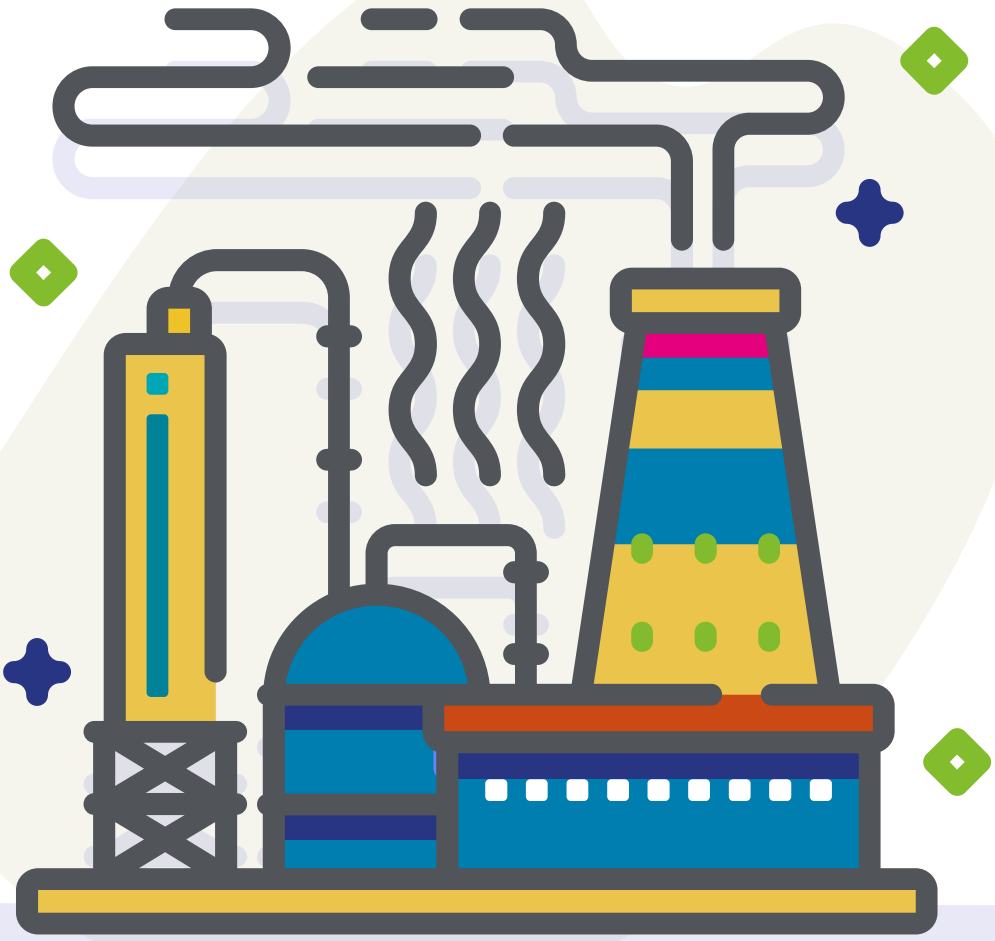
Baselining Inventory for Greenhouse Gas Emissions in the Highlands and Islands

EXECUTIVE SUMMARY



ekosgen

Practically Green

reference economic consultants

HIE
Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean

BACKGROUND AND STRATEGIC CONTEXT

Scotland has some of the most ambitious commitments to net zero and greenhouse gas reduction amongst advanced economies.

Through the Climate Change Act 2008,[1] the UK Government has committed to reducing emissions to net zero by 2050, with legally binding 'Carbon Budgets' being set as milestones towards this overall target. This caps the amount of GHG that can be emitted in the UK over a five-year period. The Climate Change Committee advises on the appropriate level of carbon budgets, each of which is set at least 12 years in advance to enable policymakers, businesses, and individuals time to respond. The carbon budgets, once accepted by Government, are legislated by Parliament. Six carbon budgets have been set to date, the most recent running up to 2037.

In Scotland, the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 sets a target to reduce Scotland's emissions of all greenhouse gases to net-zero by 2045 at the latest – five years ahead of the UK commitment. Reflecting this, climate change mitigation and adaptation and transitioning to net zero are underpinning principles of the Scottish Government's National Strategy for Economic Transformation (NSET).[2] This strategy sets out the priorities for Scotland's economy over the decade to 2032 – termed the *decisive decade* - with an overarching vision for *a wellbeing economy: thriving across economic, social and environmental dimensions*. It includes the three key ambitions for a fairer, wealthier, and greener Scotland, with the latter focused on demonstrating global leadership in delivering a just transition to net zero, creating a nature-positive economy and rebuilding natural capital. Subsequent Programmes for Government build on these commitments to address the Climate Emergency and restore Scotland's environment.

The Scottish Government's Draft Energy and Just Transition Plan[3] establishes the vision to 2045 for Scotland with regards to its energy system and how best to secure a just transition to net zero. It lays out the Government's route map in order to achieve this, reflecting the need for collaboration, a local approach and proper funding. Key ambitions set out in the document include generation of 20GW of additional renewable wind electricity by 2030, hydrogen providing 5GW (or 15% of Scotland's current energy needs) by 2030 and 25GW by 2045, and the phasing out of new petrol and diesel cars and vans by 2030 (with car kilometres reduced by 20%). It also extends to further decarbonisation action taken in industry, transport and heat and increasing contributions from solar, hydro, and marine energy.

The Environment Strategy for Scotland,[4] sets out a vision for Scotland, by 2045, to be *transformed for the better* as a result of restoring nature and ending Scotland's contributions to climate change. Related to this, Scottish Government have set targets to restore 250,000 hectares of degraded peatland by 2030 and to increase woodland cover from around 18% to 21% by 2032.[5]

Following the Climate Change Committee's latest progress report on emissions reduction in Scotland,[6] Scottish Government have confirmed that an interim target for a 75% reduction in Greenhouse Gases (GHG) by 2030 is currently out of reach. The Scottish Framework for controlling GHG emissions is now under review, and annual and interim targets are likely to be replaced by a system measuring emissions every five years (similar to the carbon budget approach adopted at UK level). Legislation is likely to be expediated to ensure the legislative framework better reflects the reality of long-term climate policymaking. In May 2024, the First Minister reiterated the Scottish Government's commitment to robust action to address the climate emergency by investment in green energy and infrastructure. This was cited as one of four priorities to be addressed in the run up to the next Parliamentary elections in 2026, alongside eradicating child poverty, growing Scotland's economy and improving Scotland's public services as an investment in Scotland's future health, equality, and prosperity.

While there are no statutory control or delegation of targets to sub-regions or sectors, it is widely recognised that the Highlands and Islands is well-suited for reducing carbon emissions and expanding renewable energy generation due to its abundant natural resources. A comprehensive understanding of our current emissions profile, renewable capacity and carbon sequestration opportunities is necessary to inform how we can effectively contribute to net-zero goals. To this effect, HIE commissioned research in 2023 to establish a greenhouse gas (GHG) inventory for the Highlands and Islands, providing a baseline on which progress against climate change targets can be measured. The study also assessed regional capacity in terms of renewable energy opportunities and explored carbon sequestration potential. The research was undertaken by ekosgen, in partnership with Practically Green and Reference Economics.

The research findings will inform mitigation and adaptation policies and support the development of both regional and more localised implementation plans for addressing the climate emergency and ensuring a just transition to net zero. This is core to HIE's Strategy 2023-2028[7] and also underpins the draft Regional Economic Strategy for the Highlands and Islands Regional Economic Partnership (HIREP) (recognising that a pan-regional, co-ordinated approach will be required to address the challenges associated with reducing greenhouse gas emissions across the region, within the timescales set out by climate change legislation).

METHODOLOGY AND SCOPE

While there are standardised processes and approaches to assessing GHG emissions, they are still in relative infancy, and are subject to ongoing revision and methodological improvements.

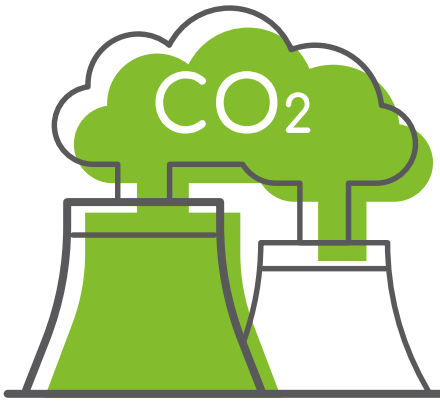
The study set out to establish a baselining inventory using a standard global methodology – the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC). However, it quickly became apparent that data was not available at sufficiently granular level for the sub-sectors outlined in the GPC. The UK local authority and regional GHG emissions national statistics dataset published by the Department for Energy Security and Net Zero (DESNZ) was then adopted as the primary data source for this exercise, given that it provides a consistent and regularly updated time-series against which progress can be tracked, and which facilitates comparison with Scotland overall. Given the top-down nature of its calculation in modelling, additional data was sourced where possible to provide more granular level analysis and address data gaps. In doing so, it was then possible to provide more detailed GHG emissions reporting on some (but not all) of the sectors and sub-sectors of the GPC. The main report explores these data gaps and variances in more detail, highlighting where compromises were made in assessing GHG emissions, and where data gathering needs to improve to better facilitate this measurement.

To provide consistent GHG measurement the term "Scopes" is used. The GPC distinguishes between emissions that physically occur within an inventory area (Scope 1), those that occur from the use of electricity, steam, and/or heating/cooling (Scope 2) and those that occur outside the area but are driven by activities taking place within the area boundaries (Scope 3). Scope 1 emissions may also be termed "territorial" emissions, because they are produced solely within the territory defined by the geographic boundary.[8]

In terms of emissions, figures in this report are based on territorial ("Scope 1") emissions for the following categories: transport; domestic; industry; commercial; public sector; agriculture; land use, land use change and forestry (LULUCF) and waste. The greenhouse gases covered include carbon dioxide, methane, and nitrous oxide, reported in carbon dioxide equivalent units (CO_2e).

In Scotland, the Climate Change Committee currently advocates the use of a GHG account to measure emissions on a territorial basis. Methodological differences, partly arising from attribution challenges, mean the baseline data presented for the Highlands and Islands does not align fully with the Scottish GHG statistics[9] published at national level. However, methodological consistency is sought as far as possible.

The Highlands and Islands baseline aimed to cover the HIREP geography. However, as a result of using the UK local authority and regional GHG emissions national statistics dataset, much of this was then limited to the six full local authorities[10] within the HIREP boundary, with some emissions estimates for Arran and Cumbrae based on alternative sources. Where more granular analysis was possible, it is reflected in the study findings. The baseline year for this exercise was 2019, the most recent (excluding COVID-19 years) for which data was available.



6,236 $ktCO_2e$ accounting for **15% of the Scottish total** (42,469 $ktCO_2e$).

Regional emissions declined by 20% between 2005 and 2019, although this lags the rate of decline across Scotland overall (33%).

Emissions per capita were higher than nationally (12.7 tCO_2e per capita versus 7.8 tCO_2e)

THE REGION'S GHG BASELINE

In 2019, the total territorial CO_2e emissions for the Highlands and Islands were estimated at 6,236 $ktCO_2e$ – accounting for 15% of the Scottish total (42,469 $ktCO_2e$). Regional emissions declined by 20% between 2005 and 2019, although this lags the rate of decline across Scotland overall (33%).

The Highlands and Islands covers 51% of Scotland's landmass and is home to 9% of its population. Given the region's vast area, emissions per km^2 were lower than nationally (0.15 $ktCO_2e$ per km^2 compared to 0.53 $ktCO_2e$). However, reflecting the low population density, **emissions per capita were higher than nationally (12.7 tCO_2e per capita versus 7.8 tCO_2e)** (Figure 1). Sub-regional variation is evident, with rates per capita highest in our island areas and lowest in Argyll and Bute (the only local authority area in the region where emissions per capita are lower than the national average). Much of the variation is driven by emissions arising from land management (see below).

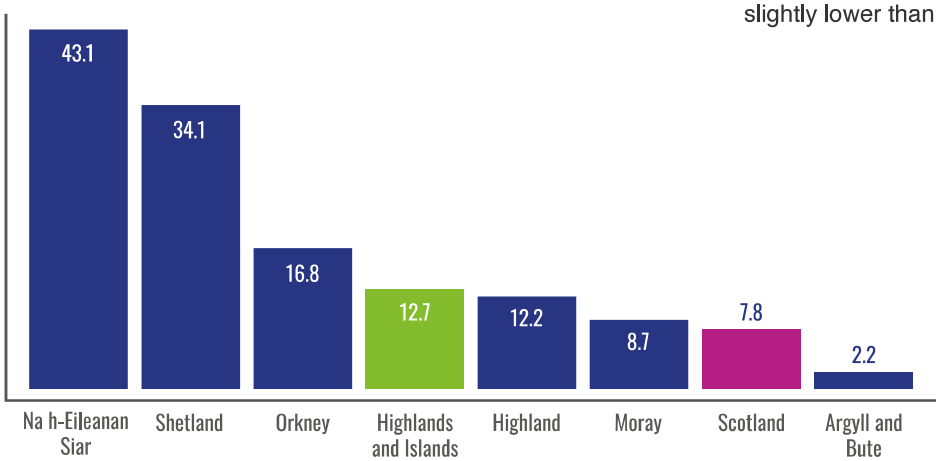
The top five sources of emissions in the region are agriculture, LULUCF, transport, domestic and industry (Figure 2). These are the same top five for Scotland overall, however the order and extent of contribution varies.

Within the region, the top two sources of GHG emissions are agriculture (26%, 1,605.0 $ktCO_2e$) and LULUCF (22%, 1,396.4 $ktCO_2e$). Together they account for just under half (48%) of the region's emissions compared to around a quarter nationally (19% and 6% respectively – ranking fourth and fifth in terms of contribution). The Highlands and Islands accounts for a disproportionately high share of Scotland's total emissions from these sectors – it makes up 51% of Scotland's LULUCF emissions, and 20% of agricultural emissions.

Transport (excluding aviation and ferries) accounts for just under a fifth of the region's GHG emissions (19%, 1,171.8 $ktCO_2e$). This was followed by domestic (14%, 898.4 kt CO_2e) and industry (13%, 780.1 $ktCO_2e$) emissions. While these make a substantial contribution to regional emissions, relative to Scotland overall they are disproportionately lower. For Scotland, transport, domestic and industry are the top three sources of emissions.

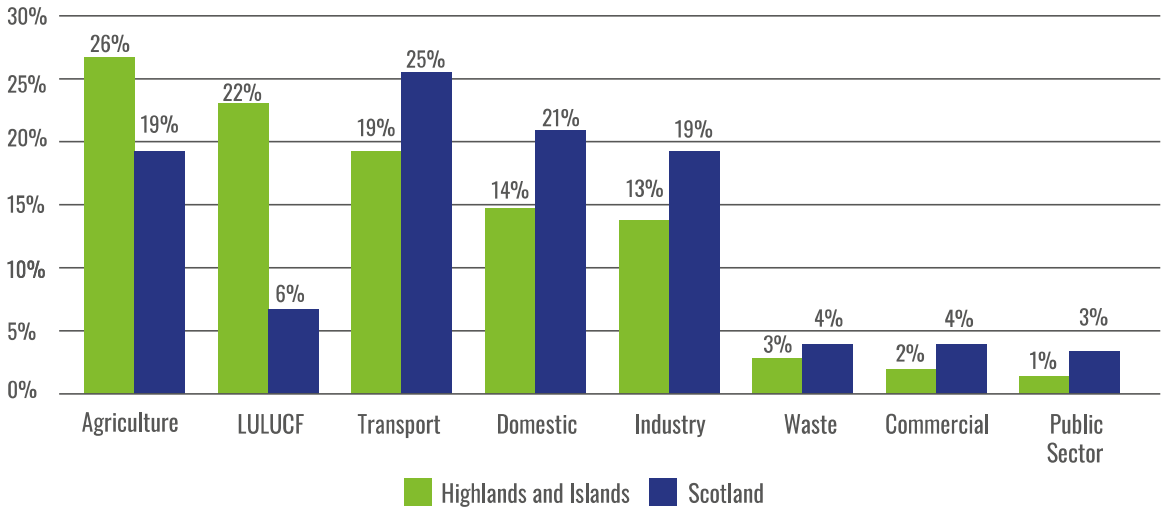
Both regionally and nationally, waste (3%, 159.5 $ktCO_2e$ regionally) and the commercial (2%, 136.9 $ktCO_2e$) and public sectors (1%, 88.4 $ktCO_2e$) accounted for a relatively low share of emissions. (Figure 2). For all three, regional emissions were slightly lower than national.

FIGURE 1: GHG EMISSIONS PER CAPITA, 2019 (tCO_2e)



Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021.
No data available for Arran and Cumbrae as data is only available at the local authority level.

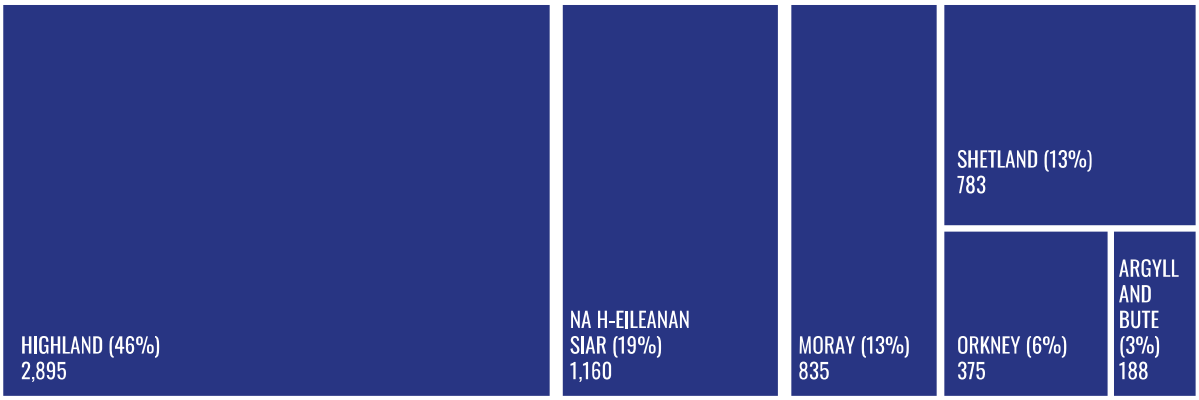
FIGURE 2: DISTRIBUTION OF TERRITORIAL GHG EMISSIONS BY SUB-SECTOR, 2019 (KT CO_2e)



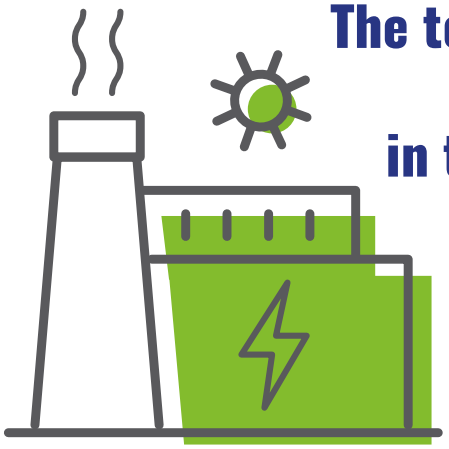
Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021. Regional figure excludes Arran and Cumbrae as data is only available at the local authority level.
Note: Transport excludes emissions from aviation and water-based transport (ferries).

Highland accounts for the greatest share (46%) of the region's total GHG emissions, followed by Na h-Eileanan Siar (19%). Argyll and Bute contributes the lowest share (3%), with effective land management having a positive impact in counteracting emissions from other sectors (Figure 3).

FIGURE 3: GHG EMISSIONS BY LOCAL AUTHORITY AREA, 2019 (KT CO_2e)



Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021. No data available for Arran and Cumbrae; data is only available at the local authority level.

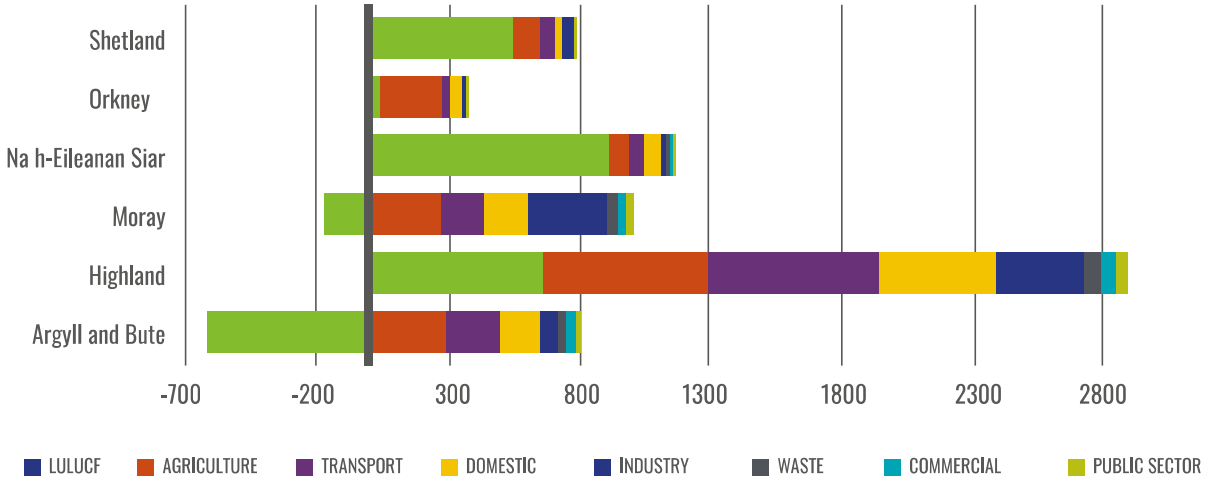


The top five sources of emissions in the region are:

1. AGRICULTURE
2. LAND USE, LAND USE CHANGE AND FORESTRY
3. TRANSPORT
4. DOMESTIC
5. INDUSTRY

There are notable sub-regional variations in terms of sub-sectoral emissions reflecting the size and population of each area, sectoral profile, and geographical factors such as the type of land and how this is managed (Figure 4). For Na h-Eileanan Siar and Shetland, LULUCF makes the greatest contribution to emissions, while in Argyll and Bute and Orkney it is agriculture. For Highland, both these sub-sectors along with transport are key emitters, whereas in Moray industry makes the greatest contribution (likely driven by the volume of distilleries and manufacturing businesses more broadly), closely followed by agriculture. It is worth noting that industrial emissions in Shetland are not particularly high despite being home to the Sullom Voe Oil and Gas Terminal – this is because emissions have been apportioned at end-user basis (at the point of consumption) rather than at source.

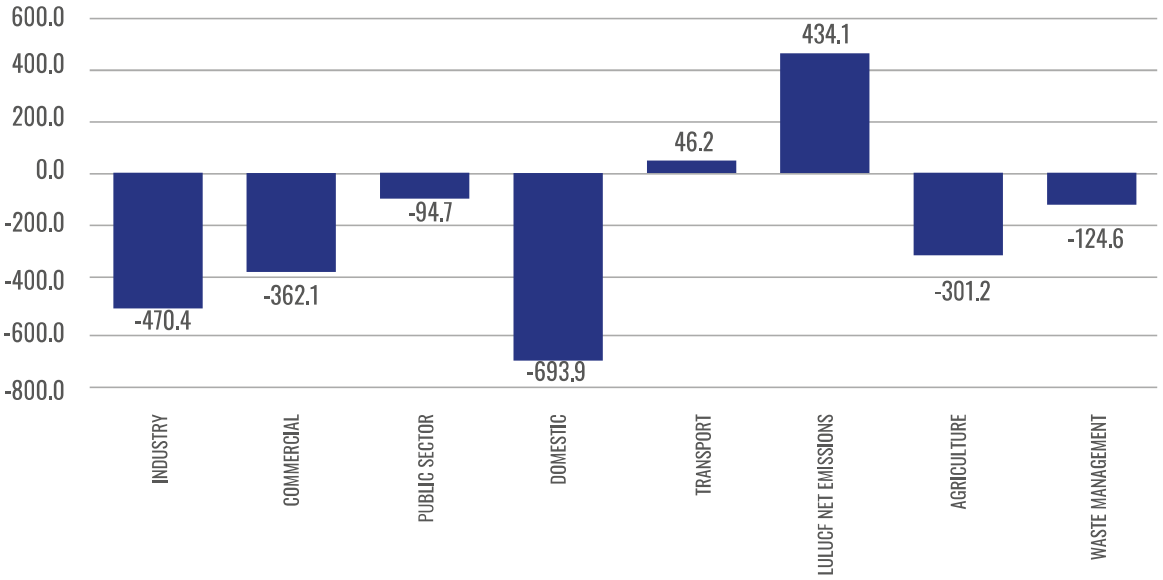
FIGURE 4: DISTRIBUTION OF TERRITORIAL GHG EMISSIONS BY LOCAL AUTHORITY AREA, 2019 (KT CO_2e)



Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021. No data available for Arran and Cumbrae; data is only available at the local authority level.

While overall, regional GHG emissions declined between 2005 and 2019 the nature and extent of change varied across the key sectors (Figure 5). There was a decline in emissions for all sectors except for transport (where emissions increased by 4%) and LULUCF (up 45%).

FIGURE 5: HIGHLANDS AND ISLANDS – CHANGE IN GHG EMISSIONS BY KEY SOURCES, 2005-2019 (KT CO_2e)



Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021. Regional figures exclude Arran and Cumbrae as data is only available at the local authority level.

Carbon Neutral Islands

The Carbon Neutral Islands (CNI) project is a 2021-2022 Programme for Government commitment aimed at supporting the islands of Cumbrae, Barra and Vatersay, Hoy and Walls, Islay, Raasay, and Yell to become carbon neutral by 2040. It provides an opportunity to demonstrate the low carbon energy potential of islands as hubs of innovation in relation to renewable energy and climate change resilience.

The Community Climate Action Plans developed for each of the islands provide a useful emissions profile highlighting target areas to be addressed to achieve net zero and setting out a range of actions for communities to implement. The profiles illustrate the variation across islands in terms of the nature and extent of emissions by source. As with our regional emissions profile, it is clear that LULUCF is fairly integral to reducing emissions at individual island level, and its success in doing so is evident in Cumbrae and Raasay. Transport decarbonisation and the energy transition will also be key.

CARBON NEUTRAL ISLANDS, EMISSIONS BY SOURCE (TCO_2e)

	LULUCF	Agriculture	Waste	Energy	Transport	Total
Barra and Vatersay	17,334	1,210	898	6,564	13,197	39,203
Cumbrae	-3,200	1,700	400	3,523	3,500	5,923
Hoy and Walls	16,928	4,652	204	3,193	2,490	27,467
Raasay	-906	513	177	1,677	789	2,250
Yell	70,742	3,887	306	7,906	6,048	88,889
Islay	not available	not available	9,500	68,300	21,500	not available

Source: Community Climate Action Plans for each Island - https://cni.scot/community-climate-action-plans-ccaps/

A MORE DETAILED LOOK AT EMISSIONS BY SUB-SECTOR

A more detailed overview of emissions for each of the sub-sectors is provided below. This draws on a range of additional data sources to help address gaps identified within the baseline emissions, and to explore drivers and thus key areas to address within sub-sectors.

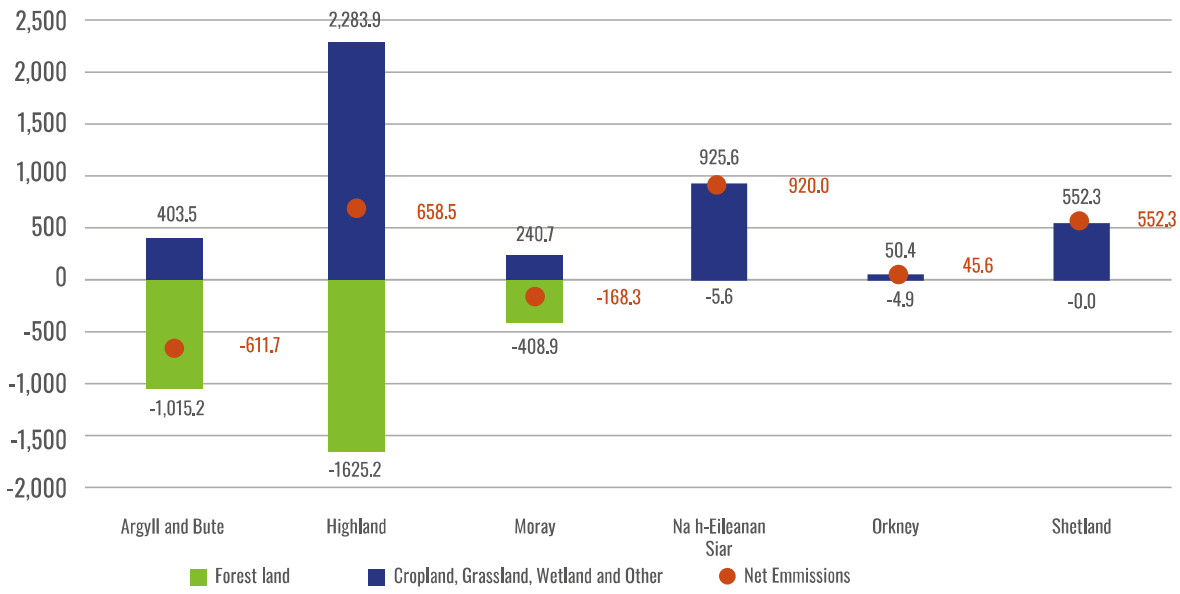
AGRICULTURE (26% OF REGIONAL EMISSIONS)

Most of our regional agricultural emissions (63%) are associated with livestock and just under a fifth (19%) from soils. Without addressing emissions related to agriculture, we are unlikely to make a substantial shift in the region's emissions profile. Change will involve consideration of land use and agricultural practices, but with competing options for land use there is undoubtedly a balance to be struck in terms of lowering emissions, maintaining biodiversity, and maintaining desirable outputs such as food production. Agritech has a role to play in the latter.

LAND USE, LAND USE CHANGE AND FORESTRY (LULUCF) (22% OF REGIONAL EMISSIONS)

Land can be both a source and sink of GHG, contributing both positively and negatively to emissions. In 2019, the region was a net contributor of LULUCF emissions, with this also accounting for just over half (51%) of the national total. Sub-regional variation was evident with Argyll and Bute and Moray both net sequesters of carbon, mainly due to their large forestry plantations. While Highland also sequestered carbon through forestry, this did not balance out emissions from other land uses (cropland, wetland, grassland etc). The Island local authorities have net positive LULUCF emissions, with agricultural land management and peatland degradation, and the absence of large forestry plantations all being factors of this (Figure 6).

FIGURE 6: LAND USE, LAND USE CHANGE AND FORESTRY GHG EMISSIONS, 2019 ($KTCO_2e$)



Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021. No data available for Arran and Cumbrae; data is only available at the local authority level.

63% OF AGRICULTURAL EMISSIONS ARE ASSOCIATED WITH LIVESTOCK AND JUST UNDER A FIFTH (19%) FROM SOILS

TRANSPORT (19% OF REGIONAL EMISSIONS)

The national UK GHG emissions statistics dataset identifies transport as the predominant source of national GHG emissions (25%), although our regional contribution to this is disproportionately lower (our road and rail transport accounting for 11% of Scotland's total). As the dataset only captures land-based transport (it excludes aviation and water-based transport) a range of additional data sources were explored to provide a broader overview of emissions from all transport types.

Unsurprisingly, most of our regional transport emissions relate to road transport and more than half of this can be attributed to petrol and diesel cars (56%) rather than other vehicle types (Figures 7 and 8). The distribution between personal (62%) and freight (38%) services is broadly similar to nationally (64% and 36%). Our road transport emissions are in line with our regional share of vehicles and vehicle km (11%), although if we look at this per km of road (64 tCO_2e) and per registered vehicle (2.9 tCO_2e), our emissions are actually lower than nationally (180 tCO_2e and 3.5 tCO_2e respectively).

FIGURE 7: ESTIMATED SHARE OF GHG EMISSIONS BY MODE OF TRANSPORT ($KTCO_2e$)

Source: DESNZ - UK local authority and regional greenhouse gas emissions national statistics: 2005-2021; Transport Scotland - assessment of the domestic Scottish ferry fleet based on 2019 data; HIAL Carbon Footprint 2023 report based on analysis for 2020.

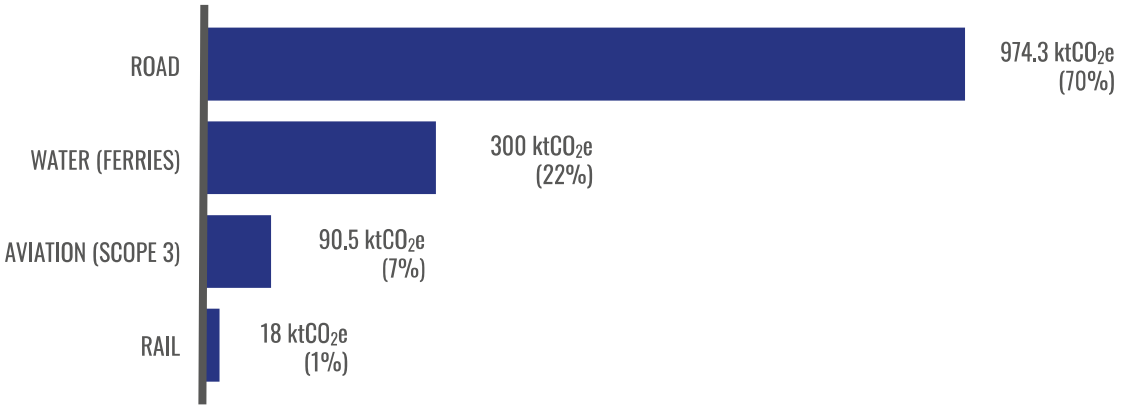
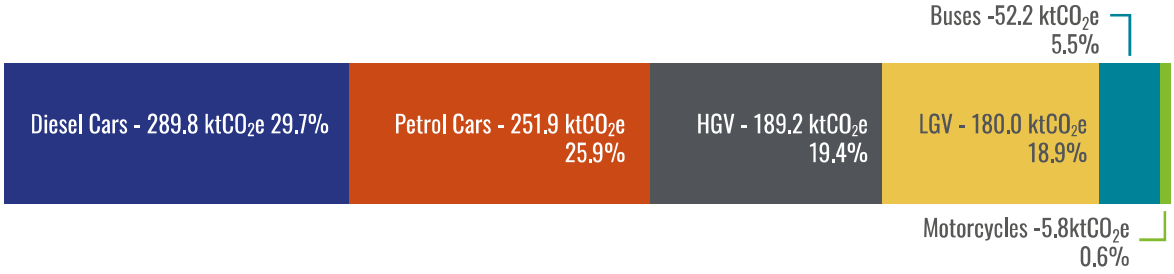


FIGURE 8: ROAD TRAVEL GHG EMISSIONS BY TYPE OF VEHICLE (KT CO_2e)

Source: Sub-national road transport fuel consumption in the United Kingdom, 2005 to 2021, Department for Energy Security and Net Zero. Data only available to local authority level, and so excludes Arran and Cumbrae. Figures may not sum due to rounding.



In terms of water-based transport (ferries) and aviation, alternative data sources estimate emissions as being between 250-300 $ktCO_2e$ for ferries,[11] and around 90.5 $ktCO_2e$ for aviation (based on scope 3 emissions). This illustrates that emissions from ferries and aviation are comparatively lower than those from road transport. However, aviation emissions per passenger are typically higher than for other modes of transport. Reflecting, in part, the absence of rail infrastructure in many parts of the region, rail emissions are relatively low (18 $ktCO_2e$). The region's rolling stock is currently diesel-powered, with no electrification of lines as yet.

Across all modes of transport, there are already a range of activities in place to support the transition to net zero. This includes Government targets to phase out the need for new petrol and diesel cars by 2030 and to decarbonise flights in Scotland by 2040.[12] Replacement programmes for the region's ferry fleets are embracing a move to vessels that use more sustainable fuel sources. Through projects such as the Sustainable Aviation Test Environment (SATE)[13] the region is leading the way on trialling and demonstrating hybrid and electric air transport. Regional groupings such as HITRANS are already supporting partnership working on these issues.

CO_2e EMISSIONS FROM PROPERTIES IN THE REGION ARE ESTIMATED TO BE 6.0 TCO_2e COMPARED TO 4.3 TCO_2e NATIONALLY.

DOMESTIC (14% OF REGIONAL EMISSIONS)

While domestic emissions are the second greatest source of emissions nationally, the regional contribution to this is proportionate to our share of properties (both 10%). However, average (mean) **CO_2e emissions from domestic properties in the region are estimated to be 6.0 tCO_2 e (higher still in our islands) compared to 4.3 tCO_2e nationally**. This reflects the nature of our housing stock, with just over a quarter of dwellings (27%) having an environmental impact rating[14] of C or above, significantly lower than the proportion nationally (41%). Social housing (housing association and local authority housing stock) was more likely to have an environmental impact rating of C or above – 50% and 33% respectively did so – reflecting that targets for minimum energy efficiency standards have been in place for the social housing sector for the last decade. Contributory factors to lower environmental impact ratings include a reliance on carbon-intensive fuels such as oil, LPG and solid fuels for heating and energy (31% use these fuel sources compared to 8% nationally), distance from on-grid energy supply and the age and construction of the housing stock. This is coupled with a high proportion of dwellings being severely or very severely exposed to wind driven rain (56%), rising to 100% for island dwellings. This typically results in higher fuel consumption in heating homes, a factor in higher levels of fuel poverty in parts of the region. Enhancing energy efficiency of domestic dwellings and transition to green energy sources is critical. However, the financial cost of transitioning as well as capacity within the supply chain to do so are significant challenges. A complicating factor is that the nature of housing stock limits the retrofit solutions which can be applied. Bespoke and innovative approaches are essential - one size does not fit all.

INDUSTRY (13% OF REGIONAL EMISSIONS)

The region accounts for 10% of industry emissions in Scotland, but 24% of Scotland's industry business base. **Emissions per industrial business are lower in the region (115.1 tCO_2e) than nationally (279.1 tCO_2e)**. Greater reliance on fuels other than gas for the provision of energy and heating will be one factor driving regional industrial emissions. The region does have a smaller number of high energy users relative to Scotland overall, and these are currently concentrated in some parts of the region such as Highland and Moray where there are more distilleries and large manufacturing plants. As an energy intensive industry, the whisky sector is leading the way in decarbonising its production processes; the Scottish Whisky Association has its own sustainability strategy which commits the sector to reaching net zero emissions in its operations by 2040. Many distilleries are implementing a range of energy efficiency and waste reduction measures, and some are also assessing and looking at ways to lower emissions in their supply chain. HIE's business panel research also suggests that businesses across the region have been taking a range of actions to increase energy efficiency of their premises and reduce emissions in their operations. However, this needs to happen at scale and be ongoing.

WASTE (3% OF REGIONAL EMISSIONS)

Waste emissions are comparatively low, both regionally and nationally, with the region accounting for around 11% of the national total. Within the region, the majority of waste emissions are from landfill (71%) with the remainder attributable to waste management. Modelling based on calculating the whole-life carbon impacts of waste suggests that **the carbon impact per person of household waste is higher in the region (1.2 tCO_2e)** than nationally (1.0 tCO_2e). The way in which waste is managed is changing, with an increasing focus on the amount and types of waste being generated and the move to a more circular economy, reducing the volume of waste disposed in landfill. However, landfill and waste treatment, and waste transfer all continue to contribute to GHG emissions.

COMMERCIAL (2% OF REGIONAL EMISSIONS)

Emissions from commercial businesses, both regionally and nationally, are comparatively lower than those from other sub-sectors. The region accounts for a relatively low share of the national total (9%), in line with its share of Scotland's commercial business base (10%). Commercial emissions per employment in the region are in line with the national figure (both 1.1 tCO_2e), **but emissions per business are lower (9.48 tCO_2e versus 11.44 tCO_2e)**. Within the region, most emissions are attributable to electricity consumption in commercial properties. Again, the age and condition of premises will be impacting on their energy efficiency.

PUBLIC SECTOR (1% OF REGIONAL EMISSIONS)

This sector contributes the lowest level of emissions, both regionally and nationally (3%). The region accounts for a relatively low share of Scotland's public sector emissions (6%) with **the rate per employment (1.3 tCO_2e)** lower than nationally (1.9 tCO_2e). The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 sets out specific climate change duties for all public bodies, and a requirement to submit an annual report detailing their compliance with these. Reflecting this, sustained policy interventions and funding have supported the evolution of the public sector estate to be more energy and resource efficient. However, there is still a significant legacy of old, high energy consuming and GHG emitting buildings that will be costly to transition.

Arran and Cumbrae

Arran and Cumbrae, despite being within the Highlands and Islands Regional Economic Partnership area, is not included within the regional GHG emissions profile, based as it is on local authority level data.

As part of the Green Islands Net Zero Project, both islands have developed Net-Zero Carbon Action Plans to accelerate their path to Net Zero by 2030. Within these, the following GHG emissions have been estimated:

- Arran: 59.5 $ktCO_2e$; 13.11 tCO_2e per capita
- Great Cumbrae: 5.7 $ktCO_2e$; 4.46 tCO_2e per capita

Emissions are not directly comparable with regional and national emissions because of methodological differences. Individual emissions profiles do provide a strong basis on which to set actions, and many of these align with what is seen regionally. Recommended actions within each plan cover: energy efficiency in buildings; community energy buying; renewable energy generation and heat production, alternative fuels, electric vehicles, public transport improvements, and skills and training to support the transition. They also set out suggested actions on carbon offsetting and sequestration to bolster net zero activity.

Source: Green Islands Plans: Arran Eco Savvy Community – http://arranecosavvy.org.uk/green-islands-plans/

Carbon sequestration

The region has a potentially disproportionate share of carbon sequestration opportunities, in terms of grassland, peatland, and afforestation (also in terms of our marine environment although that was beyond the scope of this study).

To support the fulfilment of the Scottish Government's commitments on climate change and biodiversity, a target of increasing woodland cover from around 18% to 21% by 2032 has been set.[15] Currently, around half of Scotland's woodland and forestry is in the Highlands and Islands, primarily within Highland (31%) as well as Argyll and Bute (14%) and Moray (4%) (although coverage is more concentrated within Moray and Argyll and Bute, covering around 28% of each). In addition, the region is home to 71% of land in Scotland capable of supporting rough grazing only (2,864,551 hectares) - that is comparably poor or marginal agricultural land rather than good quality land. Some, but not all, could arguably have some use for forestry as there will undoubtedly be competing demands in terms of existing land management and uses.

Of the land capable of supporting rough grazing in the Highlands and Islands, 170,103 hectares is classed as being of limited agricultural value (class 7) (66% of all class 7 land in Scotland). The majority of this is in Highland (67%). If only a small proportion (2.5%) of this land was converted to forestry, it is estimated that around 1.5 million CO_2 units could potentially be sequestered over a 30-year period. This equates to around 0.1% of current national emissions or 0.8% of regional emissions over the 30-year period. If 7.5% of the land was converted, up to 4.5 million CO_2 units could be sequestered (Table 1). This reflects the longer-term nature of forest carbon sequestration, and masks complexities such as the impact of different species, etc on overall sequestration potential. Forest carbon sequestration needs careful planning and should ideally align with the Woodland Carbon Code – planting trees at scale, without considering species, soils, environment, ecosystems, and other land uses, will not suffice.

AROUND HALF OF SCOTLAND'S WOODLAND AND FORESTRY IS IN THE HIGHLANDS AND ISLANDS

OVER A 30-YEAR PERIOD, AROUND 1.5 MILLION CO_2 UNITS COULD POTENTIALLY BE SEQUESTERED THROUGH FORESTATION OF CLASS 7 ROUGH GRAZING LAND IN THE REGION

TABLE 1 – POTENTIAL SEQUESTRATION THROUGH FORESTATION OF CLASS 7 ROUGH GRAZING LAND

Local Authority	CO_2e units at 350 per hectare		
	2.5%	5%	7.5%
Argyll and Bute	68,000	136,000	204,100
Arran and Cumbrae	-	-	-
Highland	1,248,000	2,496,000	3,744,000
Moray	129,000	258,000	387,000
Orkney	8,100	16,300	24,500
Shetland	18,300	36,700	55,000
Na h-Eileanan Siar	16,700	33,500	50,300
Highlands and Islands	1,488,400	2,976,800	4,465,200

Source: ekosgen modelling based on NatureScot/Peatland ACTION (2023) data.
Note: Given data availability, modelling was not possible for Arran and Cumbrae.

Around three-quarters (76%) of all Scotland's peatland is located in the Highlands and Islands with more than half of the region's land covered by peat and peaty soils (56%, 2.4 million hectares) (20% of land nationally).[16] However, it is estimated that the vast majority of peatland in Scotland (around 80%) is degraded at least to some degree and restoration is required to enhance its capacity to maintain carbon stocks. Reflecting this, the Scottish Government's Climate Change Plan has set a target to restore 250,000 hectares of degraded peatlands by 2030.

Since 2012, over 193,000 hectares of peatland has been restored across Scotland with some 70% of this in the Highlands and Islands. This equates to around 11,000 hectares of peatland in the region each year, a rate of c.0.5% per annum. Should this rate be maintained, around 2.1 million CO_2e units could be sequestered across the region on an annual basis, rising to 2.7 million CO_2e units if the rate of restoration were to increase by 25% (Table 2). **Based on this, by 2030, between around 15.0 million and 18.8 million of additional CO_2e units could be sequestered in the Highlands and Islands.** Taking the lower estimate of 15 million additional CO_2e units, this could potentially equate to 8.0% of regional emissions or 1.2% of national emissions over the 30-year period that the CO_2e units would need to be sequestered for, assuming a similar rate of emissions going forward.

TABLE 2 – POTENTIAL SEQUESTERED CO_2e UNITS FROM PEATLAND RESTORATION AT DIFFERENT RATES

Area	CO_2e Units per annum		
	Median restoration rate per annum	+10% above median rate	+25% above median rate
Argyll and Bute	132,240	145,464	165,300
Highland	1,683,021	1,851,323	2,103,776
Moray	23,000	25,300	28,750
Orkney	5,205	5,725	6,506
Shetland	7,565	8,321	9,456
Na h-Eileanan Siar	3,946	4,341	4,932
Arran and Cumbrae	12,139	13,353	15,174
Highlands and Islands	2,144,177	2,358,595	2,680,221

Source: Consultant calculations based on NatureScot/Peatland ACTION (2023) data. The Highlands and Islands estimate is based on the median restoration rate for the region overall. Therefore, columns do not sum to the total of the sub-regional estimates.

Peatland restoration and afforestation are significant carbon sequestration opportunities for the region, although arguably peatland offers the more immediate opportunity. While some parts of the region may always be net emitters in terms of LULUCF, this could be balanced by capitalising on sequestration opportunities elsewhere in the region. However, realising the carbon and wider benefits of sequestration activity in the region will require a proactive and coordinated whole system approach. There needs to be more focus on developing the skills and the supply chain to support activity, and how land management evolves post Common Agriculture Policy will impact on use and therefore sequestration opportunities.

56% OF THE REGION'S LAND IS COVERED BY PEAT AND PEATY SOILS

BETWEEN 15.0 MILLION AND 18.8 MILLION UNITS OF CO_2e COULD BE SEQUESTERED FROM PEATLAND RESTORATION IN THE REGION BY 2030

Renewable energy and energy consumption

The Highlands and Islands has a leading role to play in green energy generation in Scotland. The abundant natural resources at the region's disposal offer the opportunity for renewable energy generation through a number of approaches and technologies, making the region an ideal location for harnessing clean and sustainable power. The potential impact and scale of renewable energy generation cannot be understated.

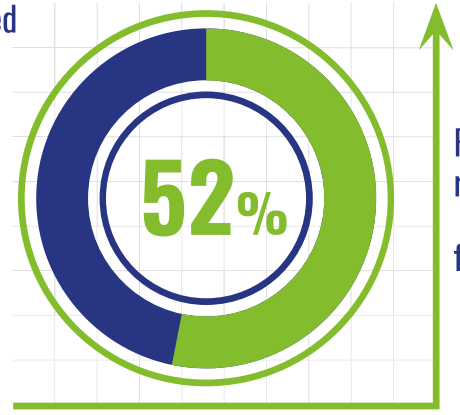
Reflecting this, according to 2023 data, the region has a disproportionate share of renewable energy generation capacity in Scotland, **accounting for around 52% (6,513 MW)** of Scotland's current installed renewable energy (12,576 MW). If all current pipeline activity is realised, **capacity in the region would increase more than four-fold (to 33,205 MW)**, with growth in all parts of the region (Table 3). If other known proposals progress, such as Earba and Fearna (pumped storage developments) in Lochaber, capacity will be far higher. Each of these is expected to exceed Coire Glas in scale and output (Earba and Fearna each have estimated capacities of 1800 MW compared to 1500MW for Coire Glas and 1000MW for Cruachan Phases 1 and 2 combined).

TABLE 3: GENERATION CAPACITY BY SUB-REGION (MW)

	Operational MW	Pipeline MW	Total operational and pipeline MW
Argyll and Bute	897.8	3,558.6	4,456.4
Highland	5,099.5	11,483.7	16,583.2
Moray	411.4	1,126.1	1,537.5
Orkney	49.8	3,678.4	3,728.2
Shetland	12.9	3,543.9	3,556.8
Na h-Eileanan Siar	40.9	3,301.2	3,342.1
Arran and Cumbrae	1.0	-	1.0
Highlands and Islands	6,513.2	26,691.9	33,205.1

Note: Based on data from the Renewable Energy Planning Database (REPD) 2023 and additional desk-based research.
The REPD only includes projects over 150kW, therefore the analysis may not capture smaller, community-based schemes taking place across the region. Reflecting this, data for Arran and Cumbrae is limited although two small hydro schemes have been included.

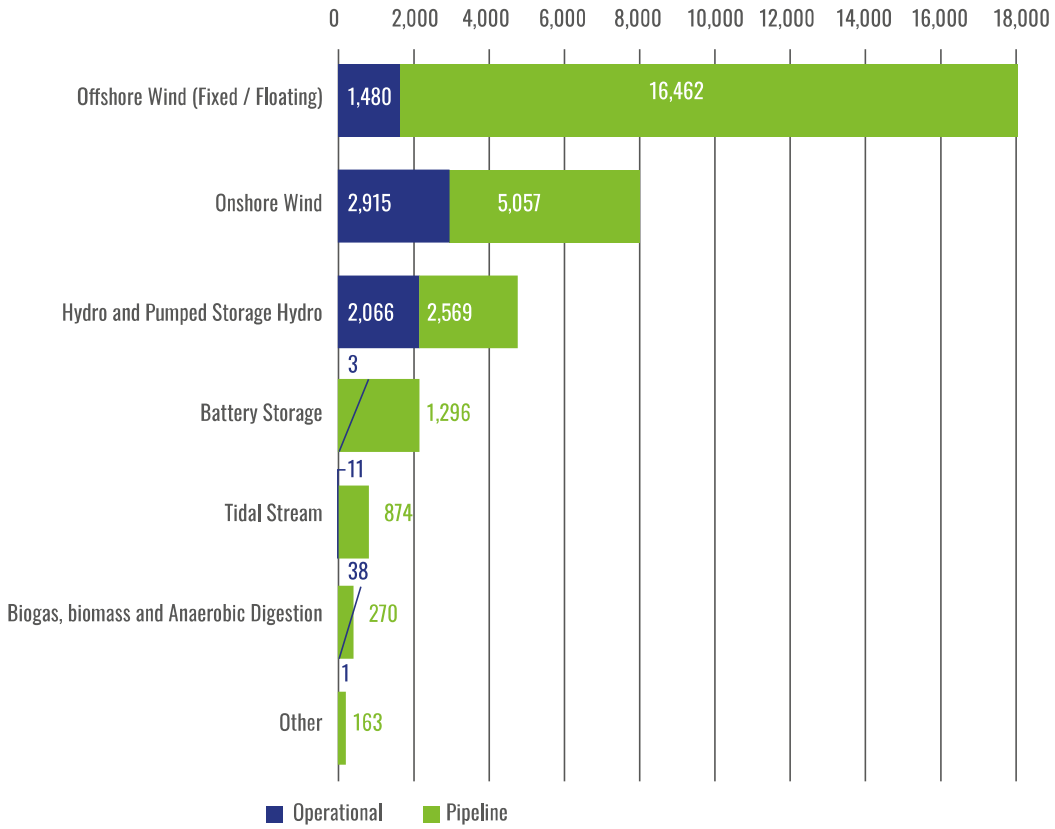
The region accounts for 52% of Scotland's current installed renewable energy



Potential to increase the region's renewable energy capacity from 6,513 MW to 33,205 MW

Onshore wind is currently the largest source of renewable energy generation in the region, followed by hydro and pumped hydro, and offshore wind. While offshore wind capacity is expected to increase to a far greater scale than other technologies, **significant increases are anticipated in generation and supply/storage capacity across nearly all renewable energy technologies, with new developments coming onstream at pace.** (Figure 9).

FIGURE 9: GENERATION CAPACITY (CURRENT AND PIPELINE) IN THE HIGHLANDS AND ISLANDS BY SOURCE (MW)



Source: DESNZ Renewable Energy Planning Database, 2023; Crown Estate Scotland, 2023; RenewableUK, 2023; ekosgen desk research. Figures and percentages may not sum due to rounding.
Note: Others include heat pump district heating, solar photovoltaics, hydrogen/ammonia, and wave energy.

The research findings illustrate well the region's potential to increase energy generation and consumption from renewable sources, and the importance of encouraging energy intensive users to take-up more renewable energy sources. Investment in the region's electricity and gas networks, development of skills to support the work required, and academic engagement are key enablers to help realise the economic and environmental opportunities within the region.

There is a need to support commercial businesses to explore energy efficiency measures (for premises and operations). The transition to renewable energy will also be important for domestic premises but change in fuel use alone will not be sufficient - building retrofit solutions will be key for both commercial and domestic premises.

CONSIDERATIONS AND EMERGING PRIORITIES

Although there are clear local differences, the overall nature of the region's emissions profile means a pan-regional, co-ordinated approach is needed to tackle the GHG emissions challenge.

This is reflected in the HIREP's draft Regional Economic Strategy which recognises that climate change adaptation, decarbonisation and energy transition are significant drivers of change for the region. Within this collaborative regional approach, a number of key considerations and emerging priority areas emerge, as outlined below:

- Shifting the dial regionally will only happen by addressing the emissions challenges associated with agriculture and LULUCF. Influencing some of the measures implementing the Scottish Government's Agriculture and Rural Communities Bill and subsequent policy and funding decisions is critical to this.
- Supporting sustainable transport and transport decarbonisation and stimulating investment and action to enable this will be key to lowering transport emissions. Encouraging modal shift along with targeted investment in sustainable transport infrastructure will be vital in this regard, whether for road transport (e.g., increasing provision of electric vehicle charging points), or for rail transport (e.g., supporting rail electrification plans set out in the National Transport Strategy 2). Continuation of ground-breaking innovation such as that epitomised by the SATE project and adopting of greener fuel sources in the ferries replacement programme will also be critical.
- Addressing carbon emissions and energy efficiency within residential dwellings and communities will be essential for driving down domestic emissions. Doing so must include influencing homeowners and private rental landlords to adopt energy efficiency measures, transition away from the use of carbon intensive fuel sources and encourage the adoption of renewable technologies (where possible) for space heating and insulation. However, cost and capacity are significant barriers, particularly in terms of retrofit solutions.
- Investment in the region's electricity and gas networks is important to increase access to more reliable and lower carbon forms of energy, including green hydrogen. It will also enable the development of decentralised and local energy networks. This can contribute to greater realisation of benefits within local communities from investment in renewable energy generation, thus aiding community wealth building at local and regional levels.
- Supporting businesses to increase awareness and understanding of net zero and its implications for them, and influencing decarbonisation activity at the enterprise and sectoral levels will be a key component of efforts to reduce the regional GHG footprint. This will extend to energy efficiency of premises, energy transition, and lowering of emissions within operations.
- Regional transformational opportunities around marine energy, green hydrogen, and offshore wind, as well as new hydroelectric schemes, are critical to decarbonisation efforts. Continuing to support the region's renewables industries will help to realise the pipeline of renewable generation capacity and contribute to a reduction in GHG emissions arising from electricity generation and consumption.
- Carbon sequestration can contribute to a reduction in the region's net emissions. There is already scope to achieve this through peatland restoration and afforestation, with other terrestrial approaches being explored along with the potential for marine sequestration. Carbon sequestration can also bring with it a wide range of other ecosystem services.
- Skills development to support the implementation of measures to address the region's carbon emissions is vital. This includes skills to support the roll-out of domestic retrofit for energy efficiency and implementation of low carbon heating technology, as well as skilled workers to maximise the potential for new forms of energy generation, including hydrogen. Without the right skills in the required volume, the Highlands and Islands will not be able to realise this potential.

The study has identified key areas where the region has an opportunity to significantly reduce its GHG emissions, notably in agriculture, land use, land use change and forestry, as well as in transport, housing, and industry. The HIREP has a significant role to play in ensuring that across these policy areas, reducing emissions is central to strategic planning and implementation. It is also critical that the HIREP takes industry and communities along on the journey to net zero.

References

1. Climate Change Act 2008 (legislation.gov.uk)
2. Scotland's National Strategy for Economic Transformation - gov.scot (www.gov.scot)
3. Draft Energy Strategy and Just Transition Plan - gov.scot (www.gov.scot)
4. https://www.gov.scot/publications/environment-strategy-scotland-vision-outcomes/
5. Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3) - gov.scot (www.gov.scot)
6. Progress in reducing emissions in Scotland - 2023 Report to Parliament - Climate Change Committee (theccc.org.uk)
7. Strategy and operating plan I Highlands and Islands Enterprise I HIE
8. Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, Page 11
9. Scottish Greenhouse Gas Statistics 2022 - gov.scot (www.gov.scot)
10. Argyll and Bute, Highland, Moray, Orkney, Shetland and Na h-Eileanan Siar.
11. This figure relates to Transport Scotland data for ferries overall. Data availability for other types of water transport, such as fishing vessels and leisure craft, is noticeably lacking at present.
12. Mission Zero for transport I Transport Scotland
13. https://www.hial.co.uk/sate
14. The environment impact rating represents the environmental impact of a dwelling in terms of carbon emissions associated with fuels used for heating, hot water, lighting and ventilation.
15. Climate Change Plan: third report on proposals and policies 2018-2032 (RPP3) - gov.scot (www.gov.scot)
16. Based on peatland class 1, 2, 3 and 5.

ekosgen

Practically Green

reference economic consultants

HIE
Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean