The James Hutton Institute

CLIMATE ACTION PLAN

2023

Executive summary

The targets set out in the following plan outline the Hutton's route to net zero for all scopes including all applicable sources of emissions as well as the likely need for sequestration via insetting and offsetting of residual emissions. Our net zero targets are:

- **We commit to net zero emissions for scope 1 and 2 by 2035.**
- **We commit to net zero emissions for scope 3 by 2040.**

In addition, we set wider targets to support the decarbonisation of the sector within our sphere of influence:

- **We commit to increase the proportion of suppliers with net zero emission targets by 5% by total spending year on year.**

Baseline footprint: the baseline year for our GHG inventory is 2019/20. It includes all scope 1 (direct) and 2 (indirect, energy-related) sources of emissions as well as all applicable (eight out of 15 categories) of scope 3 emissions (indirect), following a screening exercise.

Emissions reductions actions: achieving our emissions targets will require action from all departments across the institute: sciences, estates, procurement, IT, library services, farms and HR all have a leading role to play, coordinated by the executive team. This document sets out suggestions for actions for each source of emissions.

Managing our carbon stocks: as a landholder and an institute dedicated to researching sustainable land management, we will manage our land to minimise emissions from our peatlands, increase carbon drawdown in our woodlands as well as maintain and, if possible, enhance the carbon retained in our soils.

Monitoring, reporting and certification: we will report annually to the Scottish Government (under the Public Bodies' Climate Change Duties as amended in 2020), in our financial accounts (under Streamlined Energy and Carbon Reporting legislation) and in a standalone, publicly accessible report on our website. The reports will include a re-appraisal of our targets and action plan to ensure they are still aligned with the Paris-aligned approach set out in this document.

1 General

1.1. Background

The James Hutton Institute's 2021 climate action plan set out an ambitious plan to achieve a greater than two-thirds emissions reduction for scope 1 and 2 emissions and at least a two-thirds reduction of scope 3 emissions by 2030, based on the methodology of the Science Based Target initiative (SBTi).

The following document will be a continuation of the 2021 climate action plan, providing a path to net zero from the Hutton's baseline of 2019/20, via the interim targets of a two-thirds emissions reduction by 2030, while also including other objectives based on the SBTi recommendation to increase not only Hutton's sustainability, but achieve sustained sectoral change within the Institute's sphere of influence.

1.2. Purpose

The purpose of this document is to set out science-based greenhouse gas emissions reduction targets for The James Hutton Institute as well as a clear methodology for monitoring and reporting our progress. The document also presents a variety of actions that might be taken to achieve the targets.

This addresses a range of internal drivers:

The Hutton values include "we want to make a difference" and "we lead by example". As an environmental research Institute, advising others on how to combat climate change, we want to model best practice.

Many of our staff work on the scientific front line of climate change. Being exposed to the stark conclusions of climate science can lead to eco-anxiety, increasing baseline stress levels. One of the best ways to cope with this is to feel that you and others around you are taking action that will make a difference. Developing a net action plan is therefore a way of looking after our people.

And external drivers:

The Scottish Government is the institute's main funder and a major stakeholder in the work that we do. We seek to support progress towards the national climate change targets that were enshrined in law by the Scottish Parliament in 2019.

1.3 Scope

The scope of this document covers emission reductions with the goal to reach "net zero" emissions as well as wider sustainability objectives with regards to reducing sources of upstream emissions.

"Net zero"
For the purpose of this paper, we follow the SBTi[1] definition of net-zero emissions:

> *'To reach a state of net-zero emissions for companies consistent with achieving net-zero emissions at the global level in line with societal climate and sustainability goals implies two conditions:*
>
> - *To achieve a scale of value-chain emission reductions consistent with the depth of abatement achieved in pathways that limit warming to 1.5°C with no or limited overshoot and;*
> - *To neutralise the impact of any source of residual emissions that remains unfeasible to be eliminated by permanently removing an equivalent amount of atmospheric carbon dioxide.'*[2]

This means that Hutton will follow the 1.5°C pathway in its net-zero emission reduction plan for scopes 1, 2 and 3 as suggested by SBTi. Furthermore, the Hutton will seek to reduce its emissions as far as feasible and only neutralise residual emissions where further reduction is not possible.

2 Greenhouse gas inventory and targets

2.1. General

Our emissions reduction targets are:

- **We commit to net zero emissions for scope 1 and 2 by 2035.**
- **We commit to net zero emissions for scope 3 emissions by 2040.**
- **We commit to increase the proportion of suppliers with net zero emission targets by 5% by total spending year on year.**

[1] For the purpose of baselining, accounting for, reducing and reporting our emissions we are following SBTi guidelines. However, due to our status as a not-for profit organisation, we are currently not eligible for verification of our targets by SBTi (https://sciencebasedtargets.org/resources/files/SBTi-Corporate-Manual.pdf).

[2] https://sciencebasedtargets.org/resources/files/foundations-for-net-zero-executive-summary.pdf

To align with widely accepted warming scenarios, a 43% reduction is required at the global level between 2020 and 2030. The Scottish Parliament adopted this 43% reduction target by 2030 and a net zero emission target by 2045 in its climate legislation in 2019[3]. Our more ambitious two-thirds reduction by 2030 target and net zero by 2035 (scope 1 and 2) and 2040 (scope 3) additionally takes into account the Paris Agreement's commitment to international equity. As one of the birthplaces of the Industrial Revolution, we believe Scotland has a moral obligation to decarbonise faster than the global average.

We note that these targets are derived on the basis of linear reductions in annual emissions. If we fail to achieve year-on-year emissions reductions in line with our assumed rate of decrease (6.7% per year for scope 1 and 2; 4.2% for scope 3), emissions in subsequent years will need to fall faster. Likewise, if we have a degree of residual or non-avoidable emissions persisting beyond 2035 for scope 1 and 2 and 2040 for scope 3, it will require us to increase our reduction targets to 2035/2040. This will need to be re-evaluated regularly.

Taking these 6.7% forward we achieve net zero emissions by 2035 for scope 1 and 2 emissions, thereby exceeding the SBTi recommendation of a minimum annual linear reduction rate of 4.2%-6%. A 4.2% reduction of scope 3 emissions will reduce our emissions to less than 10% of baseline, allowing us to neutralise remaining emissions through preferably insetting or if needed offsetting schemes (more detail under section 4. Managing our carbon stocks), leading thereby to net zero emissions by 2040, in line with SBTi 1.5°C target.

The institute's emissions were baselined for the fiscal year 2019/20, in line with SBTi criteria, meaning that our targets cover all scope 1 and 2 emissions as well as relevant scope 3 emissions (see table 6).

To set meaningful targets, we will look at Scope 3 emissions separately to scope 1 and 2 emissions. This is done to ensure targets and measures to achieve targets are fit for purpose. Within the SBTi framework, scope 3 targets are also treated separately to scope 1 and 2.

2.2. Scope 1 and 2 emissions

Scope 1 and 2 emission sources are generally easier to quantify, easier to replace by non-GHG releasing alternatives and therefore easier to reduce. Scope 1 emissions include natural gas (mainly heating), fuels (diesel, petrol, propane, kerosene), agricultural emissions (BrMf fertiliser, Gs Soil/fertiliser, Gs enteric fermentation, Gs manure management) and refrigerant gas leaks. The only scope 2 emissions stem from grid electricity (generation).

We baselined (2019) and report on all of these emissions to varying degrees depending on framework (see table 1 and table 2).

Table 1 Relevant reporting requirements

Source	Scope	SBTi	PBCCD	SECR
Natural gas	1	✓	✓	✓
Fuels	1	✓	✓	✓
Grid electricity (generation)	2	✓	✓	✓
Agricultural emissions	1	✓		
Refrigerant gas leaks	1	✓		

[3] https://www.gov.scot/policies/climate-change/reducing-emissions/ . Note that the Scottish Government's headline figure of a 75% reduction by 2030 is against a 1990 baseline.

2.2.1. Baselining scope 1 and 2 emissions

The financial year running from April 2019 to March 2020 was a good baseline, as it ends before the Covid-19-induced lockdown could have any significant effect on the figures. The following table lists our scope 1 and 2 emissions sources from largest to smallest (the full breakdown is presented in Appendix 1):

Table 2 Scope 1 & 2 emission sources

Source	Scope	Emissions (tCO_2e)	Percentage
Natural gas	1	1410.0	37
Farm emissions	1	494	13
Fuels	1	261	7
Refrigerant gas leaks	1	45.2	1
Grid electricity (generation)	2	1599.2	42
Total		**3809.4**	**100.0**

This means that our total scope 1 carbon emissions are 2,210 tCO_2e while scope 2 amounts 1,599 tCO_2e, totalling at 3,809 tCO_2e.

Given that we have robust data on these emissions a plan to reduce by more than two-thirds by 2030 and reach net zero by 2035 is comparably straight forward, while keeping the proportion to be neutralised as low as feasible. To do so the goal is to reduce scope 1 and 2 emissions by more than 2,200 tCO_2e by 2030, leaving less than 1,070 tCO_2e to reach net zero by 2035. Table 3 outlines annual target emissions to achieve net zero by 2035 by an annual carbon reduction of 6.7% over 15 years from baseline year 2019/20.

The biggest contributors to scope 1 and 2 emissions are natural gas for heating and grid electricity (generation). To achieve net zero both behavioural/ operational changes as well as investment in infrastructure will be needed.

Table 3 Annual scope 1 and 2 reduction targets

Source	Scope	19/20 baseline emissions	24/25 emissions	29/30 emissions	34/35 emissions
Natural gas	1	1,410	940.0	470.0	0.0
Diesel	1	249	166.2	83.2	0.0
Petrol	1	9	5.9	2.9	0.0
Propane	1	2	0.9	0.2	0.0
Kerosene	1	1	0.9	0.6	0.0
Refrigerant gas leaks	1	45	30.2	15.2	0.0
BRMF soil-fertiliser emissions	1	172	114.8	57.3	0.0
GS soil-fertiliser emissions	1	18	11.8	5.8	0.0
GS enteric fermentation	1	270	179.6	89.6	0.0
GS manure management	1	34	22.8	11.5	0.0
Grid electricity (generation)	2	1,599	1,064.2	529.2	0.0

2.3. Scope 3 emissions

As for most businesses, scope 3 emissions are the most difficult emissions to navigate, due to varying data quality and availability and the limited influence on some of these categories. The following are the scope 3 emissions categories including the anticipated magnitude, influence, risk, stakeholders' interest, liability of outsourcing and data certainty, to be assessed according to SBTi.

Table 4 Assessment of scope 3 emission sources

Category		Magnitude	Influence	Risk	Stakeholders' Interest	Liability of Outsourcing	Certainty	Included
1	Purchased goods and services	High	Med	Med	Low	Med	Low	Yes
2	Capital goods	Med	High	High	High	Med	Low	Yes
3	Fuel and energy related activities	Med	Med	Med	High	Low	High	Yes
4	Upstream and transportation and distribution	Med	Low	Med	Low	Low	Low	Yes
5	Waste generated in operations	Low	Med	Med	High	Low	High	Yes
6	Business travel	Med	Low	Med	High	Low	High	Yes
7	Employee commuting	Med	Low	Low	Med	Med	Med	Yes
8	Upstream leased assets	Low	Low	Low	Low	Med	Low	Yes
9	Downstream transportation and distribution							N/A in research
10	Processing of sold products							N/A in research
11	Use of sold products		Med	Med	Med		Low	N/A in research
12	End-of-life treatment of sold products							N/A in research
13	Downstream leased assets	Low	Med	Low	Low	Med		In-house tenants in Scope 1 and 2
14	Franchises							N/A
15	Investments							N/A

Out of the 15 SBTi scope 3 categories, nine apply to the Hutton. For ease of accounting we combine category 1, category 2 and category 13, to one category. Category 8 is included in other categories. This leaves Hutton with 6 distinct categories.

2.3.1. Baselining scope 3 emissions

Purchased goods and services make up the largest proportion of all scope 3 emissions and indeed of all emissions, accounting for 9,987 tCO_2e. However, purchased goods and services is also the category with the largest uncertainty attached due to the methodology used to establish supply chain emissions. The approach is based on DEFRA procurement categories and emission factors, which were used to create the higher emissions supply chain tool (HESCET tool). The tool assigns emission factors to procurement categories, which are then multiplied with amount spent in said category. This inadvertently leads to higher 'on paper' emissions, if extra capital is invested to buy more energy efficient equipment.

The other SBTi scope 3 emission categories, namely, business travel, employee commuting, fuel and energy related activities, upstream transportation and distribution and waste generated in operations, are comparably small, with 785 tCO_2e, 529 tCO_2e, 469 tCO_2e, 155 tCO_2e and 3.5 tCO_2e, respectively. Additionally, the accuracy and availability of data regarding these categories is generally high and therefore also our confidence.

Table 5 Annual scope 3 reduction target

Categories	Category	19/20 baseline emissions (tCO_2e)	25/26 emissions	2030/31 emissions	2035/36 emissions	40/41 emissions
Purchased goods and services	1, 2, 8	9,986.5	7,410.01	5,262.90	3,115.80	968.69
Fuel and energy related activities	3	468.6	350.50	252.09	153.69	55.29
Upstream transportation and distribution	4	154.7	115.74	83.25	50.75	18.26
Waste generated in operations	5	3.5	2.65	1.90	1.16	0.42
Business travel	6	652.0	487.70	350.78	213.86	76.94
Employee commuting	7	661.6	494.88	355.94	217.00	78.07
Total		**11,927**	**8,861.46**	**6,306.86**	**3,752.26**	**1,197.67**

The table below indicates which emission source falls under which SBTi category.

Table 6 Scope 3 emissions by Hutton defined source

Purchased goods and services	Fuel and energy	Upstream transportation and distribution	Waste generated in ops	Business travel	Employee commuting
Water	Upstream natural gas	Grid electricity (transmission and distribution loss)	Waste	Domestic flights	Staff car commuting
BRMF fertiliser production	W2T diesel	Upstream electricity (transmission and distribution loss)	-	Short-haul flights	Homeworking emissions
GS imported feed	W2T petrol	-	-	Long-haul flights	W2T car travel (commuting)
GS fertiliser production	W2T LPG	-	-	Rail travel	-
Procurement (labs)	W2T burning oil	-	-	Car travel	-
Procurement (IT)	W2TUpstream electricity (generation)	-	-	Accommodation (UK)	-
Procurement (library)	-	-	-	Accommodation (overseas)	-
Procurement (consultancy/ professional)	-	-	-	W2T domestic flights	-
Procurement (all other)	-	-	-	W2T short-haul flights	-
Construction and capital investment	-	-	-	W2T long-haul flights	-
-	-	-	-	W2T rail travel	-
-	-	-	-	W2T car travel	-

Source	Scope	Emissions	Percentage
Lab procurement	3	5,308	44.5
IT procurement	3	1,447	12.1
All other procurement	3	1,263	10.6
Library procurement	3	1,007	8.4
Consultancy/ professional procurement	3	835	7.0

Source	Scope	Emissions	Percentage
Commuting and working from home	3	662	5.5
Business travel	3	652	5.5
Grid electricity (transmission and distribution)	3	378	3.2
Upstream natural gas	3	183	1.5
Farms (incl. fuels)	3	183	1.5
Water and waste	3	9	0.1
Changes in soil and vegetation carbon stocks	3		0.0
Construction	3		
Total		**11,927**	**100**

2.4 Emissions reduction actions

Firstly, it is important to recognise that dependent on emission source, actions will need to be different and multiple approaches may be needed for any given emission source. The table above has shown how varied the Hutton's emission sources are and the resulting emissions are likely to be a result of multiple departments. Nonetheless, it is worthwhile to get an idea of which departments have a proportionally large impact on specific emission sources:

Table 5 Proportion of emissions by department

Lead department	Emissions sources	Proportion of emissions
Sciences	Lab procurement, travel	39%
Estates	Electricity, natural gas, refrigerants, water, waste	23%
Procurement	Consultancy/professional procurement and all other procurementother procurement	13%
IT	IT procurement	9%
Library services	Library procurement	6%
Farms	Farms	6%
HR	Commuting and working from home	4%
TCD team	Construction emissions	TBD

This does not mean that science departments have full responsibility for travel for example, as there will be crossovers over most categories with most departments. However, knowing where larger percentages lie, allows to address reduction actions more directly. Going forward with emissions reduction actions, we shall continue by examining and suggesting actions for scope 1 and 2 separately from scope 3.

2.4.1 Scope 1 and 2 emissions

Target:
Exceeding SBTi guidance, we are setting an annual emissions reduction target of at least 6.7%, leading to net zero emissions by 2035.

Natural gas

Natural gas is the largest source of scope 1 emissions and is by large a result of heating, with a much smaller proportion used for grain drying.

Table 8 Impact of TCD on energy consumption

	Baseline natural gas demand		After TCD built	
Invergowrie glasshouses	3,877,181 kWh	49%	3,877,181 kWh	49%
Invergowrie other buildings	1,435,559 kWh	18%	904,285 kWh	11%
Craigiebuckler	2,560,479 kWh	33%	2,560,479 kWh	33%
Total	**7,873,219 kWh**	**100%**	**7,341,945 kWh**	**93%**

The main lever to reduce natural gas emissions is Hutton's heating infrastructure. Tay Cities Region Deal buildings at the Invergowrie site will be heated by air source heat pumps, reducing natural gas emissions by approximately 7%.

At Craigiebuckler, we are exploring the option of heat recovery from wastewater, and an initial feasibility study has been conducted, showing that sufficient heat could be recovered to heat the entire site.

The Craigiebuckler building has low thermal performance because of its extensive areas of glazing – note how it uses 78% more natural gas than the "Invergowrie other buildings" despite housing a similar number of staff. A retrofit focusing on the "conservatory"-type areas currently housing the canteen, ITS and the library could result in significant improvements. The funding awarded through the Just Transition Fund will potentially address this issue through retrofitting of these parts of the building for the establishment of the Just Transition Hub[4].

Both heating options are based on heat pumps and therefore require energy to be powered, however the Craigiebuckler feasibility study suggests that the overall energy required would be less than the current setup.

Refrigerant leaks

Refrigerant leaks make up a small proportion of overall scope 1 emissions, nonetheless refrigerants are highly potent greenhouse gases and therefore reduction of potential leaks through regular maintenance is important.

[4] Just Transition Hub https://www.hutton.ac.uk/about/facilities/just-transitions-hub

Farm emissions

Table 9 Sources of farm emissions by site

	Balruddery / Mylnefield (tCO2e)		Glensaugh (tCO2e)	
Diesel and other fuels*	206	45%	55	13%
Fertiliser production**	79	17%	11	3%
Soil-fertiliser emissions**	172	38%	18	4%
Enteric fermentation**			270	65%
Imported feed**			31	7%
Manure management**			34	8%
Total	**458**	**100%**	**418**	**100%**

Farm emissions include fossil fuels (diesel, petrol, propane, kerosene) and emissions associated with soil fertilisers, manure management enteric fermentation. The emissions caused by fuel will be considerably reduced through climate-positive farming and our green hydrogen farm, which will replace most fuels with either hydrogen based or electric alternatives at Glensaugh. Once HydroGlen is completed the emissions left are fertiliser, enteric fermentation, feed and manure management related, which will be approximately 350 tCO2e annually without other measures. However, Climate Positive Farming[5] has the potential to further decrease emissions.

Optimising fertiliser use could also yield emissions reductions. Nitrogen fertiliser in particular is carbon-intensive in its production and also drives soil nitrous oxide emissions.

At Glensaugh, the enteric fermentation emissions pose a challenge, being linked to livestock headcount. Manure management systems also differ in their climate impact, with our current unmixed deep bedding system offering some room for improvement. Aerobic composting and anaerobic digestion of manures both offer the possibility of adding value to manures while producing energy[6].

Of course, our farms also provide us with the opportunity (and the duty) to manage our below-ground and above-ground carbon stocks. This is discussed in the "managing our carbon stocks" section below.

Electricity generation

Electricity generation is the largest emission source among scope 1 and 2 emissions. It has however also seen a significant reduction of emissions in previous years, as a result of the ongoing decarbonisation of the grid and increased on-site renewable energy production through solar PV at our Invergowrie site and Glensaugh as well as a wind turbine at Glensaugh. Going forward it can be assumed that emissions will continue to reduce passively through further greening of the grid. This means the emission factor(s) for electricity will continue to fall. If present trends continue (10% year-on-year reductions), the emissions factor would fall by 65% over the decade.

[5] Climate Positive Farming Initiative https://glensaugh.hutton.ac.uk/climate-positive-farming/overview
[6] Anaerobic digestion is a relatively well-established technology, but heat from compost would be very innovative. The most advanced designs are being developed in Germany and the Netherlands under the name "Biomeiler".

A range of projects are underway that will have a significant impact on our emissions by 2030:

- **The Tay Cities Region Deal Development (electricity consumption up)**
- **Re-powering the Glensaugh wind turbine (electricity import from the grid down)**
- **Building the Invergowrie Solar Meadow (electricity import from the grid down)**
- **Further solar PV installations at Invergowrie (electricity import from the grid down)**

Taken together, the net effect of these changes will be an 18% reduction of our electricity consumption. When combined with the predicted changes in emissions factors, electricity-related emissions would fall by 71% to 573 tCO2e. This is a "default outcome", entailing no further action on our part.

Further projects may be implemented that would increase our electricity consumption. In particular, if we replace current natural gas based heating plant at our two main sites with heat pumps, this will increase our electricity consumption by approximately 30% compared to the 2019/20 baseline, leading to a net 12% increase after the above projects are taken into account. Likewise, if we switch some of our smaller petrol, propane and kerosene-powered equipment with electric alternatives, our electricity consumption will increase again (by less than 1%). These increases would be compensated by decreases in the replaced emissions sources and would result in an overall decrease in emissions.

To reach targets behaviour changes as well as infrastructure changes will be necessary. This includes changes to make science itself and support services less energy intensive. For example, we have signed up to the Laboratory Efficiency Assessment Framework (LEAF), aiming to reduce resource consumption in laboratories. Similar adjustments will need to be made over all departments within the Hutton including all staff. As we will need energy to conduct science at the Hutton, in addition to energy consumption reduction measures it will also be necessary to transition to green energy, where feasible produced on site.

Overall, the vast majority of emissions in the scope 1 and 2 category will likely require a comparably small proportion of residual emissions to be neutralised (below the maximum of 10% of baseline as suggested by SBTi). What will be required is sustained behaviour change regarding consumption as well as investment in on-site energy generation and green heating to achieve net zero emissions by 2035.

2.5. Scope 3 emissions

Targets:

- **Following SBTi guidance in line with limiting global warming to 1.5°C, we are setting an annual reduction target of at least 4.2% for scope 3 emission categories, leading to less than 10% residual emissions and net zero emissions by 2040.**
- **Increase proportion of suppliers with net zero emissions commitments by 5% total spending.**

Emission reduction actions shall be examined in line with SBTi categories.

Purchased goods and services (categories 1, 2, 8)

The annual emission reduction target for this category will be, in line with SBTi, at least 4.2%, leading to net zero emissions by 2040. The target will be reviewed annually and updated accordingly if better methodologies are available.

It would be useful to understand better where the emissions come from in the supply chain and how this will evolve over the coming decade. Therefore, we will aim to procure from organisations publishing life-cycle data of their products. Under our current cost-based method we would need to reduce our annual spending to zero in order to achieve net zero, which is not feasible. Consequentially, better manufacturer data is required to get a better picture of emissions.

As this category accounts for almost two-thirds of all Hutton emissions it may be worth looking more closely at the contributing factors:

- Lab procurement

Lab procurement includes a range of expenses:

Table 10 Sources of laboratory emissions

Expense Name	Factor	Spend	Emissions (tCO2e)
Apparatus and equipment	2.58	737,337.12	1,902
Materials (non-chemical)	2.58	525,268.70	1,355
Service/maintenance contracts	2.58	403,842.06	1,042
Chemicals	2.58	366,243.09	945
Bottled gas	0.5	49,918.69	25
External recharges (Dundee University)	0.42	39,149.22	16
Liquid gas	0.5	23,397.58	12
Controlled waste	0.39	26,855.77	10

Our footprint in this category is driven by purchases of scientific apparatus, materials (chemical and non-chemical) and service/maintenance contracts.

To reduce emissions in this category we are currently in the process of joining the LEAF, which supported thousands of research and teaching labs to reduce their carbon footprint of lab operations, particularly influencing waste, the use of consumables, and energy efficiency. However, knowledge and best practice is also shared regarding lab procurement and efficiencies of equipment.

- IT procurement

The following expense names fall under IT procurement:

Table 11 Sources of IT emissions

Expense name	Factor	Spend	Emissions (tCO2e)
Computer software	2.03	468,097.92	950
Computer purchases	1.14	188,757.34	215
Network maintenance	0.78	182,770.76	143
Server maintenance	0.78	109,026.24	85
Computer consumables	1.14	36,121.40	41
Backup security	0.42	29,651.27	12

The footprint in this category is driven in large parts by spending on computer software, followed by computer purchases and systems maintenance.

The carbon footprint of IT can broadly be broken down into emissions associated with raw materials use and equipment manufacture, and emissions associated with electricity consumption. As the electricity grids both in the UK and across the world continue to decarbonise, that part of the footprint will likely decrease. On the other hand, manufacturing IT hardware is unlikely to decarbonise to the same extent.

However, reduction actions may include to extend the lifecycle of products, purchasing equipment with known emissions, buying refurbished IT equipment as well considering rental of equipment rather than ownership, therefore reducing our proportion of lifecycle emissions.

- Library procurement

The carbon footprint of our library services is based on the following expense names:

Table 12 Sources of library emissions

Expense name	Factor	Spend	Emissions
Library periodicals	2.03	486,492.66	988
Library data management	0.27	26,448.81	7
Data purchase for projects	0.27	23,217.91	6
Publishing papers - fees	0.16	34,550.44	6

The table shows that the footprint is driven by library periodicals. This is likely due to the extensive IT systems that support our subscriptions. Again, it is likely that the electricity-related portion of that footprint will reduce, thereby reducing the emissions factor. On the other hand, the emissions associated with hardware replacement are unlikely to fall.

It is difficult to identify concrete actions for the Hutton to take, but it would be useful to gain a better understanding of whether the emissions factors will decrease in the future and by how much.

For the above mentioned procurement categories the 4.2% annual reduction will be achieved by reducing spending, particularly in high impact procurement categories as well as exploring other options to equipment/ asset ownership. For example, outright ownership may not be necessary for all equipment. Renting equipment that either is or will be refurbished would reduce our proportion of lifecycle emissions. Similarly, renting/ procuring from suppliers that refurbish equipment could further reduce emissions. Seeking out suppliers publishing lifecycle emissions would give us better data and may overall also contribute to the proposed annual target.

In addition to the annual reduction target, we will also increase the proportion of 'green' suppliers, which are suppliers that are committed to science-based targets, established net zero emission targets and/ or have substantial sustainability targets at the core of their business.

Additionally, we are actively working to reduce the carbon impact of UK agriculture, by developing a green hydrogen farm (Glensaugh), which will act as a blueprint for other agricultural holdings and rural communities in the UK.

Fuel and energy related activities (category 3)

This SBTi category includes all well-to-tank fuel emissions as well as upstream natural gas and electricity (generation). As discussed under scope 1 and 2 emissions natural gas for heating will need to be replaced by alternative heating arrangements. Similarly, fossil fuels will be replaced by green fuels such as green hydrogen and/or green electricity.

Waste generated in operations (category 5)

Waste generated is largely a result of purchased goods, but the overall emissions caused are significantly lower (3.5 tCO_2e per annum), which is largely due to waste treatment in Scotland and particularly due to our contractors, which do not landfill. Reduction of emission in this category can be achieved through working with our supply chain and including packaging, end-of-life treatment, extended producer warranty arrangements among others in purchasing considerations.

Business travel (category 6)

Business travel emissions break down as follows:

Table 13 Sources of business travel emissions

Source	Baseline Emissions (tCO_2e)	Proportion of total	21/22 emissions for comparison (tCO_2e)
Domestic flights	54	8%	5
Short-haul (EU) flights	122	19%	14
Long-haul flights	324	50%	9
Rail travel	33	5%	2
Car travel, including fuel cards and expense claims	56	9%	18
Accommodation (UK)	33	5%	7
Accommodation (overseas)	31	4%	5
Total	**653**	**100%**	**60**

Business travel is the second largest SBTi category amongst the Hutton's scope 3 emission sources, with 653 tCO2e per annum as per baseline.

From baseline our travel emissions were mainly driven by the flights we take (70% of travel emissions), with long-haul flights alone accounting for close to half of travel emissions. As can be seen in table 13, the Covid-19 pandemic had a sizeable impact on travel patterns. As can be seen total travel emissions in 2021/22 are less than 10% of baseline (2019/20). While globally there were some restrictions still in place, many countries, including the UK, had no travel restrictions in place at this point, but travel emissions remained low. This might indicate that travel behaviour has already changed among staff.

Substantial staff consultation will be necessary to agree a final approach but any strategy to reduce travel emissions will need to include a combination of:

- Potential ban on domestic flights
- Considerable reduction of flying (tele-presence, innovative long-distance collaboration, re-localisation)

The lockdowns associated with the Covid-19 pandemic resulted in a 91% reduction in travel-related emissions, with 98% year-on-year reductions in emissions from air travel and 92% reductions in emissions from accommodation. This gives an idea of what is possible. A two-thirds reduction on baseline travel emissions would still allow for 3.6 times more travel than we undertook during the lockdowns, more if we use less carbon-intensive modes of travel.

Absolute net zero by 2035 will likely not be possible at least not exclusively due to Hutton's actions. Nonetheless, we are aiming to decrease associated emissions by 6.7% annually and offset the 'hard-to-avoid' proportion. To maximise reductions in our control it is currently discussed to ban domestic flights, encourage rail and bus travel within the UK and encourage colleagues to consider whether in-person participation is necessary at events outside the UK.

We are also increasing the number of electrical vehicle (EV) charging points on site and considering supporting colleagues with purchasing EVs through a salary sacrifice scheme.

Employee commuting (category 7)

Table 14 Commuting and homeworking emissions

Source	Baseline emissions (tCO2e)	20/21 emissions for comparison (tCO2e) – during Covid-19 pandemic	21/22 emissions for comparison (tCO2e) – post Covid-19 pandemic
Staff car commuting*	654	269	362
Home-working emissions	8	77	43
Total	**662**	**346**	**405**

This category also includes emissions from homeworking and is in terms of the Hutton's control similar to business travel. While we have some influence over this category, a proportion of emissions resulting from commuting will likely remain without offsetting. We will target an annual emission reduction of 6.7% and offset remaining "hard-to-avoid" emissions. Measures to be taken are to encourage colleagues switching to EVs by providing incentives, such as on-site charging points or potentially a salary sacrifice scheme for EVs. Other options include an internal car sharing platform, or continue promoting the cycle to work scheme and offer colleagues good on-site cycling infrastructure.

The carbon benefits of working from home depend on the commuting distance and mode (or mix of modes) of travel on one hand, and the extra heat demand due to working from home on the other. Supporting employees to work from home if they have a long car-based commute could result in emissions reductions.

It can be seen that during the Covid-19 pandemic the emissions were lowest due to a larger proportion of staff working from home, reducing therefore emissions. Post Covid-19 emissions are nonetheless still significantly below pre pandemic levels, suggesting that more flexible working arrangements became the norm and consequentially reducing Hutton's emissions more than a third in this category.

Collecting more accurate data on staff commuting patterns through regular surveys, complemented by other sources of data, would help to inform the actions in this section.

Construction emissions (multiple categories)

Hutton will need to agree on how to deal with impacts of construction and resulting emissions. Option for future construction projects (Just Transition Hub, HydroGlen), may include using the BREEAM[7] or Passive Haus standard from the onset of a development and therefore reducing construction associated and lifecycle emissions.

Construction projects will nonetheless cause emissions, making offsetting necessary. Avoiding emissions in the planning stages will decrease offsetting costs significantly.

The TCD development adds annually approximately 2,000 tCO_2e to Hutton's emissions budget from FY 2021/22 – 2023/24, which will add significant offsetting expenses. Considering upcoming construction projects at Glensaugh, Craigiebuckler and the ongoing works at Invergowrie it will need to be discussed how to deal with resulting emissions.

The Scottish Government suggests to options to deal with construction emissions:

- Insetting: Enhancing the carbon sequestration of our land holdings.
- Offsetting: Externally verified carbon credits[8].

We currently do not have the capacity to inset these amounts of carbon as discussed in Managing our carbon stocks.

Offsetting seems to be the more immediate action to take, however costs associated are considerable at current prices of approximately £15/tCO_2e.

It will need to be discussed whether we can increase our insetting capacity or purchase external credits.

[7] Building Research Establishment Environmental Assessment Method
[8] https://www.gov.scot/publications/public-sector-leadership-global-climate-emergency/pages/12/

3 Managing our carbon stocks

The debates and conceptual uncertainties surrounding net zero are covered in Appendix 2. This section simply seeks to outline the various climate-positive ways in which we could manage the carbon stocks on our land.

The Environment Agency's report *"Achieving net zero – a summary of the evidence behind potential carbon offsetting approaches"* was published in May 2021[9]. This is primarily useful in the way that it allows comparison of different measures. An adapted version of the summary table[10] is reproduced here, omitting measures not relevant to our estate:

Table 15 Assessment of carbon draw down potential

Measure	Emissions reduction or carbon removal?	Confidence in the science	Potential per unit area	Speed of impact	Longevity
Upland peat restoration	Both	Med	High	Slow	Long
Woodland creation	Removal	High	High	Slow	Long
Mown grasslands	Removal	Low	Low	Med	Short
Floodplain restoration	Removal	Low	High	Slow	Med
Constructed wetland	Both	Low	Unknown	Unknown	Unknown
Arable soils	Both	Med	Low	Med	Med
Pasture soils	Both	Low	Low	Med	Med
Hedges and trees	Removal	Med	Med	Slow	Long
Enhanced weathering	Removal	Low	Med	Slow	Med
Biochar	Removal	Med	High	Fast	Long

* Peatland restoration has a much higher potential to reduce emissions than to draw down carbon from the atmosphere.

From this long-list, it's clear that woodland creation and peatland restoration should be considered, and these are discussed in more detail below. Additionally, biochar scores relatively well. Biochar is not discussed further in this document, but a review paper was written in the context of the Glensaugh Climate-Positive Farming initiative[11]. For more detailed discussion of the other measures, it is worth referring to the original Environment Agency report, but also to discuss them with research teams at The James Hutton Institute who are actively researching climate-positive land management.

[9] https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/achieving-net-zero-carbon-emissions-a-review-of-the-evidence-behind-carbon-offsetting

[10] https://assets.publishing.service.gov.uk/media/6093ab72d3bf7f013dea69fa/Achieving_net_zero_-_a_review_of_the_evidence_behind_carbon_offsetting_-_infographic.pdf

[11] See https://glensaugh.hutton.ac.uk/research-data/climate-positive-farming-reviews or the direct link to the document here: https://www.hutton.ac.uk/sites/default/files/files/publications/ClimPosReview-Biochar-Msika2020.pdf

In February 2023, the Scottish Government published guidance for carbon insetting and offsetting under the Public Body Climate Change Duty (PBCCD) scheme[12]. While the guidance is intended for public bodies, it is certainly also helpful for our purposes, due to the Hutton's reporting under PBCCD as well as due to the lack of guidance on the topic. This might also hint at future wider ranging regulations covering offsetting and insetting. While the guidance does not cover any specific in- offsetting schemes it provides a direction for internal policies and aligns in some parts to SBTi guidance:

- Nature based solutions;
- Scottish rather than international offsets;
- Maximise insetting were possible;
- Carbon reductions from insetting projects should be externally verified, however there is no requirement to do so.
- Purchased offsets should be verified under Scottish Government supported carbon codes or other government backed codes.
- Carbon credits need to be verified under Scottish Government supported carbon codes to be sold.
- NETs are currently not accounted for in the Scottish GHG inventory.

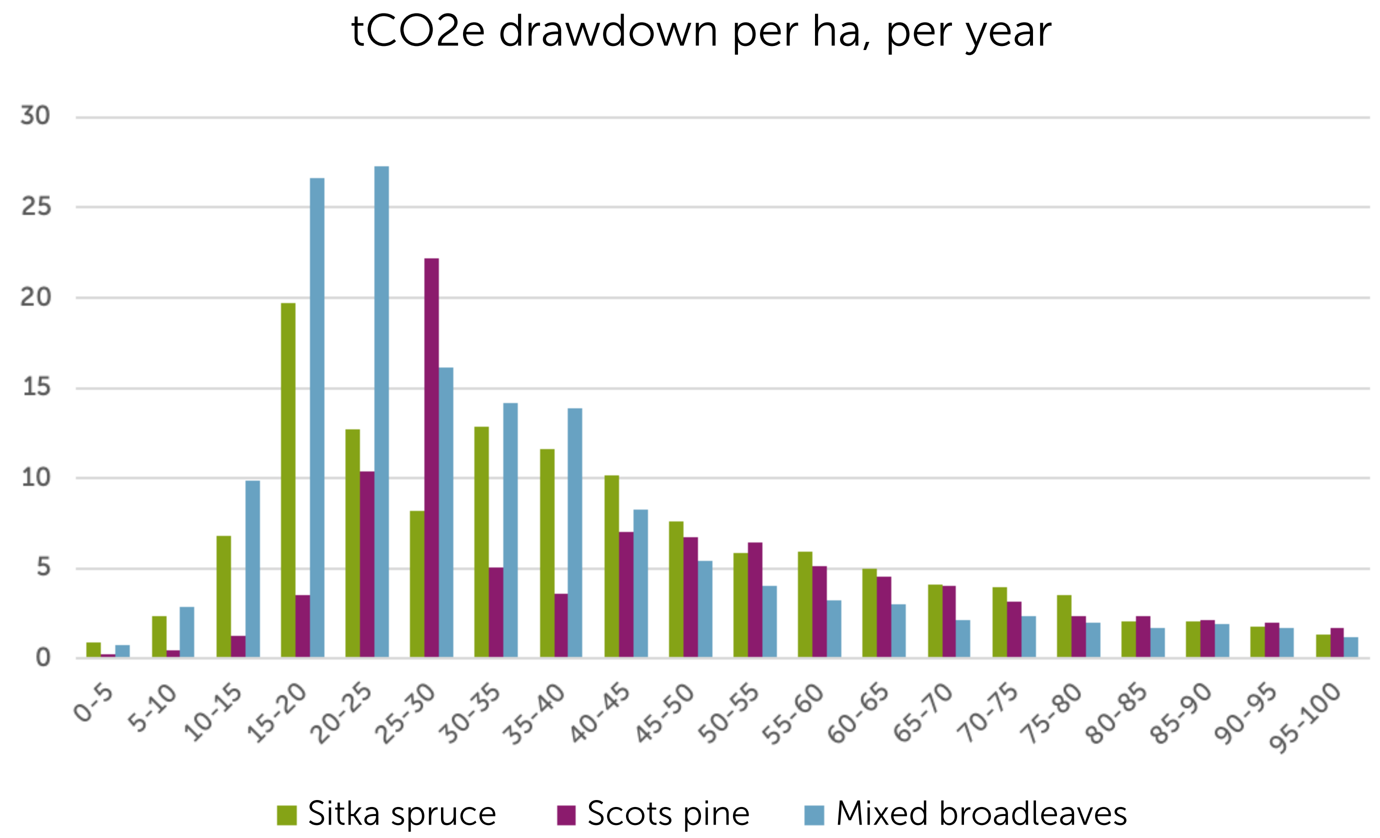
Taken these points into account there is potential for insetting at Glensaugh from tree planting.

According to SBTi we are allowed to inset/offset 10% of baseline emissions. This amounts to 1,574 tCO2e. These are likely to be split over all three scopes, however with the biggest proportion covering scope 3 emissions.

[12] PBCCD Insetting and Offsetting Guidance https://sustainablescotlandnetwork.org/uploads/store/mediaupload/2110/file/Public%20Bodies%20and%20Climate%20Change%20Duties%20-%20Guidance%20on%20carbon%20insetting%20and%20offsetting%20-%20February%202023.pdf?mc_cid=5e4ace4978&mc_eid=616d992f6b

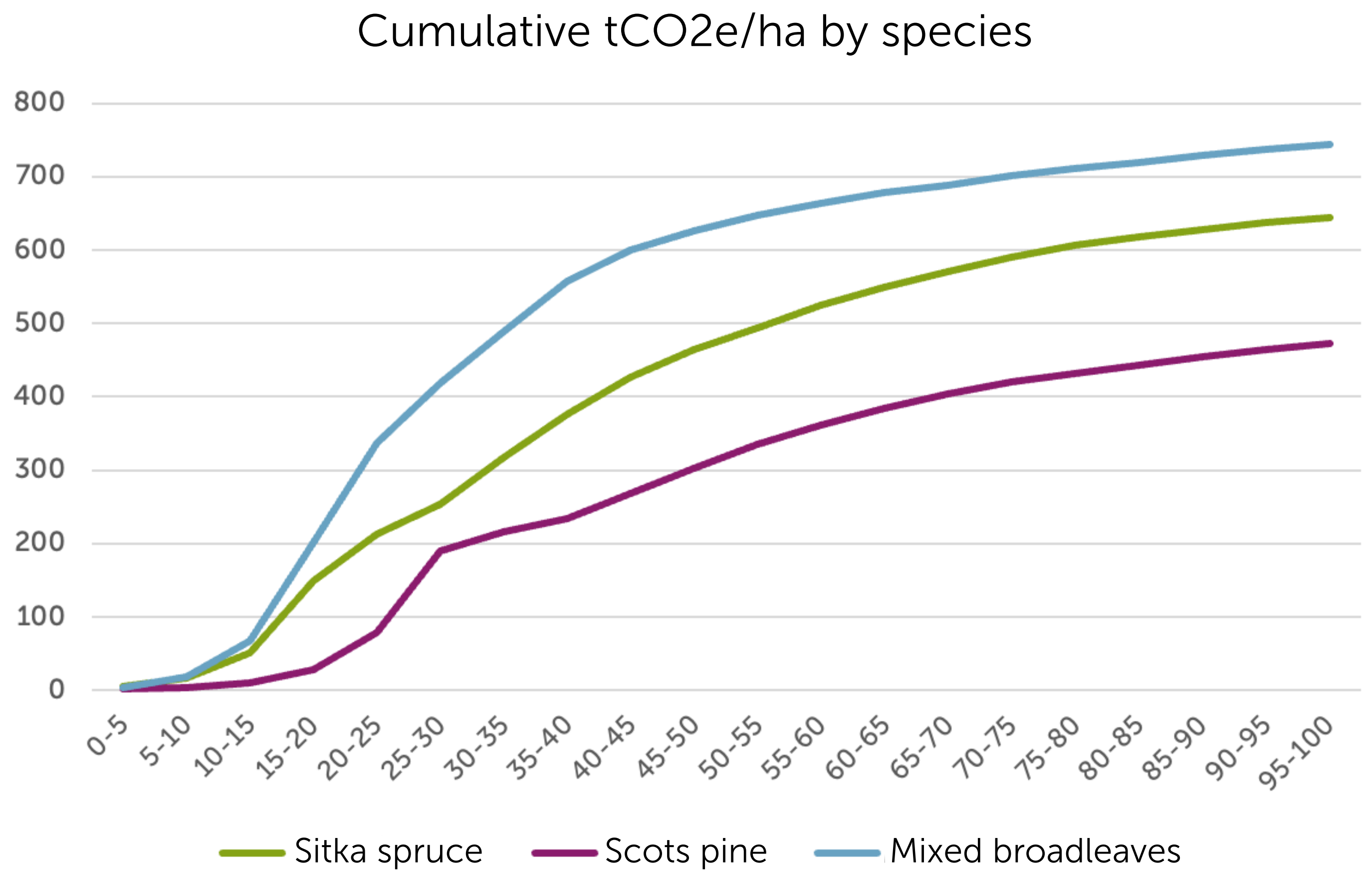
3.1 Tree planting

Tree growth is the most effective biological way of drawing down atmospheric carbon per unit area. Growth rates vary according to species, growing conditions, age of the trees and management. The following graph shows this based on woodland carbon code calculations for Glensaugh conditions.



It's clear that Sitka spruce and mixed broadleaves grow at a similar rate and grow faster than Scots pine. The rebound in growth rates for the conifers is likely due to the effects of thinning the woodland at those ages.

Converting this to cumulative figures show how much carbon can be stored in a hectare of tree biomass over its lifetime. Woodland planted before 2030 will have drawn down between 400 and 690 tCO2e/ha by 2100. This must be offset against the carbon released from the soil when the trees are planted. On organomineral soils, this can be around 29 tCO2e/ha. On organic soils with a high organic matter content, tree-planting can release significantly larger amounts of carbon, largely offsetting any carbon sinks from the tree growth for decades.



Since 2008, 70 ha of trees have been planted and over 2021/22 a further 110 ha were planted at Glensaugh. The Hutton is currently in the process of validating the woodland creation through the Scottish Woodland Carbon Code. This is estimated to sequester 18,678 tCO2e over 85 years. If this is considered as a linear carbon draw down, approximately 220 tCO2e would be sequestered annually, accounting for approximately 15% of the Hutton's residual emissions. By 2035, the trees planted will be approximately 15 years old and reach peak carbon sequestration, supporting the net zero 2035/2040 goal. This will be further discussed under "How much is enough".

3.2 Peatland restoration

Peatland restoration is another significantly climate-positive action that is being taken at Glensaugh. However, it is crucial to understand that, by contrast to tree growth, peatland restoration is primarily an emissions reduction measure, rather than a way of drawing large amounts of carbon down from the atmosphere.

A fuller and likely more accurate understanding of peatland restoration could be sought from several Hutton scientists. In simple terms, a natural peat bog is approximately climate-neutral, drawing down carbon dioxide, but releasing small amounts of methane and nitrous oxide. By contrast, a degraded peat bog releases all of these gases. The emissions depend on the level of degradation. Most peatlands across the UK are in a degraded state and are net emitters of greenhouse gases. Restoration aims to bring peatlands from a degraded state to a state nearer the natural equilibrium.

The peatland carbon code provides the following emissions figures for different states of peat:

Table 16 GHG emissions of peat of varying quality

State	Net greenhouse gas emissions ($tCO_2e/ha/yr$)
Actively eroding (worst)	23.84
Drained	4.54
Modified	2.54
Near natural (best)	1.08

From this, it's clear that restoring any actively eroding peat should be a priority.

The peatland carbon code estimates 1,961 tCO_2e in avoided emissions over the duration of the peatland restoration project (45 years), leading to an annual emission avoidance/ reduction of approximately 45 tCO_2e.

It also needs to be considered whether verification through the peatland and woodland code as our planting and restoration efforts would need be used for insetting and following the recently released guidance by the Scottish Government verification for insetting is not required.

3.3 How much is enough

Our baseline carbon footprint is missing data on carbon stock changes in the soils and vegetation that we manage (this is currently assessed and will be added). If we only estimate these for areas where we plant new woodland or restore peatland, then we are assuming that the rest of our landholding is at net zero, neither emitting nor drawing down carbon. This assumption needs to be tested: our peatlands are a likely source of emissions whereas our existing woodlands are drawing down carbon. Developing a method to estimate carbon stock changes across our whole landholding (possibly at multi-year intervals rather than annually) would be the most robust way of accounting for these emissions.

In the absence of this whole-site data, we still need to make decisions on how much new woodland to plant and whether we will need to purchase external carbon offsets to reach a credible "net zero" position. There is no simple answer to this question and no established position.

There are two ways to present a "net zero" position: Conventionally, "net zero" is defined as the point at which annual emissions are equal to annual carbon draw-down. However, woodlands complicate this position as their growth rate varies from year to year, peaking around year 20 and then falling.

Trees planted will grow slowly for the first 10 years, drawing down less than 10 $tCO_2/ha/yr$. Trees are likely to peak carbon sequestration between 2035-2040, the years of our net zero goals for scope 1 and 2 and scope 3 emissions, respectively.

It is conceivable to reach "net zero" on this basis in a particular year, only for tree growth to slow down and to find oneself back in a net-emitting situation the next. This complexity can be reduced by adopting a "cumulative net zero" approach, by which we are pledging to maintain the trees planted at Glensaugh, and consequentially "using" our resulting sequestered emissions as if trees would sequester carbon linearly over the 85 years project.

3.4 Carbon neutralisation ('offsetting') and net zero

Several position papers on net zero and carbon neutralisation have been published over the last few years, including a net zero standard from the science-based targets initiative[13]. As the definition given under point 1.3, net zero emissions describes reaching an equilibrium between, emitting GHGs as a result of business operations, including up- and downstream activities, and the drawdown of emissions. This means emissions caused, need to be abated. This makes 'neutralisation' an option to abate for 'hard-to-avoid' emissions. It is important that neutralisation is only used for residual emissions and not as a means to avoid emissions reduction, as the process of neutralisation is not as direct as is emitting, which makes it impossible to account like for like emissions. Furthermore, for long-term science-based targets, SBTi requires at least a 90% reduction of emissions by 2050, meaning that not more than 10% of residual emissions shall be neutralised by permanent carbon removals. In the case of Hutton's scope 3 emissions we could start removing residual 10% from 2040.

Despite not setting strong targets, there are three strong reasons to act now in relation to carbon draw-down (in addition to woodland creation): Firstly, to align the Institute's activities with the assumption of significant positive action in relation to land use, land use change and forestry (LULUCF). Secondly, most nature-based measures to reduce emissions or draw down carbon, especially woodland planting, take over a decade to make a difference, so early action will make our road to net zero smoother once we are in a position to set targets. Thirdly, cost associated will likely increase significantly over the next decade and therefore finding a way to inset emissions would be financially viable. Section 5 "managing our carbon stocks" provides more details on actions we could take.

3.5 External carbon offsets

Purchasing carbon credits externally may be necessary. However, this comes with significant reputational risks, mainly related to verification and certification of carbon credits. Useful guidance has been published by the Environmental Association for Universities and Colleges in January 2021[14] and there will likely be further work on this as the wider academic sector seeks to develop net zero-aligned climate action plans.

[13] https://sciencebasedtargets.org/net-zero
[14] https://www.eauc.org.uk/file_uploads/the_carbon_offsetting_briefing.pdf

4 Monitoring, reporting and certification action

We will report annually to Scottish Government Government (under the Public Bodies' Climate Change Duties as amended in 2020), in our financial accounts (under SECR legislation) and in a standalone, publicly accessible report on our website. We will ensure internal coherence of our reports.

The reports will include annual emissions, annual carbon sinks, and a re-appraisal of our targets and action plan to ensure they are still aligned with the Paris-aligned approach set out in this document or any subsequent national and international agreements.

5 Appendix 1: Complete baseline GHG inventory

Source	Scope	Baseline 2019/20 emissions (tCO2e)	% of total
Natural gas	1	1,410	9%
Diesel	1	249	2%
Petrol	1	9	0%
Propane	1	2	0%
Kerosene	1	1	0%
Refrigerant gas leaks	1	45	0%
BrMf soil/fertiliser	1 (Ag)	172	1%
Gs soil/fertiliser*	1 (Ag)	18	0%
Gs enteric fermentation*	1 (Ag)	270	2%
Gs manure management*	1 (Ag)	34	0%
Grid electricity (generation)	2	1599	10%
Grid electricity (transmission & distribution losses)	3	136	1%
Domestic flights	3	48	0%
Short-haul flights	3	110	1%
Long-haul flights	3	292	2%
Rail travel	3	28	0%
Car travel (business)	3	45	0%
Accommodation (UK)	3	33	0%

Source	Scope	Baseline 2019/20 emissions (tCO2e)	% of total
Accommodation (overseas)	3	31	0%
Car travel (commuting)	3	521	3%
Homeworking emissions	3	8	0%
Water (supply and treatment)	3	6	0%
Waste	3	4	0%
Upstream natural gas	3	183	1%
Well-to-tank diesel	3	59	0%
Well-to-tank petrol	3	2	0%
Well-to-tank LPG	3	<1	0%
Well-to-tank kerosene	3	<1	0%
Upstream electricity (generation)	3	223	2%
Upstream electricity (transmission and distribution losses)	3	19	
Well-to-tank domestic flights	3	5	0%
Well-to-tank short-haul flights	3	12	0%
Well-to-tank long-haul flights	3	32	0%
Well-to-tank rail travel	3	5	0%
Well-to-tank car travel (business)	3	11	0%
Well-to-tank car travel (commuting)	3	133	1%
BrMf fertiliser production	3	79	1%
Gs imported feed*	3	31	0%
Gs fertiliser production*	3	11	0%
Procurement (labs)	3	5,308	34%
Procurement (IT)	3	1,447	9%
Procurement (library)	3	1,007	6%
Procurement (consultancy/professional)	3	835	5%
Procurement (other)	3	1,263	8%

*- Figures for Glensaugh are from 2018 and have not been re-calculated.

6 Appendix 2: Net zero critiques

Net zero is a contested concept, with many environmental groups criticising it as an exercise in greenwashing, providing organisations and countries with a justification to continue emitting greenhouse gases on the premise that these emissions can be "netted off" in some way. This greenwashing can also take more subtle forms, with some organisations setting targets to "reduce emissions as much as possible and then netting off the residual emissions". This sounds reasonable but the statement "reducing emissions as much as possible" leaves a lot of room for interpretation. Climate science demands that we challenge the boundaries of what emissions reductions we consider possible. In the words of one article, we need "Less Net, More Zero" in the debate[15]. On the 4th of November, 2021, the Scottish Government published its guidance for Public Sector Leadership on the Global Climate Emergency[16] in which it clearly states that "most sectors, including the public sector, will need to reduce emissions close to zero without offsetting for Scotland to meet its national climate change goals." (p. 1)

Beyond these critiques, climate science tells us that we will not achieve our target of keeping global heating below 1.5°C without significant efforts to draw down carbon from the atmosphere, even under the most rapid emissions reductions scenarios. This means we need to invest in carbon draw-down and the sooner, the better. Whether we use this to claim that the Institute is at "net zero" or not is a moot point.

[15] See the article "Less Net, More Zero" from the Science-Based Targets initiative: https://sciencebasedtargets.org/blog/science-based-net-zero-targets-less-net-more-zero

[16] https://www.gov.scot/publications/public-sector-leadership-global-climate-emergency/