to support CCUS and the hydrogen sector is the Emerging Energy Technology Fund (EETF), which has a budget of £180 million for 5 years. The fund is divided into 3 main programs: Green Hydrogen Fund (£90 million),[150] Scottish CCUS Cluster (£80 million)[151] and the Hydrogen Innovation Scheme (£10 million).[152] The first two programmes are aimed at supporting and accelerating the use of hydrogen and CCUS. Ministers however acknowledge that UKG funding is critical in securing the growth of the CCUS cluster initiative. The SG is currently vying for another opportunity through the track 2 sequencing process for CCUS.[153]

Discrete programmes such as the Low Carbon Manufacturing Challenge Fund (LCMCF)[154] and the Scottish Industrial Energy Transformation Fund (SIETF)[155] are purposely aimed at supporting large and small firms to reduce their energy consumption and lay out plans to achieve net zero emissions.

The current set of policies have a focus on industrial energy demand reduction but more investment is needed, in partnership with private firms, to significantly alter internal production processes and product design. There is too much reliance on hydrogen and carbon capture and storage as a silver bullet for the decarbonisation of the sector, which (although they may present long-term economic opportunities for Scotland) are technologies still in early development.

The SG has specific powers on supporting the skills transition within industries, encouraging innovation through product and process efficiency and also in setting regulations and standards on limiting air pollution. However in the context of carbon mitigation and net zero, key decisions around CCUS, industrial electrification, hydrogen finance and bioenergy are mostly reserved to the UKG.

The current delivery plan is unlikely to meet Scotland's 2030 goals for industrial decarbonisation which needs to see emissions fall by a third in 2030. Recommendations from the CCC mention that the SG needs to: improve data collection and reporting on industrial decarbonisation to monitor progress; continue supporting decarbonisation technologies and innovation; set ambitious targets for resource efficiency for 2030; ensure resource efficiency policies are placed before 2025; and to continue building on repair and reuse policy.

- *Public investment - conclusion*

Public investment is one of the most powerful economic policy levers to kick-start the growth of new sectors and industries and deliver the necessary public infrastructure while also de-risking and leveraging private finance. Sectors such as rail transport and water, delivering public goods, are largely

owned and operated by the SG and capital and resource investment (i.e. public funding) in these sectors is critical in achieving decarbonisation. It is beyond the scope of this research to estimate the investment needs for the SG across the low carbon economy but the CCC estimated an investment of roughly 1-2% of GDP annually into the UK economy between now and 2050. If downsized to Scotland, the SG's current scale of investments would match the degree of funding necessary. However, these costs are highly volatile and rely considerably on technological cost curves which are harder to forecast and further depend on large scale deployment of technologies to drive down costs.

The growth of renewables in particular has been rapid, with electricity generation occasionally surpassing nation-wide power demand, but similar growth in low carbon technologies in transport, heating and industry has been slow. Public investment to encourage the early adoption of technologies like EVs, heat pumps and green-steel making processes is currently not driving their uptake enough to put the SG on track to meeting its climate targets. Public finance will also be critical in sectors like hydrogen and CCUS but these are primarily led by schemes from the UKG.

3.5.2 Direct and indirect taxes

HM Treasury and HMRC administer a relatively small number of taxes with explicit environmental objectives, including:

- Climate Change Levy – a tax collected by energy suppliers and paid by businesses and the public sector to encourage them to become more energy-efficient and thereby reduce greenhouse gas emissions.
- Carbon Price Support – which aims to drive electricity generators to invest in low carbon electricity by increasing the cost of the fossil fuels they use. The Climate Change Levy and Carbon Price Support raised £2.0 billion in 2019–20.

Other taxes, such as fuel duty (also known as hydrocarbon oils duty, raising £28 billion in 2019– 20), could have an impact on the Government's environmental objectives, but do not have specific environmental objectives. In 2019–20, £37 billion of revenue came from taxes related to fossil fuels and carbon emissions, with £9 billion of it coming from Vehicle Excise Duty, Landfill Tax, emissions trading scheme receipts, and Carbon Price Support.[156] The revenue is collected by the UK Treasury and transferred to devolved nations through the block grant process.

An important tax exemption that is set by Westminster is the rebate on red diesel in agriculture, forestry and aquaculture, which encourages higher emissions in these sectors.[157] The scope of vehicles qualifying for this tax exemption in the aforementioned sectors was reduced in April 2022 by the

UKG, but the sectors nonetheless continue to received favourable tax treatment of their use of this fossil fuel.[158]

Taxes and charges within the powers of the SG have significant potential to help reduce travel by car in line with the net zero mission and the SG's target to cut car kilometres by 20% by 2030. Transport Scotland is currently exploring options for demand management to achieve the required reduction in the distance travelled by cars, but any such measures will not be introduced until 2025.[159] Road user charging has been shown to be effective at reducing car travel and can help precipitate modal shift.[160, 161] Road user charging schemes can currently be introduced by a Scottish local authority provided that they help to achieve policies contained in that authority's local transport strategy.[162] Other measures are available at local authority level to raise the cost of car travel relative to sustainable forms of travel, including linking the cost of local authority parking permits and visitor parking charges to vehicle emissions and vehicle size (as has recently been introduced by Lambeth Council in London, facilitated by making Controlled Parking Zones across the whole district)[163] and implementing workplace parking levies such as the scheme applied by Nottingham City Council.

The SG has an as yet unused power to introduce its own Air Departure Tax.[164] There is potential for this to be used to disincentivise air travel and in the case of domestic flights, to make alternatives such as rail relatively more attractive (where practicable). The OBR estimates this tax could generate between £300 - £450m for the SG. In theory, a frequent flyer levy (FFL) approach could ensure that any new flight tax is progressive, for example by having a low or zero rate on the first flight each year and raising the tax per passenger on each subsequent flight that year.[165] Exemptions could also be applied on lifeline routes to islands. Income from this fiscal reform could be targeted at other carbon reduction strategies. A number of practical challenges would apply to implementing a FFL, however, including requirements for industry to collect additional data on passengers and flights taken, SG to monitor this data, and potential legislative competence issues that would need to be clarified (as the existing powers are limited to a tax on carriers and may not allow for a tax on passengers), and the compatibility of an exemption for lifeline routes with the post-Brexit UK laws on subsidy control. A considerably more manageable, but still progressive alternative, is a first-flight-discount. Taxes on air travel would be increased, commensurate with its climate damage, ideally via a carbon tax (though devolved power over these is complex), but potentially also via an air departure tax. Citizens would then apply via a government portal for a once-a-year discount on the tax component of a single flight. This acts to blunt the regressive impact of increasing taxes, protecting travel opportunities for lower-income groups, while ensuring air travel plays its part in decarbonising the economy. The administration is far simpler and it can be dovetailed with existing policies.

Providing that there is a commensurate rise in the basic tax on air travel, this can still be designed in such a way as to be a revenue raiser for the SG, while providing a means for further exemptions for the Highlands and Islands, whose residents could be afforded more discounted passes.

The SG could raise the Land & Buildings Transactions Tax (LBTT) that applies to agricultural land and woodland to parity with the equivalent tax on residential land, and could apply a surcharge to larger landholdings or multiple plots of land with the same owner, to discourage further concentration in land ownership at the point of purchase.[166] Given that land changes hand relatively rarely, however, this would not have a significant short-term impact on the concentration of ownership more broadly. Modelling undertaken by the Scottish Land Commission found that introducing a surcharge rate of 4% could reduce concentration of land holdings by 2.5% over 20 years and generate roughly £25 million in additional tax revenue over a five-year period.[167] The Scottish Land Commission goes on to state that "public policy intervention will be required to ensure an appropriate balance of public and private benefit. In relation to potential windfall gains a well-designed tax instrument could incentivise carbon sequestration and, where there are significant increases in value created by carbon and natural capital markets, ensure a fair public share of that value."

Scottish council tax is devolved and could potentially be a tool for driving decarbonisation and nature restoration. Offering differential rates of council tax for properties linked to energy efficiency could be considered as an incentive for households, especially those in the higher bands, to invest in energy efficiency. Ensuring they don't negatively impact the fuel poor families is vital and the politics of council tax is fraught with risk which makes it a less compelling option.

The SG has little scope for offering significant tax credits for spurring the growth of nascent low carbon sectors. Existing schemes such as the Social Investment Tax Credit and Seed Enterprise Investment Scheme are quite small[168] and the SG's preferred approach to support fledgling firms, particularly in the low carbon sector, is through the Scottish National Investment Bank. Scottish Enterprise is another example of the SG supporting start-ups with debt and equity finance instruments, typically with finance of up to £2m.[169]

Carbon border taxes are being actively considered by the European Union which could have a considerable effect on businesses in Scotland and across the UK. ClimateXChange estimates that aluminium, iron, steel and fertiliser production sectors in Scotland would face considerable uncertainty, and Scottish businesses as a whole could face tentative additional costs of £75m in 2030.[170] These industries are much smaller in capacity than the rest of the UK, but Scotland can consider how it can use its economic policy levers to support the manufacture of 'green steel', which is a significant

decarbonisation challenge not just for the UK but internationally. Powers relevant to a carbon border tax are reserved to UKG, albeit managed together with the devolved administrations as part of the emissions trading system, meaning that any changes would need to be agreed accordingly.

The SG has powers to introduce a local carbon tax, similar to the one rolled out in some of the provinces in Canada. The Institute for Public Policy Research (IPPR) explored this option further in a 2019 report.[171] Other potential ideas in the IPPR report included a local inheritance tax, local income tax assignation and supplemental charges to business rates – which all present their own unique political and policy challenges and could encounter administrative and resource constraints at the SG and local authority levels.

Mechanisms such as the European Union Emissions Trading Scheme (EU ETS) generate billions in revenue and European directives require member states to ringfence some of that revenue to reinvest in the low carbon and natural economy. The UK ETS does not hypothecate such revenues but some economists argue the case of a so called 'double dividend', where better environmental (first dividend) and economic outcomes (second dividend) are both achieved through taxation.[172] For instance, the Government could consider utilising the revenue from its environmental taxes to slash non-domestic rates for businesses adopting low carbon measures. However, some studies have shown that whilst the environmental dividends were almost always guaranteed, the evidence for achieving economic dividends is more ambiguous.[173]

3.5.3 Planning framework

The National Planning Framework 4 (NPF4) was recently adopted by the SG.[174] It supersedes NPF3 and Scottish Planning Policy. NPF4 incorporates a suite of 33 policies ranging from climate mitigation and biodiversity enhancement to community wealth building (including support for development proposals linked to community ownership and management of land) and active transport.[175]

On energy, NPF4 notes that development proposals for all forms of renewable, low-carbon and zero emissions technologies including batteries and other ancillary technologies and services such as transmission grids and carbon capture will be supported.

The NPF4 states that "*(energy) development proposals will only be supported where they maximise net economic impact, including local and community socio-economic benefits such as employment, associated business and supply chain opportunities.*" Hard coding this into the planning framework is more likely to lead to better outcomes for economic development.

The NPF4 makes good strides to incorporating net zero and nature positive outcomes as central principles in the development management process.

Furthermore, the addition of the national spatial plan within the Framework helps set clear priorities for specific strategic investments. However, the SG, in conjunction with Scottish Local Government Authorities, needs to recognise the limits of planning-as-regulation in ensuring that new development and re-development in Scotland delivers fully sustainable and just places.

There is potential to make greater use of planning levers to support a net zero economy, as shown by several international examples of upfront capital investment for transport led development, expenditure on public led land assembly at existing use values, and local revolving infrastructure funds which enable local government to benefit from the gains of land value uplift. Vauban (Freiburg, Germany), Ijburg (Amsterdam, Netherlands) and Hammarby (Stockholm, Sweden) are examples of places that have adopted alternative development models in which local government takes a proactive rather than reactive approach to development in order to use land value uplift to ensure that communities are developed sustainably with low or zero carbon buildings, a range of active and public transport choices, and at densities which avoid sprawl and biodiversity loss.

Without such an approach, the SG will still be able to focus on national infrastructure projects, but will not be able to break the link between development and negative emissions and biodiversity loss at source. The SG needs to lead place development, including with greater upfront investment in amenities and infrastructure, to ensure high-to-full levels of public and active transport use and more compact development to avoid continuing car dependency, sprawl, and high materials use being permanent outcomes of the development system.

3.5.4 Regulation

Regulation, particularly in the form of product and process standards, has been one of the biggest drivers of decarbonisation over the last three decades. For instance, building standards have progressively improved with older homes being significantly more energy inefficient than the ones built over the last decade.

Regulations pertaining to the energy standards of new builds are fully devolved with Scotland able to diverge (albeit marginally) from the standards in England. Improved energy standards came into force in December 2022, requiring any new build to achieve a 32% reduction in carbon emissions compared to 2015. New regulations also propose to phase out the use of gas boilers in new builds from April 2024, requiring developers to use zero carbon alternatives.

However, within the same context of buildings and domestic heating, the SG has limited policy levers to drive higher adoption of low-carbon heating

technologies such as heat pumps. Many relevant powers (relating to areas such as funding, finance and product standards) are reserved to the UKG.

Literature on energy efficiency suggests a huge 'performance gap', sometimes up to 40% between modelled improvements in energy efficiency and the real world outputs.[176] This risks undermining any buildings efficiency policy and it is critical to therefore ensure that the actual performance of new buildings and energy efficiency measures aligns with expectations. Assessing compliance with standards, expanding performance testing and enhancing monitoring and enforcement of standards, with adequate funding for local authorities, is vital to plug the performance gap.

One underused lever that may allow the SG to further support the decarbonisation of buildings is the climate change burden. A burden is positive or negative obligation affecting land which binds the current owners and all future owners of the land.[177] A climate change burden can be entered into voluntarily by the owner of a plot of land and certain bodies: the Scottish Ministers, or any of their legally designated conservation bodies, which include among other organisations all Scottish local authorities, the National Trust for Scotland, NatureScot, Plantlife, the John Muir Trust, the Royal Society for the Protection of Birds, the Scottish Wildlife Trust and the Woodland Trust.[178,179] Additional organisations can be designated as conservation bodies via secondary legislation.[180] The Title Conditions (Scotland) Act 2003 allows climate change burdens to be created "for the purpose of reducing greenhouse gas emissions" and states that these burdens "may only consist of an obligation, in the event of the burdened property being developed, for the property to meet specified mitigation and adaptation standards".[181] The specific mitigation or adaptation standards required in the burden would be added to the deed for the land, and may include things like reducing certain forms of emissions to a specified level by a specified method, or ensuring carbon sequestration by requiring the planting of certain species of trees at a specified density per hectare.[182] The agreement can be tied indefinitely to that plot of land even if it changes ownership in future, giving the potential to attach permanent conditions to lower emissions from plots of land and buildings if the existing owners and a relevant public body are able to enter into a climate change covenant. Between 2009 when the climate change burden was made possible in legislation and 2020, there is no evidence that this power has ever been used, suggesting it could offer untapped potential as a lever to drive progress towards a net zero and nature positive economy.[183]

The NPF4, as mentioned, signals that local development plans and proposals, including construction of new buildings, should consider the embodied emissions of the input materials. It doesn't however set any specific standards for developers to adhere to.

The CCC highlighted the lack of robust regulations in driving uptake of energy efficiency measures in the private rented and owner occupied tenures. The fallout from the pandemic led to the SG deferring its standards for the private rented sector (PRS) while maintaining the medium term target of all PRS homes achieving a minimum EPC C rating by 2028. This matches the ambition of the UKG, albeit it currently does not have a statutory underpinning. These minimum energy efficiency standards offer the necessary impetus for landlords to invest in their properties, however, without adequate resourcing of local authorities to enforce these standards, there is a high risk of missing these targets. Educating tenants of these regulations is another tool in enhancing adherence which the SG has been undertaking through Home Energy Scotland, Energy Savings Trust and other consumer facing groups.

The SG has no powers in introducing vehicle standards for new cars and vans entering the market as this is fully reserved to the UKG. Similarly, mandates on Sustainable Aviation Fuels (SAF) are currently fully reserved but are likely to have a considerable impact on the SG's upcoming aviation strategy. The current focus however, is heavily on R&D.

In the energy supply sector, regulatory levers in relevant policy areas are largely reserved to the UKG, including a reform of the electricity market and directed phasing out of non-renewable electricity generation technologies. Achieving Scotland's ambitions in this area therefore depends on its ability to work with the UKG and, ultimately, the right decision being made in Westminster. The UK needs a fit for purpose regulatory framework to facilitate the transition to net zero electricity supply. The existing framework was designed to support an energy market dominated by a small number of large utility companies and is not ready for the transition to a less centralised and intermittent electricity generation from renewables. In 2022, the UKG launched a review of electricity market arrangements (REMA) and is currently working to publish a second consultation later in 2023.

3.5.5 Policy levers for a net zero economy - conclusion

On the aggregate level, the amount of public investment in net zero in Scotland is in line with the CCC's recommended level of 1-2% of GDP, but certain sectors are still not receiving enough investment to achieve their targeted rate of decarbonisation. The investments mobilised through SNIB are making a contribution but remain small relative to the scale of the challenge. In the transport sector, too much public investment is going into roads, while public transport and 20-minute neighbourhoods are in need of greater funding. Additional funding will be needed to hit energy efficiency targets in non-fuel poor homes and to expand heat networks, while public funding for industry would benefit from increased attention to reducing the impact of

production processes and product design rather than focusing heavily on hydrogen and carbon capture and storage.

Aside from public investment levers, tax can play a crucial role in mitigating environmental externalities and influencing consumer and business behaviour. The SG however has so far been limited in its use of its tax powers to incentivise low carbon investments and behaviour, in part due to the constraints of the devolution settlement. Significant revenue generators such as income tax and business rates would require complex reform that can be politically and administratively challenging. Evidence from countries like Canada show how policies such as a local carbon tax (with a public dividend), could be used to go above and beyond the UK level tax policies. Taxes such as these would need to raise sufficient revenues to mitigate the expense of their introduction and administration.

Similarly, on regulation and standards, large reductions in carbon emissions from sectors like private transport and industry are currently led by the UKG. For instance, the upcoming Zero Emission Vehicle mandate, which could apply to all parts of the UK, is expected to deliver the highest emission reductions across the economy over the coming decade. More ambitious regulations on controlling emissions from buildings across all tenures are welcome but need to bring developers and builders along who might face challenges servicing two separate markets while potentially adding to further costs to the transition.

3.6 Current use of policy levers for a nature positive economy

3.6.1 Public investment

Public investment, whether via direct investment in conservation of nature or forestry or through subsidies to nature-related economic sectors, will be an important component of a just transition to a nature positive Scottish economy, although the scale of the challenge will also require policies to steer other sources of investment. The following sub-sections assess the existing use of public investment in a number of important nature-related sectors of the Scottish economy.

- *Agriculture*

The Scottish agriculture sector is heavily reliant on public subsidies in terms of the proportion of farmers requiring subsidies to break even, although the extent of this reliance varies among different types of farming. In 2021-22, only 44% of farms had an income greater than zero, excluding subsidies.[184] Livestock farming, particularly in Less Favoured Areas with poorer quality land, is not profitable without subsidy on the majority of farms.[185] Evidence suggests that subsidies make the agriculture sector less economically efficient.[186] At the same time, there is a clear recommendation from the international

literature to reduce subsidies currently supporting activities which are harmful to biodiversity.[187, 188, 189, 190] Given that many forms of agriculture harm biodiversity (with intensive agriculture in particular being a major cause of biodiversity loss in Scotland), and given that agriculture is a heavily subsidised economic sector, this international recommendation is clearly relevant in this context.

Agricultural support payments receive a large amount of public funding each year, with Basic Payments less linked to environmental outcomes (outside of the minimum requirements of cross compliance) currently forming the largest single item of agricultural support and related payments in the Budget.[191] The greening component sets low requirements for nature positivity by stipulating that only 5% of arable land needs to be managed for biodiversity.[192] A number of smaller components of subsidies are conditional on better environmental outcomes being achieved. Ahead of the forthcoming Agriculture Bill, a new system of subsidies with a greater link to the net zero and nature positive missions is under development. While the pace of change is slow in light of the environmental crises (with implementation from 2025), this reflects the scale of the change required and the lack of alignment between the previous CAP system of payments and the net zero and nature positive missions. While the SG has stated that at least half of all funding to farming and crofting will have enhanced conditionality by 2025, it is currently unclear what weight will be given to payments under the tiers that are conditional on environmental impact versus the base level payments with weaker conditionality (i.e. what proportion of the typical payment in monetary terms will be the conditional component versus the unconditional).[193] A recent collaborative process of Farmer Led Groups looked at how different agricultural subsectors could reduce their environmental impact, but this process took an incremental rather than a transformational perspective and lacks alignment with ambitious national net zero and nature positive goals.[194] The Agriculture Reform Implementation Oversight Board is working to implement the recommendations of the farmer-led groups into policy in a way that addresses food production, net zero and nature positive goals.[195]

Another key theme of the recommendations for the sector from international literature on nature positive economies involves scaling up good practice within agriculture. Part of this could involve shifting the balance of what is produced by Scottish agriculture (in areas where land is of sufficient quality to do so) away from meat and animal feed[196] and increasing subsidies to organic agriculture[197] and nature positive forms of plant-based food production.[198] A number of technical changes have the potential to partly reduce the negative impacts of agriculture, including bio-pesticides and microbial and organic fertilisers; crop rotation; micro-irrigation; increasing areas for nature and sequestration within farms; better use of data on large

farms; biotechnology (gene editing, selective breeding and cropping);[199] the use of GM crops; vertical farming; production of meat analogues; precision agriculture; and integrated pest management.[200] The SG stated its aim in the March 2022 *Vision for Agriculture* to become a global leader in sustainable and regenerative agriculture.[201] Forthcoming policies to achieve this would benefit from greater clarity on what the end goal for regenerative agriculture looks like under a nature positive economy. While some of the methods mentioned above can make agriculture more regenerative, i.e. maintaining or increasing yields while having positive impact on soil, water, biodiversity and reducing pollution,[202] technical changes on their own will not be sufficient to meet the nature positive mission without significant changes in production and consumption patterns.[203] There is a commitment under the current SG Programme for Government to double the amount of land farmed organically, and while AECS funding (see below) will contribute to this, it is unclear whether there will be sufficient funds put towards this, or demand from the sector, to achieve the target.

The Agri-Environment Climate Scheme (AECS) funds management of agricultural land that supports the achievement of SG environmental goals. About £30-40 million is awarded annually to land managers, covering approximately 20% of agricultural land in Scotland and targeting improvements in outcomes such as biodiversity, climate change, water quality and flooding, organic farming and the historic environment.[204] The AECS demonstrates the potential of enhanced conditionality in agricultural support payments but its scale remains small relative to the main support payments described above, which are less conditional. Independent analysis commissioned by the RSPB recently found that Scotland needs to invest £1.17bn a year over 10 years to encourage more climate friendly farming.[205] This implies a near doubling of the existing SG budget for agriculture.

One recent trial, NatureScot's *Piloting an Outcomes Based Approach in Scotland*, illustrated the possibility of paying farmers for public goods (often nature positive outcomes).[206] This is part of a wider *Farming with Nature* programme, supported by the SG, which is looking at similar issues.[207] Given that large areas of land in Scotland are currently operating farming approaches that are unprofitable without subsidy and in some cases could be better managed for biodiversity, there appears to be significant potential for a transformative impact on biodiversity via a more ambitious shift in subsidies in favour of nature restoration and conservation, particularly in areas currently under rough grazing.

- *Forestry*

The effective management and protection of Scotland's forests will form an important part of achieving the nature positive mission. Part of this will overlap with conservation and nature restoration activities as discussed elsewhere in

this report. The effective protection of critical forests (places with the highest current conservation value, such as native woodland) may require interventions such as designating protected areas with strict boundary enforcement and leveraging the non-timber value of these forests.[208] Another important element is the reforestation of degraded landscapes, in a way that is adapted to the future impact of climate change and involves meaningful engagement with local residents.[209] Further recommendations for a nature positive approach in this sector relate to the sustainable management of forests used for timber production, via improved felling techniques, managing production to minimise felling, forest assessment, approaches that maximise carbon capture and voluntary certification schemes.[210] Participatory community forest management is also seen as a means of achieving more sustainable exploitation of timber.[211]

The Scottish Forestry Grant Scheme, which is currently the funding source for most new woodland,[212] pays grants per hectare of trees planted depending on the species and location. The funds disbursed by the scheme as of the end of March 2023 totalled £382m, or an average of £48m per annum over eight years, far less in absolute value than the annual subsidies paid to the agriculture sector.[213] Agriculture also receives more subsidies relative to its land area. Agriculture (70%) covers at least 3.8 times as much land area as forestry (18.5%)[214] in Scotland, but the former receives 5.4 times as much in subsidies (£420m per annum from the Basic and Greening payments)[215] than the latter (£77m in the 2023/24 budget, already a significant increase on the previous two years).[216] There is potential to adjust the rates paid under the scheme to give a greater emphasis on native forests in light of their higher biodiversity value,[217] as opposed to conifer forests, which sequester carbon more quickly[218] and have so far received more than half of the total spend on the scheme.[219] Grants could also be weighted towards particular regions in line with wider plans, as has been the case with the Central Scotland Green Network.[220] Other potential changes to improve the broader social impact of the scheme include capping the total amount that a single landowner received from the scheme (which would also redirect more of the total budget to smaller forestry operators) and attaching conditions on the recipients such as the Fair Work First criteria.[221]

Forestry and Land Scotland (FLS) manages forests covering approximately 6% of Scotland's land area[222] and derives its income from a range of sources, including (in descending order): timber sales, SG funding (both general subsidy and linked to specific programmes such as peatland and woodland restoration), leasing for renewables, estates income and visitor income.[223] FLS engages in the management, acquisition and restoration of forests and peatland. There is precedent in other countries for organisations of this type having a much larger national footprint. FLS's Finnish equivalent, Metsähallitus, owns land equivalent to around one third of the country.[224]

➢ *Conservation and restoration of nature*

In the Scottish Biodiversity Strategy, the SG commits to produce a Biodiversity Investment Plan which will review the available sources of public and private funding for biodiversity restoration.[225] The scale of the nature positive mission suggests a need to combine funding from different sources, although the balance between public and private funding is likely to have implications for achieving a just transition. Public funding is an important factor in increasing the land area dedicated to conservation in a just way (i.e. so that the use of the land for nature is managed democratically). Sufficient resourcing and state support has been shown to be necessary for protected areas to achieve their conservation aims.[226] The designation and management of protected areas in Scotland has required large resource commitments.[227] Private investment has the potential to rapidly scale up conservation, but it has certain characteristics that pose a risk to a just transition. Conservation and restoration projects are not always inherently profitable[228] and the blended finance approaches required to overcome this tend to involve public funds being used to subsidise private investors' returns. Delivering nature positive investments at a profit for those who already have access to large amounts of capital is likely to widen wealth inequality, compared with delivering the same projects through public-sector bodies without profit via taxation. Private investment-led conservation is also less likely to give local communities a meaningful say in major decisions (when compared with public sector delivery that is decided based on a democratic mandate), a key recommendation of the international literature in this sector (albeit sometimes framed in terms of indigenous people, in a global context).[229,230,231] In light of this, it may be necessary to explore other levers such as taxation or public borrowing for nature investment to deliver a just transition in conservation and restoration. The forthcoming Biodiversity Investment Plan offers an opportunity to consider these issues in depth.

The Scottish Biodiversity Strategy also aims for protected areas to be larger, better connected and in good condition by 2045, and proposes to create one new National Park and better realise the potential of National Nature Reserves for landscape-scale conservation by 2030.[232] The Strategy does not cover the rewilding approach, however, which could be incorporated further into SG policy and potentially offers a better benefit-cost ratio to more active forms of restoration. A recent study by NatureScot undertook a review of cases of rewilding and gave comprehensive recommendations for how it could be applied in Scotland.[233] There are promising examples of rewilding projects that include local communities, as highlighted by the Scottish Land Commission, that could be built on.[234]

There is significant expenditure of £400m across several years committed to peatland and woodland restoration, although the progress on both still lags behind the CCC's recommended levels. While the existing £250m, ten-year

public funding package for peatland restoration is substantial, annual progress on peatland restoration is significantly behind both the SG target and the CCC's far higher recommendation to achieve net zero. This suggests that more funding will be needed, in addition to overcoming supply constraints for contractors and skilled workers in the sector.[235]

Forestry and Land Scotland (FLS) has recently embarked on an acquisition strategy to purchase land for afforestation, peatland restoration and climate mitigation, backed in part by £30m of SG funding.[236] The Crown Estate Scotland is also purchasing land with climate change mitigation and environmental sustainability among many criteria that are informing their investment of £70m for the period from 2020 to 2023.[237] The SG also provides separate grants for restoration via the Nature Restoration Fund (£65m over three years)[238] and some of the funding under the £22m Natural & Cultural Heritage Fund. The Agri-Environment and Climate Scheme (AECS), which funds management of agricultural land that supports the achievement of SG environmental goals with around £30-40m per annum, has achieved some restoration-related improvements, albeit habitat restoration is not the scheme's main focus.[239] It is not clear that the combination of these funding streams will be sufficient to acquire land or ensure its conservation on behalf of the public in line with the Scottish Biodiversity Strategy target of increasing the protected proportion of Scotland's land area from its current level of 23% to a target of 30% by 2030.[240]

There has been exceptionally high demand for rural land in recent years for a variety of reasons including high timber prices and forestry values.[241] There has been a shift in the drivers of purchases of Scottish estates in favour of carbon offsetting and environmental restoration.[242] This excess demand for rural land has driven up prices,[243] making public land acquisition more difficult without the use of additional levers such as taxation (see taxation section below) or Compulsory Purchase Orders (CPOs, see regulation section below).

- *Fisheries*

The international literature on nature positive economies recommends that governments should end harmful subsidies to the fisheries sector, especially those linked to reducing the cost of inputs such as fuel, which tend to encourage overfishing.[244] Fuel subsidies have the effect of increasing effort and overfishing, which can only partly be offset by fisheries management, and contribute to increased emissions.[245] Marine Voyagers' Relief, which is set under reserved powers by the UKG, gives 100% relief on fuel duty costs for eligible fishing vessels. The SG supported the UKG's backing of the WTO's Agreement on Fisheries Subsidies which prohibits harmful fisheries subsidies, which are a key factor in the widespread depletion of the world's fish stocks, but this is yet to be ratified.[246]

- *Aquaculture*

The aquaculture sector receives some public funding from Marine Fund Scotland,[247] which supports individual firms and requires some of the supported projects to be aligned with outcomes on net zero, sustainability and the Blue Economy Vision for Scotland.[248] The Scottish Sustainable Aquaculture Innovation Centre also receives some funding.

3.6.2 Supporting private investment

The international literature offers various different perspectives on the role of private finance in achieving the nature positive mission. It is generally acknowledged that private finance will have some role to play, because the scale of the required investment is larger than the available public finance mechanisms and the pool of private capital is far larger than public funds.[249] The SG's current approach supports a heavy reliance on private finance for both the net zero[250] and nature positive[251] missions, but it is important to consider the implications of this approach as outlined below.

The Dasgupta Review unpicks the different types of green finance and assesses how applicable they are to nature positive projects. Dasgupta distinguishes between investing in pure conservation and restoration ("given market pricing and profitability prospects, there is no case for private financial investment in restoration and conservation activities"), and investing in real economic activities that minimise harm to the biosphere (e.g. sustainable agriculture, low-carbon energy, green infrastructure, eco-tourism). The Review outlines some mechanisms that have been applied in green finance: green bonds, sustainability-linked loans, private equity funds for biodiversity, environmental impact bonds, insurance products and carbon markets.[252] For pure conservation projects, there are significant barriers to attracting private investment due to a lack of profitability, often a small scale, and a lack of a track record of profitability.[253] One way to overcome these barriers is through blended finance (i.e. providing government grants and guarantees that lower private risk and lead to a higher private return). This has been used in interventions such as restoration, reforestation, ocean waste management, sustainable agriculture and sustainable forestry.[254]

The Stockholm Environment Institute emphasises the role of private investment in bringing innovation to market and calls for governments to provide the enabling conditions for commercialising sustainable businesses.[255] They advise that a consistent policy environment helps to set the terms of engagement for private investors and reduce their risk.[256] They note that green bonds are more suited to mature green investments, rather than novel or complex projects.[257]

The OECD frames the transition to a nature positive economy as an investment opportunity, calling on governments to strengthen enabling

conditions for private investment in nature, via coherent and strong government commitments to biodiversity, predictable regulation that is effectively enforced, sticking to timelines, and reforming due diligence processes for biodiversity.[258] This predictable policy environment is seen as a way to improve the risk-return profile of projects supporting biodiversity goals. The OECD also recommends that governments should create pipelines of bankable biodiversity projects, by assembling data on the returns and impacts of such projects.[259] In terms of specific approaches, they advocate for the use of blended finance, green bonds, certification and labelling of green financial products and crowdfunding digitally for green investments from citizens.[260] The latter approach is similar to the model of raising finance from citizens through Community Municipal Investments, which is being implemented currently by a handful of local authorities in England to fund clean energy investment.[261]

There are risks to achieving a just transition inherent in a reliance on private investment. Private investment in harmful sectors continues largely unabated, with existing financial flows that damage nature ($2.6tn in 2019) being far larger than those that aim to improve biodiversity (up to $13.6bn in 2020).[262] In light of this, a prominent role for private investment in the transition is likely to further reward some of those who have profited significantly from bringing about the current crises. One of the alternatives to private investment is taxation, which has the potential to recycle some of the current system's profits into the transition to a new system. The other potential downsides to private investment in nature positive interventions include a reduction in democratic control over how the money is spent, and the potential for sub-optimal intervention design in cases where there is little real profitability such as nature conservation.

However, given the scale and pace of the investment required, some element of private investment is needed and the focus then should be on how and where it can be best utilised. A 2021 study by the Green Finance Institute, which estimates the requirement for private finance for nature in Scotland at £20bn over ten years,[263] operates on the assumption that no additional public funds can be committed to this investment and calculates the gap between the authors' estimates of the cost of nature investment to achieve current strategies, and the existing public spending committed. This significant assumption should be subject to closer scrutiny, by developing a more detailed analysis of the suitability of different nature investments for private investment and the other options for funding.

There have been a number of recent developments in enabling private investment in Scottish nature, with the SG having committed to a public sector partnership to develop a high integrity, values-led market for responsible investment in natural capital in the National Strategy for Economic Transformation.[264] Following on from this, the SG produced its

Interim Principles for Responsible Investment in Natural Capital in 2022 to set out what high-integrity private investment looks like.[265] Recent SG-commissioned research looked at the options for encouraging more private finance into peatland restoration through a Scotland Carbon Fund and/or a Price Floor Guarantee.[266] The Facility for Investment Ready Nature in Scotland (FIRNS), launched in early 2023, will give grants of up to £240,000 to nature restoration organisations to help develop a viable business case and financial model to attract private investment.[267] A pilot of private investment in nature projects was also launched in early 2023 by NatureScot, involving a blend of public and private investment.[268] This pilot could lead to £2bn of private investment over the next 20-30 years. The pilot is expected to fund tree planting in two locations in Scotland, with the resulting carbon credits being sold to provide a return to the private investors, and the expectation for a community benefit to be provided in all pilots. The public investment component has so far included funding the project scoping stage, and is expected to involve some forestry grants expenditure on a case-by-case basis.[269]

Past applications of blended public and private investment, via the Non-Profit Distributing and hub models of Private Finance Initiative, encountered significant problems including poor long-term value for money. While there are differences in approach between these past examples and the recent initiatives involving private investment in nature, any application of blended finance for nature should incorporate the lessons from the past, including following Audit Scotland's recommendation of enhanced "transparency and scrutiny of how value for money is considered as part of decision making, the costs and benefits of using private finance, and the management of risks and outcomes delivered".[270] Binding social and environmental outcomes, similar to those expressed in the Interim Principles for Responsible Investment in Natural Capital, would also help to ensure investments achieved their nature positive aims.

3.6.3 Direct and indirect tax

A number of tax reforms in relation to nature-based sectors may be relevant to the nature positive and the net zero missions. Land for agriculture, forestry and aquaculture is currently exempt from non-domestic rates (business rates). This incentivises the use of land for these activities, some of which have negative impacts on the net zero and nature positive missions (e.g. intensive aquaculture, finfish farming) and raises the market price of rural land, despite there being no clear public interest argument for the exemption.[271] The removal of this exemption on forestry and aquaculture land (and potentially on agriculture subsectors that are relatively more profitable) could raise revenue to invest in public nature conservation projects or acquisition of forestry land. It would also be one means of correcting for the extensive tax exemptions enjoyed by timber producers: income from this sector is exempt

from income tax and corporation tax and while timber land is subject to capital gains tax, the timber itself is exempt.[272] Changes to taxation of the sector would potentially reduce private demand for forestry land, making public or community land purchases more affordable. It is important to note that powers over income tax, corporation tax and capital gains tax and associated exemptions for these taxes are reserved to the UKG.

The OECD recommends that governments should apply biodiversity-relevant taxes as part of a suite of instruments to drive a transition to a nature positive economy. This could include a tax on pesticides or on fertilisers. France applied such a tax but the rate was low enough that it didn't have much impact on reducing pesticide use.[273] Similar taxes have been used in Denmark (with mixed effectiveness),[274, 275] Sweden, Norway and Washington State.[276] However, with all these examples, it is necessary to note that Scotland has limited tax powers under the devolution settlement.

Taxation may offer the means to better reflect the environmental impact of certain food products, a similar impact as the recommendation for removing harmful subsidies to agriculture mentioned above. Evidence suggests that price is a key determinant of the foods we consume, but other research finds that a carbon-related food tax would be regressive, so may not align with just transition ambitions.[277] Indirect taxes such as VAT and duties on alcohol and tobacco are regressive and the SG lacks powers over their rates, the tax base or its administration.[278] Applying a new tax on environmentally harmful foods may require additional devolved powers. Increasing fuel tax can be an effective way to raise revenue for green investment, as shown by the example of Costa Rica,[279] albeit sometimes with regressive effects, but is not currently within the SG's powers.

3.6.4 Planning framework

On biodiversity, NPF4 sets out that local development plans should "promote nature recovery and nature restoration across the development plan area, including by: facilitating the creation of nature networks and strengthening connections between them to support improved ecological connectivity; restoring degraded habitats or creating new habitats; and incorporating measures to increase biodiversity, including populations of priority species." Proposals that will result in any loss of ancient woodlands, or an adverse impact on native woodlands, hedgerows and individual trees of high biodiversity value will not be supported.

Scotland's Chief Planner has acknowledged that there is no single accepted methodology for calculating 'enhancement' of biodiversity, although research has been commissioned to explore options for developing a biodiversity metric or other tool specifically for use in Scotland. The lack of a clear definition for 'enhancement' could result in significant delays for projects

or inadvertently setting the wrong precedent through a misinterpretation or an insufficient application of the biodiversity policy in the planning framework.

The lack of a capital spending programme alongside the NPF4 could also prove to be a significant challenge in its application. With a shortage of adequate and skilled planners in already stretched local councils, the RTPI has warned that the delivery programme could be undermined without the necessary capital allocation.[280]

3.6.5 Regulation

Regulation will be a crucial lever in steering behaviour in a number of economic sectors to drive a rapid and just transition to a nature positive economy. The following sub-sections assess the existing use of public regulation in a number of important nature-related sectors of the Scottish economy.

- *Land use and conservation*

Beyond the investment of money in designation and management of areas for conservation, a number of levers relating to ownership offer varying levels of potential to transform the biodiversity impact of land management in Scotland and to ensure high environmental standards and integrity.[281] The purchase of land by the SG or local communities on the open market has the potential to lead to better management for nature, but is unlikely to achieve a rapid improvement given that farmland is often held for many decades between sales.

An additional regulatory lever relating to the land market is public interest tests, which have been proposed by the SG for inclusion in the forthcoming Land Reform Bill as a way to apply conditions to large land transactions which pose a risk to the public interest.[282, 283] The public interest can be broadly defined while remaining compatible with underlying human rights law, and can include the need for environmental protection.[284] While this power would not necessarily affect what occurs on the land once it changes hands, there is potential to use it to block land transactions that are clearly detrimental to biodiversity. The 2022 SG consultation on Land Reform in a Net Zero Nation found that a majority of respondents supported the introduction of this lever and highlighted aspects requiring further attention such as the threshold for minimum size of transaction above which the test is applied, the definition of the public interest, and the inability to apply the test to land sold via shares in companies without changes to companies law from the Westminster Government.[285]

A further, seldom-used lever for improving environmental outcomes from land management is the conservation burden (or conservation covenant). This is an agreement to do (or not do) something on land for a conservation purpose,[286] which can be entered into voluntarily by the owner of that plot of land and certain bodies: the Scottish Ministers, or any of their legally

designated conservation bodies, which include among other organisations all Scottish local authorities, the National Trust for Scotland, NatureScot, Plantlife, the John Muir Trust, the Royal Society for the Protection of Birds, the Scottish Wildlife Trust and the Woodland Trust.[287] Additional organisations can be designated as conservation bodies via secondary legislation.[288] The Title Conditions (Scotland) Act 2003 allows conservation burdens to be created "for the purpose of preserving, or protecting, for the benefit of the public - (a) the architectural or historical characteristics of any land; or (b) any other special characteristics of any land (including, without prejudice to the generality of this paragraph, a special characteristic derived from the flora, fauna or general appearance of the land)."[289] The agreement can be tied indefinitely to that plot of land even if it changes ownership in future, giving the potential to attach permanent conditions that promote biodiversity on plots of land if the existing owners and a relevant organisation are able to enter into a conservation covenant.[290] There appear to be numerous purposes for a conservation covenant that would contribute to a nature positive economy, such as requiring that an area should remain in woodland use and maintain woodland cover from a certain date forward (as is currently required by an existing conservation burden for a plot of land in the Scottish Borders),[291] a prohibition on the use of pesticides on a property,[292] or conditions that would promote the conservation of a given species on a site. However, conservation burdens appear to have been used very rarely in Scotland since the relevant legislation was enacted in 2003, with the majority of cases relating to cultural rather than natural conservation.[293] There appears to be significant unused potential for the relevant public bodies mentioned above to agree to place permanent conditions in favour of biodiversity on sites and properties whose owners support a nature positive economy, through the use of conservation burdens. A similar lever, the conservation easement, has been applied to an estimated 27 million acres of land in the United States, encouraged by a linked tax incentive for the landowner.[294] There may be potential to include conservation burdens as a condition attached to public funding for nature restoration, to ensure that the benefits that the public is paying for persist long into the future. This would mirror the existing rationale for the use of conservation burdens where public funds are used for preserving architectural heritage.

Another option is to use the Compulsory Purchase Order (CPO) powers of National Park authorities to buy additional land and manage it for biodiversity.[295] This would be an expensive process however, and may be subject to legal challenges if the purchase cannot be justified under the authority's mandate (or the authority is not given new powers to justify this kind of CPO). It was originally envisaged that Forestry and Land Scotland (FLS) would have CPO powers justified by its aim to manage land in a way that promotes sustainable forest management, but these powers were removed from the final legislation that applies to FLS. Amending the legislation to

restore these CPO powers would greatly increase the ability of FLS to acquire public land for the nature positive mission.

A further, ambitious option at UK level would be to vest the ownership of stored carbon in the Crown, in a similar process as was applied to coal and oil stocks in the 1930s. This would give the Crown Estate Scotland the power to require privately owned land to be managed to increase carbon storage in features such as peat bogs and trees, with incentives paid for good management and the option of legal challenge to the landowner in cases of mismanagement.[296]

- *Forestry regulation*

The Woodland Carbon Code[297] has supported some of the private investment in Scottish forestry: entry into the scheme is voluntary but standards and requirements apply once validated. The Interim Principles for Responsible Investment in Natural Capital also provide non-binding SG guidance to investors on the standards expected.[298] There has been a sharp increase in private investment in rural land and forestry in recent years, which has been analysed in detail by the Scottish Land Commission.[299] This has been enabled by a combination of factors, including the relatively light regulation of land sales in those areas, favourable tax treatment of Scottish forestry and timber production, expectations of revenue from carbon credits (a function of UK guidance on companies' use of Woodland Carbon Units[300] and the stipulations of the Woodland Carbon Code for the minimum standards in generating those units), expectation of revenue from the sale of timber, and the availability of grants from the Scottish Forestry Grant Scheme.[301] Savills Research estimates that the value of forestry sales in Great Britain rose from an average of £116m per annum in the period 2015-19 to £212m in 2020, £269m in 2021 and £295m in 2022, with Scotland making up 89% of the market as of 2022.[302] Forestry investments have provided a very strong capital appreciation for investors in the past five years, far in excess of the capital growth observed for farmland and residential and commercial property.[303] In light of these factors (not all of which are related to SG policy levers) and the recent increase in private investment in the sector, policymakers should consider certain risks to a just transition to a nature positive economy. While an increase in investment in the creation of forests is necessary for the net zero and nature positive missions, it is important to achieve this in a way that distributes the costs and benefits of the transition as equitably as possible across Scotland's population. This may mean using policy levers such as taxation, regulation or grant design to recapture some of the high financial returns that investors are receiving in the sector or to further incentivise public-owned or community-owned forestry.

➢ *Fisheries regulation*

The challenge of fisheries management in line with the nature positive mission is multifaceted, requiring a combination of conservation of protected areas of sea and sustainable management of the remaining exploitation of fish stocks.

Scotland's Marine Assessment 2020 took a detailed look at the available data on key commercial fish stocks,[304] finding that 46% of these were overfished (i.e. mortality was above the level required for maximum sustainable yield (MSY)), with substantial variation by species. The spawning stock biomass (SSB) of the Northern stock of hake has recovered strongly since 2008 following a sharp reduction in fishing mortality (which fell below the MSY level in the mid-2010s). Similarly, a reduction in mortality below the MSY level since the mid-1990s for North Sea herring has accompanied an SSB that has remained above the MSY level, demonstrating a recovery following its collapse in the 1970s and 1980s. On the other hand, cod stocks in both the North Sea and the West of Scotland remained far below their historical levels as of 2018, albeit with a limited recovery between the mid-2000s and mid-2010s in the former area, and while fishing pressure fell somewhat, it remained above the MSY level. Similar trends of fishing mortality above MSY and low stocks applied to whiting in the North Sea, whereas in the West of Scotland a reduction in fishing mortality to low levels between 2010 and 2018 allowed for a slight recovery in stocks, which remain extremely low compared with their 1980s and 1990s levels. Data on catches of cod and whiting show that while landings have fallen, discards have not, potentially preventing the recovery of these stocks from their very low levels. An assessment of the data on the above stocks, as well as the data cited earlier in this report on non-commercial fish stocks and seabirds, suggests that additional measures should be taken to align the fisheries sector with a nature positive Scottish economy.

The SG is currently using a variety of levers to manage the fisheries sector. The overarching *Blue Economy Vision* sets out six long-term economic, social and environmental outcomes aiming to transform the economy within environmental limits. The *Fisheries Management Strategy (2020)* sets out the SG's approach to managing the fishing fleet operating in Scottish waters in a sustainable and responsible way. In addition to regulation of the sector, the SG provides grants via Marine Fund Scotland (with assessment criteria relating to sustainability, biodiversity, lower carbon emissions and more circular practices). The Scottish Marine Environmental Enhancement Fund (SMEEF), which is hosted by NatureScot, is a funding initiative where those using and benefiting from Scotland's rich natural marine resource can re-invest in the health of the marine environment by making voluntary financial contributions that are used to fund projects and activities that recover, restore, or enhance the health of marine and coastal habitats and species. SMEEF's grants focus

on initiatives for restoration of marine habitats and species, marine and coastal nature-based solutions, invasive species management and research to shed new light on relevant issues.[305] Additional to this, the SG is involved in a number of relevant forms of research and development, including the SG Marine Directorate's team of around 200 scientists and engineers, who conduct research, inform policy decisions, monitor and evaluate policies, legislation, licensing; involvement in the Marine Alliance for Science and Technology Scotland (MASTS) since 2009, a consortium of organisations engaged in marine science; and involvement with international research, assessments, agreements, e.g. via ICES and OSPAR.

In the international literature on nature positive economies, governments are advised to extend the coverage of Marine Protected Areas (MPAs) and increase public investment in their designation and management.[306] Under the Scottish Biodiversity Strategy, the SG aimed to implement Highly Protected Marine Areas (a stronger form of MPA) covering 10% of Scotland's waters by 2030 but this commitment has been withdrawn after a negative response from industry and a different approach will be taken.[307] The SG is aiming to protect 30% of Scotland's land and seas for nature by 2030 under the 30x30 goal. Scotland's seas cover an area of 462,315 km^2 and Marine Protected Areas cover 37% of this (228,118 km^2)[308], albeit not all of these areas have the fisheries measures in place at present to ensure that they are managed effectively. Given the level of coverage by current MPA designations in Scotland, it may be more effective to focus on the recommendations from the international literature pertaining to enforcement within these areas.

The careful management of MPAs is equally important, to ensure that they restrict fishing activity sufficiently to allow marine biodiversity to recover and implement science-based restrictions on fishing.[309] Current MPAs globally have widely varying levels of protection, meaning that some of them have failed to achieve their environmental goals.[310] A study covering most of Scotland's inshore area found that MPAs with strong management measures covered less than 1% of the footprint of existing bottom-contact fishing in the study area, so that MPAs were in this case "unlikely to significantly reduce the fishing pressure to which benthic habitats and species are exposed".[311] This suggests that improvements to the siting and management of MPAs could improve biodiversity outcomes in Scotland's inshore seas.

The type of restriction can also be an important factor in achieving nature recovery at sea: bottom-contact gears (including the gears used by trawlers) are known to have a significantly more harmful impact on marine fauna and sea-floor carbon storage.[312, 313, 314] Marine Scotland modelling estimated that a trawl ban within three nautical miles of the coast would result in an increase in gross value added of around £6 million.[315] Modelling of the economic and ecosystems services impacts across the EU suggests there could be a strong

net benefit of banning bottom-contact fishing gears in areas of Scotland's seas, even after accounting for the loss of catch for these vessels.[316] A multi-criteria data analysis of the impact of different gears in the Scottish *Nephrops* fishery against the SG's objectives across 17 metrics covering economic, social and environmental impact found that creelers performed better than trawlers.[317]

For the fishing that continues outside MPAs, it is recommended that the management approach be based on scientific evidence, i.e. careful and regular assessment of fish stocks in each area that is fished.[318] This requires public investment in inshore fisheries management bodies to resource this evidence generation and the enforcement of resulting spatial restrictions, as well as potential reforms to the remit (mandate and areas covered) of these bodies for better alignment with the nature positive mission. Current management practices do incorporate scientific advice, but Scotland (like many other European countries) has in recent years allocated total allowable catch in excess of the level consistent with MSY, suggesting that scientific advice is not always fully implemented in practice. Between 2001 and 2020, Scotland's total quotas exceeded advice by an estimated 1.2 million tonnes (as part of a total of around 9 million tonnes in excess of scientific advice across the EU as a whole).[319]

The distribution of quotas to small fishers (boats of under 10m in length) is an important consideration for a just transition, as this group is less economically resilient than the large players in the sector and has typically received a very small share of the overall UK quota.[320] These small fishers are also likely to fish in a way that is less harmful to nature by using more selective gears, meaning a quota redistribution has the potential to improve environmental outcomes in the sector.[321] Due to the capacity within the 10 metre and under sector and the nature of the species caught by different fleets in Scotland at present, there may be challenges in the short term to increasing the quota share of small fishers. Any potential changes could be phased in over time, with the details of the final distribution worked out in collaboration with small fishers.

A further priority for a just transition should be the working conditions in the sector, especially offshore, where there is emerging evidence of poor conditions and labour abuses, particularly for migrant workers.[322] The recent UK Nationality and Borders Act, which requires crew members in UK waters to have a skilled worker visa, bringing their wages up to the statutory minimum, is not likely to change the circumstances of crew on UK vessels operating offshore.

- *Aquaculture regulation*

There have been a number of significant developments in policy and regulation relevant to the sector in recent years. SEPA's marine fish farm

framework has been implemented since 2019 with a "tighter seabed standard and enhanced modelling and environmental monitoring". SEPA is also currently consulting on a new risk-based framework for managing interaction between sea lice from marine finfish farm developments and wild salmonids. A review of regulation in the sector was undertaken by Professor Russel Griggs OBE in 2022, and the SG has accepted its recommendations in principle and has recently set up the Scottish Aquaculture Council and asked the Scottish Scientific Advisory Council to consider the commissioning, use and communication of science in aquaculture consenting. The 2022 Seafood Strategy includes outcomes aiming for greater sustainability in the sector, although these are likely to conflict with other outcomes aiming to achieve "international competitiveness" and growth in seafood exports, so that the strategy's effectiveness vis-à-vis the nature positive mission may depend on which outcome is prioritised. The recently published Vision for Sustainable Aquaculture places a greater emphasis than before on developing the sector within environmental limits and improving community benefit, but again the test of achieving these outcomes will be in whether they are prioritised over outcomes relating to attracting investment and improving international competitiveness.[323] The SG has regulatory powers to require companies to report certain environmental risks (e.g. there is a requirement to notify the regulator on site escapes of fish), can issue enforcement notices for a variety of issues under different layers of legislation, and can issue fines for failure to comply with enforcement notices. The SG has committed to explore the introduction of fines for fish farm escapes, with the ultimate aim of ring-fencing this money for wild salmonid conservation and research.

Policy 32 of the NPF4 places a greater emphasis than before on minimising the negative environmental impacts of new aquaculture developments, setting conditions as well as stating that developments will need to comply with the national and regional marine plans and the other relevant regulatory frameworks on environmental impact. The open-water elements of new aquaculture developments are exempt from Policy 3 of NPF4, which would otherwise have required them to protect and enhance biodiversity, but are covered instead by the aforementioned marine plans.[324, 325] Given the recent issues with the sector's impact on nature mentioned above, there is a need for more evidence on the environmental impact of the sector to inform more effective regulations via these marine plans, if the sector is to be compatible with the nature positive mission.

- *Business disclosures and financial and companies regulation*

There is a gap in understanding when it comes to nature within companies and the financial sector, including in terms of the dependency of companies' business models on nature and the negative impacts their operations have on nature.[326] This often leads to nature being invisible when key decisions are made and supports conditions in which businesses continue

to degrade biodiversity. There are various ways in which governments could increase the consideration of nature by companies through the regulation of business and financial disclosures.

Governments can develop guidance for companies on the valuation of natural capital as part of their economic decision making.[327] This may include advocating for companies to use the same natural capital framework as the SG uses and there may be options to further encourage natural capital measurement by building it in as a requirement or a criterion in SG procurement. The SG has begun implementing wording and guidance for public bodies to help them to procure in a way that is aligned with the net zero, nature positive and circular economy missions,[328] and this in turn aligns with Scottish Enterprise free business sustainability support.[329]

Governments should also aim to improve companies' management and disclosures of biodiversity considerations, building on the work of the Task Force on Nature-related Financial Disclosures.[330] The UK has adopted a target under the Kunming-Montreal Global Biodiversity Framework to encourage businesses to disclose their biodiversity dependencies, impacts and risks and to reduce their negative impacts.[331] Part of the challenge of this measurement and disclosure is a technical one, i.e. finding ways to represent the complex impacts of a company on biodiversity in a tractable model and reporting format. Given that company law is generally set at the UK level, initiatives for the SG on this recommendation may need to focus on voluntary collaboration of Scottish businesses or advocacy for change at Westminster.

Another way in which companies could take better account of their impact would be to embed biodiversity considerations into their due diligence risk management processes. In doing this, they could draw on resources such as the OECD Guidelines for Multinational Enterprises.[332] Enforcing this change would likely require changes to financial regulation and company law, which again is a reserved power and not available to the SG at present.

Additional recommendations on financial regulation call for financial firms and central banks to better understand, assess and manage nature-related financial risks.[333] One recommendation that is more relevant to the SG is to embed biodiversity goals in core public finance institutions and policy, including in climate finance facilities and national planning. The Scottish National Investment Bank has a mission for net zero but not one explicitly focused on a nature positive economy. Its Ethical Investment Policy does specify that it supports the aim of at least maintaining current biodiversity, will avoid investments that harm biodiversity and will invest in some projects that improve biodiversity.[334] Given that the Bank's current missions are likely to lead only indirectly to investments that improve biodiversity (e.g. through its investments in afforestation for net zero reasons), it would be a positive step to give the nature positive goal a similar level of priority to net zero by incorporating it into the Bank's missions directly.

3.6.6 National measures of success and incorporating biodiversity into government policy

The international literature on achieving a nature positive economy places substantial emphasis on the development and adoption of national measures of success that are broader and more appropriate than traditional growth and output metrics. While it is important to emphasise that the inclusion of natural capital on an equal footing with financial or physical capital will not necessarily lead to it being valued more highly, it would nonetheless be a positive development that would better align decision-making with the nature positive mission.

Recommendations for what the overarching measure should look like vary, with the Dasgupta Review advocating for an inclusive wealth metric which is "the sum of the accounting values of produced capital, human capital and natural capital" and is closely correlated with social wellbeing across generations,[335] while the OECD recommends "a multi-dimensional measurement framework to assess national performance, including measures on the environmental dimensions of human well-being and the stocks of natural capital that underpin current and future well-being".[336] Similarly, both studies suggest that natural capital accounting should be developed (with a need for investment to do this) to track movements in natural capital and to evaluate the impact of policies.[337, 338] Dasgupta further recommends that the productivity of capital investments should be measured using inclusive wealth, to give a fuller picture of the impact of an investment on the different capitals.

The next step after developing improved measures of success is to incorporate them into the everyday operations of the SG. This would involve mainstreaming biodiversity and natural capital into all relevant strategies, plans, programmes, policies and projects; setting time-bound targets, roles and responsibilities (in the Government) on biodiversity; strengthening inter-ministerial coordination on biodiversity; and developing indicators to monitor progress on the mainstreaming of biodiversity within the Government.[339] These actions can be complemented by applying biodiversity goals directly in fiscal policy. To do this, the SG could use green budgeting tools such as social cost-benefit analysis that includes nature outcomes; quantify its own biodiversity-related spending and that of the Scottish National Investment Bank; and assess the impact of public spending on biodiversity with a focus on the expenditure that harms biodiversity.[340] Budget proposals are assessed against climate change (emissions) impacts at present but not against biodiversity impacts.

The SG has a solid foundation from which to further incorporate these indicators and approaches. As a multi-dimensional measure of success, Scotland has 81 indicators within its National Performance Framework. Progress towards a wellbeing economy is also regularly assessed by the SG

through its Wellbeing Economy Monitor.[341] The Natural Capital Asset Index (NCAI) is included as an indicator within the National Performance Framework. It monitors the quality and quantity of terrestrial habitats in Scotland, according to their potential to deliver ecosystem services now and into the future. Scotland was the first country in the world to publish detailed measurements of the annual change in its natural capital. The NCAI measures relative change in the extent and condition of each of seven ecosystems (Broad Habitats). The National Performance Framework also includes a separate less direct indicator which measures the accessibility of green and blue space to the population. The NCAI was evaluated by The James Hutton Institute in 2014 and the methodology was revised to take account of their findings, however NatureScot accepts that the NCAI is a work in progress and has committed to refining its methodology and data. NatureScot notes that "the NCAI is a good indicator of terrestrial habitats' contribution to wellbeing, but it does not account for Scotland's considerable marine habitats and does not demonstrate changes in biodiversity or a habitat's resilience to outside pressures." They suggest that "some of these shortcomings can be assessed using the newly developed ecosystem health indicators", but it doesn't appear that these are being routinely used by the SG.

3.6.7 Policy levers for a nature positive economy - conclusion

As mentioned earlier in this report, it is challenging to assess the impact of existing SG policies on a complex set of outcomes like biodiversity and there is a lack of precise evidence on this topic, but this subsection provides a broad assessment of the sufficiency of currently used policy levers.

The scale of public investment in the transition to a nature positive economy is not yet large enough relative to the scale of Scotland's 2030 and 2045 goals. While neither source is as detailed as the equivalent net zero assessments, the Green Finance Institute estimate of a requirement of £20bn in investment over the next decade for nature restoration in Scotland and the RSPB estimate of a required investment of £11.7bn over a decade to make Scottish agriculture more climate friendly, give an indication of the size of the gap. These are significant sums of capital but there is no dearth of private capital interest in Scotland's natural assets, raising important questions on how local communities can benefit in the long term alongside nature restoration and climate mitigation. There has been a lot of work done already on attracting private investment into nature projects, but there would be value in a clearer assessment of which funding gaps can be most appropriately filled by private rather than public funds, and binding criteria will need to be developed to reduce the risk to a just transition.

In agriculture, public investment is gradually becoming relatively more aligned with a nature positive economy and grants are expected to become

more conditional, but the proof will be in the detail of implementation and a more ambitious pace of change is needed that is commensurate with the scale of the challenge. The current impact of agriculture and related public spending on biodiversity is not well understood and the pace of transformation in the sector is not high enough to meet nature positive goals. In relation to the conservation and restoration of nature, there is likely to be a need for greater public spending or use of other levers to meet ambitious 2030 targets for protected areas. The significant increase in private demand for land presents a risk to delivering nature positive outcomes in these sectors and there is potential to reassess the combined policy levers affecting this to secure a fairer distribution of costs and benefits.

On regulation, there is potential to make greater use of levers for conservation such as CPOs and conservation burdens. Fisheries regulation could be better resourced to enforce protection in MPAs and to increase spatial restrictions on the most harmful forms of fishing. While biodiversity metrics in Scotland's seas have recovered somewhat from a low base, significant further improvement is needed. Aquaculture regulation would benefit from a deeper understanding of the sector's impact.

The SG has limited powers over taxation for a nature positive economy, but there is potential to make progress by removing business rates exemptions on nature-related sectors. The NPF4 provides a good basis for biodiversity to be incorporated into planning but more work will be needed to make it operate effectively in practice.

There has been good progress on applying broader-based national measures of success and measuring and tracking natural capital in Scotland, However, the next challenge will be to embed these approaches more widely across the economy, for example through green budgeting by the Government and encouraging the disclosure of nature related impacts, dependencies and risks by businesses.

As shown in the first section of this report, many of the indicators of biodiversity and the key pressures on biodiversity are still not showing improvement in Scotland, demonstrating that at a broad level, transformative change to the economy is still needed to achieve long-term nature positive goals.

3.7 Current use of policy levers for a circular economy

3.7.1 Public investment

Scotland has adopted a trailblazer approach to reducing single-use waste through policies that are coming into force - incentivising changes in both consumer and producer behaviour. The impact of the schemes will only be known in the coming years. Schemes like the Circular Economy Business Support and Circular Economy Investment Fund, with an outlay of £18m and administered by Zero Waste Scotland, are supporting small and medium sized

enterprises to invest in innovation and new products and processes that contribute to a circular economy.[342] The Government has also committed £70m to improve recycling rates with local authorities receiving the funding.

The Food Waste Reduction Action Plan was introduced in 2019, highlighting that Scottish households waste £1bn worth of food annually. The plan set targets to reduce municipal food waste by a third by 2025 on 2013 levels with £30m of public money invested so far, but progress on this investment and targets has been difficult to measure.

Although a broader issue than circular economy, in the context of food policy, there is little to no public investment in communication on climate friendly diets, alongside a lack of policy guidance on the issue.

The Government has set timelines for eliminating biodegradable waste reaching landfills, reducing waste arising and household waste recycling with good to average progress on all of them.

3.7.2 Direct and indirect taxes

The Aggregates Levy at the UK level is a tax to encourage the use of recycled materials over the extraction of rock, sand and gravel which can damage the environment. The tax raised £0.4 billion in 2019–20, including from quarry operators. There has been a reduction in the use of virgin aggregates since the Aggregates Levy was introduced, but it is unclear how much of this can be attributed to the Levy alone.[343] Recycled aggregates now constitute a quarter of all aggregates in Scotland,[344] similar to the figures at the UK level.[345] The SG however is committed to introducing a Scottish Aggregates Tax Bill, following a consultation on substituting the UK wide tax with a domestic one, but this is yet to be operationalised.[346]

The SG introduced its own landfill tax in 2015 that aims to reduce the amount of waste that reaches a landfill. It raised £101m in 2022 and is only expected to generate £16m in 2027 as landfill waste continues to reduce considerably. Landfill waste stood 4.3 million tonnes in 2015.[347] In 2021, landfill waste was 3.5 million tonnes, meaning an 18.7% reduction in waste since the introduction of the tax.

The SG has had a charge on single-use carrier bags since 2014 with a minimum charge of 5p which subsequently increased to 10p per single-use bag. The charge was widely noted to be successful with a significant reduction (up to 80%) in the first year of its implementation while generating a small revenue for retailers.[348] The SG is also exploring a single-use drinks cup charge to reduce litter and waste going to landfill and reduce overall consumption of single use cups. Very few jurisdictions have attempted this but voluntary approaches by private firms such as Starbucks have highlighted good preliminary results with an increase in the adoption of reusable cups.

Scotland is set to introduce a new deposit return scheme which introduces a 20p charge on drinks containers (plastic, aluminium and glass) that can be redeemed by the consumer after returning the container to an eligible return point. The scheme has encountered political opposition from the UKG but the SG aims to roll it out from October 2025. Similar schemes in countries like Germany have had tremendous success with very high recycling rates (e.g. 99% for drinking cans).

The UK introduced its plastic packaging tax (PPT) from 1st April 2022 with the aim of encouraging the use of recycled plastic within packaging. It applies to plastic packaging manufactured in or imported into the UK which does not contain at least 30% recycled plastic by weight. From 1st April 2023, the tax was set to £210.82 per tonne of plastic packaging.

3.7.3 Planning

On waste, NPF4 has a clear emphasis on reducing waste while encouraging a circular use of physical resources. The framework allows for the capture and use of gases from existing waste and landfill sites but discourages proposals, unless under specific circumstances, for the construction of waste to energy plants.

3.7.4 Policy levers for a circular economy – conclusion

Tax and regulation seem to be the most effective levers in directing consumer and producer behaviour to achieve the circular economy outcomes. However, with under 2% of the economy that is circular, Scotland has a long way to go across all sectors of the economy. Scotland has positive examples of firms practicing sustainable fashion, environmentally friendly materials in buildings and active travel and shared transport solutions, but these remain very small in size and need to be scaled up significantly. Using less, using longer, recycling and regenerating are the four pillars of a circular economy and the upcoming Circular Economy Bill, which has already been delayed a few years since the pandemic, should address how policy can support these pillars.

The previous section on levers for a nature positive economy also addresses some of the priorities and challenges for developing nature-related aspects of the circular economy, including transitions to regenerative agriculture and aquaculture and other land-based and marine sectors.

3.8 Current use of policy levers for cross-cutting issues

3.8.1 Public procurement

The SG sets expectations of all public bodies to demonstrate how climate and circular economy concerns are considered and prioritised in their procurement activities. The way in which the Scottish public sector spends on

contracts can influence the development of economic activities that support the creation of a net zero, nature positive and circular economy and can shape economic behaviour.

A set of Sustainable Procurement Tools have been developed that offer all public bodies the information and guidance they need to sufficiently consider climate change in their procurement decisions. Different local authorities have varying capacities to incorporate this guidance in their procurement practice. A cursory look at a few annual public body climate change reports from local authorities in Scotland suggests the interpretation of the guidance is limited to projects that already have a direct relevance to climate mitigation or adaptation (e.g. EV charging) as opposed to assessing the indirect and induced climate impacts of all procurement activity.[349]

Within certain large-scale net zero or nature positive public investments, the SG has the potential to support the growth of a local supply chain through how it approaches its procurement. Social procurement is one such approach where public procurement agencies leverage their purchasing power to generate social value. This could include stipulations regarding green skills and training, diversity targets, job quality (e.g. living wage) or supporting small and medium enterprises through subcontracting and supply chain investments. Scotland has a positive legacy of social procurement contracts with community benefit clauses (CB), first introduced in 2008, leading to specific outcomes such as the delivery of training and upskilling of workers amongst their contractors.[350] The introduction of the Procurement Reform (Scotland) Act 2014 meant that for any contract with a value of £4 million or more, the organisation procuring the contract must consider if it imposes a community benefit clause. This is complemented by the Sustainable Procurement Duty which requires public bodies to consider and act on opportunities to achieve economic, social and environmental outcomes through procurement.[351] Appropriate guidance is also provided to understand and assess the lifecycle impacts of products and services procured by public bodies.

In 2015, the University of Glasgow evaluated the impact of CB clauses of 24 contracts on training and employment. Their research showed that CB had a positive impact on training, as the training target was exceeded: the number of trained individuals was more than 6,700, compared with an original target of 1,014.

One potentially impactful use of procurement for all three missions would be to use the procurement of food by public bodies to support organic and regenerative agriculture and decrease the carbon and land footprints of the food purchased. In schools in particular, a shift towards much less use of meat and dairy in school meals could help young people to form long-term dietary habits that are compatible with the missions. The use of this lever in relation to food is being considered by the SG in the forthcoming Good Food

Nation Plan, which will set out the need to work towards sustainable food systems. Increasing the sustainability of food procurement may also feature in an update on *Catering for Change*, as mentioned in the current Programme for Government. The City of Edinburgh Council recently proposed an eventual shift to fully vegan meals in their schools and public offices.[352]

The SG could also support the development of new businesses that operate circular economy models (such as use-oriented or result-oriented product-service systems) by favouring them in their procurement and publicising the benefits to material use achieved through this procurement to improve social acceptance of the circular approaches.[353] In practice, this would mean procuring to rent all sorts of equipment rather than buying it (and securing approval from finance teams to do this), or paying for the results rather than the products themselves. Work is already underway in this form of mission-focused procurement: the SG set up a National Climate and Procurement Forum in 2019, has issued two policy notes setting out expectations on public bodies to support climate and circular economy ambitions through their procurement,[354] and promotes its Sustainable Procurement Toolkit.[355] Zero Waste Scotland (which is SG funded) also provides a number of grant schemes for circular practices,[356] including through the Recycling Improvement Fund[357] and the Circular Textiles Fund.[358]

3.8.2 Research and Innovation

The UKG published the UK Research and Development Roadmap in January 2021 highlighting its commitment to increase public investment to £22 billion per year by 2024 for R&D and to commit 2.4% of GDP by 2027.[359] The document pointed out the importance of R&D to address the challenge of net zero.

SG statistics show the Gross Expenditure on R&D (GERD) which includes: Private Non-Profit (PNP) sectors, Business Enterprise (BERD), Government (GovERD) and Higher Education (HERD). The expenditure on GERD was £4.8 billion in 2020, which is £58 million higher than 2019 and representing 3.13% of the GDP of Scotland in 2020.[360]

Scotland is a middling country in OECD terms with regards to public R&D spending. Innovation funding is predominantly skewed towards net zero related outcomes as seen with the multiple schemes in the public funding section.

Scotland currently underperforms in securing funding from institutions such as Innovate UK, with per business spend below London, Wales and a significant part of England.[361] Similarly funding from the UK Research Council has gradually declined over the last decade, impacting a key driver of innovation in Scotland.

In the energy sector where Scotland has already made considerable progress in decarbonisation, a £75m energy transition fund has been set up to build on Scotland's competitive advantage (e.g. Aberdeen's place as a global energy hub) and explore further opportunities for growth in sectors such as hydrogen, automation of offshore technologies and effective use of data for technology optimisation.

The SG is committed to investing £50m a year as part of its Strategic Research Programme to advance innovation in agriculture, natural resource management and the environment. Similarly, the SG funds the Climate Change research institute and other research and demonstration projects in negative emissions and certain place-based initiatives on climate adaptation.

The impact of the mentioned investments is yet to be assessed as they have only been announced in the last 5 years.

In Scotland, R&D is also delivered by non-departmental public bodies such as Scottish Enterprise, Innovation Centres and other institutions like the Scottish National Investment Bank (SNIB), which invest in different R&D projects. For example, the SNIB has committed £415.1 million to a wide range of projects, mostly net zero related.[362] Similarly, Scottish Enterprise has invested in and incubated successful firms innovating around transport electrification, aerospace technologies and fuel cell engines, to name a few.[363] However, a potential issue could be the non-coordination of these bodies on R&D and exploiting possible overlaps.

Lastly, another major source for R&D research is the UK Research and Innovation (UKRI), which is a non-departmental public body sponsored by BEIS.[364] UKRI has a combined budget of £6 billion for the UK and diversifies its investment in different areas like research grants, collective programmes skills, and infrastructure.[365]

As is evident, a significant amount of R&D investment can be attributed to the growing of the net zero economy and in particular the energy sector. Driving investments into nature recovery and circular economy, both public and private, from an R&D perspective has been much smaller in both per-capita and absolute terms.

3.8.3 Skills

The skills programme of the SG is a patchwork of targeted policies aimed at different demographics, dealing with the impacts of the pandemic and supporting the low carbon transition. The nature of the transition to a net zero and nature positive economy and the transformed nature of that end state for the economy will require particular skilled workers. The CCC's assessments of the pathway towards net zero have identified shortages of skills as a barrier to tree-planting and peat restoration rates reaching their target levels, and

their findings on the decarbonisation of buildings at the local authority level drew attention to a lack of the necessary skills in data analysis and project management to carry out the delivery of complex projects.

The SG and Skills Development Scotland recently published the Climate Emergency Skills Action Plan (CESAP) 2020-2025.[366] The plan builds on and influences concurrent policies supporting access to green jobs, such as: Younger Persons guarantee, Fair Start Scotland, Apprenticeship Transition Plan and the Partnership Action for Continuing Employment (PACE).[367] It includes the Green Jobs Fund which has a £100 million budget for 5 years to foster green jobs through investment in research and development and physical infrastructure. However, it is worth noting that across the UK, a significant proportion of the 2030-2035 workforce is already in the labour market today. This means the focus should also be equally on ensuring the current workforce has the necessary skills to contribute to the low carbon economy through a range of programmes: the National Transition Training Fund, the Young Person's Guarantee and Fair Start Scotland.

A 2022 report commissioned following on from CESAP looked at existing green jobs relevant to net zero in Scotland, applying a typology that included novel occupations created under the transition to net zero, occupations where skills will change significantly in the transition, and occupations for which there will be increased demand.[368] This found that 40% of jobs in Scotland in 2021 were green jobs, that green jobs were significantly higher paid than non-green, and that these jobs were mostly held by men (72%) and those aged 25-49 (58%).[369] The report found that most of the novel occupations created in the transition were within sectors covered by CESAP (72% of all 'new and emerging' green jobs) but that most green jobs were jobs that already exist but will require enhanced skills and knowledge: this group made up 26% of all existing jobs in Scotland. Its recommendations included developing a green skills taxonomy to build on the green occupations taxonomy, and encouraging the greening of the remaining 60% of jobs that were currently classified as non-green under the taxonomy.

The CESAP also aims to publish regional skills assessments, which will help create a database and aid on forecasts.[370] Other programs include the development of a Green Internship by Zero Waste Scotland and the Green Jobs Workforce Academy. The impact of these programs is yet to trickle down as a significant skills gap remains across different sectors. Improving the supply of skills without a sufficient growth in demand is also hampering the necessary private investment in the upskilling of the workforce (e.g. skills investment in the private building retrofit sector has been slow across the UK with an equally slow uptake of home retrofitting measures).

Another important policy is the Industry Delivery Plan for Green Heat that aims to support upskilling of workers on energy efficiency and low carbon heating skills with £1.5 million in aid delivered.[371] The program includes heat pump

training with a mobile training centre and it is currently developing a pathfinder research that will identify skills gaps and forecast future demand on skills.

The SG's National Mission for Jobs includes a £60 million investment into a new Youth Guarantee, helping young people aged 16-24 transition into education, training or work.[372] Early performance of the policy based on the Government's own indicators suggest the policy has limited the rise in youth unemployment but it remains higher than pre-Covid levels.[373] The aim of the policy is also to encourage the growth of short term industry focused courses for young people but there is no explicit focus on the low carbon economy. The SG has also introduced a series of training support programmes, such as the National Transition Training Fund with a budget of £25 million; the Partnership Action for Continuing Employment (PACE) and the Job Start Payment, all focused on supporting employment in response to the fallout from the pandemic.

The SG also launched the Adult Learning Strategy for Scotland 2022-2027, which does not have an allocated budget but clearly identifies ways to bring about systemic change in the learning experience for adults in Scotland.[374] New Economics Foundation research shows that investment on skills, at the UK level, disproportionately benefits the already high skilled workforce, often leaving behind the low income, precarious work force.[375] The SG's adult learning strategy introduces novel approaches such as community-based adult learning and addressing systemic inequalities further entrenched by the pandemic linking its wellbeing outcomes to its skills agenda. However, we are yet to fully see the impact of these approaches and how it particularly impacts the Government's objectives on a net zero, nature positive and circular economy.

The Nature-Based Jobs and Skills Action Plan 2022-23 provides a detailed list of the nature-based jobs needed for the future and sets up the objective of having sufficient skills and capacity to support the nature-based sector by 2030.[376] While the plan provides a comprehensive view of the need for skills development and job creation in the nature sector, it is quite early to evaluate the impact of these measures which have only initiated over the last year, with the early part of the action plan focused more on engaging different stakeholders, understanding demand and learning from pilots.

In May 2023, an independent review of the post-school education and skills system was published by James Withers.[377] The review was not specifically focused on the gaps to net zero or a nature positive economy but makes general recommendations on improving the post school education infrastructure to meet the challenges of the future. Among several recommendations, the review advocates for a new national funding body, that rationalises the several, disjointed policies and funding pots and administers all publicly funded post-school learning and training provision.

3.8.4 Consumer information

Consumer information, such as product labelling, may be a useful lever to encourage a shift in behaviour away from consumption that creates high emissions or damages biodiversity. Among the recommendations of the international literature on this, there is a focus on sectors with a major impact on nature such as meat and dairy production and fast fashion (the latter through the production of materials).

In their 2020 report, *The Future Of Nature And Business*, the World Economic Forum recommend that governments should consider more comprehensive labelling requirements on food products to encourage consumers to buy more nutritious foods and shift away from environmentally harmful products.[378] Although the products to label are not specified in that report, the evidence on both emissions and land footprint (and therefore biodiversity impact) suggests that meat and dairy products could be subject to labelling clarifying that they have the highest negative impact on the environment and nature.[379] Some forms of farmed fish may also be relevant for this labelling where they have a high impact on nature or are produced via carbon-intensive methods such as recirculating aquaculture. Among other countries, Denmark will soon be the first to introduce a government-led scheme for climate labelling on food.[380] A related form of labelling could specify animal welfare outcomes for meat, fish and dairy products to guide consumers away from the most intensively produced products, given that there is likely to be some correlation between animal welfare and impact on emissions and nature.[381]

It is important to note that information is not necessarily the most effective way to change behaviour, particularly when it comes to diet. Research suggests that previous government campaigns focused on individual behaviour change and voluntary reductions in unhealthy food consumption have not been particularly effective, while finding that public health campaigns have a limited effect in shifting behaviour, and price and convenience are key drivers of the way we eat.[382]

A further recommendation on labelling involves ensuring that food is consistently labelled with its shelf life to reduce waste in distribution and consumption.[383] The SG currently funds an initiative with WRAP to share good practice on the way products are packaged, labelled and priced.[384]

3.8.5 Ownership

Community Wealth Building (CWB) is a key objective within the NSET. The Government defines CWB as a way to "harness the economic leverage of local 'anchor' organisations (such as local councils, health service providers, universities, colleges, housing associations, or large local private sector employers) to tackle long standing systematic challenges and structural

inequalities within our communities". The SG has an ambition to be the first country to introduce a Community Wealth Building Act and has recently consulted on it.[385] The SG aims to introduce policies that will accelerate CWB by giving communities a greater stake in the economy.

Greater ownership of assets in community ownership, co-operatives, social enterprises and employee-owned firms is another key objective within a wellbeing economy. Government data indicates that assets under community ownership have risen to 612 in 2020 from 48 in 2000.[386]

A few local authorities have been running pilots on CWB practices which include growing local supply chains, supporting the creation of good fair work, using land as a tool to achieve net zero, maximising community benefit through public procurement and supporting local firms to bid for government contracts.

CWB and its components[387] have the potential to contribute to the just transition to a net zero, nature positive and circular Scottish economy in a number of ways. Greater use of anchor organisations' procurement to shape local economic activity can be harnessed to encourage the growth of businesses compatible with and contributing to the three missions. Localising supply chains has the potential to cut down on transport emissions. A greater ownership stake for residents in their local economy (including businesses, assets and land) may offer an increase in democratic decision-making that could support a fairer transition in these sectors and could facilitate a wider sharing of the financial returns from transition investments via plural ownership forms. The socially just use of land and property could include reducing the impact of buildings and land on nature and emissions, particularly if space is used for maximum social value over the long-term and the lives of buildings are prolonged. Where CWB contributes to fairer and better-remunerated work, it could potentially allow residents the time and income to make more sustainable consumption choices.

The recent SG consultation recognised that the CWB approach can play a key role in a just transition to a net zero, nature positive, circular economy 'including through actions such as sustainable procurement, a focus on fair and green jobs, green investment decisions and recognising the ecological value of land'. It outlined proposals for taking forward some of these opportunities under CWB 'pillars'. For example, the 'spending pillar' will seek to harness the spending power of anchor organisations to support net zero and environmental ambitions through the creation of local supply chains; while the 'land and property pillar' will seek to grow the ecological value that local communities gain from land and property assets in order to help 'tackle climate change and protect our natural capital'.

3.9 Section A: Conclusion

Over the last two decades, the SG has made considerable progress in cutting carbon emissions from electricity generation and supply but similar progress towards **net zero** has not been made across other sectors. The Climate Change Committee, the Government's statutory advisory body, has highlighted how the Government is **considerably off track** to meeting its climate targets, particularly in sectors like transport, agriculture and domestic heating.

As our preliminary research also highlights, although there have been pockets of success, overall **progress has been limited** on creating a **nature positive** and a **circular economy** where bold targets have been set but the necessary legislation, policies and implementation are still in train, making the exercise of evaluating against outcomes more challenging.

Our review of overall performance across all three aspects (net zero, nature positive and circular economy) indicates that the SG has shown good **intentions** in setting the policy direction but the evidence of actual **progress** suggests **major risks that 2030 targets will be missed** unless efforts are increased.

Our analysis of the SG's use of its economic policy levers clearly shows that **public investment** is the most effective lever in the Government's toolkit, and can be deployed to leverage greater levels of private finance, increasing the scale of investment. However, investment levels are significantly lower than that which is necessary and investment from the UKG is often scarce and highly competitive. Investments via the Scottish National Investment Bank, and those committed to pilot programmes through schemes such as the Energy Transition Fund, are invaluable in kick-starting the growth of key sectors and industries critical to the long term health of the Scottish economy, but the evidence is clear that the scale of investment is inadequate and not in line with the short term targets. With the Government investing billions in the transition, we note that more could be done in attaching conditionalities to investment in order to secure its just transition outcomes.

Our research clearly highlights a strongly emerging trend towards **private investment** in managing Scotland's vast natural assets, and this **risks** undermining the wider wellbeing goals of the Government unless accompanied by adequate **safeguards**. Private investment in economic activities harmful to the three missions continues largely unabated, meaning that giving a prominent role to private investment in the transition is likely to further reward some of those who have profited significantly from bringing about the current crises. The other potential risks posed by private investment in nature positive interventions include a reduction in democratic control over how the money is spent, and the potential for sub-optimal intervention design in cases where there is little real profitability such as nature

conservation. In cases where blended finance is applied (public funds used to subsidise private returns), care should be taken that terms are carefully scrutinised so that the public secures good value for money. For the private investment that does occur to support the three missions, it will be important to attach binding conditionality to maximise social and environmental outcomes in the relevant projects.

Our research highlights the limited impact and effectiveness of Scotland's current use of other economic policy levers such as **tax, regulation and public procurement**. This is explained, partly, by the fact that key regulatory and tax powers are **reserved** to the UKG. However, some of the low hanging fruit such as policies on building regulations and plastic bag surcharge have already been implemented and the **scale** of these levers is often too small, with limited scope for significant divergence (with an aim to drive greater ambition) from similar policies at the UK level. The Future Homes Standard and the Deposit Return Scheme are two recent examples of regulatory divergence that might be necessary to meet the SG's overarching goals but are often challenging to implement. In some sectors, **competing priorities** affecting the implementation of transformative levers, such as road user charging, an Air Departure Tax and significant reform to agriculture payments, will need to be addressed so that policies are commensurate with the scale of the climate and biodiversity emergencies.

In Section C below, we set out a more detailed set of **recommendations** by economic sector, seeking to set out explicit steps for how the SG can use existing levers more effectively and identify new levers that could be deployed in order to improve its chances of delivering the Environment Strategy 'economy' outcome.

3.9.1 Alignment with National Strategy for Economic Transformation

Lastly, the Environment Strategy 'economy' outcome, which is the subject of this report, aligns directly with the 'greener economy' ambition contained within the NSET. Both are described in terms of the just transition to a net zero, nature positive economy (with the Environment Strategy explicitly noting that this will rely on the shift to a circular economy, and the NSET emphasising the importance of rebuilding Scotland's natural capital). This section provides some brief, initial reflections on the approach to achieving these goals set out in the NSET and through this report.

While there are some areas of overlap between the NSET and the report, our research considers a wider range of economic sectors in an effort to cover some of the topics not covered in detail by the NSET, which was primarily focused on five programmes of action that were assessed as having the greatest potential benefit. This potential benefit in the case of the NSET was defined by economic performance, which in turn was defined broadly as including 'economic growth, environmental sustainability, quality of life and

equality of opportunity and reward'.[388] While the NSET goes further than economic strategies in most developed economies, our research is focused more broadly on a just transition to a net zero, nature positive and circular economy, which necessarily gives a higher priority to environmental and social outcomes.

There are numerous initiatives contained in the NSET that support the **net zero** mission. Under the 'New Market Opportunities' programme, these include a net zero industrial strategy approach with clusters and supply chain development, renewable energy and hydrogen projects and research and development support to sectors relevant to net zero. The Regional Economic Partnerships highlighted under the 'Productive Businesses and Regions' programme have a strong focus on net zero, including renewable energy, CCUS, hydrogen and heat decarbonisation, while the 'Skilled Workforce' programme includes a recognition of the changing skills needs created by net zero and some relevant projects such as the Green Jobs Workforce Academy.[389]

Mirroring the findings of our 'overall performance summary' earlier in this report, the NSET contains less material relevant to the other two missions. The **nature positive** mission is mentioned as part of the 'New Market Opportunities' programme, which aims to establish a values-led, high-integrity market for responsible private investment in natural capital in Scotland.[390] There is an emphasis on the opportunities for nature-based businesses created under the nature positive mission. This approach broadly aligns with some of the recommendations in Section C such as increasing nature restoration, supporting low-impact forms of shellfish aquaculture and catalysing a shift towards organic or regenerative agriculture. However, the NSET does not go into detail on whether such businesses should prioritise nature impact or growth first and foremost.

The 'New Market Opportunities' programme briefly mentions the **circular economy** as an economic opportunity and other parts of the NSET could indirectly increase circularity through renewable energy and regenerative nature-based activities. However, there is a general lack of circular economy focus across most of the economic projects and recommendations contained in the NSET. The focus of these parts of the NSET is generally on increasing growth and productivity (which may contradict the more circular use of resources), as well as developing skills and improving job quality.

This report reflects a different framing from the NSET on the relationship between economic growth and the three missions. As highlighted in our earlier section on the wider economic model and transformational change, a focus on permanent economic growth will make it more difficult to achieve the three missions due to the limited scope for decoupling this growth from resource use and impact on nature. In its first three ambitions, the NSET places a heavy emphasis on increasing growth and productivity, and although the

strategy goes further than economic policies in most developed economies in considering sustainability, the impact of this targeted growth on emissions, biodiversity and material use is not assessed in depth.

Similarly, the net zero and nature positive missions are framed in the NSET as economic opportunities first and foremost, whereas our research has found that only some of the required transformations for these missions are profitable and there are some crucial transformations that are not economic opportunities (e.g. regulation to protect nature or limit certain economic activities). Some economic opportunities mentioned in the NSET, such as the growth in food and drink exports or tourism, may contradict the three missions unless they are carefully aligned. Others such as timber production for use in construction will require taking account of the trade-offs between the nature positive and net zero missions. In addition, parts of the NSET seek to make Scotland a first mover and more competitive in certain economic sectors, so that the country reaps a larger share of the benefits of transition. There is a tension between this framing and the interconnected nature of the global climate and nature crises, which will need to be solved everywhere in order for the benefits to be felt anywhere. For a just transition it will be important to consider whether the Global South will be able to achieve the three missions in a way that is compatible with Global North countries continuing to make substantial profits. Achieving a just transition at a global scale may require collaboration to take precedence over economic competition.

The NSET effectively incorporates a number of projects aimed at the employment component of a just transition, including a skills guarantee for workers in carbon-intensive sectors, projects to narrow gender gaps in key economic sectors, projects supporting disabled people, people with caring needs and those at risk of poverty and the use of conditionality in public spending to achieve Fair Work criteria.[391] There is potential to give greater attention to the fair distribution of the benefits from transition, however. For example, parts of the NSET seek to make Scotland 'a magnet for inward investment and global private capital' (albeit with safeguards to encourage a values-led and high-integrity approach) and to 'enable the Scottish financial services industry to reap the benefits of the new energy opportunities'.[392] These aspects of the strategy could risk creating a situation where major investors who have benefited from the climate and nature crises also reap substantial returns from the transition. Regulation and taxation can be powerful levers to address these risks and create a just transition, by encouraging an equitable distribution of returns.

A final reflection on the NSET and this report relates to the way in which the transition will be delivered. The sixth programme under the NSET relates to 'A Culture of Delivery' and includes a number of important projects to support effective delivery and accountability to the public. Nonetheless, while the NSET focuses heavily on collaborative decision-making that brings together all

parties across the economy and secures general approval, the strategy does not discuss the role of power dynamics and vested interests in this process. Our recommendations include cases where achieving broad-based appeal and general approval may not always be possible, such as regulatory restrictions on extractive or polluting economic activities that are currently well-established and profitable, or changes to how certain sectors operate that may encounter resistance from vested interests. Such instances will be unavoidable in our view if the three missions are to be achieved, as Scotland cannot meet its goals through win-win interventions alone.

4. SECTION B: Our approach

4.1 Theory of Change

Following on from the review of existing policy levers and evidence base, a Theory of Change (ToC) approach was undertaken to map out the key intermediate outcomes on the pathway to a net zero, nature positive, circular economy (i.e. the overarching 'economy' outcome), and to identify how existing policy levers could go further, or new policy levers could be adopted, to steer the economy of Scotland onto a more direct path to achieving these goals.

A ToC is a framework that outlines how particular interventions or initiatives are expected to bring about desired outcomes, and usually consists of a visual representation of the ultimate aim, intermediate short, medium or long-term outcomes, specific activities or interventions, and the underlying assumptions of how activities and outcomes are connected.

A ToC framework is a useful tool rather than an exact science. Its value lies primarily in representing complex systems filled with important details and assumptions, and mapping these out in a systematic and explicit manner. However, a ToC is only as good as the assumptions it makes, and different theories of change can be produced prescribing different solutions for the same problem – for example, as a result of different evidence or value and belief systems. This is especially true when working in the inherently political field of environmental and social policy.

As part of this project, we produced two different ToCs, one for achieving a net zero economy and one for achieving a nature positive economy. Net zero and nature positive are treated as two distinct goals, albeit many of the actions and intermediate outcomes are closely related. We describe some of the synergies and contradictions below. In drafting the ToCs, we also drew on circular economy literature, although we considered circular economy as a means to achieving environmental and social aims, rather than an end in its own right. For this reason, insights related to circular economy form part of the

two overarching ToCs on net zero and nature positive, as opposed to being incorporated within their own ToC.

Overall, the approach we took to drafting the ToCs was that of a broad review and synthesis, which took the work and evidence from Section A, and incorporated major national and international studies of need and best practice in the net zero and nature positive fields of study. The goal was to enable the project to move from a review and assessment of existing levers, to a set of recommendations for future levers and adaptation of levers, which are set out in Section C. The ToC work therefore forms part of the bridge between these two sections.

Given the huge scope of the task, the ToCs set out a general map for achieving a given mission, rather than one chosen path. As set out below, a broad range of national and international literature was reviewed to list out many intermediate outcomes and a great variety of policy levers that can be used to achieve them. The result is what we believe to be a comprehensive menu of policy choices that can be further judged against relevant criteria – for example, distributional considerations and existing evidence of efficacy.

4.1.1 Format

The ToCs were drawn up in Miro, an online collaboration platform suitable for producing and sharing large flowcharts and diagrams. Due to the scope and complexity of the systems represented, the ToCs require a large format; the figures in this report only show a high-level, schematic representation of the ToCs. For the full diagrams, see Appendix 2 and 4.

4.1.2 Theories of Change and our recommendations

As mentioned, the subsequent recommendations set out in Section C of this paper draw on the ToCs, as well as the Section A work and a wider review of current SG policy and national and international literature. The Section C recommendations go beyond the broad ToCs and prioritise specific policy levers. The selection of recommendations: reflect the 'art of the possible' in terms of being within the areas of devolved policy responsibility for the SG; follow on from Section A analysis in terms of being based around identified areas of sufficiency / insufficiency; incorporate a wider literature review of national and international best practice, including the views of the SG and Working Group experts; and finally incorporate the New Economics Foundation's own policy judgements that form part of our core mission for 'cutting carbon emissions, boosting nature, and creating good jobs'.

4.2 Policy Levers

To support the development of the ToCs, we created a new list of policy levers – domains which included 33 distinct policy levers grouped in 6 overarching categories as shown in Table 1 below. This list includes both areas of devolved and areas of reserved powers, and draws on the review of relevant net zero, nature positive and circular economy literature, a survey of levers completed by SG policy teams, and our own extensive work in public policy. The full list of policy levers is shown separately in Appendix 1.

The list overlaps directly with the policy-lever domains set out in Section A, but rationalises that list in order to systematically group sub-levers for the purposes of formally and diagrammatically mapping them within a ToC structure. Whereas the Section A analysis starts by reviewing known policies against the three missions (net zero, nature positive, circular economy), the ToC analysis takes those levers and organises them into groups which can then be systematically applied to sectors of the economy.

Table 1: Policy Levers

Public investment	Levers including strategic and local infrastructure funding and delivery, public subsidies, investment in R&D, crowding in private investment, public procurement.
Taxation	Levers including production taxes, consumption taxes, income taxes, wealth taxes, land use taxes, tax reliefs, carbon pricing.
Direct control	Levers including management of activities and assets in public sector control, and further democratisation of industries, land, and natural resources.
Regulation	Levers including land use planning, building codes and housing standards, industrial regulation, regulation of financial markets.
Market creation	Levers including emissions trading schemes and creating carbon offset and natural capital markets.
Information and education	Levers including schooling, upskilling and retraining, access to information, provision of guidance and advice, awareness raising.

4.3 Net zero ToC

To map short, medium and long-term outcomes, the net zero ToC chiefly draws on Scotland-specific CCC reports, the SG's updated Climate Change Plan and other policy documents, NEF's own research, and additional sources including the UKG Carbon Budget Delivery Plan. Following the scope of the project, the focus of the ToC is on Scotland's territorial emissions only (Scotland's overseas footprint is the focus of a separate Environment Strategy outcome: '*We are responsible global citizens with a sustainable international footprint*').

The ToC is structured by economic sector as defined in Scottish Government policy and the CCC reports. The diagram includes specific short, medium and long-term outcomes on the path to net zero, structured under key overarching outcomes as set out in Table 2 below which are matched with plausible policy levers as outlined in relevant literature.

Table 2: Net zero outcomes

Electricity	Outcomes including renewable electricity generation from onshore and offshore wind, hydro, solar and tidal energy, and biomass and waste with CCS/CCUS
Buildings	Outcomes including zero emission heating, building insulation, and reduced energy consumption from appliances
Transport	Outcomes including greening fleets, modal shift and reduction in number of journeys across personal road transport, HGVs, waterborne transport, aviation, rail and bus public transport, and active travel
Industry	Outcomes including resource efficiency, embodied carbon, energy efficiency, industrial fuel switching, industrial processes, CCS/CCUS in industry and sectoral composition of the economy
Waste	Outcomes including waste reduction from consumption and product reuse, increased recycling, and technological improvements in waste processing
Land use, land use change and forestry	Outcomes including carbon capture in wetlands, woodlands and marine ecosystems, and biomass for energy with CCS/CCUS

Agriculture	Outcomes including reducing emissions through a range of sustainable farming practices
Engineered removals	Outcomes including CCS/CCUS in industry and energy, direct air carbon capture and storage, and enhanced natural processes

See Appendix 2 for the full ToC diagram.

4.4 Nature positive ToC

The Nature Positive ToC draws on a selection of authoritative national and international literature and key reports including *The Future Of Nature And Business* (World Economic Forum),[393] *The Dasgupta Review*,[394] *Biodiversity, natural capital and the economy* (OECD),[395] and *Stockholm+50: Unlocking a Better Future* (Stockholm Environment Institute).[396] A supporting research project by the James Hutton Institute, *Driving the Transition to a Nature Positive Economy: A Synthesis of Policy Levers for Governments*[397] supplements this report by presenting a rapid review of policy levers recommended in the international literature, and examples of best practice in the use of these levers.

The ToC provides an overview of the findings and recommendations from the literature and plots out the key outcomes and levers in a synthesis diagram. The full set of outcomes from each of the source reports is shown separately in Appendix 3. As it was more challenging to assess the impact on biodiversity of individual levers (compared with the greater volume of existing evidence on the emissions impact of certain policies for net zero), the nature positive ToC should be considered more of a road-map of outcomes and levers required for this mission rather than an assessment of causal impact of those levers. Table 3 below outlines some of the key outcomes from the Nature Positive ToC.

Table 3: Nature positive outcomes

Nature's supply	Outcomes across land and ocean use, built environment, energy and extractives and circular economy – including ecosystem restoration and sustainable land and ocean management, preventing land and ocean use expansion, regenerative agriculture, planet-compatible consumption, compact urban environment and nature positive infrastructure, circular and resource-efficient production
Measures of economic success	Outcomes including mainstreaming a multi-dimensional framework to assess national

	performance and natural capital accounts, and setting of targets and responsibilities
Institutions and systems	Outcomes including assessment and removal of environmentally harmful public spending, the use of green budgeting tools, citizen empowerment, effective institutions
Financial sector	Outcomes including mainstreaming natural capital valuation, embedding biodiversity considerations in financial risk assessment, enhanced understanding of nature-related risks and embedding of biodiversity goals by central banks and wider financial sector, facilitating private investment in nature
Research and development	Outcomes including changing the selection environment for innovation and enhancing public funding for innovation
International trade	Outcomes including assessing the impacts of free trade agreements on biodiversity and tackling illegal wildlife trade. Note that these outcomes were outside the scope of this research and hence they were not taken forward into the recommendations.[398]

See Appendix 4 for the full ToC diagram.

4.5 Overlap

For the purpose of developing ToCs, net zero and nature positive were considered as distinct goals, with different pathways, policy levers and measurement frameworks required to monitor progress, but there are some levers and outcomes that are common to both. Both missions relate to the fundamentals of our relationship with the natural environment, and achieving them will require a whole system transformation across all areas of the economy.

As such, we identified that there are number of synergies and conflicts on the path to a net zero, nature positive economy, with the key ones set out in Table 4 below.

Table 4: Net Zero x Nature Positive

Cross-cutting		SYNERGY: Climate change is one of the drivers of biodiversity loss. Net zero as part of a global climate change mitigation effort is necessary part of halting further biodiversity loss.

Land Use		SYNERGY: Reducing consumption and shifting to planet-compatible diets reduces GHG emissions from over-production while preventing habitat loss (e.g., from extraction of raw materials and energy production).
		SYNERGY: As well as reducing GHG emissions, net zero measures help to reduce other forms of pollution which drive biodiversity loss.
		CONFLICT: Some net zero strategies are land intensive (see Energy and Industry below), heightening land use conflict between nature restoration, energy and biomass production, agricultural uses, and the built environment and infrastructure.
		SYNERGY: Protection and restoration of wetlands, woodlands, marine and coastal ecosystems is crucial for biodiversity, while also enhancing the function of these ecosystems as carbon sinks.
		SYNERGY: Good city planning is key to reducing emissions from transport and the built environment (e.g., increasing urban density and managing sprawl), while also reducing the footprint of the built environment and increasing the presence of nature cities.
Energy		CONFLICT: Renewable electricity sources have lower power densities, requiring in some cases considerably more land per unit of energy produced. This heightens land use conflict between energy production, nature restoration, agricultural uses and the built environment. Bioenergy in particular poses direct risks to biodiversity in cases where the biomass is not sustainably produced.
Industry		CONFLICT: The shift to timber in construction raises similar issues to the use of biomass for energy /

		energy with CCS. Depending on the source and associated land management regime, timber and biomass production can negatively affect biodiversity.
		SYNERGY: Improved resource and energy efficiency, longer lifecycles of materials products and other circular economy principles help to reduce both GHG emissions and habitat loss (e.g., from extraction of raw materials and energy production).
Agriculture		SYNERGY: Shifting to more sustainable agricultural practices reduces GHG emissions while also reducing pressures on biodiversity, including shifting away from meat and dairy which require a lot of space, water and energy.
Fisheries		SYNERGY: A reduction in intensive fishing practices such as bottom-contact fishing would reduce negative pressure on marine biodiversity while potentially increasing the ocean's capacity to store carbon.

As can be inferred from the above summary of the ToC process and from the full ToC diagrams, applying the breadth of levers to the range of sectors, and across the temporal ranges for outcomes (short, medium, long-term) leads to a high degree of multiplicative complexity for mapping levers to outcomes.

The goal of Section C, as set out in the following pages, was therefore to attempt to distil the ToC findings to enable meaningful recommendations for policy levers that could build on the sufficiency and efficacy gaps as set out in Section A.

5. SECTION C: Recommendations

The policy-lever recommendations in section C are grouped according to sector, which is the logical framing following the synthesis of Section A lever-domains and the ToC process, which took known lever-domains and sub-levers and grouped them to test short, medium and long-term outcomes

against economy sectors. In essence, Section C therefore takes off from the end of the ToC process in Section B.

5.1 Net zero economy recommendations

5.1.1 Electricity

Emissions from electricity supply in Scotland have fallen dramatically in the past decade as renewable electricity generation increased nearly threefold between 2009 and 2019.[399] The emissions reduction pathway in Scotland's updated Climate Change Plan aims to achieve zero emissions from electricity supply in 2029. At the same time, Scotland's electricity supply will need to accommodate increased demand, particularly from heating (heat pumps), transport, or electrification in industry. Specific targets are currently missing for renewable energy storage.

➢ *Public investment*

As mapped out in our theory of change for reaching net zero territorial emissions in Scotland, the potential role of public investment and subsidies in transitioning to net zero electricity supply spans from supporting local energy schemes through grants and subsidies all the way to the direct delivery or investment in large-scale renewable energy generation and storage facilities. However, generation, transmission, distribution and supply of electricity is a reserved policy area, considerably limiting the scope for independent SG policy. There is potential to increase the broad social benefits accruing from the energy system to encourage a just transition to net zero.

Recommendations:

- Work with the UKG and Scotland's industry to maximise the social value from private investment in renewables, including through increased local content (supply chains based in Scotland) and employment – one specific approach could be through the ongoing review of future Contracts for Difference rounds that is considering 'non-price' factors (e.g. local supply chains) in upcoming auction rounds.
- Expand the opportunities available under the SG's Community and Renewable Energy Scheme (CARES) to support the development of community energy projects at a larger scale than currently seen in Scotland - similar to examples of 'Bürgerenergie' in Germany, Denmark, or Austria.
- Advocate to the UKG for a publicly-owned clean energy generation company that would ensure that Scotland's communities reap the benefits of local natural resources rather than foreign investors - similar to EDF in France, EnBW in Baden-Württemberg (Germany), or Vattenfall in Sweden.

➢ *Regulation*

Regulatory levers in relevant policy areas are largely reserved to the UKG, including a reform of the electricity market and directed phasing out of non-renewable electricity generation technologies. The UK needs a fit for purpose regulatory framework to facilitate the transition to net zero electricity supply.

Recommendations:

- Advocate to the UKG for the fast development of a market design for a fully decarbonised, resilient electricity system that is flexible, promotes the participation of smaller players, provides incentives for the development of new renewable energy projects, and ensures that the low cost of renewable energy is passed on to households.

5.1.2 Buildings

As covered in Section A, the emission reduction pathway in Scotland's updated Climate Change Plan sets out to reduce annual emissions from buildings to 2.6 MtCO2e by 2030, a 71% reduction on the sector's emission in 2021. Following the Climate Change Commission reporting and methodology, emissions from construction and embodied carbon in buildings are not covered in this section but under industry.[400]

➢ *Public investment*

Public investment plays a crucial role in decarbonizing Scotland's buildings, and particularly in improving energy efficiency and installing low carbon heating in the existing building stock across residential, commercial, and public buildings and across all tenures – social homes, owner-occupied homes, and homes in the private rented sector. Adequate local authority funding will be needed to enable the use of other levers including the monitoring and enforcement of standards, or effective use of planning powers. The next steps to improve effectiveness in this sector for a net zero economy should include meeting the levels of funding that the CCC has assessed as necessary to hit net zero targets and expanding the focus into the private rented sector, which has received relatively less attention to date, including through greater funding for local enforcement capacity.

Recommendations:

- Allocate funds that are commensurable with Scotland's ambitious targets to decarbonise the building stock. For example, Germany's Climate and Transformation Fund allocates an equivalent of more than three times per capita annual funding to building retrofit than the commitment in Scotland's Heat in Buildings Strategy.

- Address the existing lack of emphasis on improving energy efficiency and heating in the private rented sector. While prioritising fuel poor households is commendable, Scotland will need to increase the existing financial support programmes and incentives offered to non fuel-poor households if it is to meet its targets.
- Adopt an area-based approach centred on communities and local authorities in order create good, low carbon jobs, support local supply chains, and ensure that communities benefit from local multiplier effects. A number of local authorities in Scotland have made progress on growing local supply chains and supporting the creation of good work opportunities through community wealth building pilots. The scale of building improvements needed across Scotland presents a unique opportunity to scale up local authority activity in this area.
- Provide sufficient funding to local authorities and build planning and enforcement capacity locally. This is necessary to help close the existing performance gap between predicted and actual performance of buildings. Without adequate funding at a local level, other key levers including building and heating regulation, local planning, and enforcement will fail.

➢ *Regulation*

Regulation and standards have driven much of the historical progress on improving energy efficiency of buildings, from building codes to heating systems and households appliances, and regulation continues to be a key lever for achieving Scotland's goals. While some relevant powers including product standards are reserved to the UKG, regulation pertaining to building energy standards, as well as relevant planning powers are devolved policy areas. As noted earlier in this report, there is currently a lack of robust regulation for energy efficiency and heating in existing buildings after proposed regulations were deferred in 2020.

Recommendations:

- Consult, finalise and table legislation in line with Scotland's Heat in Buildings Strategy, alongside delivery plans including adequate public investment allocation as outlined above/below and funding for local authorities.
- Progress with EPC reform as per the CCC recommendations, building on the ongoing consultation on EPC reform.[401]
- Fully assess the potential for using climate change burdens to secure reductions in emissions from privately-owned land and buildings and should scale up their use where possible.

5.1.3 Transport

Emissions from transport account for the largest share of Scotland's territorial emissions and have fallen only very slightly in the past decade. The CCC recommendations highlight several gaps in the SG's ambitions, including no existing commitment on reducing demand in aviation.[402]

Recommendations:

- Adopt a 2030 aviation demand reduction target in line with the CCC's pathways to net zero. To meet the targets set out in the updated Climate Change Plan which exceed in ambition CCC's Balanced Pathway, the SG needs to aim for a 13% reduction in aviation demand on 2019 levels as set out in CCC's Tailwinds scenario.

➢ *Public investment*

To reduce emissions from transport in line with its commitments, the SG will need to ensure that public spending and subsidies across all modes of transport and infrastructure align with its targets. Public investment is needed to enable modal shift to more sustainable modes of transport, the greening of transport fleets, and to help reduce the overall number of journeys taken across Scotland. Stronger funding and plans to deliver the 20-minute neighbourhoods approach will also help to reduce transport emissions.

Recommendations:

- Re-prioritise all current and future transport spend to reflect the SG's commitments to reduce emissions from transport. In particular, the SG should re-consider spending earmarked for increasing or subsidising private road travel, and direct it towards public transport, place-based transformation, and decarbonisation of shipping.
- Increase spending on public transport with a focus on the provision of a reliable, affordable and green bus service in Scotland's rural areas, including through publicly owned transport services. Roll-out the committed spending on bus priority measures on roads and motorways.
- Increase local authority funding to support NPF4 implementation and introduce an adequate capital spending plan to bring 20-minute neighbourhoods in Scottish towns and cities.
- Invest in decarbonisation of the maritime sector in line with CCC recommendations, including zero-carbon fuels, vessel technologies shore power and electric recharging infrastructure at all of Scotland's major ports.

➢ *Regulation*

Many regulatory levers remain reserved to the UKG, including vehicle standards, fuel efficiency, or sustainable fuel mandates. Some progress has

been made in areas of devolved responsibility including the introduction of low emission zones in Glasgow, Edinburgh, Dundee and Aberdeen, and place-based policies, public transport and plans to enable public transport franchising legislation.

Recommendations:

- Franchise public transport and deliver integrated nationwide fare structure ensuring that the cost of public transport is cheaper than the cost of driving – such as Austrian 'Klimaticket' with standard local, regional and national multimodal travel rates.
- Provide transitional support in the form of grants, subsidies, or low-interest loans ahead of the start of low emission zone enforcement, and consider phased implementation allowing sufficient time for affected individuals and businesses to adjust.

5.1.4 Industry

In 2019, emissions from industry were 9.6 MtCO2e (23% of Scotland's territorial emissions), compared to 12.4 MtCO2e in 2009 (or 23% of Scotland's territorial emissions in 2009).[403] [404] The emission reduction pathway in Scotland's updated Climate Change Plan sets out to reduce annual emissions from industry to 7.3 MtCO2e by 2030, 24% reduction on the sector's emission in 2019. This target reflects the relative difficulty in reducing emission from industry, with the majority of emission reduction expected to happen between 2030 and 2040. [405]

- *Public investment*

Key investment levers to decarbonise industry remain reserved to the UKG including strategic investment in energy hubs and clusters or industrial electrification. At present, Scotland's prospects of meeting its objectives in industrial decarbonisation depend on securing more investment from Westminster.

Recommendations:

- Work with Westminster to secure more finance for decarbonising Scottish industry under the UKG's cluster approach to decarbonisation, and step up funding available for private firms to alter their internal production services and product design.
- The current focus on hydrogen and carbon capture aligns with long-term economic opportunities, but Scotland also needs to focus on imminently reducing the carbon footprint of energy-intensive industries through technologies currently available at commercial scale. These include improving energy and resource efficiency, fuel switching via electrification

and the use of sustainable biomass, and accelerating the substitution of carbon-intensive materials with alternatives (e.g. in construction).

➢ *Regulation*

While much of regulation remains reserved to the UKG, there are significant areas of devolved responsibility including environmental and pollution standards in industry, or building regulations which can drive change in the construction industry.

Recommendations:

- Set resource efficiency targets for key energy-intensive and high emission industries and improve data collection to enable better monitoring of progress. Implement resource efficiency regulation in devolved areas of industry.
- Implement whole life carbon policies through building regulation, planning policy and infrastructure planning to encourage use of renewable construction materials and drive decarbonisation of Scottish construction industry.

5.1.5 Development planning

The fourth Scottish National Planning Framework makes good strides to incorporating net zero and nature positive outcomes as central principles in the development management process. Furthermore, the addition of the national spatial plan within the Framework helps set clear priorities for specific strategic investments.

However, the SG, in conjunction with Scottish Local Government Authorities, needs to recognise the limits of planning-as-regulation in ensuring that new development and re-development in Scotland delivers fully sustainable and just places.

The SG therefore should consider a greater range of options for enabling Local Government in Scotland to invest in and direct local economic development needs in their areas. In particular, the SG should look to international examples of upfront capital investment for transport led development, expenditure on public led land assembly at existing use values, and local revolving infrastructure funds which enable local government to benefit from the gains of land value uplift. Vauban (Freiburg, Germany), Ijburg (Amsterdam, Netherlands), Hammarby (Stockholm, Sweden) are examples of places that have adopted alternative development models in which local government takes a proactive rather than reactive approach to development in order to use land value uplift to ensure that communities are developed sustainably with low or zero carbon buildings, a range of active and public transport choices, and at densities which avoid sprawl and biodiversity loss.

Without such an approach, the SG will still be able to focus on national infrastructure projects, but will not be able to break the link between development and negative emissions and biodiversity loss at source. The SG needs to lead place development, including with greater upfront investment in amenities and infrastructure, to ensure high-to-full levels of public and active transport use and more compact development to avoid continuing car dependency, sprawl, and high materials use being permanent outcomes of the development system.

Recommendations:

- Assess opportunities for local government bodies in Scotland to take a more proactive role in planning and developing places that are compatible with a net zero, nature positive and circular economy, drawing on good practice abroad. This is likely to require working with the UKG to make legislative changes applying reserved powers as well as making use of some devolved powers. Some of the levers considered may include:
    - Increasing funding to local planning departments to resource them to undertake more proactive planning, rather than reactive.
    - Potential uses of CPO powers to enable land assembly.
    - Models such as development corporations that allow a more proactive approach to planning at a neighbourhood scale.
    - Options for how revolving infrastructure funds or lending from the Scottish National Investment Bank can be used to finance the upfront costs of creating these neighbourhoods.
    - Legislative changes that would enable the public to capture more land value uplift from development, via approaches such as land readjustment or strategic public land ownership (as used successfully in countries such as the Netherlands and South Korea).[406]

5.2 Nature positive economy recommendations

5.2.1 Conservation and restoration of nature

Protecting and restoring areas of land and ocean for nature will be an essential part of any mission to restore biodiversity and create a nature positive economy.[407, 408,409] This will require a set of interventions to increase the natural areas that are protected, restored and returned to nature.[410]

The SG is aiming to protect 30% of Scotland's land and seas for nature by 2030 under the 30x30 goal,[411] and also has an outcome in the Scottish Biodiversity Strategy to achieve protected areas covering 30% of land by 2030. This will require rapidly increasing from the status quo, in which 18% of Scotland's land area (c. 14,000 km^2) is currently protected and a further 5%

(c. 3,900 km^2) is national parks.[412] As discussed in Section A, public funding appears better suited to delivering this increase in conservation than private funding (which would come with risks to a just transition and technical issues around an inherent lack of profitability). In light of this, it may be necessary to explore other levers such as taxation or public borrowing for nature investment to deliver a just transition in conservation and restoration. The SG has very limited borrowing powers at present, which could present an obstacle to investment in conservation unless further devolution can be agreed. The forthcoming Biodiversity Investment Plan offers an opportunity to consider these issues in depth. Another component of the approach could involve using the Compulsory Purchase Order (CPO) powers of National Park authorities to buy additional land and manage it for biodiversity[413] and restoring these powers to Forestry and Land Scotland (FLS).

In terms of the approach to restoring nature, there is potential to further incorporate re-wilding approaches into SG policy, including by using recent recommendations for its application from NatureScot[414] and by building on good practice from rewilding projects that include local communities, as highlighted by the Scottish Land Commission.[415]

There is potential to apply novel policy levers to achieve better biodiversity outcomes on privately owned land in the long-term. Two such approaches described earlier in this report are conservation burdens that could be scaled up between public organisations and landowners who are well aligned with nature positive goals, and potential legislative options to vest the ownership of biological carbon in Crown Estate Scotland to better manage its condition and maintenance.

Recommendations:

- Increase investment in nature conservation and restoration, funded by a redirection of existing subsidies (see separate section on agriculture) and taxation via environmentally linked taxes (see separate section above) or in the longer term, via general progressive taxation. However, the SG's tax powers are limited, meaning that funding from this source may require further devolution or action by UKG.
- Invest to replicate successful models of inclusive rewilding across Scotland, building on existing good practice.
- Restore and maximise use of CPO powers to bring land into public ownership for nature restoration and restore CPO powers to FLS.
- Fully assess the potential for using conservation burdens to secure long-term biodiversity improvements on privately-owned land and scale up their use where possible.
- Explore longer-term options for vesting the ownership of biological carbon in Crown Estate Scotland.

5.2.2 Forestry

The effective management and protection of Scotland's forests will form an important part of achieving the nature positive mission. Forest cover in Scotland rose from 4.5% in 1905 to 19.1% in 2022,[416] but remains substantially lower than many EU countries, where the average forest cover is 39%.[417] Although many different types of forest cover can support biodiversity, it is important to distinguish between uses with relatively high biodiversity value (such as mixed or semi-natural woodlands) and commercial forestry (which is not always of high biodiversity value). However, given the potential for forests to contribute to the nature positive mission, and to capture and store carbon for net zero,[418] there is a need for further ambition to restore forest cover in Scotland to move closer to the EU average. However forestry receives less grant support relative to the land area covered than agriculture at present and there is potential to adjust the design of forestry grants to maximise social impact and encourage a just transition in the sector. There has been a sharp increase in private investment in rural land and forestry in recent years due to a combination of factors (not all of which are related to SG policy levers). While an increase in investment in the creation of forests is necessary for the net zero and nature positive missions, it is important to achieve this in a way that distributes the costs and benefits of the transition as equitably as possible across Scotland's population. This may mean using policy levers such as taxation, regulation or grant design to recapture some of the high financial returns that investors are receiving in the sector or to further incentivise public-owned or community-owned forestry.

Recommendations:

- Increase funding to FLS to accelerate the rate of land acquisition for afforestation and to support its other activities in nature restoration.
- Increase SG support to community-led forestry projects.
- To contribute to a just transition where the benefits of nature-related investment are broad-based, recalibrate policy measures in the sector to recapture some of the gains accruing to large investors in forestry, potentially using levers such as changes to taxation, reforms to forestry grant design, public interest tests and taxation of carbon units.[419] Some of the most relevant tax levers for the sector are reserved to UKG, meaning changes would need to be negotiated at that level.
- Cap the amount a single landowner can receive under the Scottish Forestry Grant Scheme to ensure that the funding is distributed in a way that is more compatible with a just transition.

5.2.3 Agriculture

As noted in Section A, agriculture is one of the largest contributors to biodiversity loss in Scotland, through its direct effects on nature (intensive use

of soil and land, pollution via pesticides and fertilisers) and through the use of land that could otherwise support higher biodiversity, for example as semi-natural habitats or under conservation measures.[420,421] Biodiversity losses have been driven, in particular, by a trend towards increasing intensification of agriculture, which has become more pronounced in the past 50 years.[422] At the same time, certain lower intensity forms of farming can benefit biodiversity, for example by preventing undergrazing.[423] The complex relationship between Scottish farming and biodiversity poses a challenge for adapting international recommendations to the local context. There is a need for further evidence on the impact of existing farming practices on biodiversity and a clearer definition than is offered in the *Vision for Agriculture* of what sustainable and regenerative agriculture will look like to give greater clarity to SG policies on the sector's contribution to the nature positive mission.

Food production and supporting biodiversity are not mutually exclusive. However, given the finite area of land available for uses such as conservation and forestry, reducing the land footprint of agricultural uses such as livestock, dairy and non-food production could make more land available to support biodiversity while maintaining a secure food supply. In addition to rebalancing land uses in this way, there is potential to improve the management of existing agricultural land to reduce its negative impact on biodiversity and encourage positive contributions to biodiversity. The Scottish agriculture sector is heavily reliant on public subsidies in terms of the proportion of farmers requiring subsidies to break even. There is a clear recommendation from the international literature to reduce the subsidies currently supporting harmful activities, such as the overuse of fertiliser and increasing intensification (both harmful to biodiversity) and the forms of farming that have relatively higher emissions.[424, 425, 426, 427] The reduction of these subsidies can also contribute to a just transition, as they tend to benefit a small number of producers whereas the costs to biodiversity and emissions fall on every member of society.[428, 429, 430] Ahead of the forthcoming Agriculture Bill, the SG is developing a new system of subsidies with a greater link to the net zero and nature positive missions. It has stated that at least half of all funding to farming and crofting will have enhanced conditionality by 2025. However, it is currently unclear what weight will be given to payments under the tiers that are conditional on environmental impact versus the base level payments with weaker conditionality.[431] As noted in section A, there appears to be significant potential for a transformative impact on biodiversity via a more ambitious shift in subsidies in favour of nature restoration and conservation.

Recommendations:

- When putting the *Vision for Agriculture* and the *Agricultural Reform Route Map* into practice,[432] reform payments to farmers with a heavy emphasis

on meeting net zero and nature positive goals. This would make subsidies heavily conditional on nature positive (not just less harmful) activities such as conservation or rewilding. There is potential to drive a rapid transformation from unprofitable and environmentally harmful forms of farming towards conservation and restoration of nature. This is likely to be most effective in subsectors that are more reliant on subsidies. This subsidy reform could achieve a fairer outcome for the population as a whole, by investing public money in national natural capital. It could also offer a more inclusive way of restoring nature that involves local residents, relative to the alternative of commercial afforestation.

- Undertake an assessment of national land use in light of the nature positive and net zero missions and goals for sustainable food production, exploring the balance of different forms of farming, areas of conservation, forestry, industry and urban development to meet these missions. This would allow consideration of the ideal mix of these activities, with subsidies used to achieve this mix, as opposed to the existing approach of minimising the environmental impact of current land use without significantly altering the mix of uses.
- Undertake a deeper assessment of the impact of existing agricultural production on biodiversity and nature, to understand which activities in the sector need to end to achieve the nature positive goals, and which parts of the sector can incrementally reduce their impact.
- Focus greater attention on the compatibility of policies such as the food and drink sector strategy and rural development policies with the nature positive mission.

5.2.4 Fisheries

As in many countries, Scotland's fisheries have been subject to overexploitation in past decades, leaving stocks at reduced levels[433] and having negative knock-on effects to the abundance of other marine species.[434] There have been some improvements in certain important commercial fish stocks in recent decades. There is still much room for improvement, given that 28% of the most important commercial stocks are currently not being fished sustainably (i.e. are being overfished). Outside of a small number of economically important fish species, very little is known about the majority of unmonitored and unregulated fish populations.

The challenge of fisheries management in line with the nature positive mission is multifaceted, requiring a combination of conservation of protected areas of sea and sustainable management of the remaining exploitation of fish stocks. Governments are advised to extend the coverage of Marine Protected Areas (MPAs) and increase public investment in their designation and management.[435] The SG is aiming to protect 30% of Scotland's seas for

nature by 2030 under the 30x30 goal and MPAs already cover 37% of sea area[436], albeit not all of these MPAs have the fisheries measures in place at present to ensure that they are managed effectively. Current MPAs globally have widely varying levels of protection, meaning that some of them have failed to achieve their environmental goals.[437] A recent study covering most of Scotland's inshore area found that the way in which these MPAs were managed was "unlikely to significantly reduce the fishing pressure to which benthic habitats and species are exposed".[438] This suggests that improvements to the siting and management of MPAs could improve biodiversity outcomes in Scotland's inshore seas.

The type of restriction can also be an important factor in achieving nature recovery at sea: bottom-contact gears (including the gears used by trawlers) are known to have a significantly more harmful impact on marine fauna and sea-floor carbon storage.[439, 440, 441] Research discussed in Section A indicates that there is potential to improve the combined economic, social and environmental outcomes of fishing activity through a spatial ban on bottom-contact fishing in some areas of Scotland.

The distribution of quotas to small fishers (boats of under 10m in length) is an important consideration for a just transition, as this group is less economically resilient than the large players in the sector and has typically received a very small share of the overall UK quota.[442] These small fishers are also likely to fish in a way that is less harmful to nature by using more selective gears, meaning a quota redistribution has the potential to improve environmental outcomes in the sector.[443] Initiatives to increase the quota share distributed to the 10 metre and under sector would need to be phased in and agreed in collaboration with those fishers to ensure that technical factors are aligned for successful implementation.

A further priority for a just transition should be the working conditions in the sector, especially offshore, where there is emerging evidence of poor conditions and labour abuses, particularly for migrant workers, and recent legislative changes will not be sufficient to reach all of the affected workers.[444]

Recommendations:

- Increase public investment in MPAs to allow for better management and enforcement of the areas under protection.
- Implement increased spatial restrictions on bottom-contact fishing across a wider area of Scotland's seas and provide sufficient resources to enforce these measures, to reduce the damage to marine ecosystems that these gears cause.
- Consider ways to recalibrate regulation of the sector to maximise the combined economic, social and environmental net benefit, such as

redistributing a greater proportion of the fishing quota towards small fishers.

- Collect evidence on labour conditions in the sector, act on existing evidence through stricter enforcement and remove loopholes that exclude migrant fisheries workers from UK employment standards, so that the Fair Work First standards are implemented for all workers in Scottish fisheries.
- Review subsidies to the fishing sector and their impact on biodiversity and work with the UKG to remove fuel subsidies to the sector.

5.2.5 Aquaculture

Aquaculture is an important primary sector of the Scottish economy, with farmed salmon making up over one third of national food exports in 2021.[445, 446] Although the sector has the potential to form an important source of sustainable food supply in a nature positive Scotland, it faces issues with its current environmental impact, as highlighted in Section A.[447] There appears to be an evidence gap on the environmental impact of finfish farming in Scotland (especially in light of the recent growth of the subsector).[448] Other forms of aquaculture, such as farming of oysters, mussels and seaweed, typically have far less negative environmental impact but are small economically relative to farmed salmon.[449] As shellfish aquaculture and seaweed farming are less capital intensive than finfish aquaculture, they have lower barriers to entry for new local business formation (which could contribute towards a just transition), whereas the finfish farming sector is highly concentrated in the hands of a few large companies, some of which are foreign-owned.[450]

The recently published Vision for Sustainable Aquaculture places a greater emphasis than before on developing the sector within environmental limits and improving community benefit. However, there is potential for conflict between these outcomes and others focused on attracting investment and improving international competitiveness, unless the former environmental and social outcomes are prioritised.[451] Given the recent issues with the sector's impact on nature mentioned above, there is a need for more evidence on the environmental impact of the sector to inform more effective regulations via national and regional marine plans, if the sector is to be compatible with the nature positive mission.

Recommendations:

- In light of the rapid growth of the sector, the likely risks to nature from certain forms of aquaculture and the lack of detailed evidence on the sector's impact on nature, continue to invest in building the scientific evidence base as a foundation for how the sector is regulated.

- Direct funding towards lower-impact forms of aquaculture, such as shellfish aquaculture and seaweed farming. Consider options for incubating local start-ups in these forms of sustainable aquaculture. There is also potential to apply stricter conditions to the Marine Fund Scotland grants, requiring that all projects address biodiversity outcomes, which would favour the aforementioned forms of aquaculture.
- Prioritise environmental outcomes in the upcoming sectoral vision, with an outlook that frames the economic sector as existing within Scotland's ecosystems, rather than a focus on mitigating the damage from the sector or framing environmental outcomes as an added bonus to economic growth.

5.2.6 Supporting private investment

A range of perspectives on the role of private finance in achieving the nature positive mission is offered by the international literature. Most studies agree that private finance will have some role to play, since the scale of investment needed exceeds the available public finance mechanisms and the pool of private capital is far larger than public funds.[452] The SG's current approach supports a heavy reliance on private finance for both the net zero[453] and nature positive[454] missions. However, it is important to consider the implications of this approach, as outlined in Section A of this report. There are potential issues to applying private finance in some cases due to scale, profitability and the need to ensure a just transition that fairly shares the benefits and costs of transition investment.

A more detailed assessment is needed of where private finance is most appropriate. The current estimate of the scale of private finance required for nature in Scotland (£20bn over ten years, based on a 2021 Green Finance Institute study)[455] operates on the assumption that no additional public funds can be committed to this investment - calculating the gap between the authors' estimates of the cost of nature investment to achieve current strategies, and the existing public spending committed. As noted in Section A, this significant assumption should be subject to closer scrutiny, by developing a more detailed analysis of the suitability of different nature investments for private investment and the other options for funding.

As it implements its commitment to a public sector partnership to develop a high integrity, values-led market for responsible investment in natural capital, the SG should incorporate the lessons from past use of blended finance, including enhanced "transparency and scrutiny of how value for money is considered as part of decision making, the costs and benefits of using private finance, and the management of risks and outcomes delivered".[456] Binding social and environmental outcomes, similar to those expressed in the Interim Principles for Responsible Investment in Natural Capital, would also help to ensure investments achieved their nature positive aims.

In addition to raising additional funds through progressive taxation (e.g. income tax for higher earners), other alternatives to blended private finance include public borrowing and green bonds (albeit under current powers this is capped at £450m per year),[457] negotiating an increase to borrowing limits and capital grants with the UKG or significant legislative change to allow bond issuance and lending to public bodies by the Scottish National Investment Bank.[458] Additional options include crowdfunding digitally for green investments from citizens through models such as Community Municipal Investments, which is being implemented currently by a handful of local authorities in England to fund clean energy investment.[459]

Recommendations:

- Conduct a bottom-up multi-criteria assessment of required nature investments that assesses where private investment is more or less suitable and considers alternative public funding options, to generate a clearer picture of the finance gap for nature investment.
- Ensure that any private investment in nature positive projects is governed by binding criteria for social and environmental benefit such as those expressed in the Interim Principles for Responsible Investment in Natural Capital, and that the details of blended finance arrangements are subject to sufficient public scrutiny in line with the recommendations of Audit Scotland on PFI approaches.
- Assess the potential for certain nature investments to be funded through green bonds and the options for green bond issuance.
- Consider options for funding nature positive investment through progressive taxation powers that are currently available, such as the top rate of income tax.
- Work with Westminster to secure powers for broader forms of taxation such as land tax, wealth tax or corporation tax, and an increase to borrowing limits and capital grants where the relevant investment is required by the net zero and nature positive missions.

5.2.7 National measures of success and incorporating biodiversity into government policy

The international literature on achieving a nature positive economy places substantial emphasis on the adoption of national measures of success that are broader than traditional growth and output metrics, such as including measures of natural capital alongside financial or physical capital.

The SG already has 81 indicators within its National Performance Framework, including the Natural Capital Asset Index (NCAI), giving it a solid foundation from which to further incorporate these indicators and approaches. NatureScot notes that "the NCAI is a good indicator of terrestrial habitats'

contribution to wellbeing, but it does not account for Scotland's considerable marine habitats and does not demonstrate changes in biodiversity or a habitat's resilience to outside pressures." They suggest that "some of these shortcomings can be assessed using the newly developed ecosystem health indicators", but it doesn't appear that these are being routinely used by the SG.

The next step after developing improved measures of success is to incorporate them into the everyday operations of the SG. As noted in Section A, this would involve mainstreaming biodiversity and natural capital into all relevant strategies, plans, programmes, policies and projects; setting time-bound targets, roles and responsibilities (in the Government) on biodiversity; strengthening inter-ministerial coordination on biodiversity; and developing indicators to monitor progress on the mainstreaming of biodiversity within the Government.[460] When implementing the new nature restoration targets contained in the forthcoming Natural Environment Bill, there will be an opportunity to advance the process of mainstreaming biodiversity across the Government. This could be done by requiring contributions towards nature restoration targets across different Government portfolios, in a similar way to the contributions to statutory climate targets and reporting that are already in use.

Complementing this approach, biodiversity goals could also be applied directly in fiscal policy. To do this, the SG could use green budgeting tools such as social cost-benefit analysis that includes nature outcomes; quantify its own biodiversity-related spending and that of the Scottish National Investment Bank; and assess the impact of public spending on biodiversity with a focus on the expenditure that harms biodiversity.[461] Budget proposals are assessed against climate change (emissions) impacts at present but not against biodiversity impacts.

Recommendations:

- Continue to develop the NCAI to improve its coverage of marine habitats and other important outcomes raised in assessments.
- Incorporate the nature positive mission into all future SG policies and strategies (starting with the targets from the forthcoming Natural Environment Bill) and assess ways to monitor this mainstreaming of biodiversity (e.g. regular reviews to check progress) and potential to set up new inter-departmental groups to improve coordination on the nature positive mission.
- Apply green budgeting to quantify the public spending contributing to improved biodiversity in each year's budget, with an aim to increase this as a proportion of total SG spending.

- Assess the biodiversity impacts of budgets in a similar way as is currently done for net zero.
- Conduct an assessment of the negative biodiversity impacts of current public spending, which should include an analysis of subsidies to land-based and extractive economic sectors and tax treatment of these sectors.

5.2.8 Business disclosures and financial and companies regulation

The gap in understanding among companies and the financial sector on their nature-related impacts, dependencies and risks often leads to nature being invisible when key decisions are made and supports conditions in which businesses continue to degrade biodiversity.[462] There are various ways in which governments could increase the consideration of nature by companies through the regulation of business and financial disclosures.

As outlined in Section A of this report, the SG is already working with public bodies and via Scottish Enterprise to help them better align their decision-making with the net zero, nature positive and circular economy missions. Financial and companies regulations are reserved policy levers, which limits their current immediate use for these missions in Scotland, but there may be opportunities for collaboration with the UKG to strengthen use of these levers.

One recommendation that is more relevant to the SG is to embed biodiversity goals in core public finance institutions and policy, including in climate finance facilities and national planning. For example, the Scottish National Investment Bank has a mission for net zero but not one explicitly focused on a nature positive economy.[463] Given that the Bank's current missions are likely to lead only indirectly to investments that improve biodiversity (e.g. through its investments in afforestation for net zero reasons), it would be a positive step to give the nature positive goal a similar level of priority to net zero by incorporating it into the Bank's missions directly.

Recommendations:

- Include a more deliberate emphasis on creating a nature positive economy in the missions of the SNIB
- Collaborate with Scottish businesses to increase the rate of voluntary measurement and disclosure of nature-related risks and impacts
- Explore options for influencing UK-wide financial and companies regulations to require nature-related disclosures by companies and the consideration of nature risks in financial decision-making

5.3 Circular economy recommendations

As outlined earlier in this report, the level of circularity in Scotland's economy at present is far lower than other peer countries, meaning significant further

progress is needed. Waste reduction and recycling targets are ambitious but are likely to be missed without large-scale and rapid system change.

The initial route map to 2025 consultation highlighted several new measures across different packages, targeting specific areas ranging from household recycling to circular construction practices. The approaches suggested in the route map are comprehensive but governance and delivery will pose significant challenges – as is evident with the attempts to roll out the deposit return scheme which has already been deferred by several months. Some directions for further progress towards a circular economy, based on what has worked in other countries, are outlined in the recommendations below.

Recommendations:

- Provide incentives for businesses to invest in improving product and process standards, embedding circular practices from cradle to grave. The Netherlands consistently stands out as a pioneering example for business investments in a circular economy, driven by tax breaks and incentives such as the Environmental Investment Allowance and Arbitrary Depreciation of Environmental Investments, where firms can recoup taxes on profits commensurate to their investments in reducing their material footprint.464 These incentives have translated to an investment of €3.5bn in 2022 in the Netherlands compared to just £1.5bn over the last four years in Scotland.465 Such fiscal incentives, though powerful, are reserved to the UKG and Scotland should actively call on the UKG to strongly consider such measures, extending them to incentivising domestic households alongside businesses.
- Setting a clear target for reduction of per capita material use and intensity would be important in signalling intent and building the circular economy strategy around. Currently at 18.5 tonnes of material use per capita, Scotland needs to chart a path to reducing this to 8 tonnes, which is deemed sustainable. More broadly, and in accordance with the recommendations of several Scottish environmental charities, we recommend the Government adopt a similar governance approach to meeting its circular economy outcomes as it does on carbon targets. This could be done by requiring and tracking contributions towards circular economy goals from different Government portfolios, as is currently done for statutory climate targets.
- Explore how Extended Producer Responsibility (EPR), which exists in sectors such as plastic packaging, could be extended to the textile sector, with the aim of reducing the volume of textile related products consumed per capita and cutting down the waste associated with textile production.
- Explore specific incentives for consumers and businesses to promote the product-as-a-service model that encourages leasing and sharing of goods. Car-pooling, renting power tools or sharing company printers and

copiers are some examples where employee incentives such as successful bike to work schemes could be replicated.

- Fully integrating Scotland's climate change plans with any upcoming circular economy strategy will be critical in ensuring targets, policies, their governance and delivery are aligned.
- We recommend Scotland follow the example of Sweden and strongly consider consumption-based emissions in its climate change and circular economy plans. This could begin with using public money, through local and national procurement, to identify and drive down consumption emissions, subsequently expanding it to private investment.

5.4 Cross-cutting recommendations

5.4.1 Taxes, charges and fees

Taxation has the potential to support the net zero mission by dis-incentivising certain forms of economic activity that increase carbon emissions. As outlined in Section A, measures such as road user charging, local parking charges and permits, and workplace parking levies have the potential to drive a reduction in car travel and encourage a shift in favour of more sustainable transport modes. This could help to address the risk of missing net zero targets relating to a 20% reduction in car kilometres by 2030. Further taxation levers that could be applied to reduce car kilometres, such as vehicle excise duty and fuel duty, are reserved to the UKG. Another area of transport emissions where action is needed according to the CCC is in aviation, and there is potential for a well-designed Air Departure Tax to be used to disincentivise some air travel without disproportionately affecting those most vulnerable (see Section A). In nature-related sectors, there is potential to remove existing non-domestic rates exemptions to raise revenue for nature restoration and to put these sectors on a par with other industries and land uses. It may also be possible to use the Land and Buildings Transaction Tax (LBTT) to help to discourage the concentration of land ownership by adjusting its application to owners of multiple landholdings. The OECD recommends that governments should apply biodiversity-relevant taxes as part of a suite of instruments to drive a transition to a nature positive economy, which could include a tax on pesticides or on fertilisers, albeit a lack of devolved powers may form an obstacle to introducing these taxes.

Recommendations:

- Accelerate the introduction of road user demand management schemes (before 2025) to achieve the required reduction in vehicle kilometres travelled by car, and work with local councils to maximise the use of road user charging, parking permits, charges and workplace levies to disincentivise unnecessary car journeys.

- Using powers under the Air Departure Tax, develop and introduce a tax measure that is progressively structured to reduce unnecessary air travel in a just way. This could potentially take the form of a frequent flyer levy (if administrative and legislative circumstances allow for this) or an air departure tax with first-flight discounts.
- Remove the exemption from business rates for timber companies and finfish aquaculture firms.
- Raise the level of LBTT for agricultural and forestry land on par with the rate for residential land, and consider options for an LBTT surcharge to larger landholdings or multiple plots of land with the same owner.
- Explore options (in light of Scotland's devolved powers and the Internal Market Act) for implementing taxes on pesticides and fertilisers to reduce their use in agriculture, forestry and aquaculture.

5.4.2 Skills and advice

The transition to a net zero and nature positive economy will require particular skilled workers. For net zero, shortages of skills have been identified in tree-planting, peat restoration, data analysis and project management for the local delivery of complex buildings decarbonisation projects.

Skills policy needs to not only train up new entrants to the workforce, but also equip the current workforce with the necessary skills to contribute to the low carbon economy. Policies on skills actively align with wellbeing outcomes, but more detail is needed on skills needs and policies for outcomes like nature restoration and circular economy. For example, the CESAP mentions the importance of circular economy skills but does not provide a clear methodology that defines these skills or any strategy.

The CESAP likewise does not offer much detail on nature-based jobs and skills but could be refined using evidence from a 2020 NatureScot assessment of the topic.[466] While the Nature-based Jobs and Skills Action Plan 2022-23 provides a detailed list of the nature-based jobs needed for the future and actions to develop these, it lacks a clear timeline. [467]

Recommendations:

- Produce a clear timeline for the development of skilled workers, setting out the actions that are needed to deliver the necessary skills over the next ten years.
- In addition to developing a pipeline of skilled personnel newly entering the workforce, place an equal focus on ensuring that the current workforce has the necessary skills to contribute to the net zero, nature positive and circular economy.

- Work with all relevant agencies, including Skills Development Scotland, the Scottish Funding Council, and the Scottish Cities Alliance, to ensure action in the following areas:
    - A better understanding of the principles of a circular economy and the identification of the skills that are required to deliver it
    - Tree planting and peatland restoration skills development programmes to scale up the number of entrants into these sectors and build a skilled workforce large enough to deliver the requisite rates of activity for net zero in line with CCC advice
    - Identification of key skills gaps in the sectors critical to the transition to a nature-based economy and development of training in those occupations
    - Supporting Local Authorities to remedy the technical and analytical skills gap relating to the decarbonisation of buildings
    - Developing workforce skills to build and maintain zero-emission vehicles
    - Encouraging more students into STEM subjects throughout primary and secondary education
    - Consider the merits of developing Higher Technical Qualifications
    - Developing skills in Green Finance options
    - Providing careers advice and awareness of the green economy targeted at young people (14 to 19) and adults (25 to 44)

5.4.3 Innovation and research and development

Innovation and R&D policy for net zero and nature positivity in Scotland can do more across both the public and private investment spheres, including across higher education research and small and large business R&D.

As a starting principle, the SG should be aware of the most effective ways it can influence R&D and innovation. Much private business investment in R&D is currently incentivised by the system of tax reliefs which is not a devolved competency for the SG. Additionally, a proportion of the higher education institutional R&D system is supported by UKG funded research councils and departmental funding.

Nonetheless, the SG can still have significant impact across the academic and business spheres of R&D and innovation in two key ways, as follows:

➢ *Setting a prioritised framework for institutional R&D*

The SG should set a clear framework of principles and priorities for the areas in which higher education and collaborative R&D can have maximum impact in Scotland for both net zero and nature positive outcomes. This should

provide guidance and leadership to both business and research institutions as to the strategic areas in which the SG will support and encourage new R&D. In particular this should include explicit encouragement and support for R&D that:

Has a spatial focus which reflects the different requirements of the significantly diverse geographies of Scotland. At present, much research takes place within research institutions within Scotland's central belt and is often not spatially focused or diversified.

Is specifically targeted to areas which interact with and support the public investment capabilities of the SG. For example, this would include R&D in just transition areas which will need some degree of public-led initiative, particularly because they involve networks or spatial requirements which mean they have features of public goods, first mover dis-benefits or natural monopolies, and which will therefore be unlikely to be delivered effectively or at all by the private sector on its own. For example this would include:

- Large energy storage and transmission facilities
- Networks – for example for alternative heating, electric charging, etc.
- Public transport stocks and inter-modal infrastructure.

Focuses on encouraging R&D in the most hard to decarbonise sectors, which are the least attractive to most research because there are less easy-wins or clear next steps for R&D. These sectors will include: aviation, shipping, energy storage, construction materials.

Builds-in consideration of nature positive outcomes into net zero R&D and innovation, even if it requires broadening the scope and resource requirement of an R&D project. For example, ensuring that negative marine biodiversity impacts are considered and captured upfront in R&D for new offshore wind.

Building on the recently published National Innovation Strategy,[468] the SG should continue to formalise its support for innovation and R&D which tries to overcome the kinds of market failures as set out above. For R&D to achieve maximum impact, it needs to focus on the hardest market failures in the hardest to improve sectors. Formalisation of these strategic priorities could include a written framework identifying the ways in which the strategy's *Energy Transition* priority can support innovation for a net zero, nature positive and circular economy, as well as providing resources to work with R&D institutions or businesses to support applications for funding that best meet strategic priorities.

- *Understanding and mitigating against path-dependency in private sector R&D*

Scotland has good business support service organisations, but they need full understanding and ability to overcome private sector market failures in

business innovation and R&D for net zero and nature positivity. In particular, business support services provided – such as finance or start up support provided by SNIB or Scottish Enterprise – will need a strategy for overcoming existing problems of path-dependency within business R&D and innovation. The challenges of path-dependency mean that the most radical sector-changes required may not take place because it is easier for businesses to tweak or amend existing practices and approaches rather than adopt entirely different ways of doing business.

This means that greater levels of support should be made available for businesses who are able to show that they are investing in first-mover innovation, which has a clear rationale for how it will open new markets in clean technologies or services.

5.4.4 Procurement

The way in which the Scottish public sector spends on contracts can influence the development of economic activities that support the creation of a net zero, nature positive and circular economy and can shape economic behaviour. As outlined in Section A, there is potential to use this lever to switch food procurement to healthier vegetarian or vegan meals, which would directly reduce the public sector's impact and help to encourage a shift in diets among public workers and pupils. Procurement also offers a way to increase circularity in parts of the public sector while helping to develop more circular supplier companies in the process, and can be used to maximise social value outcomes such as job quality, diversity and skills development to encourage a just transition.

Recommendations:

- Switch food procurement to vegetarian food across all SG catering and explore a switch to vegan food as standard.
- Assess the potential to procure from circular economy product-service systems across all departments and implement a plan to increase the proportion of circular suppliers to the SG.
- Develop new contracting guidance for public procurement in sectors such as buildings and transport to secure outcomes relevant to the net zero, nature positive and circular economy missions, as well as broader outcomes on job quality, diversity and skills.

5.4.5 Consumer information

Consumer information, such as product labelling, may be a useful lever to encourage a shift in behaviour away from consumption that creates high emissions or damages biodiversity. Among the recommendations of the international literature on this, there is a focus on sectors with a major impact on nature such as meat and dairy production and fast fashion (the latter

through the production of materials). Labelling can be used to clarify the impact of a given product on emissions and nature and thus how compatible it is with a net zero and nature positive economy, though a caveat to this lever is that research has found that other factors such as price and convenience tend to have a larger influence on the food people purchase than information.[469] Consistent labelling of shelf-life can help to increase circularity in food systems.

Recommendations:

- Consider options for food labelling schemes to clearly show the emissions and nature impact of different foods to consumers at the point of purchase.
- Continue working with sectoral organisations to improve consistency of practice and labelling on shelf-life.

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