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Plymouth’s greenhouse gas reporting 2024

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Cover image: Plymouth Sound

Management summary

Plymouth City Council (PCC) declared a Climate Emergency in 2019 and pledged to work towards creating a carbon neutral city by 2030. The target year is 20 years in advance of the 2050 national net zero target required under the Climate Change Act and reported on in the Sixth Carbon Budget.

Plymouth's greenhouse gas (GHG) emissions decreased by 56 kt CO_2e (5%) between 2021 and 2022, from 1,051 kt CO_2e in 2021 to 995 kt CO_2e in 2022. The decline reflects the continued decarbonisation of the power sector through national renewable electricity generation and was enhanced by the higher winter temperatures and energy prices, reducing emissions from buildings. Meanwhile, transport now accounts for 34% of emissions having seen a 3% rise over the year. The overall trajectory remains downward, albeit at a slowing pace.

By following a newly defined current trend (an exponential decline based on the 2008 to 2022 emissions) 2008 emissions would be halved by 2030 and result in average annual emissions decline of 23 kt CO_2e with emissions in 2030 projected at 726 kt CO_2e. A linear decline in emissions from the projected 2024 value to zero in 2030 requires an annual reduction of 149 kt CO_2e, 15% of 2022 emissions, for each of the six years to 2030. This amount is 6.5 times the reduction rate of the current trend.

Cumulative emissions from 2021 to 2030, based on the current trend, are projected to reach 8.6 MtCO_2e, almost double the projection of 5.1 Mt CO_2e, had a linear decline been achieved as set out just three years ago.

Future emissions trajectories for Plymouth following the Climate Change Committee's Sixth Carbon Budget show the emissions reduction pathway where Plymouth mirrors the national trajectory to net zero in 2050. Achieving this target would require average annual emissions reduction of 34 kt CO_2e from 2022 to 2050, which is 1.5 times the reduction rate of the current trend. This illustrates the extent of the changes needed for Plymouth is to meet the Sixth Carbon Budget 2050 net zero trajectory.

Contents

1 Introduction

The 2008 Climate Change Act, with subsequent amendments, sets a legal obligation for net zero emissions in UK by 2050. The Act established the Climate Change Committee (CCC). The CCC sets five-year carbon budgets for the UK, the most recent of which is the Sixth Carbon Budget[a] [1] covering the period from 2033 to 2037. In 2019, increasing urgency to address climate change led Plymouth City Council (PCC) to declare a Climate Emergency and pledge to work towards net zero by 2030 [2], pledging the city to become carbon neutral by 2030. Many of the city's businesses and organisations have also pledged their commitment to carbon neutrality and a Plymouth Net Zero Partnership aims to provide effective visible strategic leadership in driving Plymouth's transition to net zero greenhouse gas (GHG) emissions.

Since 2019, the Centre for Energy and the Environment (CEE) at the University of Exeter has provided annual quantified projections of GHG emissions for Plymouth to assess progress towards net zero. Initial projections examined the challenge of net zero by 2050 (the national timeline at the time. Further analysis assessed how Plymouth might be able to develop a trajectory to net zero by 2030 [3]. The work included an assessment of Plymouth's greenhouse has (GHG) emissions between 2008 and 2016, which was subsequently expanded to cover the years from 2017 to 2021[4–7].

The earlier reports responded to the City Council's Climate Emergency Action Plans, which aimed to capture city-wide commitments to climate action. However, this approach was reviewed during 2022, and the Climate Connections Plymouth website[b] now sets out an overall city plan for net zero. From March 2023, the City Council has been preparing its own three-year Net Zero Action Plan (NZAP), which it rolls forward on an annual basis. This covers the Council's commitment to tackle its own direct and indirect GHG emissions and to use its influence to promote emissions reductions across the city. The NZAP sits alongside the climate commitments of all organisations, businesses, groups, and individuals across the city as part of delivering a net zero Plymouth.

The 2021 monitoring report [5] adopted the net zero trajectories set out in the Carbon Neutral Plymouth report [3] and PCC's 2019 and 2021 Climate Emergency Action Plans [8,9] to identify a series of more specific and timely metrics for monitoring progress towards carbon neutrality in the city. The purpose of the metrics is to indicate the potential scale of intervention that may be needed on a trajectory to net zero by 2030. The metrics help focus attention on key areas for intervention and establish the urgency for accelerated action and were updated in July 2023 [6].

This study provides an updated greenhouse gas (GHG) inventory for the city with the 2024 data and estimates the annual emission reduction to achieve zero GHG emissions in 2030. Publication of most of the required data occurs two years in arrears, so this update extends the historic time series to 2022.

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[a] This study makes extensive use of material from the Sixth Carbon Budget. References to the CCC refer to the Sixth Carbon Budget unless stated otherwise

[b] Can be visited at: https://climateconnectionsplymouth.co.uk/

2 GHG inventory update

This section presents the updated GHG inventory time series, extended to cover the period 2008 to 2022.

2.1 Methodology

The GHG inventory is compiled on a territorial basis. Territorial emissions are those arising from within the boundaries of Plymouth and are within the control of people living, working, and visiting the city[c]. The one exception is the power sector, which is assessed based on electricity consumption in the area, assuming national average electricity supply emission factors. The publication year of territorial GHG emissions for local authority areas lags the data year by 2 years, so the most recent data available is for 2022.

2.1.1 Methodology changes in this update

The methodology is generally the same as that followed for the 2016 to 2021 footprints, outlined in Internal Document 964 [10]. Subsequently, there have been year-on-year improvements to the underlying data sets which affected the methodology for the 2020 and 2021 footprints, as reported previously [6,7,11,12].

The only methodology change for the 2022 data is for emissions from fluorinated gases (F-gases) [13]. These were previously estimated using F-gas data published by the National Atmospheric Emissions Inventory (NAEI) and apportioning them based on commercial electricity consumption. F-gas data is now taken from the final UK greenhouse gas emissions national statistics [14] (also based on the NAEI data apportioned using commercial electricity consumption). There have also been revisions to the source data, including a sectoral re-classification of emissions and updates to some of the emission estimation models. These are described in more detail in Internal Document 1064[d] [13].

2.1.2 Reporting categories (sectors)

The GHG inventory for Plymouth reports emissions under the following categories:

- **Power:** emissions resulting from electricity consumption.
- **Buildings:** emissions resulting from fuel combustion in the domestic, commercial, and public administration sectors.
- **Industry:** emissions categorised as from industry in the government local authority CO_2 dataset [15], including large industrial installations but excluding electricity (reported under power).

[c] The territorial emissions method is consistent with the approach taken in UK national reporting, i.e. considers all the emissions arising from activity within Plymouth. An alternative approach is a consumption-based footprint, which would include upstream and downstream emissions arising outside an area, e.g. the manufacture, use and disposal of goods, services, and food from/to elsewhere.

[d] In the absence of national data, waste emissions have been assumed to be the same as for 2021

- **Transport:** emissions from road and rail vehicles (emissions from electric vehicles are also reported under power; emissions from aviation and shipping have not been included due to lack of data).
- **Agriculture:** emissions from fuel use (excluding electricity), livestock, and arable operations in the sector.
- **Land use** (including land use change and forestry)**:** emissions are produced by biomass removal and are removed (sequestered) by biomass growth. Draining or wetting organic soils, soil mineralisation, and fertilizer application in the forestry industry are also included (however, fertilizer use in agriculture is reported under agriculture).
- **Waste:** emissions from the disposal of solid waste and wastewater.
- **F-gases:** emissions from the consumption of fluorinated gases.

2.2 Results

The data series has been extended to 2022, and values for previous years have been revised because of the methodology changes described in Section 2.1.1 and revisions to underlying data.

2.2.1 Headline emission results for 2022

Total greenhouse gas emissions in Plymouth in 2022 are estimated at 995 kilotonnes of carbon dioxide equivalent (kt CO_2e), a decrease of 56 kt CO_2e (-5%) from 2021[e].

The breakdown of emissions reported for 2022 is shown in Figure 1, and in greater detail in Figure 2 (as detailed in Appendix A).

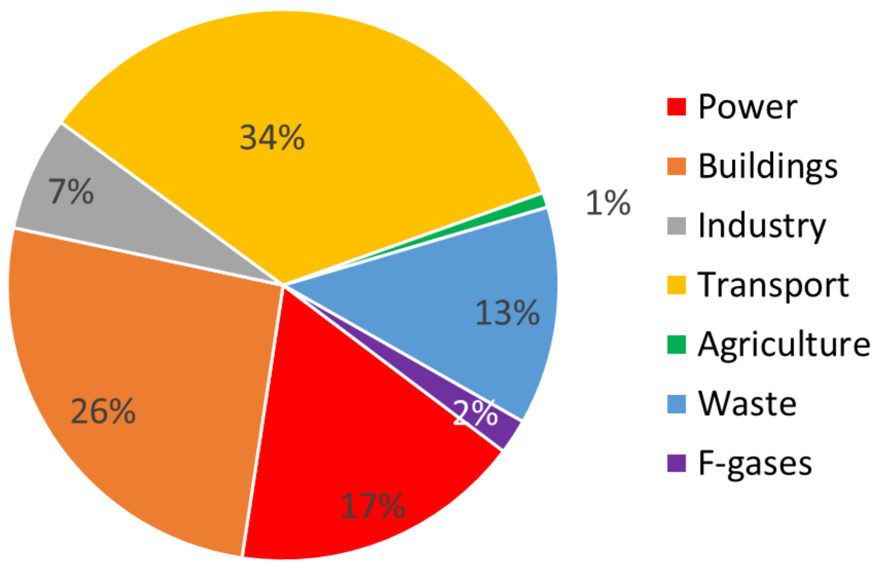


Figure 1. The sources of Plymouth's GHG emissions in 2022[f]

[e] The comparison is with the latest (revised) 2021 figure of 1,051 kt CO_2e
[f] Land use (0.17 kt CO_2e) is not plotted

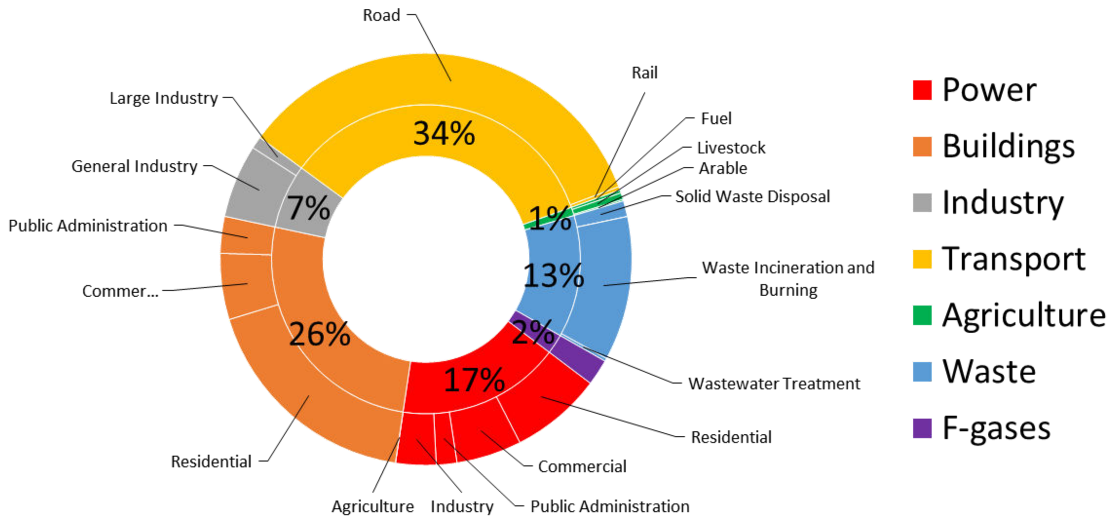


Figure 2. The sources of Plymouth's GHG emissions in 2022: detailed split between sectors[g]

2.2.2 Impact of data revision and methodology changes

The 2023 inventory report [7] estimated 2021 GHG emissions to be 1,075 kt CO_2e. However, with the revised methodology and additional data now included, the revised total GHG emissions figure for 2021 is 1,051 kt CO_2e, a reduction of 24 kt CO_2e or 2%. The underlying data sources often include revisions to the historical time series data when data are released. Hence, differences between the values in the 2023 inventory report [7] and the revised values presented in this report are partly attributable to data revisions and partly to methodology changes (described in Section 2.1.1).

Figure 3 shows the revised figures with the extended historical data and Figure 4 compares the previously reported and revised values for each of the years 2008 to 2021, along with the values calculated for 2022.

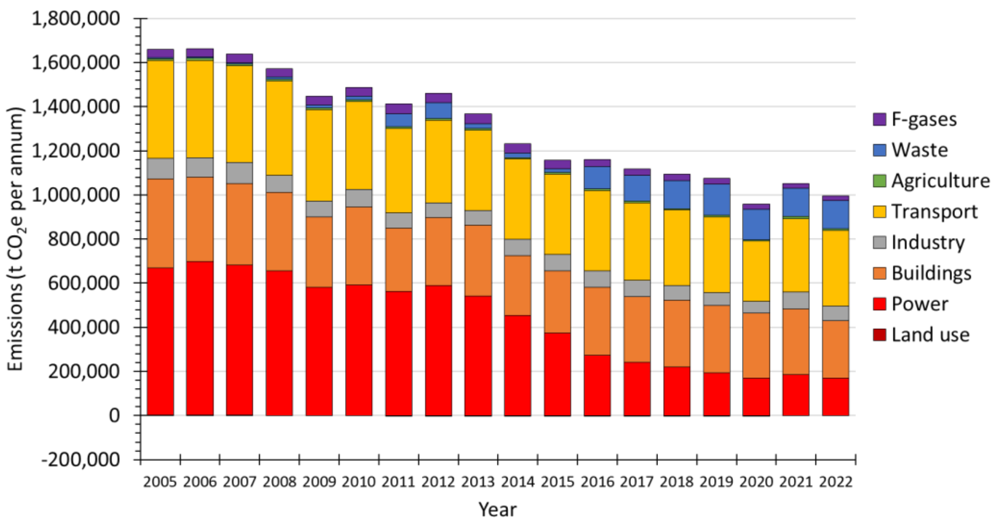


Figure 3. Sources of greenhouse gas emission in Plymouth from 2005 to 2022

[g] Land use (0.17 kt CO_2e) is not plotted

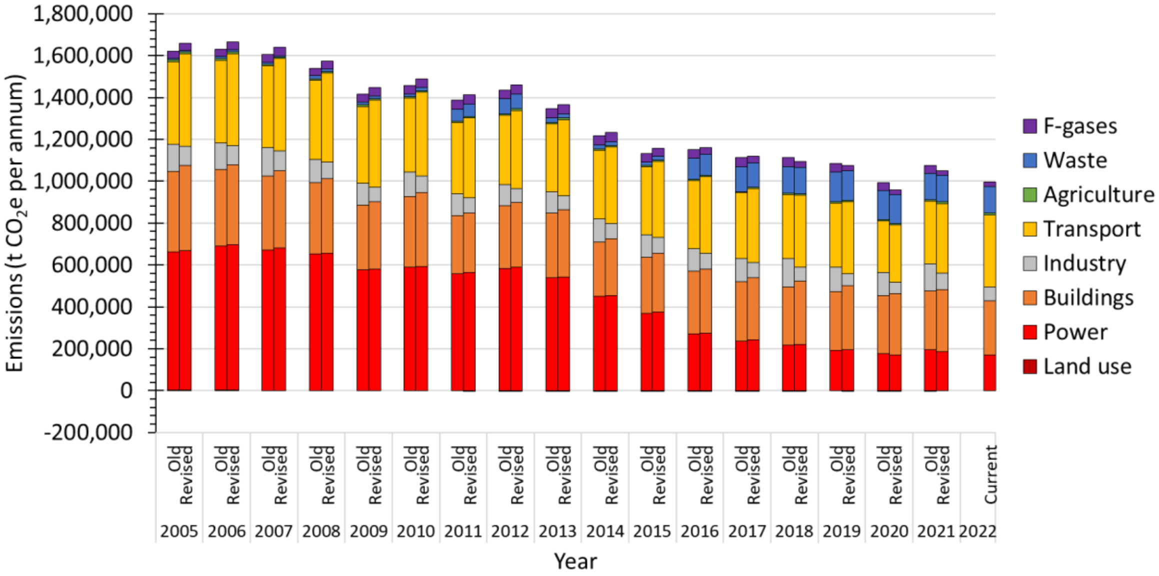


Figure 4. Comparison of previously reported [7] *and revised GHG emissions for the years 2005 to 2022*

The greatest absolute change in the 2021 emission estimates due to data revisions has been for the industry sector, with a reduction of -55kt CO_2e or -42% due to the sectoral reallocation of emissions to match the government's latest Territorial Emission Sectors (TES) classification [16]. Transport emissions have been revised up by 36 ktCO_2e (12%) and F-gas emissions have revised down by -14 kt CO_2e (-39%), both due to updates to the emission estimation models [13]. Land use experienced the largest percentage change (133%), changing from a net sink (-41 t CO_2e) to a small source (14 t CO_2e). Finally, there has been a 1 kt CO_2e increase (13%) in reported agricultural emissions due to the methodology changes and data revisions described in Section 2.1.1. Emissions from all other sectors changed by less than 10% due to methodology revisions.

2.2.3 Progress in reducing emissions

A general downward year-on-year trend in emissions is evident from the revised data series in Figure 3, except for the waste sector. The increase in the waste sector over the period from 2016 to 2019 is attributable to the commissioning of the Devonport combined heat and power energy-from-waste (CHP EfW) facility in 2016. After the initial rise, emissions have trended slightly down over the past three years. Overall, GHG emissions have reduced by 37% (-578 kt CO_2e) since 2008. This is mainly attributable to the power sector, which has seen a 74% reduction in emissions through the national decarbonisation of electricity production.

2.2.3.1 Annual incremental change 2021 to 2022

The 2023 inventory report [7] extrapolated the decline in emissions between 2016 and 2019 forward to create a linear trajectory that was referred to as "current trend", which was assumed to be followed in 2022. This implied an annual decrease in emissions of 20 kt CO_2e, resulting in estimated emissions in 2022 of 1,055 kt CO_2e. Reported total GHG emissions for 2022 of 995 kt CO_2e are 60 kt CO_2e lower, indicating that the anticipated level of decarbonisation has been underestimated.

Annual changes in emissions from 2020 to 2021 are shown in Table 1. The greatest year-on-year decrease in 2022 has been in the buildings sector, with a decline of -40 ktCO2e (-14%). Activity in the building sector was impacted by the warmer temperatures and higher energy prices in 2022, resulting in lower fuel demands in both domestic and commercial buildings. After a rise in emissions in 2021, the power sector has returned to its decarbonisation pathway through the increased use of renewables, with emissions decreasing by -14 kt CO2e (-8%). Transport emissions saw an increase of 10 kt CO_2e (3%) following the removal of the last COVID-19 travel restrictions. Industry has seen a decline in emissions of -10 kt CO_2e (-13%) likely due to a decrease in emissions from large industrial installations. Other sectors have seen annual changes of between 0% and 10%, except for land use (which is now a net source and has increased by 1157% (0.16 kt CO_2e) since 2021).

Table 1. Annual (2021 to 2022) changes achieved in sectoral GHG emissions, based on the revised data series

Sector	2021	2022	Change Achieved 2021 to 2022	
	t CO_2e	t CO_2e	t CO_2e	%
Power	184,232	170,248	-13,984	-8%
Buildings	298,792	258,372	-40,420	-14%
Industry	76,876	66,900	-9,976	-13%
Transport	333,445	343,131	9,687	3%
Agriculture	8,610	8,743	133	2%
Land use	14	170	157	1157%
Waste	127,285	127,435	150	0%
F-gas	22,128	20,322	-1,806	-8%
Total	1,051,381	995,322	-56,059	-5%

2.2.3.2 Progress from 2008 towards zero emissions

Figure 5 shows the changes achieved in each sector since 2008[h] and compares historic emissions for each sector with a linear trajectory from 2008 to zero in 2030. Only for the power and land use sectors do the trajectories achieve zero GHG emissions by 2030.

The increase in waste sector emissions in 2016 is a result of the development of the Devonport CHP EfW plant. The plant treats waste from outside Plymouth. The associated emissions are included because the inventory is performed on a territorial basis, but they are attributable to behaviours outside of the geographic area. Additionally, the emissions values do not consider the biogenic content of the waste nor emissions offset by the generation of electricity. However, use of heat from the EfW plant results in lower emissions from the fuels displaced.

Resumption of progress in the power sector after the unexpected uptick in 2021 is attributable to further decarbonisation of grid electricity nationally; emissions are calculated using a national average emission factor for electricity generation, transmission, and distribution. Thus, changes in grid carbon intensity will largely take place outside the city.

A further increase in transport sector emissions since last year's inventory (where the sharp decline in transport emissions in 2020 attributable to the Covid-19 pandemic was mostly lost

[h] Updated versions of Tables 1 and 2 included in the 2021 monitoring report are available in Appendix B. These quantify changes since 2008 and since 2016.

after travel restrictions were subsequently removed) is particularly concerning as this sector is a major source of GHG emissions, and reductions since 2008 fall well short of the level of change required to meet zero emissions.

While the substantial decrease in emissions in the buildings sector is a positive outcome, it is likely to be a response to higher temperatures and higher energy prices. Structural change in energy efficiency and heating systems is necessary if long-lasting impacts are to be achieved in the decarbonisation of this sector.

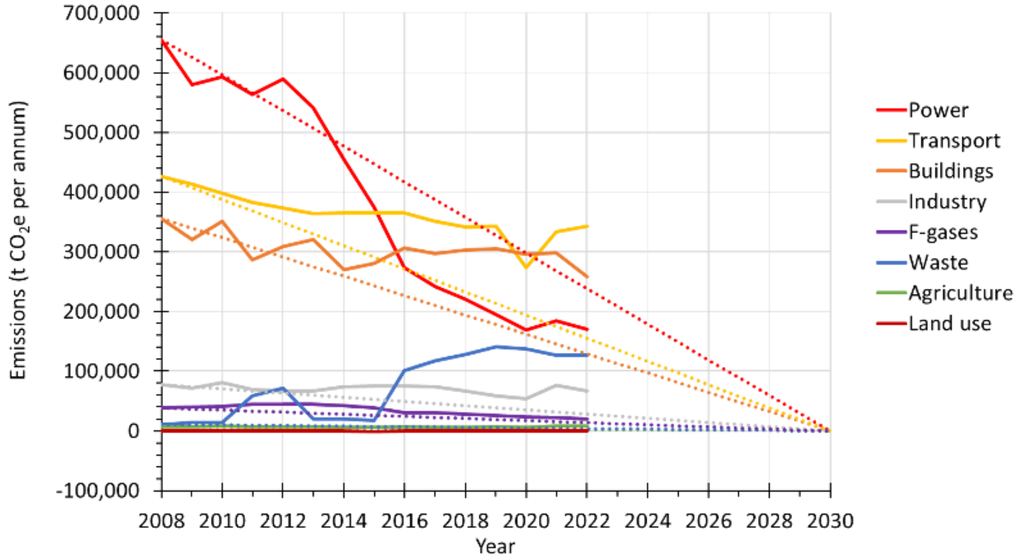


Figure 5. Emissions against a linear trajectory to zero by 2030 (dotted), 2008 base, by sector

Figure 6 shows the progress in reducing GHG emissions from all sectors combined. Progress again falls short of delivering zero in 2030. After the bounce back from lower emissions during the COVID-19 pandemic in 2020, emissions have returned to a downward trajectory with a higher rate of decline (-56 kt CO_2e) than that of the 2016 to 2019 trend (-20 kt CO_2e). However, this is likely to be due to exceptional circumstances in the energy market and, even if it was to be continued, it would perhaps only reduce 2008 emissions by two thirds in 2030.

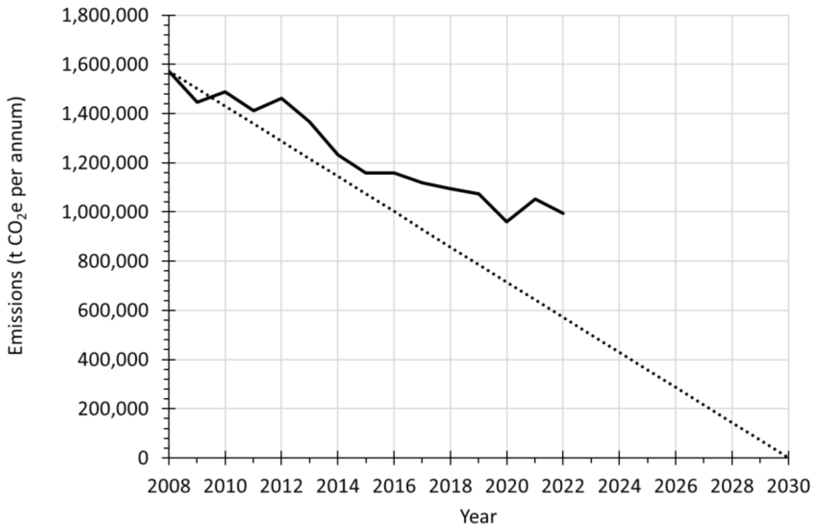


Figure 6. Emissions against a linear trajectory to zero by 2030 (dotted), 2008 base, total emissions

2.2.4 Future emissions trajectories to 2030

This section considers the magnitude of future GHG emissions reductions required to achieve zero emissions by 2030.

2.2.4.1 Definition of current trend

Figure 7 extrapolates Plymouth's total GHG emissions from the city's 2022 actual emissions based on a newly defined "current trend" to depict future emissions reductions. This current trend was derived as an exponential decline based on the historical emissions data from 2008 to 2022, as the bulk of emissions reduction through grid decarbonisation has already been achieved and, based on the current trajectory, the amount of decarbonisation projected will diminish every year. The new "current trend" suggests that emissions reduce on average by 23 kt CO_2e per year between 2022 and 2050, with emissions in 2030 of 726 kt CO_2e. However, the continuation of the current trend without local GHG reduction relies on unrealistic grid decarbonisation. While it may be realistic to assume current trend estimates for the near future may be achieved with grid decarbonisation, a reduction from non-power sectors will be required to continue to follow and exceed the current trend if net zero by 2030 is to be achieved.

2.2.4.2 Linear decline to 2030 from 2023 or 2024

Emissions reductions to zero in 2030 could take many alternative trajectories. For example, a possible but unlikely trajectory would be to follow the current trend from 2022 until 2029 with zero occurring in one step the following year. This would create cumulative emissions of 8.6 Mt CO_2e from 2021 to 2030 (see Figure 8). The 2023 inventory report [7] examined a linear decline in emissions from a 2023 value (based on the current trend) to zero in 2030. This showed a decline of 148 kt CO_2e per year and cumulative emissions of 6.3 Mt CO_2e from 2021 to 2030. Re-working this analysis using the latest historic data and new current trend revises these values to 132 kt CO_2e per year and cumulative emissions of 5.8 Mt CO_2e, as plotted in Figure 7 and Figure 8.

It is unlikely that radical reductions in emissions across all sectors were delivered in 2023. Thus, the annual linear reduction in emissions that would be necessary to deliver zero emissions in 2030 starting from 2024 has been determined. The two-year lag in emissions reporting has been addressed by assuming that emissions follow the "current trend" in 2023 and 2024. Achieving this endpoint will require concerted effort from all stakeholders within the city: businesses and residents as well as the council itself, as acknowledged by the IPCC.

Delaying the start of the linear decline to zero from 2023 to 2024 increases the required annual reduction in emissions from 132 to 149 kt CO_2e: the latter represents an additional 126 kt CO_2e (548%) reduction per year over and above the current trend (Figure 7).

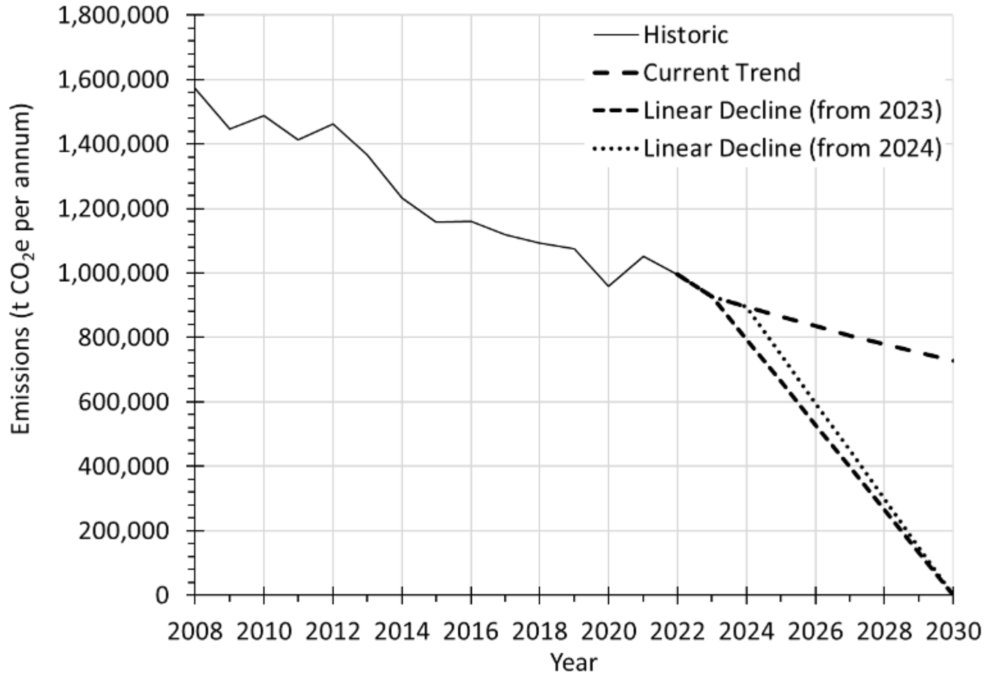


Figure 7. Emissions following the current trend with a linear decline trajectory from 2021 or 2024 to zero by 2030

Figure 8 shows the cumulative emissions from the current trend and linear decline trajectories. Current trend cumulative emissions from 2021 to 2030 reach 8.6 Mt CO_2e (previously 9.8 Mt CO_2e[i]), while linear declines for 2023 and 2024 reach 5.8 Mt CO_2e (previously 6.3 Mt CO_2e), and 6.1 Mt CO_2e, respectively.

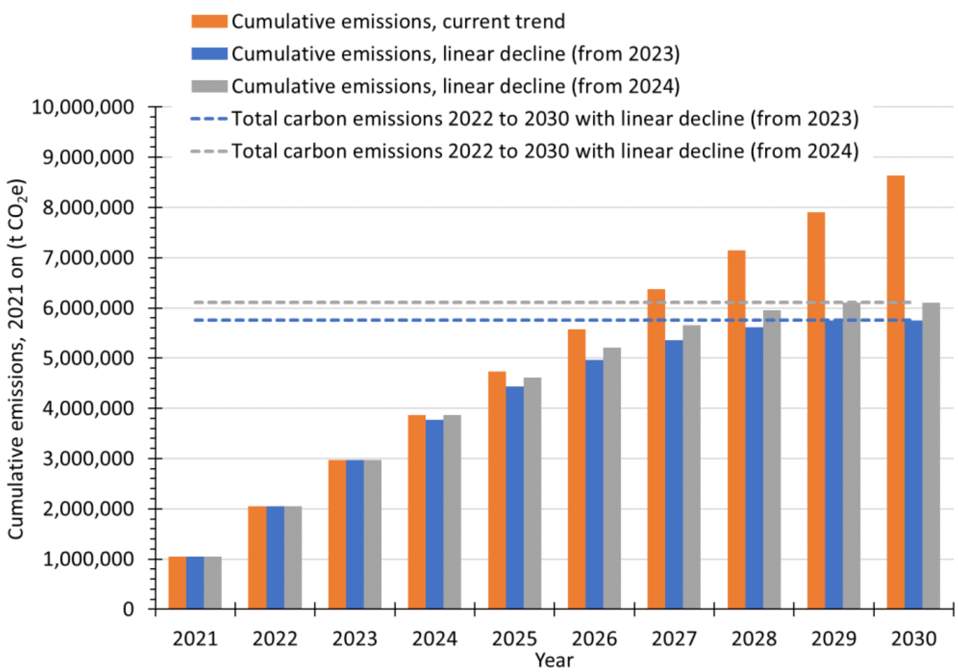


Figure 8. Cumulative emissions under alternative trajectories: extrapolating the current trend, or linear decline to zero in 2030 starting in either 2023 or 2024.

[i] These figures are quoted from the 2023 inventory report and do not include the impact of revisions to historic data

2.2.5 Comparison with previous years

Table 2 compares the linear GHG emissions reduction strategies to zero emission in 2030 outlined in the previous monitoring report and the current report. The table shows that each year that passes where the trajectory to zero emissions in 2030 is not met, adds to the rate of emissions reductions required in subsequent years and to the resulting cumulative emissions.

Table 2. GHG emissions linear reductions reported in 2021, 2022, 2023, and 2024[j]

Report year & decline start year	2021	2022	2023	2024
Annual GHG reduction required (kt CO_2e)	117	124	132	149
Increase in annual emissions reduction required from 2021 (kt CO_2e)		7 (6%)	8 (6%)	17 (11%)
Cumulative emissions from 2021 to 2030 (Mt CO_2e)	5.3	5.5	5.8	6.1
Increase in cumulative emissions from 2021 (Mt CO_2e)		0.2 (4%)	0.2 (5%)	0.3 (5%)

Since 2021 the rate of GHG emissions reduction required to reach zero emissions in 2030 has increased by over one third and the cumulative emissions that result have increased by almost a quarter. Under the current trend in this year's report the 5.3 Mt CO_2e cumulative emissions estimated for a linear decline from 2021 is likely to be exceeded in 2026 (Figure 8).

2.2.6 Future emission trajectories following the Sixth Carbon Budget to 2050

Future emissions trajectories for Plymouth following the Climate Change Committee's Sixth Carbon Budget Balanced Pathway [1] to net zero in 2050 have been estimated. Emissions offset from land and GHG removals have not been included since they are impracticable on a large scale in Plymouth, which is predominantly urban (reducing opportunities for sequestration through planting).

The future trajectories have been calculated from future national emissions set out in the CCC 2023 Report to Parliament [17] by scaling these to match emissions reported in Plymouth in 2022. These trajectories illustrate pathways for each sector to reach net zero based on a set of assumptions of policy and plan implementation outlined within the CCC's report. These estimates were produced on a national level and have been scaled to each sector within Plymouth based on a factor derived from the ratio of Plymouth sectoral emissions in 2022 to national sectoral emissions in 2022.

Figure 9 shows the future trajectory of total emissions in Plymouth following the Balanced Pathway to net zero excluding offsets from land and GHG removals. Consequently, residual emissions of 57 kt CO2e are projected in 2050. Following this pathway involves an average annual emissions reduction of 34 kt CO_2e, which is almost 50% greater than that achieved by the current trend. The comparison between the Balanced Pathway trajectory and the current trend illustrates that significant emissions reductions beyond the current trend are required to meet net zero by 2050 as established under the Climate Change Act. Initial extrapolation of the current trend appears to indicate that Plymouth is outperforming the balanced pathway trajectory in decarbonising. However, this is due to the simplistic assumption of an exponential current trend that may overestimate Plymouth's decarbonisation potential in the near future.

[j] These figures are revised from the 2023 inventory report and include the impact of revisions to historic data or the change to an exponential current trend to extrapolate emissions

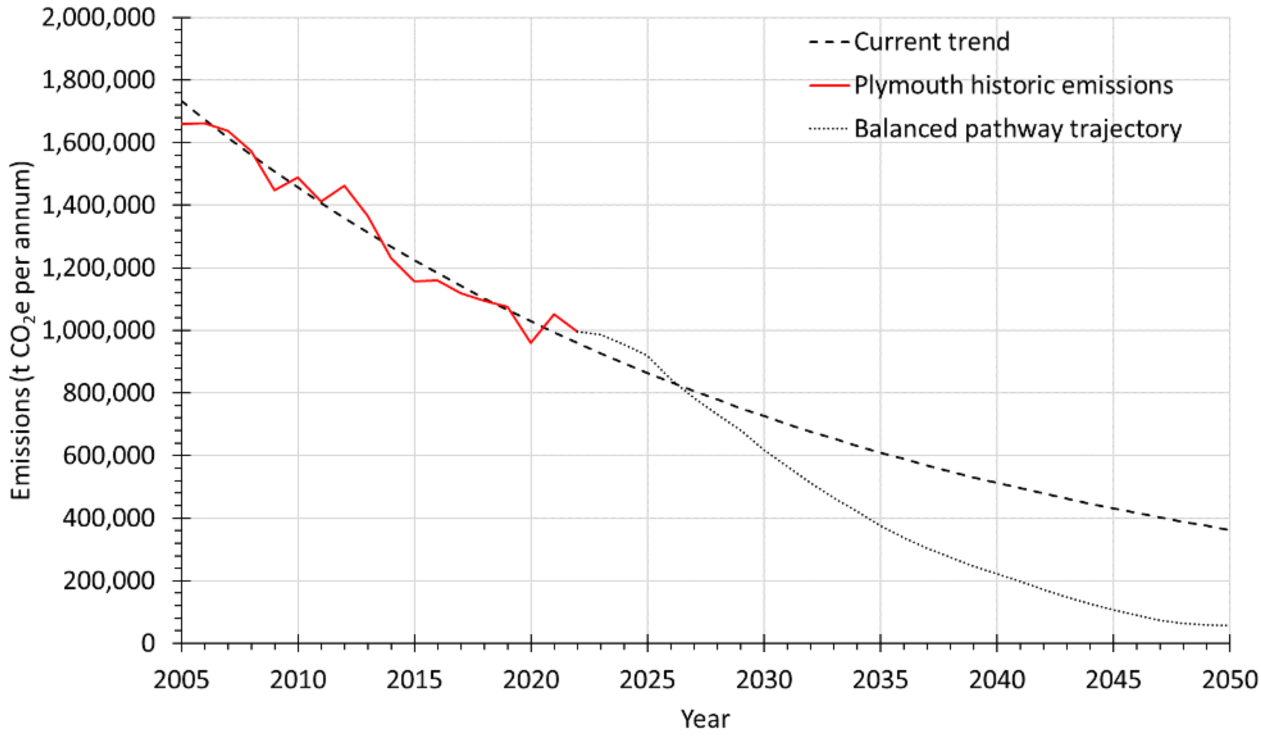
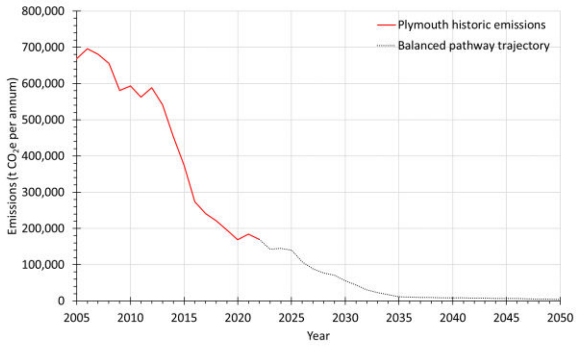
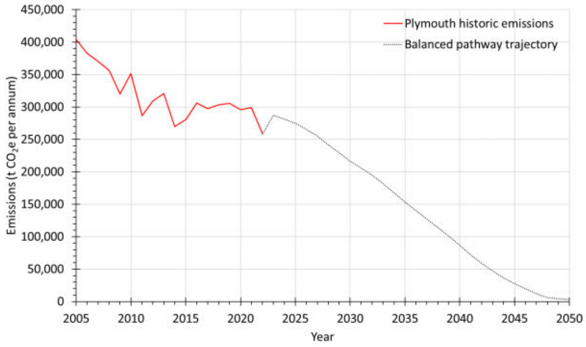


Figure 9. Future GHG emissions in Plymouth compared to the national balanced net zero pathway

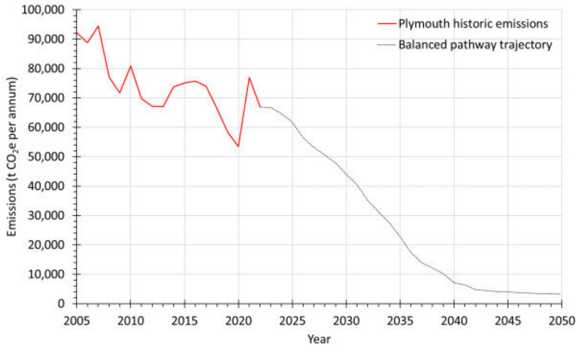
Figure 10 a to h depicts the future trajectory of total emissions in Plymouth following the balanced net zero pathway for each sector. The trajectory for land use is shown for information but has not been included in the overall totals depicted in Figure 9. As on a national scale it is foreseen for land use to become a net sink (negative values), it cannot adequately be scaled to Plymouth's emissions due to its urban nature. Most land use emissions derive from the conversion of land to settlement, counteracting any carbon sequestered by forests or grasslands and making land use a net source. Thus, the trajectory shows a linear decline and sets the target of eliminating these by 2050 by avoiding emissions from urbanisation.



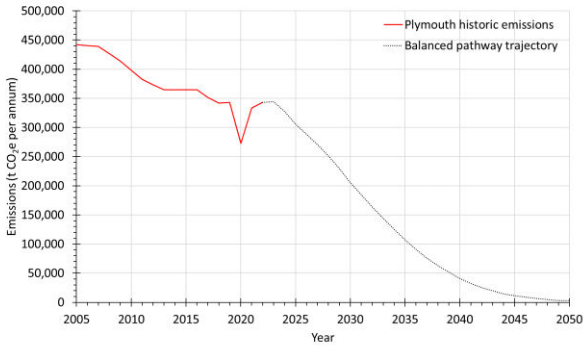
a. Power



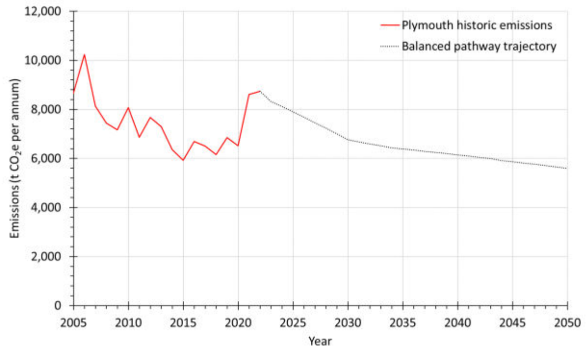
b. Buildings



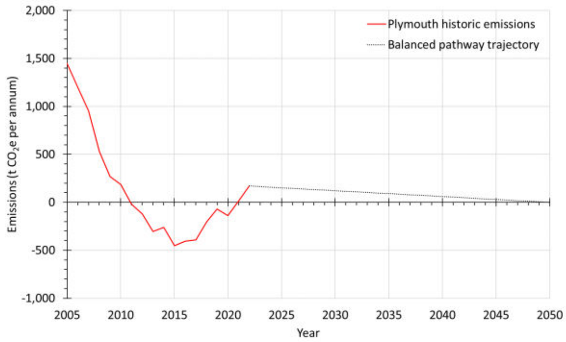
c. Industry



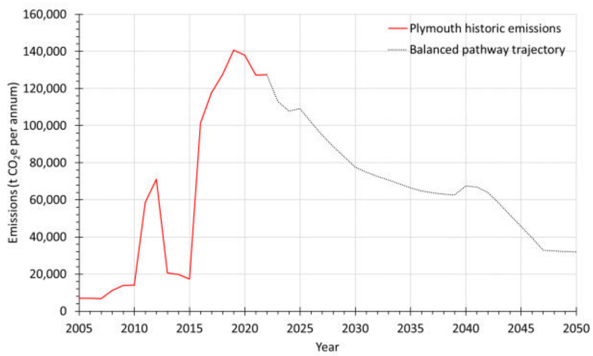
d. Transport



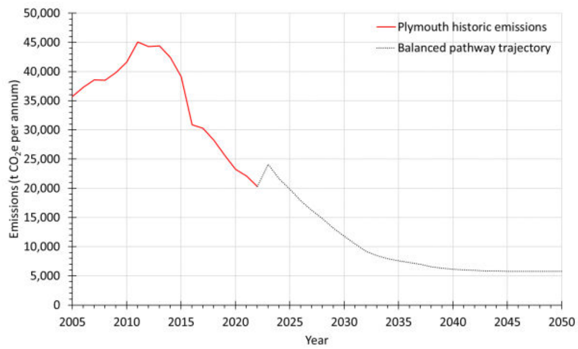
e. Agriculture



f. Land Use



g. Waste



h. F-gases

Figure 10. Future GHG emissions in Plymouth by sector compared to the national balanced net zero pathway

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Appendix A. Breakdown of Plymouth's 2022 GHG emissions

Table A-1. Sub-sector breakdown of CO_2e emissions in Plymouth in 2022

Sub-sector	t CO_2e	Sector
Residential Electricity	71,549	Power
Residential Fuel	178,027	Buildings
Commercial Electricity	50,977	Power
Commercial Fuel	51,615	Buildings
Public Administration Electricity	16,082	Power
Public Administration Fuel	28,729	Buildings
Industry Electricity	31,476	Power
Industry Fuel	57,291	Industry
Large Industry	9,609	Industry
Industrial Processes	0	Industry
Industry Product Use	20,322	F-Gases
Agriculture Electricity	164	Power
Agriculture Fuel	2,363	Agriculture
Agriculture Livestock	5,186	Agriculture
Agriculture Arable	1,194	Agriculture
Land Use and Land Use Change	170	Land Use
Road Transport (exc. Electricity)	340,352	Transport
Rail Transport (exc. Electricity)	2,780	Transport
Solid Waste Disposal	12,346	Waste
Biological Waste Treatment	0	Waste
Waste Incineration and Burning	112,739	Waste
Wastewater Treatment	2,350	Waste
TOTAL	995,322	

Appendix B. Updated emissions compared to 2008 and 2016 baselines

Table A-2. Changes achieved from a 2008 and 2016 baseline in kt CO2e. Negative values indicate a reduction. Values in green exceed the annual reduction required for zero carbon by 2030 on a linear trajectory; those in red do not

Sector	Change achieved (kt CO_2e)		Average annual change achieved (kt CO_2e)		Annual change required to achieve zero carbon by 2030 (kt CO_2e)	
	2008 to 2022	2016 to 2022	2008 to 2022	2016 to 2022	2008 to 2030	2016 to 2030
Power	-485.5	-103.8	-34.7	-17.3	-29.8	-19.6
Buildings	-97.8	-47.8	-7.0	-8.0	-16.2	-21.9
Industry	-10.2	-8.9	-0.7	-1.5	-3.5	-5.4
Transport	-83.5	-21.5	-6.0	-3.6	-19.4	-26.0
Agriculture	+1.3	+2.1	+0.1	+0.3	-0.3	-0.5
Land use	-0.4	+0.6	-0.0	+0.1	-0.0	+0.0
Waste	+116.2	+26.0	+8.3	+4.3	-0.5	-7.2
F-gases	-18.2	-10.6	-1.3	-1.8	-1.8	-2.2
Total	-578.0	-163.9	-41.3	-27.3	-71.5	-82.8

Table A-3. Changes achieved from a 2008 and 2016 baseline in percentage terms. Negative values indicate a reduction. Values in green exceed the annual reduction required for zero carbon by 2030 on a linear trajectory; those in red do not

Sector	Change achieved (%)		Average annual change achieved (%)		Annual change required to achieve zero carbon by 2030 (%)	
	2008 to 2022	2016 to 2022	2008 to 2022	2016 to 2022	2008 to 2030	2016 to 2030
Power	-74%	-38%	-5%	-6%	-5%	-7%
Buildings	-27%	-16%	-2%	-3%		
Industry	-13%	-12%	-1%	-2%		
Transport	-20%	-6%	-1%	-1%		
Agriculture	+18%	+31%	+1%	+5%		
Land use	-68%	-142%	-5%	-24%		
Waste	+1037%	+26%	+74%	+4%		
F-gases	-47%	-34%	-3%	-6%		
Total	-37%	-14%	-3%	-2%		