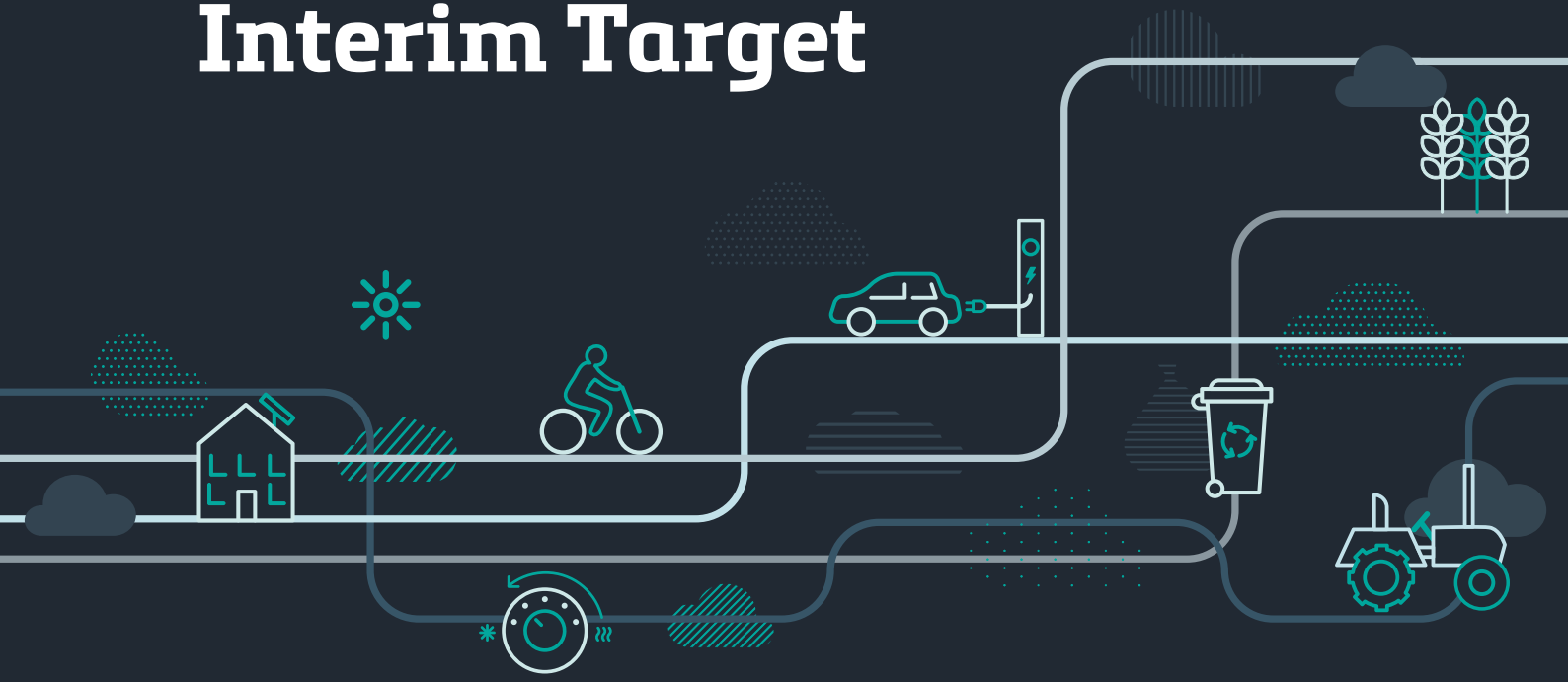
Llywodraeth Cymru
Welsh Government

Llywodraeth Cymru 2022

Final Statement for the First Carbon Budget and 2020 Interim Target



Presented to Senedd Cymru pursuant to sections 41 and 43 of the Environment (Wales) Act 2016

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Contents

Executive Summary

This is the final statement for the first carbon budgetary period covering 2016 to 2020 as required under section 41 of the Environment (Wales) Act 2016 and the first interim target, 2020, as required under section 43 of the Environment (Wales) Act 2016.

This statement sets out the steps taken to calculate the Net Welsh Emissions Account for the first carbon budget (CB1) and interim target. The Net Welsh Emissions Account is what Welsh Government compare against the first carbon budget to determine whether it has been met.

It shows that Welsh Government has **met both the first carbon budget and interim target**. The interim target for 2020 was set at a 27% reduction (which equates to emissions totalling 40,374 $ktCO_2e$ in 2020). The final Net Welsh Emissions Account (NWEA) for the interim target year of 2020 saw a 39.2% reduction (emissions totalled 33,612 $ktCO_2e$). **Therefore, the 2020 Interim Target has not only been met, but surpassed its original target** by 6,762 $ktCO_2e$.

The first carbon budget (CB1) was set at an average reduction of 23% (which equates to a total budget of 212,933 $ktCO_2e$). The final Net Welsh Emissions Account for CB1 saw a 27.8% reduction (a total budget of 199,718 $ktCO_2e$). **Therefore, CB1 has also been met and also surpassed its original target** by 13,216 $ktCO_2e$.

This statement also shows delivery progress in relation to Prosperity for All: A Low Carbon Wales (also known as the first Low Carbon Delivery Plan (LCDP1)). A Monitoring, Reporting and Verification (MRV) system has been developed for this statement, providing an insight into how the policies set out in the Plan have contributed to meeting the targets and budgets.

This statement also sets out in Annex 1, the Welsh Governments first legislative assessment of consumption emissions in Wales. The assessment shows estimated consumption emissions fluctuated slightly with a small increase (of approximately 2%) over the budget period that data are available for (the years 2016 to 2019). Overall since 2001 (the first available year of data) consumption emission estimates have shown a general downward trend dropping approximately 27% from 49 to 36 $MtCO_2e$.

Structure of statement

This statement has been laid out in the following sections and annex:

- **Part 1** provides an introduction to the Net Welsh Emissions Account (NWEA) and sets out the final amount of the Net Welsh Emissions Account for the first carbon budget period (2016-2020) and the first interim target year (2020); including the amount of units which were credited to and debited from the Net Welsh Emissions Account during the first budgetary period.
- **Part 2** explains what Welsh Ministers consider to be the reasons why the carbon budget for the period has been met and an assessment of how the policies and proposals set out in the Low Carbon Delivery Plan (LCDP1) have contributed to the delivery of the carbon budget period (2016-2020) and interim target year (2020).
- **Part 3** summarises the Welsh Greenhouse Gas emissions statistics for the first carbon budget period (2016-2020) and interim target (2020), covering emissions, removals and net emissions of each of the seven legislated greenhouse gases, individually and collectively.
- **Part 4** describes Welsh Governments next steps and future updates.
- **Annex A** sets out the Wales consumption emissions footprint and methodology.

Introduction

Following publication of the Greenhouse Gas Inventory (GHGI) emissions data[1] and Written Statement issued by the Minister of Climate Change in June 2022, Welsh Government announced that it would likely have met its first carbon budget (also known as budgetary period) (2016-2020) and interim target (2020).

This statement sets out the full Net Welsh Emissions Account (NWEA), upon which, Welsh Governments legal targets are based. It details **the analysis of the data, the final carbon accounting choices and progress in relation to its first low carbon delivery plan, Prosperity for All: A Low Carbon Wales (or also known as, Low Carbon Delivery Plan 1 (LCDP1)).**

The first plan set out how the Welsh Government will ensure Wales lived within the allocated budget for the carbon budget 2016-2020 and meet the 2020 interim target.

Under section 39 of the Environment (Wales) Act 2016, it states that *'Welsh Ministers must prepare and publish a report for each budgetary period setting out their proposals and policies for meeting the carbon budget for that period'.* As the carbon regulations[2] which set the levels for the first budgetary period were not introduced until 2018, this meant that the first low carbon delivery plan, published in 2019, was already over halfway through the first budgetary period, and consequently adopted the Climate Change Committees (CCC) recommended pathway and the specific sectoral contributions. This applies to Carbon Budget 1 (CB1) only.

Whilst this statement focuses on progress made during CB1, the Welsh Government have built on the publication of its first plan and continued to make significant key steps that will drive delivery. To view Welsh Government's latest actions and legislation please see Net Zero Wales, which sets out the actions Wales is taking in the second carbon budget (CB2), covering the budgetary period 2021-2025.

Background and Legislative Context

The Environment (Wales) Act 2016 introduced a legally binding target for emissions in 2050 to be at least 100% below the baseline (Net Zero).[3] The Act also allowed for interim targets for 2020, 2030 and 2040, as well as carbon budgets, which set the trajectory to ensure Wales meets the targets in the Act. Carbon budgets represent legally binding limits on the total amount of greenhouse gases that can be emitted in Wales for a given five-year period. The Welsh Ministers must also set a legally binding limit on the amount of international offsets they can use towards each carbon budget.

1 The Welsh Greenhouse Gas Inventory provides a modelled estimate of Welsh GHG emissions compiled in line with international carbon reporting practice. The Welsh GHGI data was originally published on 17/06/2022, but subsequently updated on 20/09/2022 to correct a data error. This publication uses the updated data throughout. Welsh Greenhouse Gas Inventory Statistics are published annually, typically in June, and approximately two years in arrears, at Report: Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2020 - NAEI, UK (beis.gov.uk).
2 The Climate Change (Carbon Budgets) (Wales) Regulations 2018.
3 The baseline year is 1990 or 1995, depending on the gas – see section 38 of the Act.

Welsh Government's legislative pathway is set at the following levels:

- 2050: At least 100% below the baseline ('net zero')
- 2040: 89% below the baseline
- 2030: 63% below the baseline
- CB3 (2026-30): 58% average reduction
- CB2 (2021-25): 37% average reduction, with an international offset limit of 0%
- CB1 (2016-20): 23% average reduction with an international offset limit of 10%

In order to measure compliance against the carbon budget (section 41) or interim target (section 43), Welsh Ministers must lay before the Senedd a final statement before the end of the second year after the budget finishes, which includes:

- information on emissions of greenhouse gases and removals of greenhouse gases from the atmosphere;
- information on use of international offsets;
- the final amount of net Welsh emissions for the period;
- an explanation of why the Welsh Ministers consider a carbon budget has, or has not, been met;
- an explanation of why the Welsh Ministers consider a target has, or has not, been met (for decadal interim target years only).
- an assessment of whether the policies and proposals for meeting the budget have been carried out, and their contribution to meeting the budget; and
- an estimate of Welsh consumer emissions for the budgetary period.[4]

This report meets the statutory duty under the Act by combining the first carbon budget (2016-2020) and interim target (2020) statements required under section 41 and 43 of the Act.

4 The emissions of greenhouse gases, whether in Wales or elsewhere, that may reasonably be attributed to the consumption and use of goods and services in Wales during the period

Part 1: Performance against Welsh Governments Carbon Budgets and Interim Targets

The Environment (Wales) Act 2016 and the associated carbon budget[5], and interim target regulations[6] describe a series of limits on greenhouse gas emissions from Wales that must not be exceeded. Progress against these statutory limits is measured on the basis of the Net Welsh Emissions Account (NWEA).

Key Points

- The interim target for 2020 was set at a 27% reduction (which equates to emissions totalling 40,374 $ktCO_2e$ in 2020). The final Net Welsh Emissions Account for the interim target year of 2020 saw a 39.2% reduction (Emissions totalled 33,612 $ktCO_2e$). **Therefore, the 2020 Interim Target has not only been met, but has surpassed its original target** by 6,762 $ktCO_2e$.
- The first carbon budget (CB1) was set at an average reduction of 23% (which equates to a total budget of 212,933 $ktCO_2e$). The final Net Welsh Emissions Account for the CB1 saw a 27.8% reduction (a total budget of 199,718 $ktCO_2e$). **Therefore, CB1 has also been met and outperformed its original target** by 13,216 $ktCO_2e$

The first step of the accounting process is to calculate the Net Welsh Emissions. These are defined as the sum of total emissions released to the atmosphere from Wales (plus emissions from International Aviation and International Shipping assigned to Wales), minus any removals of greenhouse gases that occur as a consequence of land use, land-use change, or forestry, activities in Wales.

Figure 1 describes how the Net Welsh Emissions Account is defined.

5 The Climate Change (Carbon Budgets) (Wales) Regulations 2018
6 The Climate Change (Interim Emissions Targets) (Wales) Regulations 2018

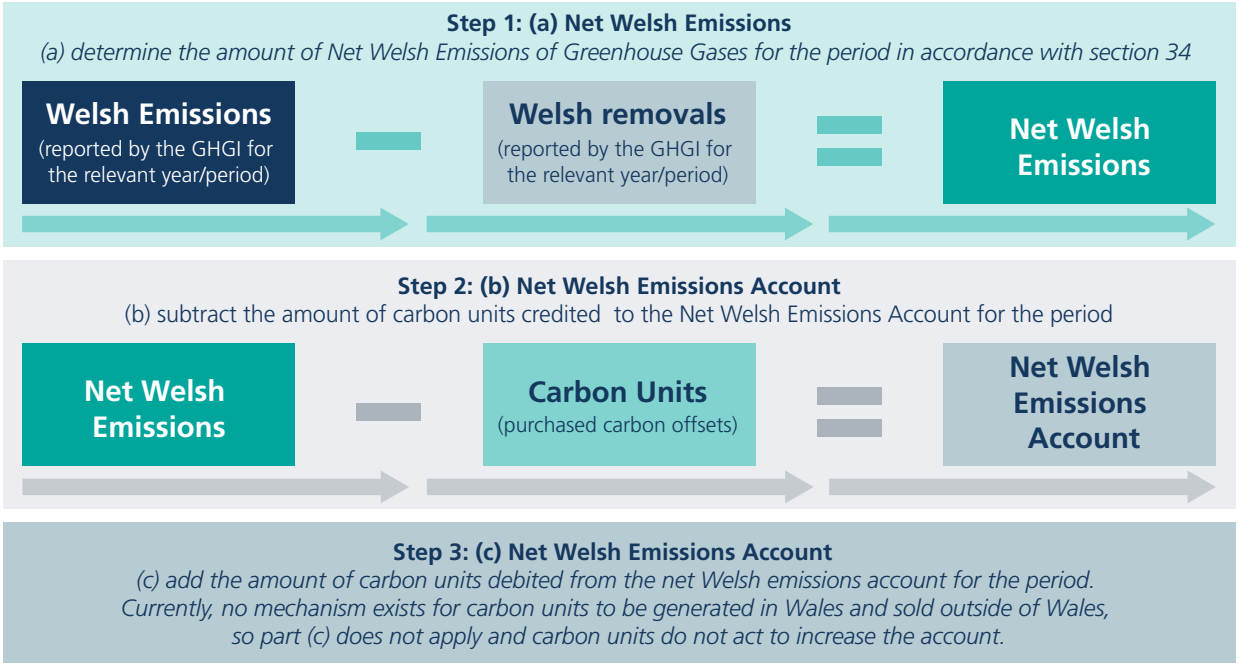
Figure 1: The calculation for the Net Welsh Emissions Account

Environment (Wales) Act 2016

33 The net Welsh emissions account

(1) The 'net Welsh emissions account' for a period is the amount calculated as follows –
(a) determine the amount of net Welsh emissions of greenhouse gases for the period in accordance with section 34;
(b) subtract the amount of carbon units credited to the net Welsh emissions account for the period;
(c) add the amount of carbon units debited from the net Welsh emissions account for the period.

Calculating the 'Net Welsh Emissions Account'



Emissions and removals of greenhouse gases are reported for Wales on an annual basis through the Welsh Greenhouse Gas Inventory. The latest data[7] reports Welsh emissions and removals for the period 1990-2020, covering data for the 2020 interim target and the complete period of Carbon Budget 1 (2016-2020).

The calculation described above establishes Net Welsh Emissions, which are then adjusted to account for any international offsets which have been brought in from overseas by the Government to offset Welsh emissions. These offsets are required to meet the definition of a statutory Carbon Unit, and as such can only originate from the purchase of Certified Emission Reductions issued under Article 12 of the Kyoto Protocol and the decisions adopted under the UNFCCC or the Kyoto Protocol. Where Welsh Ministers declare a permitted offset is to be credited to the Net Welsh Emissions Account, Net Welsh Emissions are reduced by the specified amount.

7 The Welsh Greenhouse Gas Inventory provides a modelled estimate of Welsh GHG emissions compiled in line with international carbon reporting practice. The Welsh GHGI data was originally published on 17/06/2022, but subsequently updated on 20/09/2022 to correct a data error. This publication uses the updated data throughout. Welsh Greenhouse Gas Inventory Statistics are published annually, typically in June, and approximately two years in arrears, at Report: Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2020 - NAEI, UK (beis.gov.uk).

The Carbon Accounting (Wales) Regulations 2018 do not provide a route for the generation of carbon credits in Wales that could be sold to a third party outside of Wales. Therefore, there is no requirement to further adjust the account to ensure that sold units are removed from the Welsh account.

The above calculations define the Net Welsh Emissions Account. The NWEA for 2020 is then assessed against the specified limits for the interim target year, to establish Wales's statutory progress.

Whereas the interim targets are a fixed limit, the legislation permits a limited number of adjustments to the carbon budget levels specified in regulation. These adjustments need to be considered as part of the process of assessing the statutory progress for the carbon budget period.

The first of these adjustments permits that the legislated carbon budget can be increased by an amount borrowed from the subsequent carbon budget period. This has the effect of reducing permitted emissions in the future budget period and increasing the permitted emissions in the current budget period. The maximum that can be carried back is limited to 1% of the total carbon budget from which the carry back originates.

The second adjustment is made in a situation where the Net Welsh Emissions Account has been reduced in excess of the carbon budget limit. In this situation it is permitted to carry forward any unused carbon budget to the following carbon budget period. In doing so, the current budget period is reduced by an amount equal to the amount of carry forward, and the future budget period is increased by this amount.

Each year the Greenhouse Gas Inventory reports on Welsh emissions and this data is used to provide non-statutory progress updates issued by the Government and to update the National Well-being Indicator relating to territorial emissions (Indicator 41). The latest data published for the emissions year 2020 also includes a complete revision of the time-series to 1990, ensuring methodological consistency across the time-series. The statutory progress statement assesses the full time-series of emissions using the latest dataset (1990-2020) and as such, the emissions reported here may differ from those previously reported in historical publications, which have not been updated to reflect the latest scientific understanding of Welsh emissions.

Carbon Budget 1 and 2020 Interim Target performance

The final Net Welsh Emissions Account for the interim target year of 2020 is 33,612 $ktCO_2e$. The interim target for 2020 specifies that emissions should not exceed 40,374 ktCO2e. Therefore, **the 2020 Interim Target has not only been met, but has been outperformed by 6,762 $ktCO_2e$, as described in Figure 2.** Compared to a specified reduction of 27% the NWEA for 2020 has reduced by 39.2%.

Figure 2: 2020 interim target performance in Wales

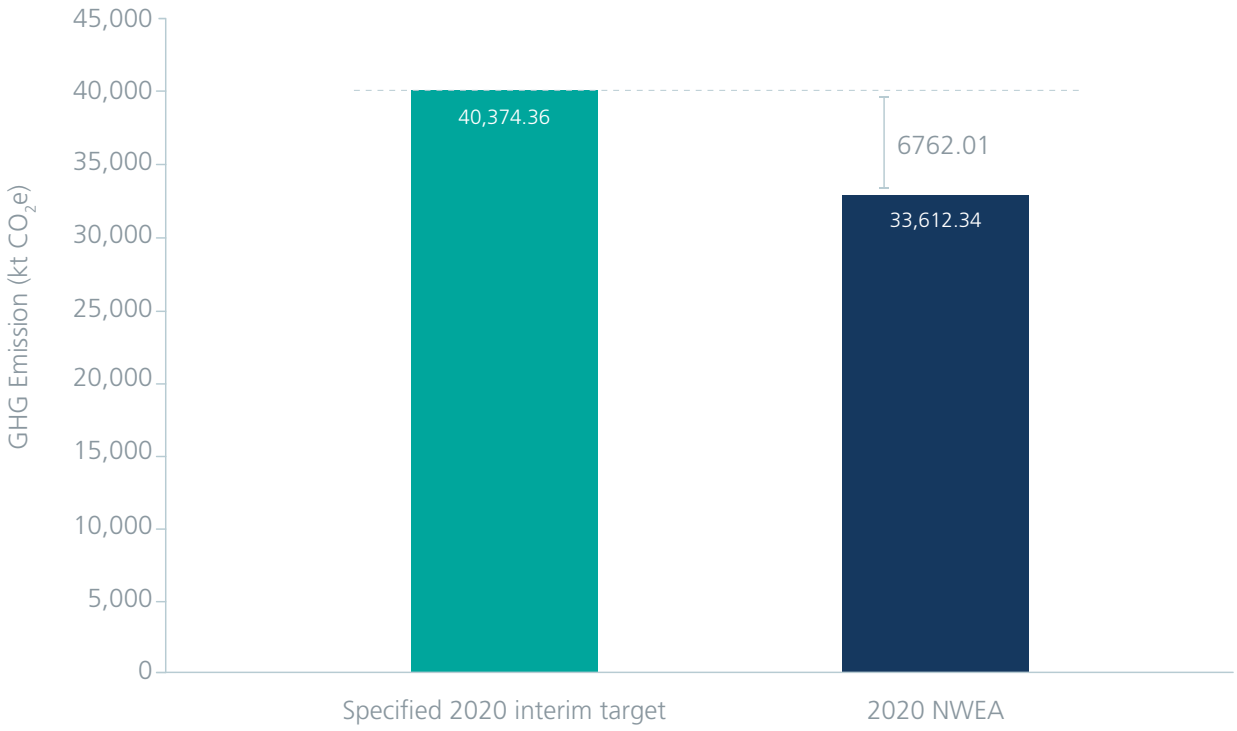


Figure 2 illustrates the 2020 interim target performance in Wales, showing that the 2020 interim target has been met.

The final Net Welsh Emissions Account for Carbon Budget 1 is 199,718 $ktCO_2e$. The carbon budget limit specifies that emissions should not exceed 212,933 $ktCO_2e$. Therefore, **Carbon Budget 1 has also been met and outperformed.** For the Carbon Budget 1 period the over-performance is 13,216 $ktCO_2e$, as described in Figure 3. The specified percentage reduction required for Carbon Budget 1 is an average reduction of 23%, whereas the NWEA for Carbon Budget 1 has achieved a greater average reduction of 27.8%.

Figure 3: Carbon Budget 1 performance in Wales

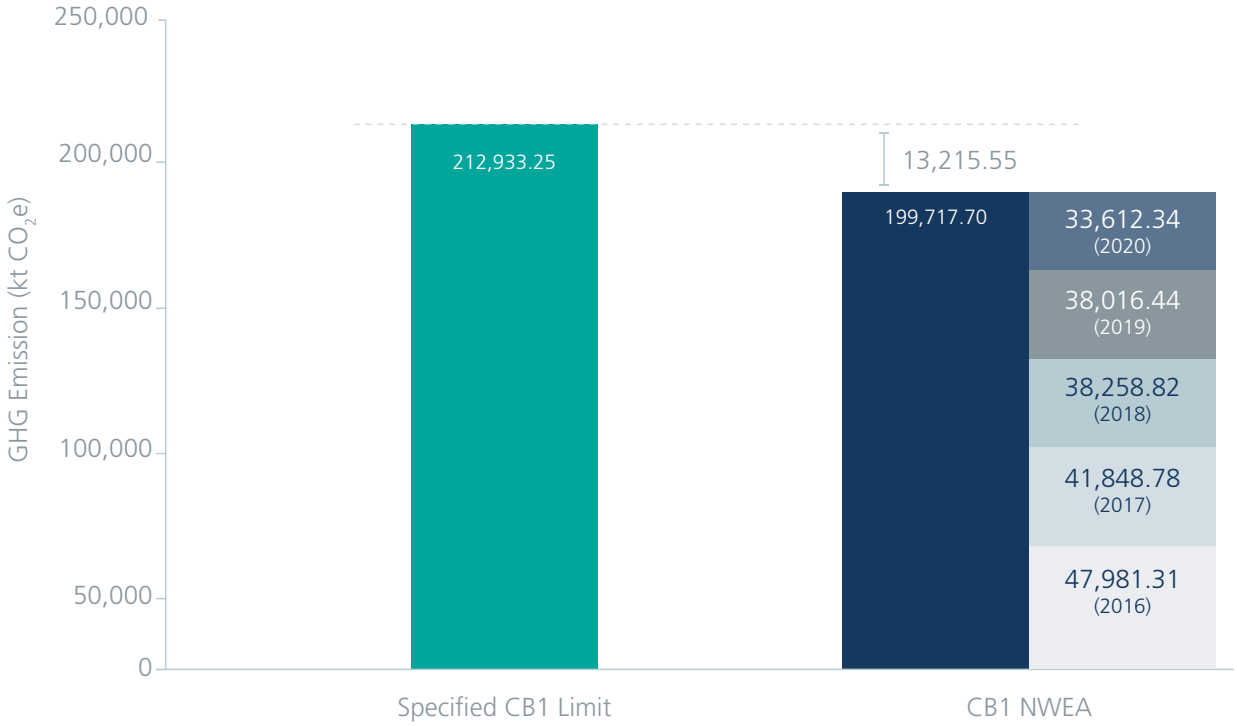


Figure 3 illustrates the Carbon Budget 1 performance in Wales, showing that Carbon Budget 1 has been met.

This section has shown that the statutory targets for the 2020 interim target and for Carbon Budget 1 have been met and outperformed.

For further information about how Welsh Government calculate the NWEA please see Part 3.

Part 2: Why the Carbon Budget and Interim Targets have been met

As well as reporting on whether the Welsh Governments targets and budgets have been met, the Environment Act also requires that the statement must highlight the reasons **why** it has been met and provide an **assessment of progress** in relation to the proposals and policies in its first plan, Prosperity for All: A Low Carbon Wales (LCDP1).

Whilst the Greenhouse Gas Inventory provides data on emissions levels, it does not provide the detailed information needed to effectively monitor and report policy progress. Consequently, the Welsh Government has put in place a comprehensive performance monitoring framework to help track progress towards meeting the emissions reductions targets set out in LCDP1. The Monitoring, Reporting and Verification (MRV) system provides an insight into how the policies set out in the plan have contributed to meeting the targets and budgets.

The MRV system consists of a suite of quantitative decarbonisation performance indicators which are structured within three 'tiers' which seek to track progress from the national level down to the policy level. Welsh Government is building its evidence base and will improve the system over time. This will be an ongoing task for the duration of the net zero journey and will always be associated with a degree of uncertainty. Whilst the MRV provides coverage of all emissions sectors, it should be noted that there are some policies for which a quantitative indicator is not suitable, or data cannot be obtained to quantitatively track progress. In these cases, qualitative information is used to provide an assessment of progress.

Key Points

- Over CB1 (2016 to 2020) a large proportion of the emission reductions came from the **closure of Wales' last coal-fired power station, Aberthaw,** in 2020.
- In 2016, the Power sector accounted for 33.6% of total emissions (making it the largest contributor that year) but this was reduced to only 15.6% of total emissions in 2020.
- Additionally, the **impact of COVID, particularly in the transport sector in 2020,** led to significant reductions in GHG emissions in the final year of the reporting period.

Assessment on why the first Carbon Budget (CB1) period and Interim Target has been met

This section provides a summary of overall performance assessed using the performance indicator framework; this includes sector-level GHG emissions, and policy/proposal implementation actions and changes to activity data that have affected these levels over the CB1 period.

The infographic on page 14 gives a high-level overview of CB1 performance, assessed using Wales' decarbonisation performance indicators. Its shows that

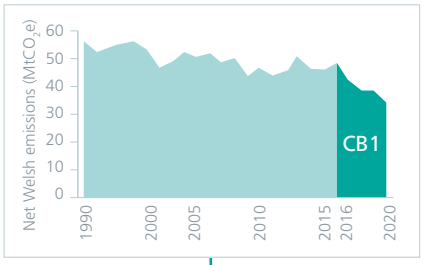
- **The Welsh Government has met its first carbon budget and interim target, and total Welsh emissions have declined over the budget period.**
- **At the sector level[8], emissions described by the Tier 1 indicators show that, 5 sectors** (power, transport, industry, waste and F-gases) have **seen strong declining emissions over the period** (rated green), **2 sectors** (buildings, agriculture) **have seen more limited change in emissions** over the period (rated amber), and the **LULUCF sector has seen a substantial decrease in the size of the sink** it provides over the period (rated red).
- **Over the period these emission reductions have been driven by changing patterns in Wales' consumption and production activities** (tracked by 57 Tier 2 indicators). **28 of these activity indicators are rated green, including major increases in the proportion of electricity generation from renewables, major decreases in the proportion of waste sent to landfill, and strong decrease in transport energy use and industrial energy use.** The sectors seeing the highest proportions of green-rated Tier 2 indicators were **power (89%), waste (75%) and Public Sector (75%).** Of the remaining activity indicators 7 are rated red, 11 are rated amber, and 11 could not be rated. The sectors seeing the lowest proportions of green-rated Tier 2 indicators were LULUCF (0%), Buildings (0%) and Agriculture (17%).
- The individual policies and proposals alongside the broader ambitions set out in LCDP1 can influence consumption and production activities in Wales. The Tier 3 indicators assess the extent to which these policies have been carried out. Of the 57 Tier 3 indicators, 14 are rated green (i.e. desired direction of travel achieved) primarily within the Power (6 green), Buildings (3 green), Waste (2 green) and Industry (2 green) sectors. There are also 2 Tier 3 indicators rated red occurring within the Waste and Power sectors, where the desired direction of travel has not been achieved. The MRV system introduced in this statement is continuing to be developed and currently there are 40 Tier 3 indicators that are not rated, either because data was not available, or because the desired direction of travel was not clear.

8 The sector definitions used throughout this document are from Prosperity for All: A Low Carbon Wales (Low carbon delivery plan | GOV.WALES). These sectors are different to those used in the Net Zero Wales Carbon Budget 2 (2021-25) (Net Zero Wales Carbon Budget 2 (2021 to 2025) | GOV.WALES). Detailed information on what is included in each sector is available in the published policy papers.

Whilst it is not possible to establish directly the cause and effect across the indicator dataset (see limitations), the MRV system demonstrates that where strong policy performance can be seen (e.g. power, waste, industry), it's often observed through positive changes in the activities driving emissions, which drive reductions in the sectoral GHG emissions.

The MRV system is described in more detail in the following section, as well as key data for each sector. In addition, the supporting indicator dataset is available to support this statement at: Carbon Budget 1 (CB1): Final Statement of Progress: supporting dataset – Performance Indicators

Welsh Net Emissions by 30% over CB1



Key driver over CB1: Closure of Aberthaw

Key driver over CB1: Impact of COVID

Wales' decarbonisation performance indicators for LCDP1 show:

Power

Tier 1	G Emissions ↓68% over CB1
	9 indicators (8 green, 1 not rated)
Tier 2	**Priority indicator:** 98% ↓ in proportion of generation from renewables over CB1
Tier 3	11 indicators (6 green, 1 red, 4 not rated)

Buildings

Tier 1	A Emissions ↑0.1% over CB1
	4 indicators (1 red, 3 amber)
Tier 2	**Priority indicator:** 0.4% ↓ decrease in buildings energy use over CB1
Tier 3	13 indicators (3 green, 10 not rated)

Transport

Tier 1	G Emissions ↓26% over CB1
	14 indicators (6 green, 4 red, 4 not rated)
Tier 2	**Priority indicator:** 19% ↓ in transport energy over CB1
Tier 3	7 indicators (1 green, 6 not rated)

Industry

Tier 1	G Emissions ↓10% over CB1
	6 indicators (4 green,1 red, 1 amber)
Tier 2	**Priority indicator:** 4% ↓ in industrial and commercial energy use over CB1
Tier 3	5 indicators (2 green, 3 not rated)

Agriculture

Tier 1	A Emissions ↓3% over CB1
	6 indicators(1 green, 2 amber, 3 not rated)
Tier 2	**Priority indicator:** 8% ↓ in ruminant livestock numbers over CB1
Tier 3	8 indicators (no ratings)

LULUCF

Tier 1	R Emissions ↑13% over CB1
	6 indicators (1 red, 2 amber, 3 not rated)
Tier 2	**Priority indicator:** 1% ↓ in total woodland area over CB1
Tier 3	3 indicators (no ratings)

Waste

Tier 1	G Emissions ↓15% over CB1
	8 indicators (6 green, 2 amber)
Tier 2	**Priority indicator:** 51% ↓ in proportion of generation from renewables over CB1
Tier 3	6 indicators (2 green, 1 red, 1 amber, 2 not rated)

F-gases

Tier 1	G Emissions ↓13% over CB1
Tier 2	No indicators developed
Tier 3	

Public sector and cross-cutting

Tier 1	G Emissions ↓7% over CB1*
	4 indicators (3 green, 1 amber)
Tier 2	**Priority indicator:** 2% ↓ in public sector GHG emissions 2019-2020
Tier 3	4 indicators (no ratings)

*It only includes emissions from Public sector buildings.

Introducing the Monitoring, Reporting and Verification (MRV) system

The Monitoring, Reporting and Verification (MRV) system provides an insight into how the policies set out in the plan have contributed to meeting the interim targets and carbon budgets.

The MRV system consists of a suite of quantitative decarbonisation performance indicators which are structured within three 'tiers' which seek to track progress from the national level down to the policy level, as described in Part 4 of LCDP1.

These are:

Tier 1 = Overall **sector emissions** plus split of emissions by sub-sector, using data from the GHGI;

Tier 2 = Activity data, e.g. consumption and production information, that directly drives changes in emissions levels of the sector;

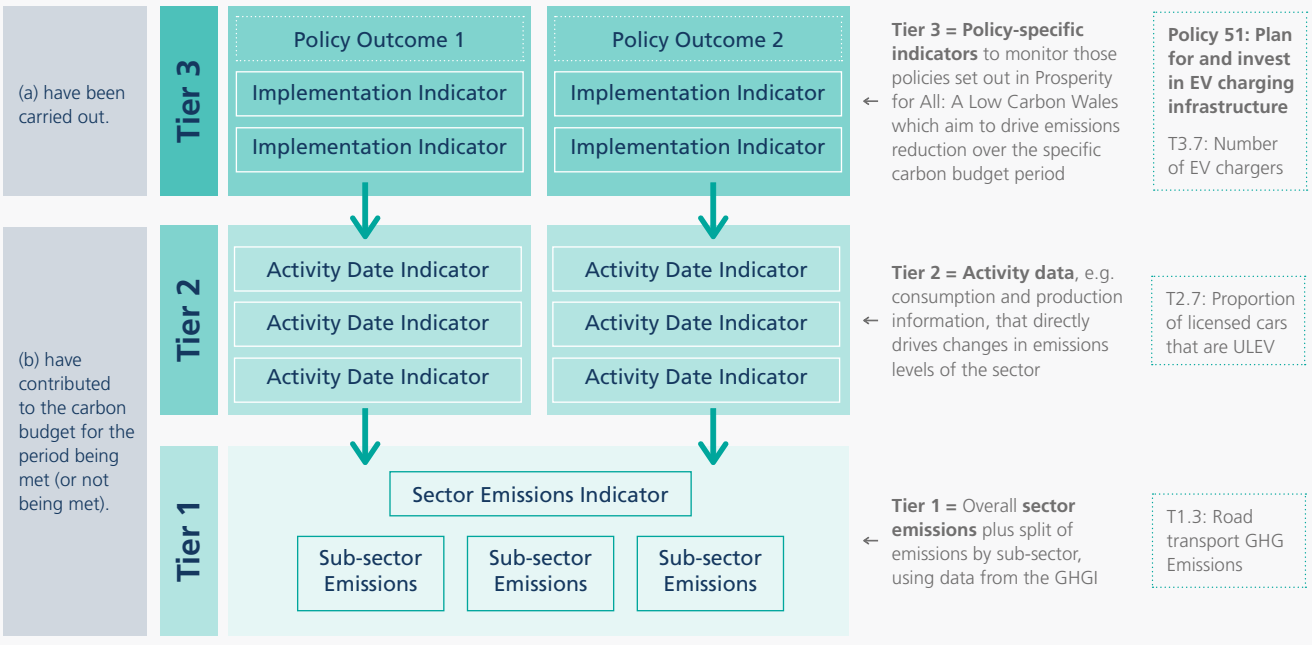
Tier 3 = Policy-specific indicators to monitor those policies set out in Prosperity for All: A Low Carbon Wales which aim to drive emissions reduction over the specific carbon budget period.

The following diagram sets out how these tiers relate to each other. The basic concept is that change in one tier should effect change in the metrics at the tier below, e.g. changes to the extent of policy implementation actions should have an effect on specific activity data within the sector.

41 Final statement for budgetary period

(9) In particular, it must include the Welsh Ministers' assessment of the extent to which their proposals and policies for meeting the carbon budget for the period -

(a) have been carried out, and
(b) have contributed to the carbon budget for the period being met (or not being met).

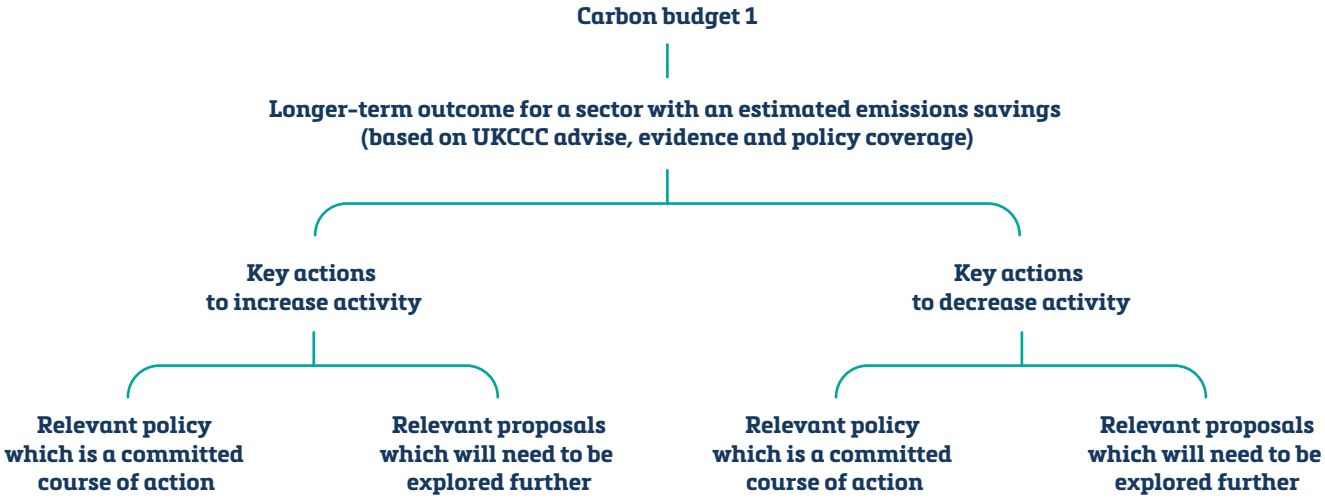


Welsh Government policies and proposals

The sector chapters in LCDP1 set out how policies and proposals contribute to meeting sector emission reduction pathways. For its first plan, the Welsh Government aligned the chapters with the CCC sector emission pathways[9]: Power, Buildings, Transport, Industry, Land Use, Agriculture, Waste and F-gases.

For each sector pathway, it developed a Policy Framework consisting of a Policy Outcome, Policies and Proposals.

Policy Framework explained



To help track progress of the implementation of the policies and proposal, the Welsh Government has put in place a comprehensive performance monitoring framework.

There are 101 polices and proposals in LCDP1; this includes 25 cross-cutting policies, 52 sectoral policies, and 24 proposals. Of these policies and proposals, 30 policies and 1 proposal could be tracked via Tier 3 indicators. The remaining policies and proposals are tracked via qualitative commentary.

9 Future supporting Monitoring and Reporting Frameworks may have slightly different definitions, and this will be reflected in the format of the indicator framework.

Tracking Progress (direction of travel)

As described above, the Welsh Government's performance indicator framework is a relatively new and evolving approach to monitoring and reporting the impact of its policies, and as such, gradual improvements are expected. Currently, Prosperity for All: A Low Carbon Wales, is only able to use proxy data to assess performance, which does not in many cases directly measure implementation of specific policy interventions but **provides an indication of 'direction of travel' of that policy towards emissions reduction.** It does not necessarily reflect the performance of a particular policy with regards to its primary purpose, or the policy goals of a particular sector to deliver wider outcomes.

As such, progress can only be assessed in relation to the observed direction of travel (compared to the desired direction of travel).

A threshold of 5% is used to ensure confidence in the observed direction of travel (i.e., a change of less than 5% in either direction will be rated amber, as Welsh Government cannot be confident in the observed trend). The rating symbols are summarised below:

Rating symbol	Meaning
G	Desired direction of travel achieved
A	No significant direction of travel observed
R	Desired direction of travel not achieved
N	No data available or direction of travel not determined

Tier 1 progress

For Tier 1 indicators, two ratings are presented:

1. a "**CB1 Progress**" rating - an assessment of the direction of change from 2016 to 2020. The rating is assigned by reference to a threshold, used to determine whether a change is 'significant' or not, where a change exceeding 5% in either direction is required for the change to be considered 'significant'. This approach provides an indication of the general direction of travel.
2. an assessment of "**2020 Progress**" is given to indicate whether progress has occurred at a sufficient scale and rate over the period. This is assessed by comparing with the anticipated contribution specified in the CCC's 2020 pathway[10] (scored via a tick or cross).

In LCDP1, each chapter set out the estimated sector contributions relating to Welsh Governments 2020 target and its first carbon budget 2016 to 2020.

These were derived from the CCC's recommended emission pathway[11] based on emissions data available when their advice was published (1990-2015 GHGI). This was subsequently updated to reflect the 1990-2016 GHGI data that became available ahead of the publication of the LCDP1. All the absolute values for target and budget contributions will vary slightly from year to year, as the scientific understanding of GHG emissions in Wales improves.

With four years of improvement and a new understanding of emissions since the original plan was published, the absolute values quoted in LCDP1 are now considerably outdated, therefore, Welsh Government compared the sector level percentage emission reductions in 2020 relative to the base year (1990), with the anticipated CCC emission reductions for 2020.

This provides a useful guide to assess progress beyond just the direction of travel, to give an indication of how the scale and rate of reductions at the sector level compares to the pathway originally anticipated by the CCC.

Tier 2 progress

For Tier 2 indicators two progress ratings are presented:

1. a "**CB1 Progress**" rating – this is an assessment of the change from 2016 to 2020 to provide an indication of the general direction of travel. If it is the case that some years are missing data, this rating uses the best available data (e.g., if 2016 is missing, the "CB1 Progress" rating will look at 2017-2020 instead – where this is the case, it has been documentedin the supporting data stated).
2. a "**Progress Since 2020**" rating (i.e., the change from 2020 to 2021, if this data is available).

10 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in Annex 3 - Constructing emissions pathways. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

11 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in Annex 3 - Constructing emissions pathways. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Tier 3 progress

Where feasible, Tier 3 indicators are also assigned a "**CB1 Progress**" rating, and a "**Progress Since 2020**" rating.

However, in some cases, the desired direction of travel is difficult to establish, particularly for those indicators looking at "number of projects delivered each year" or "investment delivered each year" under multiple programmes.

Initially, one might expect annual delivery of projects/investment to increase each year; however, it could be the case that such programmes were designed to frontload delivery into earlier years, which would likely be more beneficial in terms of reducing emissions. This type of programme-specific information was not available, so a progress rating could not be stated for such indicators. As such, progress over CB1 for most Tier 3 is reported in terms of "**Total Delivery over CB1**" (e.g., £XX of funding or XX number of projects delivered in CB1).

Limitations

Whilst a MRV systems is a useful tool in giving a macro-overview, there are some limitations in the development of them and the conclusions which can be drawn and it useful to in some instances to undertake further research to understand what is happening.

Direction of travel not determined

As noted, there are cases where a desired direction of travel cannot be specified due to the complicated policy and activity landscape. For example, from an emissions perspective it is desirable for bus fuel-use to decrease, but at the same time, policy to encourage public transport use could drive an increase in bus journeys; this may lead to increased bus fuel use. If this is replacing car fuel-use, an increase in bus fuel-use could be seen as positive. Where the direction of travel is complicated, or dependant on other policies, changes over CB1 are reported, but not rated. Wales' performance indicator framework is a relatively new and evolving approach to monitoring and reporting the impact of decarbonisation policies, and as such, improvements over time are expected.

In other cases, the desired direction of travel has not been stated as it is contingent on other factors. For example, the desired direction of travel for energy from waste (EfW) might be to increase in the short term, but this contrasts with other policies in the waste-sector to reduce the amount of waste produced in the long-term, which would ultimately reduce the waste available for EfW plants. Where this is the case, this has been explained and changes over CB1 are reported, but not rated.

Policy links

It should be noted that while some Tier 2 indicators have policy links, this is not the case for most (as it is generally Tier 3 indicators that directly link to the numbered policies in the LCDP1).

Financial year vs. calendar year

In some cases, data covers a financial year, rather than a calendar year. In these cases, this has been clearly stated alongside the data.

Timeline constraints

Data collection and analysis for the 2022 update of these indicators was performed from July to August 2022. Any data published, or updated, after August 2022 has not been included (except for the BEIS subnational energy consumption statistics). More recent data will be explored and included (if relevant) in future updates of the performance indicators.

Impact of COVID

It should also be noted that, as this assessment of progress is based on 2020 data (where possible), there are likely to be some COVID effects distorting the data and trends; the data reported therefore need to be considered within this context.

The COVID pandemic caused a sudden and very large change in economic activity which affected nearly all economic sectors. In many cases, economic activity was heavily reduced.

The "Progress Since 2020" rating (see discussion above) aims to address this, by capturing any rebound effects, but some COVID impacts are ongoing into the start of CB2. A "Progress Since 2020" rating is not available for Tier 1 indicators as 2020 is the latest year available for the GHG inventory.

Data quality and availability

Data used to track policies within the indicator framework is the best available at the time of updating the indicator framework. Effort is made to ensure data is as representative of the policy or indicator as possible. However, in some cases, the data used is driven by what is available, rather than the best possible data to track a policy.

Sectoral results

This section outlines a further breakdown of progress across the different sectors[12].

Power Sector

The Power sector covers electricity generation in Wales from fossil fuel and renewables.

The Power sector anticipated contribution in the CCC's 2020 pathway shows that for 2020 emissions should be no more than 2% higher than the base year (1990)[13]. To achieve this the sector's focus was on:

- reducing overall power generation from fossil fuels;
- increasing the deployment of renewable energy to meet the target for Wales to generate 70 per cent of its electricity consumption from renewable energy by 2030; and
- increasing support for innovation in the Power Sector.

The power sector has made positive progress in the implementation of its policies. As key parts of Energy policy are not devolved and Wales is part of an interconnected power system, UK Government policies leading to fossil fuel reduction have been paramount in the emission reduction in the sector, especially the phasing out of unabated coal, which has a significant impact in the budget period. Power generation from coal-fired plants has decreased to zero, with no coal-fired power plants present in Wales as of 2020. This is important and will need to continue going forward to keep the savings.

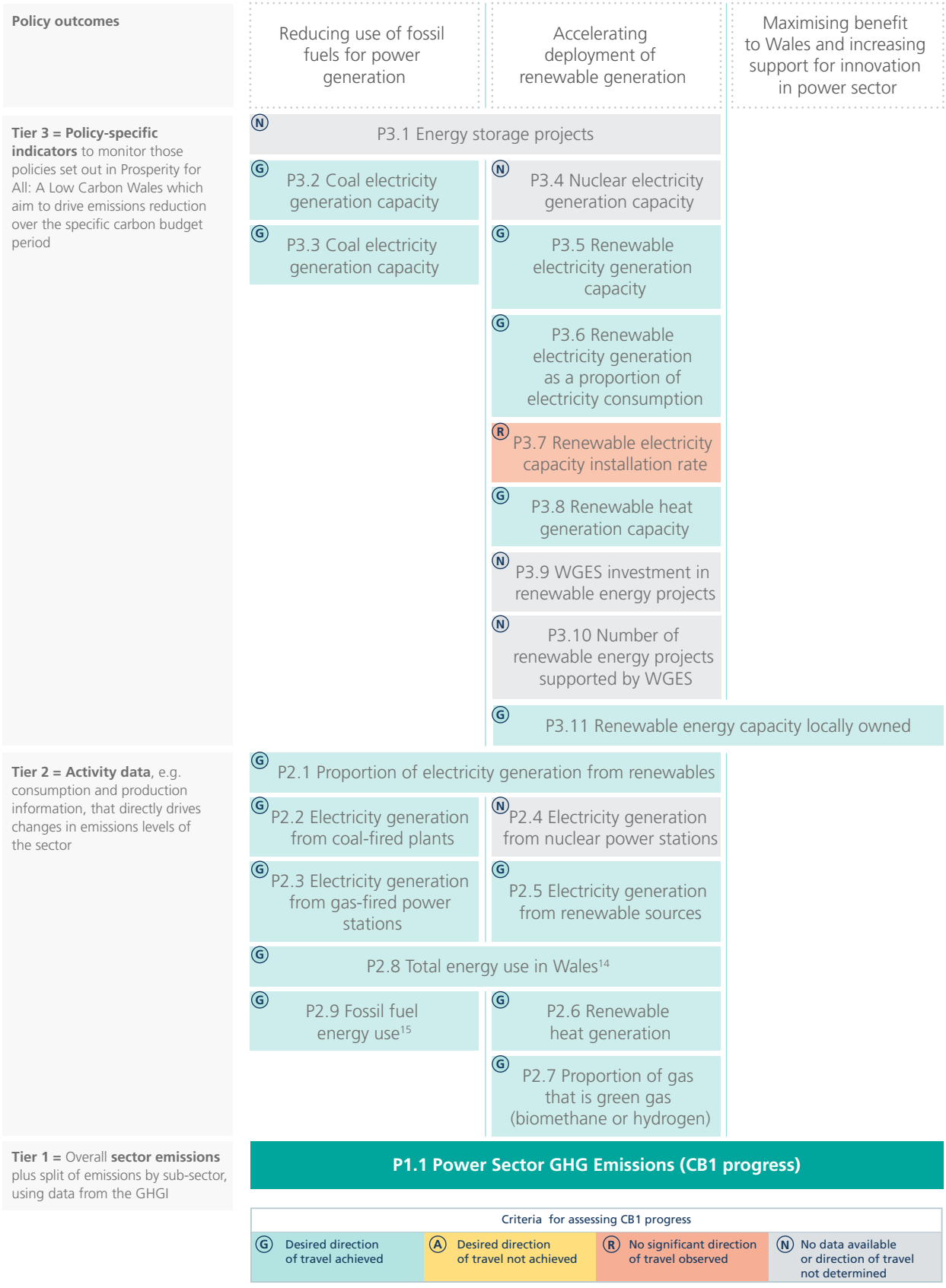
The significant reduction in fossil fuel electricity generation as well as the investment and implementation of renewable generation by energy companies, public bodies, communities, etc has supported the key indicator data. The proportion of electricity generation from renewables increased by 98% throughout the budget period. Over the same period, the proportion of electricity supplied generated from renewables increased from 46% to 55%.

These key policies and activities have also helped to support the overall emission reduction and the anticipated contribution to CCC's 2020 pathway.

12 For the data sets please see Carbon Budget 1 (CB1): Final Statement of Progress: supporting dataset – Performance Indicators
13 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in Annex 3 - Constructing emissions pathways. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Overview of Power indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.



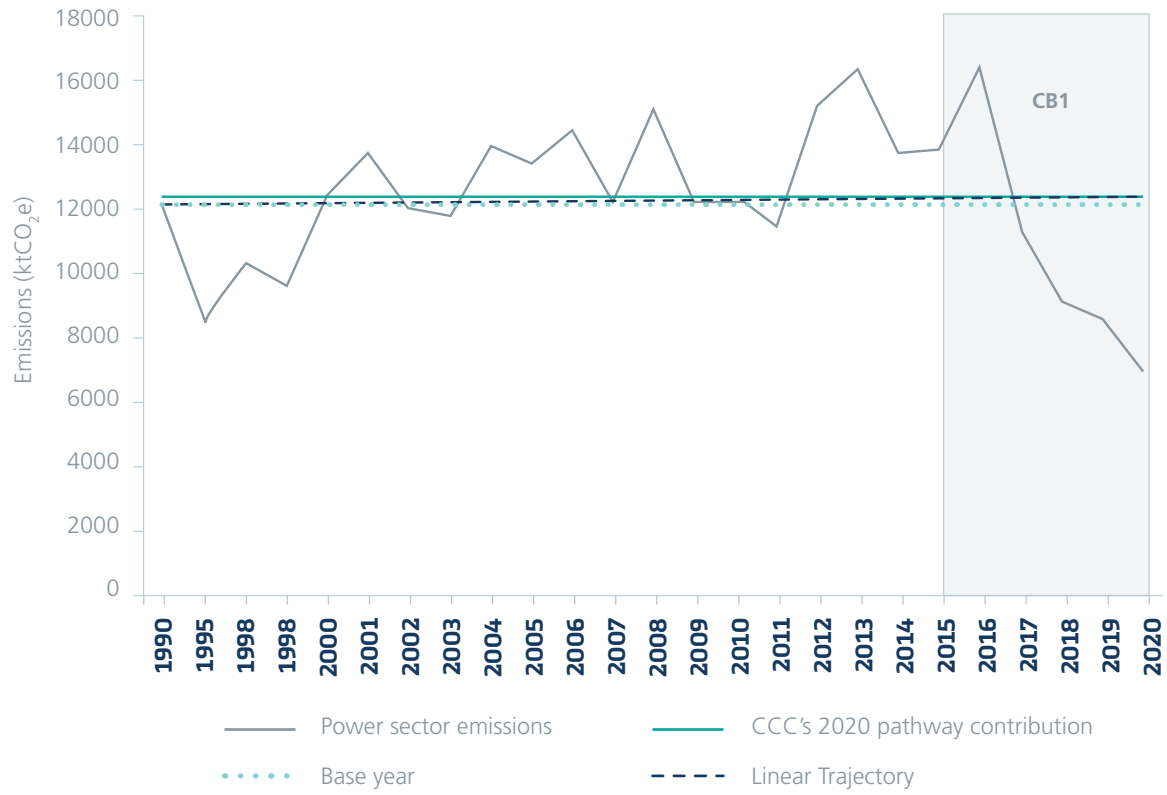
14 Total energy use refers to energy use in all sectors and not just electricity generation.
15 Fossil Fuel energy use refers to fossil fuel use in all sectors and not just electricity generation.

Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the power sector has been rated green in terms of CB1 progress, and the anticipated contribution to CCC's 2020 pathway ("2020 progress") has been met.

Emissions for the power sector have historically displayed a high level of volatility, with significant fluctuations present throughout the time-series. Despite this, **the power sector achieved a 68% decrease in emissions from 2016-2020, with 2020 emissions 53% lower than the base year.** The power sector has emitted a total of 46.59 $MtCO_2e$ during the carbon budget period.

Indicator	Power Sector GHG Emissions
Code	P1.1
Anticipated contribution to CCC's 2020 pathway	No more than 2% higher than the base year (1990)
2020 progress	✔ 53% reduction from base year (1990) in 2020
CB1 Progress	G 68% decrease from 2016 to 2020



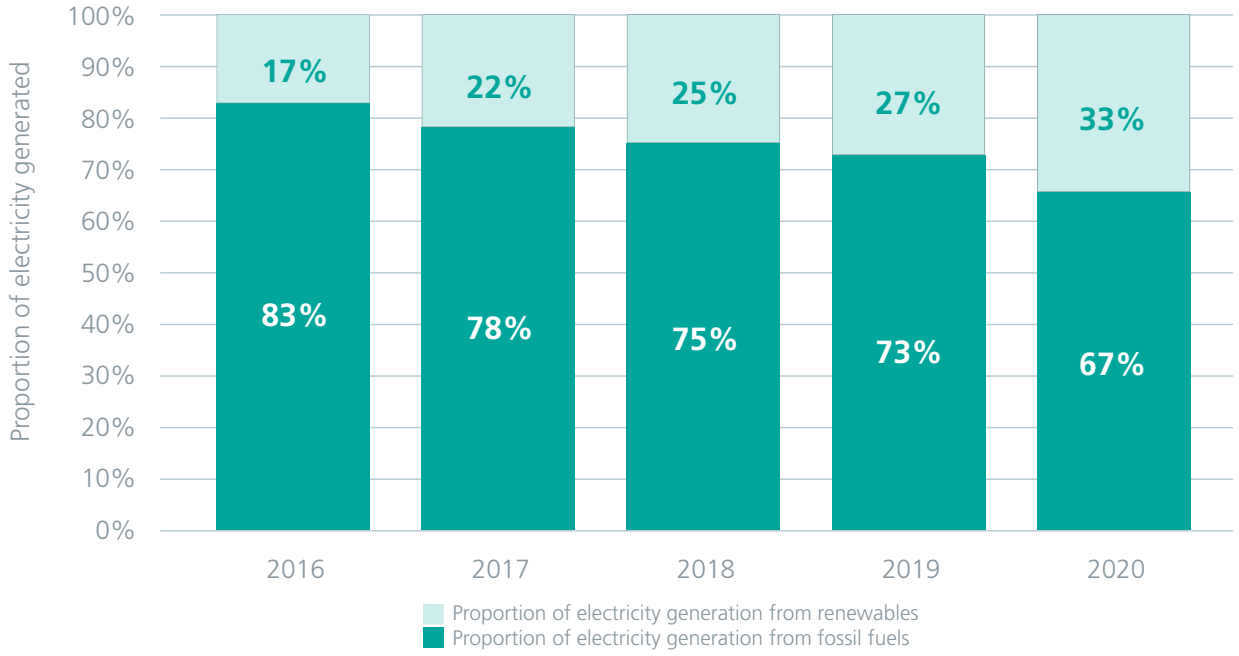
Data Source	NAEI GHGI 2020

Tier 2 - Activity data

Of the 9 Tier 2 indicators for the power sector, 8 have been rated green, and 1 could not be rated.

The activity data from the power sector such as electricity generation from coal-fired plants, gas fired plants and generation from renewables shows that the activity is heading in the desired direction of travel. The proportion of electricity generation from renewables is identified as a key indicator and shows that the proportion of power generation from renewable sources has steadily increased over time, reaching 33% of total power generation in 2020. The proportion of energy generated from fossil fuels has continuously decreased over CB1, decreasing from 83% in 2016 to 67% in 2020.

Indicator	Proportion of electricity generation from renewables
Code	P2.1
Desired direction of travel	Increase
CB1 progress	G 98% increase from 2016-2020
Progress since 2020	N No data available



	2016	2017	2018	2019	2020
% Fossil fuels	83%	78%	75%	73%	67%
% Renewables	17%	22%	25%	27%	33%

Description of trends	The proportion of power generation from renewable sources has steadily increased over time, reaching 33% of total power generation in 2020. Electricity generation from renewable electricity increased by approximately 200 GWh between 2019 and 2020, mostly due to an increase in estimated onshore wind generation resulting from above average windspeeds, rather than a significant increase in renewable capacity. The proportion of energy generated from fossil fuels has continuously decreased over CB1, decreasing from 83% in 2016 to 67% in 2020.
Data Source	Energy Generation in Wales reports 2016-2020 and Regen dataset

Tier 3 and wider information

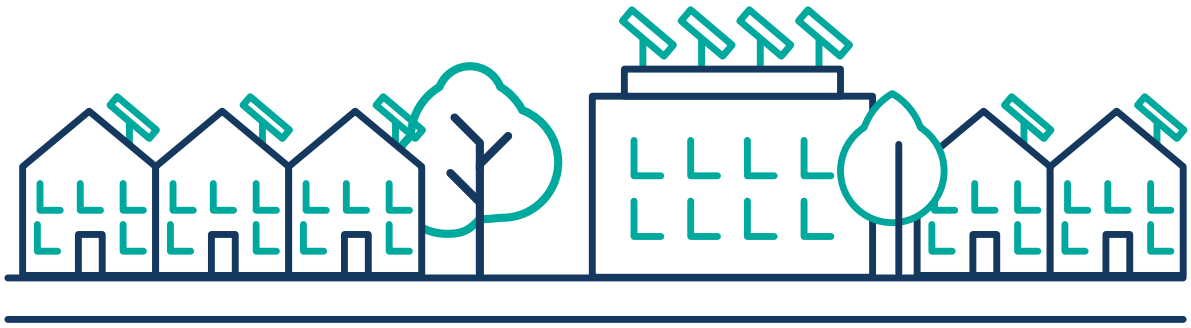
Eleven Tier 3 indicators have been developed for the Power sector, of these, 6 were rated green (i.e., achieving the desired direction of travel over CB1) and 1 was rated red (i.e., not achieving the desired direction of travel). A further 4 could not be rated. These indicators show that:

- Renewable electricity generation capacity has increased over the period, although there has been a levelling off of the increase in installed capacity in the last few years (the rate of capacity installation fell from 2016 to 2020). However, many of the levers to influence the amount of generation from fossil fuels in Wales are held by the UK government.
- Support for renewables has been provided from a number of sources. For public sector bodies and community energy projects, the Welsh Government Energy Service has provided a total of £32.6million of investment for renewable energy between 2018 and 2020.
- Local ownership of renewables generation technology has also increased, with a total of 859MW of locally owned renewable capacity in 2020; this translates to meeting 86% of the 1 GW local ownership target by 2030. However, there has been an observed decrease in the installation rate of renewables across CB1.
- Funding for energy innovation comes from a number of sources, with various innovation competitions taking place (e.g. consenting barriers for small and medium scale. No collated dataset has been established to identify how this policy is being implemented across all funding sources. There has however been a substantial increase in the number of energy storage projects, due to increases in domestic scale storage installed to complement solar PV. A total of 537 projects were delivered between 2016 and 2020. However, the annual number of projects recorded by this indicator decreased from 209 in 2019 to just 5 in 2020, as consenting barriers for small and medium scale batteries were removed from the Development of National Significance (DoNS) dataset on 1 April 2019. This follows the implementation of Policy 27 which aimed to remove barriers to consenting for storage by emoving batteries as part of the DoNS process. Further indicator development will be required to track future battery storage projects in Wales.

The LCDP1 set out 11 power sector polices and 1 proposal, of these, 4 policies are tracked directly with Tier 3 indicators, as outlined above. The remaining 7 policies and 1 proposal are tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

- Energy consenting powers arising from the Wales Act 2017, Planning Policy Wales and the Welsh National Marine Plan, are all now in place.
- In January 2021 the Welsh Government alongside the other Governments of the UK, acting as the UK Emissions Trading Scheme (UK ETS) Authority, launched the UK ETS, ensuring Wales remains part of an emission trading system.
- The principal barrier to deployment of renewables in Wales and the rest of the UK continues to be the lack of a consistent and predictable route to market, where a potential project has sufficient certainty of future income in order that it can source capital funding at a market rate. Net Zero Wales clearly outlines Welsh Government's ask of the UK Government for a long-term approach which supports a broad range of renewable technologies, creating a sustainable market for the wide range of low carbon heat technologies needed to deliver Welsh renewable and decarbonisation targets.
- The transformational change necessary to decarbonise the energy system requires change and innovation across the whole system. However, there are still many major infrastructure decisions made by UK Government and others. Welsh Government need to explore the need for greater investment in renewable generation and enabling infrastructure, such as storage, smart technology, data and grids.

For the full indicator data set please see Carbon Budget 1 (CB1): Final Statement of Progress: supporting dataset – Performance Indicators



Buildings Sector

This sector covers the residential sector (all of Wales' housing including owner occupied, private and socially rented homes) and the non-domestic buildings in the public and commercial sectors[16].

The Buildings sector's anticipated contribution in the CCC's 2020 pathway shows that for 2020 emissions should be 30% lower than the base year (1990)[17]. To achieve this the sector's focus was on:

- energy efficiency measures;
- low carbon heating measures; and
- behavioural change measures to the way we run buildings

The building sector has made some progress in the implementation of its policies. However, due to data availability qualitative information has been provided. In terms of existing homes, the Warm Homes schemes have seen increases in the funding provided and its reach. The Innovative Housing Programme (IHP), which is targeted at new homes, has provided grants totalling over £118 million (for 2,033 homes) from 2017-2020.

The Public Sector has **continued to show leadership** and has led progress through the support of schemes such as the Welsh Government Energy Service, which has invested £51.4 million for energy efficiency public sector projects between 2018 and 2020, delivering 205 energy efficiency projects.

The activity data shows that Building sector energy demand has kept relatively constant throughout the first budget period, whilst domestic electricity consumption has decreased, gas has stayed the same, showing further improvements are needed.

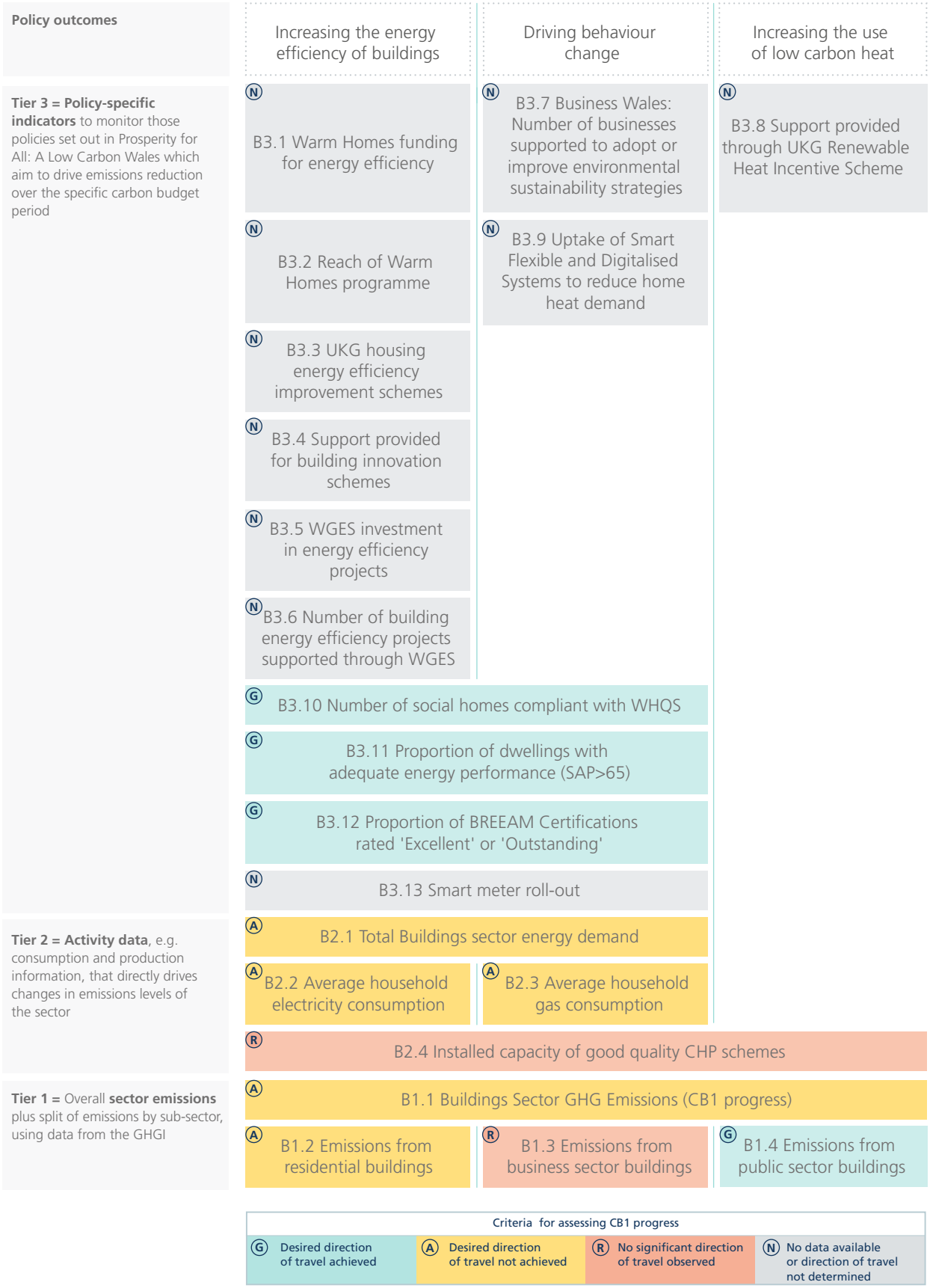
These key policies and activities have helped to support the overall emission reductions achieved by the building sector and have helped the sector to deliver the anticipated contribution set out by CCC's 2020 pathway.

16 Emissions from the buildings sector do not cover emissions from electricity used in buildings, some of the policies to decrease buildings emissions may increase electricity consumption in another sector. This will be considered going forward.

17 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in Annex 3 - Constructing emissions pathways. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Overview of Buildings indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.

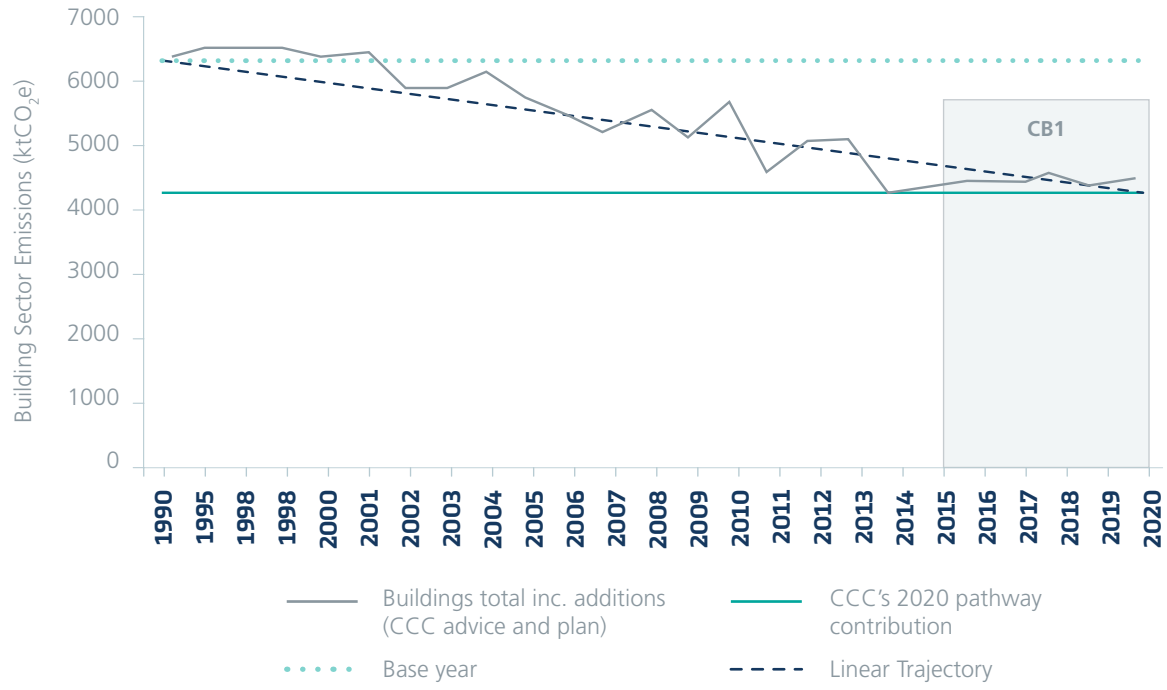


Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the buildings sector as a whole has been rated amber in terms of CB1 progress, reflecting the limited change over the CB1 period. However, the anticipated contribution to CCC's 2020 pathway has been met. Of the 3 subsector Tier 1 indicators, Public sector buildings has been rated green, residential buildings has been rated amber, and business sector buildings has been rated red.

Overall, emissions from the buildings sector have decreased over time, with some fluctuations, reducing by **30% in 2020 compared to the base year.** Over the CB1 period, emissions have remained relatively stable emitting a total of 21.91MtCO_2e during the first carbon budget period.

Indicator	Buildings Sector GHG Emissions
Code	B1.1
Anticipated contribution to CCC's 2020 pathway	2020 emissions should be 30% lower than the base year (1990)
2020 progress	✔ 29.8% reduction from base year (1990) in 2020
CB1 Progress	A 0 .1% increase from 2016-2020



Data Source	NAEI GHGI 2020

Tier 2 - Activity data

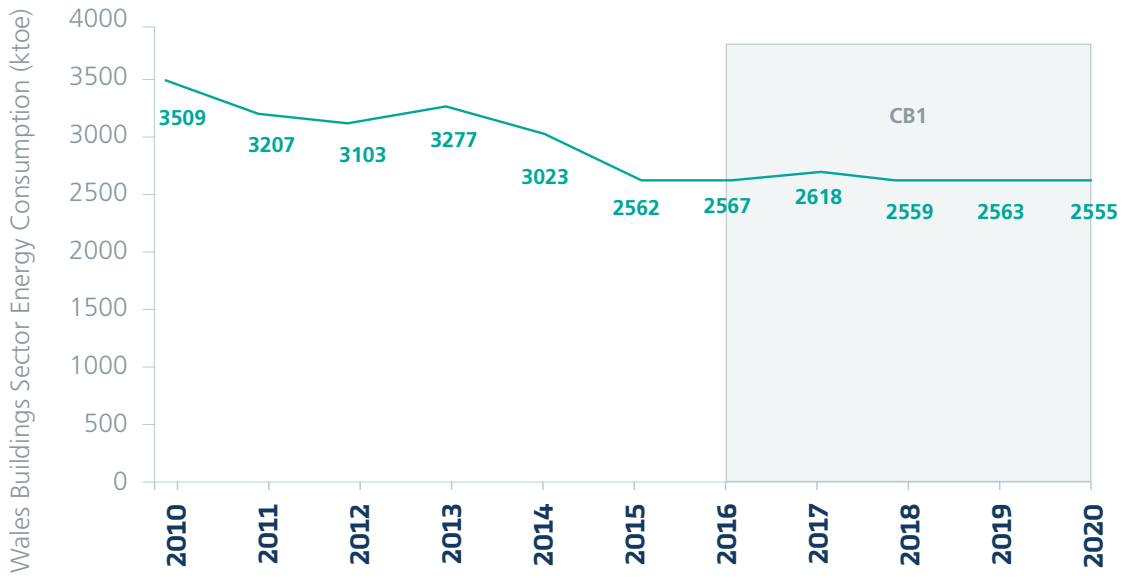
Of the 4 Tier 2 indicators for the Buildings sector, 1 has been rated red (i.e., not achieving the desired direction of travel), and 3 have been rated amber (i.e., no significant direction of travel observed).

The Building sectors total energy consumption is identified as the key tier 2 indicator for the sector and has trended downwards between 2010 and 2015. However, it has since stabilised, with little change over the CB1 period.

The further Tier 2 indicators illustrate that whilst there has been an overall decrease in average domestic gas consumption since the early 2000s, there have been small increases over CB1 (2016-2020). Average household electricity consumption decreased gradually between 2016 and 2019. However, it increased by 4% between 2019 and 2020 meaning that consumption in 2020 was broadly similar to 2016, this was most likely driven by restrictions related to Covid-19.

The key indicator showing total building sector energy demand gives an overview for this area.

Indicator	Total buildings sector energy demand
Code	B2.1
Desired direction of travel	Decrease
CB1 progress (2016-2019)	A 0.4% decrease from 2016-2020
Progress since 2020	N No data available



Note: ECUK end-use data is used to apportion the amount of domestic and industrial/commercial/other fuel use (from BEIS subnational energy consumption statistics) attributed to buildings[18]

Description of trends	Buildings sector energy consumption trended downwards between 2010 and 2015 but has changed little since. The most recent data available indicates the building sector consumed almost the same amount of energy in 2020 compared to 2016: 2,555 kilotonnes of oil equivalent (or ktoe) in 2020, compared to 2,567 ktoe in 2016.
Data Source	BEIS Subnational total final energy consumption and UK energy consumption by end use (ECUK)

18 The Welsh consumption distribution is likely to differ from the UK level and so these statistics should be used to compare trends over time but should not be interpreted as the actual level of building energy use in Wales.

Tier 3 and wider information

Of the 13 Tier 3 indicators, 10 could not be rated according to the desired direction of travel (either because data was not available, or because the desired direction of travel was not clear) while 3 are green.. These indicators show that:

- Over the first carbon budget a number of schemes have been implemented to improve energy efficiency of existing housing stock and other buildings, for example the Warm Homes scheme, which have seen increases in both funding provided and reach during the measurement period. Other schemes to address energy efficiency in housing led by UK Government have however not seen the same level of investment in Wales. A substantial decrease in number of ECO measures and households in receipt of measures has occurred since the beginning of the programme, and reporting of Green Deal plans stopped in 2017 due to the low number of plans delivered.
- In terms of new homes, Welsh Government is also taking action to ensure new homes are energy efficient and low carbon. A key component of this is the Innovative Housing Programme (IHP) which aims to create demonstrator schemes to help inform Welsh Government about the type of housing it should support in the future. The scheme provided grants totalling over £118 million (for 2,033 homes) from 2017-2020.
- The Welsh Government Energy Service has a key role to play in tackling energy efficiency of these buildings. The Energy Service has provided investment of £51.4 million for energy efficiency public sector projects between 2018 and 2020, delivering 205 energy efficiency projects through the scheme over this time. Annual investment also saw an increase in 2021.
- As stated in the LCDP1, heating constitutes a major part of the decarbonisation challenge, as heat accounts for almost half of UK energy use and a third of UK carbon emissions. Welsh Government is scoping out the challenges and opportunities around low carbon heat.
- To support the increase in use of low carbon heat, there are a number of funding schemes in place at a UK level. The UK Government Renewable Heat Incentive (RHI) scheme promotes the use of renewable heat in both domestic and non-domestic settings. A total of 2,597 domestic and 613 non-domestic installations were accredited between 2016 and 2020, though annual installations generally decreased over this period.
- Welsh Government have also provided support for the uptake of smart flexible and digitalised systems to reduce home heat demand, piloting a total of 34 projects from 2016 to 2020. These projects, while small scale, will help develop its knowledge base to explore innovative approaches to smart technologies. On a wider scale, the roll-out of smart meters in housing stock will help drive behaviour change. Data on smart meter roll-out in Wales is however difficult to access, and this indicator remains under development.

- In addition, behaviour change plays a role in reducing business sector buildings emissions, and Business Wales has been successful in implementing measures to influence businesses to adopt or improve environmental sustainability strategies, reaching 2,479 businesses from 2016-2020.

The LCDP1 set out 9 building sector polices and 4 proposals, of these, 6 policies and 1 proposal are tracked directly with Tier 3 indicators, as outlined above. The remaining 3 policies and 3 proposals are tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

- The 2020 review of Part L for new homes proposed a significant reduction in emissions over current (2014) standards and points to the intention that by 2025 a further greater step change will mean no new homes will be connected to the gas network.
- Over the last 10 years Cadw has worked hard to reduce carbon emissions from the sites within its care. Recent projects at Tintern Abbey and Harlech Castle, for example, have replaced obsolete gas boilers with low carbon technologies, such as air source heat pumps and PV panels. Energy efficient lighting, including floodlights, is standard, and policies designed to maximise the re-use and recycling of materials have been introduced.
- Cadw is also working to help the wider heritage sector take action to reduce its carbon emissions and adapt to the impacts of climate change. Promoting the re-use and responsible adaptation of our existing historic buildings, for example, protects their embedded carbon, as well as their significance and contribution to economic, environmental and cultural wellbeing. Other actions include working with partners, such as the Construction Industry Training Board, Historic Environment Scotland and Historic England, to help grow a well-qualified and competent retrofit industry. Activities undertaken during the reporting period included taking part in the review of the National Occupations Standards (NOS) for Insulation and Building Treatments and the development of new retrofit pathways in the Level 4 Construction Site Supervision and Level 6 Construction Site Management NOS.
- Help to Buy Wales (HtBW) allows eligible purchasers to buy new-build homes with assistance from Welsh Government in the form of a shared equity loan. As part of the HtBW applicant affordability assessment, the EPC rating of the home to be purchased and the occupants' energy needs are considered. This assessment was developed by BRE and is known as the 'LENDERS' initiative. The aim being to raise the issue of energy efficiency with applicants and assess the impact it has/could have on their outgoings. Every HtBW applicant undergoes this assessment. These arrangements will continue through the HtBW process to ensure applicants have a clear understanding of the financial commitment they are undertaking. Taking applicants future energy costs into account as part of the affordability check is unique to the scheme in Wales.

- Welsh Government have been working with the Welsh School of Architecture since 2017 to develop the evidence base about how to decarbonise homes well through retrofit. The evidence base is now complete although the need for further research will be kept under review. The research has been crucial in informing the contents of 'Better Homes, Better Wales, Better World' (the Jofeh Report) in 2019 and the new Optimised Retrofit Programme.
- Closely aligned to the Innovative Housing Programme (IHP), the strategy 'Re-imagining social house building in Wales – A Modern Method of Construction Strategy for Wales', was launched in February 2020. It encourages social housing providers to re-examine the construction of new social housing and consider complimenting traditional construction methods with new technologies and approaches to house building. Using Modern Methods of Construction (MMC) will help meet the quality standards expected for social housing that receives public subsidy, specifically with regards to space, energy efficiency and, as far as it can be defined, beauty. Encouraging the use of MMC for the delivery of social housing will provide more homes for the residents of Wales in a way which is good for the environment, economy and businesses, for communities and individuals and the public purse.
- IHP is demonstrating that innovation can be delivered at scale. 214 zero carbon homes in Cardiff and 144 in Swansea. These show how new innovations and prototypes can become 'the norm'.

Transport Sector

The Transport sector is comprised of emissions from road transport, railways, aviation and shipping, including international aviation and shipping[19].

The Transport sector's anticipated contribution in the CCC's 2020 pathway for shows that for 2020 emissions should be 14% lower than the base year (1990)[20].

To achieve this the sector's focus was on:

- behavioural change measures (modal shift to more sustainable travel);
- increasing uptake of electric vehicles; and
- reducing emissions from road and rail transport through vehicle and fuel efficiency measures.

The Transport sector has made some progress in the implementation of its policies with over £23 million being invested in active travel (2018-2020), and the increase in support for electric vehicles and enabling infrastructure, such as chargers. Over the budget period the number of chargers situated in Wales has increased by 243% over CB1, totalling 802 in 2020, and 1039 in 2021.

The activity data from the Transport sector varied with positive progress in areas such as overall transport sector energy consumption and the proportion of transport energy consumption from renewable sources. However, improvements are needed around growing active travel and public transport use.

Whilst these policies and activities have helped to support the sector surpass the anticipated contribution to CCC's 2020 pathway, the dominant driver is likely due to the COVID 19 travel restrictions. In 2020, a significant drop in transport sector emissions was observed (a 22.5% decrease from 2019, and a 27.4% decrease from the base year). **As a result of this large decrease in 2020, transport sector emissions over CB1 (2016-2020) saw a decrease of 26% and consequently meant the anticipated CCC contribution was met.**

19 Emissions from the transport sector do not cover emissions from electricity used in transport, some of the policies to decrease transport emissions may increase electricity consumption in another sector. This will be considered going forward.

20 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in *Annex 3 - Constructing emissions pathways*. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Overview of Transport indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.

Policy outcomes	Supporting a change in travel behaviours	Increasing uptake of electric vehicles	Reducing emissions from road and rail transport through vehicle and fuel efficiency measures
Tier 3 = Policy-specific indicators to monitor those policies set out in Prosperity for All: A Low Carbon Wales which aim to drive emissions reduction over the specific carbon budget period	(N) T3.1 Investment in active travel (N) T3.2 Investment in rail network (N) T3.3 Investment in bus services	(N) T3.4 UKG incentives to promote EV uptake (N) T3.5 Investment in EV charging infrastructure (N) T3.6 Comparative cost of EVs with petrol/diesel equivalents (G) T3.7 Number of EV chargers	
Tier 2 = Activity data, e.g. consumption and production information, that directly drives changes in emissions levels of the sector	(R) T2.1 Percentage of Welsh residents using active travel as a mode of transport (N) T2.2 Kilometres of active travel infrastructure (R) T2.3 Number of rail passenger journeys (R) T2.4 Number of bus passenger journeys (as proportion of total journeys) (N) T2.5 % journeys by sustainable travel modes (G) T2.6 Total road vehicle distance travelled	(G) T2.7 Proportion of licensed cars that are ULEV (G) T2.8 Proportion of new car sales that are ULEV	(N) T2.9 Proportion of buses that are zero or ultra low emission (N) T2.10 Taxi and private hire vehicle carbon footprint (G) T2.11 Transport sector energy consumption (G) T2.12 Proportion of transport energy consumption from renewable sources (United Kingdom only) (G) T2.13 Average car CO_2 emissions per vehicle km travelled (R) T2.14 Average new car fuel consumption efficiency (Great Britain only)
Tier 1 = Overall **sector emissions** plus split of emissions by sub-sector, using data from the GHGI	(G) T1.1 Transport sector GHG Emissions (CB1 progress) (G) T1.2 Aviation GHG Emissions	(G) T1.3 Road transport GHG Emissions (G) T1.5 Navigation and shipping GHG Emissions	(G) T1.4 Rail travel GHG Emissions

Criteria for assessing CB1 progress			
(G) Desired direction of travel achieved	(A) Desired direction of travel not achieved	(R) No significant direction of travel observed	(N) No data available or direction of travel not determined

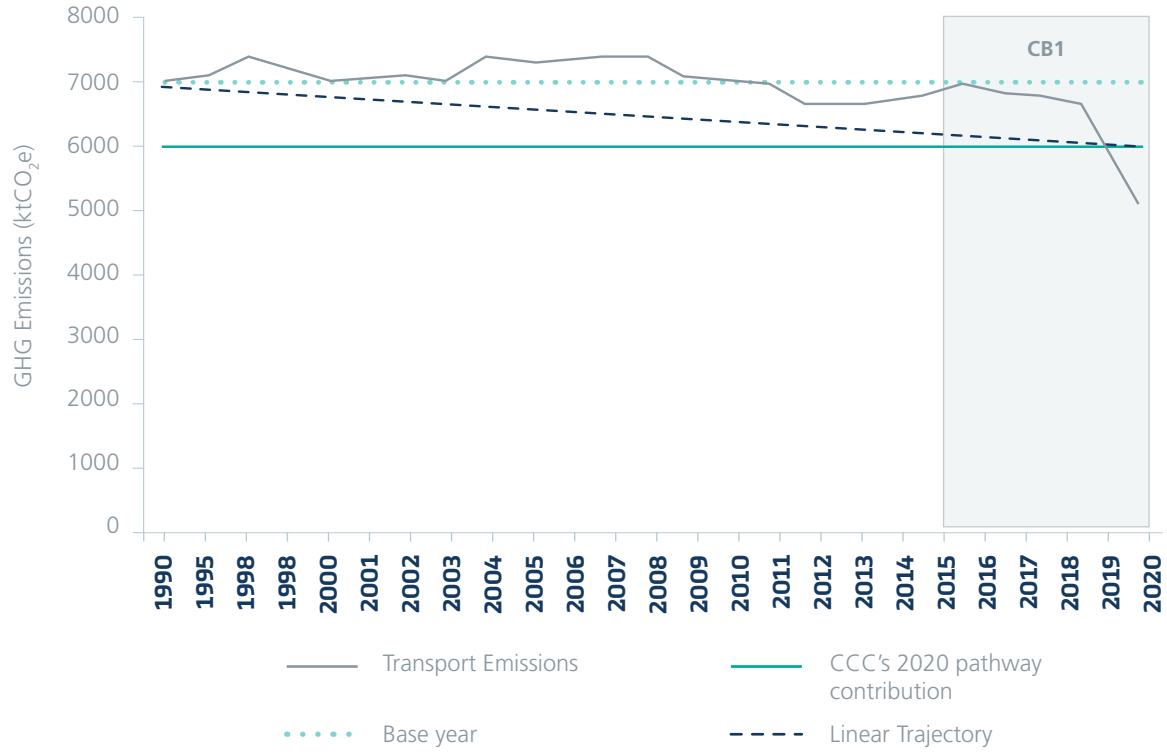
Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the Transport sector has been rated green in terms of CB1 progress, and the anticipated contribution to CCC's 2020 pathway has been met. All 4 sub-sector Tier 1 indicators relating to road Transport, rail, aviation and shipping emissions, have also been rated green, indicating an overall downward trend over CB1.

Transport sector GHG emissions have steadily decreased over time. The Transport **sector achieved a 26% decrease in emissions from 2016-2020, with 2020 emissions 27% lower than the base year.** The Transport sector has emitted a total of 32.04MtCO2e during the first carbon budget period.

From the data, it can be seen in 2020, a significant drop was observed (a 22.5% decrease from 2019, and a 27.4% decrease from the base year) - this anomalous decrease is linked to the COVID lockdowns and travel guidance and played a significant part in meeting the transport sector target.

Indicator	Transport Sector GHG Emissions
Code	T1.1
Anticipated contribution to CCC's 2020 pathway	2020 GHG emissions should be 14% lower than the base year (1990)
2020 progress	✔ 27% reduction from base year in 2020
CB1 Progress	G 26% decrease from 2016 to 2020



Data Source	NAEI GHGI 2020

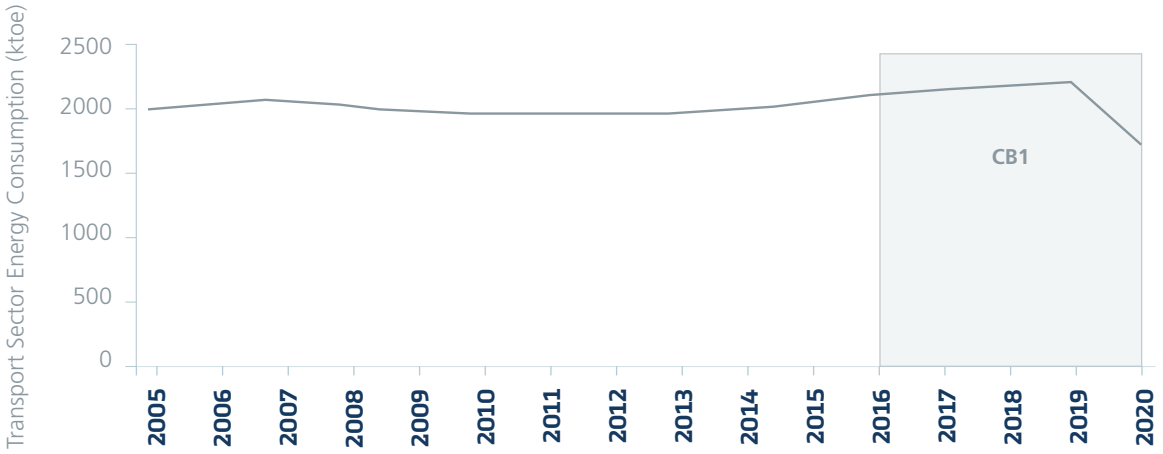
Tier 2 - Activity data

Of the 14 Tier 2 indicators for the Transport sector, 6 have been rated green, 4 have been rated red, and 4 could not be rated.

The activity data from the Transport sector varied with positive progress in areas such as overall Transport sector energy consumption and the proportion of Transport energy consumption from renewable sources. However, there has been considerable declines in the proportion of journeys undertaken by active travel and in passenger rail use, likely driven by the Covid 19 travel restrictions.

The total Transport sector energy consumption is a key indicator for the sectors and is shown below.

Indicator	Transport sector energy consumption
Code	T2.11
Desired direction of travel	Decrease
CB1 progress	G 19% decrease from 2016-2020
Progress since 2020	N No data available



Year	2016	2017	2018	2019	2020
Energy Use (kilotonnes of oil equivalent, or ktoe)	2,100	2,116	2,156	2,177	1,705

Description of trends	Transport sector energy consumption has remained relatively steady over time, fluctuating by up to 2% year on year up until 2019 (when energy consumption totalled 2,177 kilotonnes of oil equivalent (ktoe). In 2020, however, the transport sector used only 1,705 ktoe - a decrease of 22% from 2019. Between 2016 and 2019, transport sector energy consumption decreased by 19%, though this is almost completely a function of the large (22%) decrease observed between 2019 and 2020 (likely an artefact of the COVID pandemic and subsequent reduced travel).
Data Source	BEIS sub-national total final energy consumption statistics

Tier 3 and wider information

Of the 7 Tier 3 indicators developed for the Transport sector, 6 could not be rated according to the desired direction of travel (either because data was not available, or because the desired direction of travel was not clear). The one indicator that could be rated tracked EV chargers and was rated green (i.e., achieving the desired direction of travel over CB1).

Whilst few of these Tier 3 indicators could be rated, the data shows that:

- Over CB1, a total of just over £23 million has been invested in active travel. Indicators to support this work are still under development.
- Grant schemes to encourage uptake of electric vehicles are administered at the UK Government level through the Plug-in Grant (PiG) scheme. Overall, support provided by the scheme has increased over time, although there have been changes to some eligibility criteria that have produced yearly fluctuations. In 2020, a total of £6.7 million was provided in the form of PiG Category 1 grants within Wales.
- Supporting this, investment in enabling infrastructure, such as chargers, is also required – however information to track the investment related to this policy has not yet been established. The number of chargers situated in Wales has increased by 243% over CB1, totalling 802 in 2020, and 1039 in 2021.
- Due to the current gaps in the indicator framework, it is not possible to draw any further conclusions. Advice from the transport sector, and additional data, are sought, in order to progress any supplementary monitoring and reporting of this sector.

The LCDP1 set out 9 Transport sector polices and 4 proposals, of these, 3 policies are tracked directly with Tier 3 indicators, as outlined above. The remaining 6 policies and 4 proposals are tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

- National planning policy continues to be developed and revisions to Planning Policy Wales (PPW) are made relatively frequently. Edition 11 of PPW and Future Wales – the National Plan was published in February 2021, which guides the content of Strategic Development Plans and Local Development Plans. Planning Policy is prepared for other stakeholders including local planning authorities and developers. It therefore implemented by other parties and measuring the outcome of others' actions is difficult.

- Recent statistics indicate that 68 electric buses are currently in operation and an additional 14 buses funded by Welsh Government are on order. There were 2,217 locally operated bus and coach vehicles in Wales in 2020-21. The Welsh Government has provided capital grant to Carmarthenshire and Gwynedd Councils for the purchase of fully electric buses for use on the TrawsCymru strategic bus network. Carmarthenshire have been collectively awarded over £4.8m for the purchase of 8 electric buses and the construction of a dedicated depot, and Gwynedd Council £4.1m for the purchase of 6 buses and the construction of a dedicated depot. Both schemes are expected to be operational later this year with zero emission electric buses replacing older diesel buses on the key TrawsCymru. Separately, Cardiff Bus and Newport Bus have been awarded funding by the UK Department for Transport's Ultra Low Emission Bus Scheme for the purchase of 36 and 32 fully electric buses, respectively.
- Funding has been provided for zero emission taxis (including in Cardiff City Region) and a number of electric car club and electric community car schemes are being supported.

Industry Sector

The Industry sector includes manufacturing, construction, cement production, operation of machinery, food processing and the extraction and production of fossil fuels.

The Industry sector's anticipated contribution in the CCC's 2020 pathway shows that for 2020 emissions should be 35% lower than the base year (1990)[21]. To achieve this the sector's focus was on:

- Improving energy efficiency measures of material, energy and processes, innovation and waste heat
- Increase of low carbon heat and industrial process measures

The Industry sector has made some progress in the implementation of its policies. However, due to data availability and the key role of UK Government action, this is largely tracked by qualitative information. Industry sector emissions have a large impact on Welsh emissions and consequently it is key that UK Government action is maintained.

The high traded sector share in the Industry sector means that emissions within the EU/UK ETS have a significant impact on overall trends. Overall verified emissions in the ETS have decreased by 44% during CB1[22], although a large proportion of this is driven by the closure of Aberthaw power station. Total Industry sector energy consumption has declined by 4% over CB1 (excluding the influence of Aberthaw), with reductions in electricity, coal and petroleum consumption. However, Industry sector gas consumption has increased over the CB1 period.

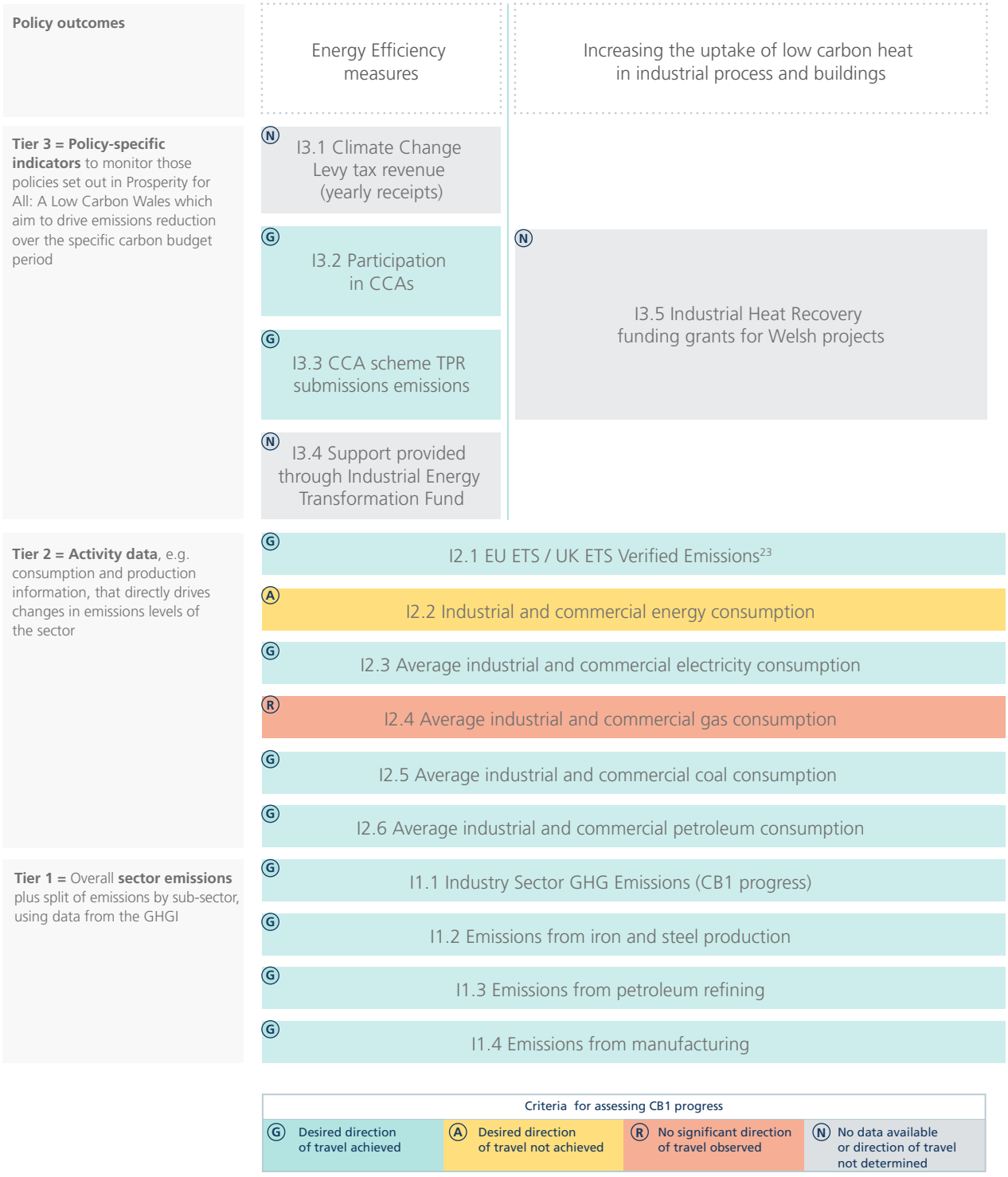
The key policies and activities in the Industry sector have helped to support the sector in reducing emissions by 41% compared to the baseline in 2020, exceeding the anticipated contribution to CCC's 2020 pathway.

21 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in *Annex 3 - Constructing emissions pathways*. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

22 Note ETS includes traded emissions from the power sector as well. When looking at emission from the industry sector, traded emissions have decreased by 8%.

Overview of Industry indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.



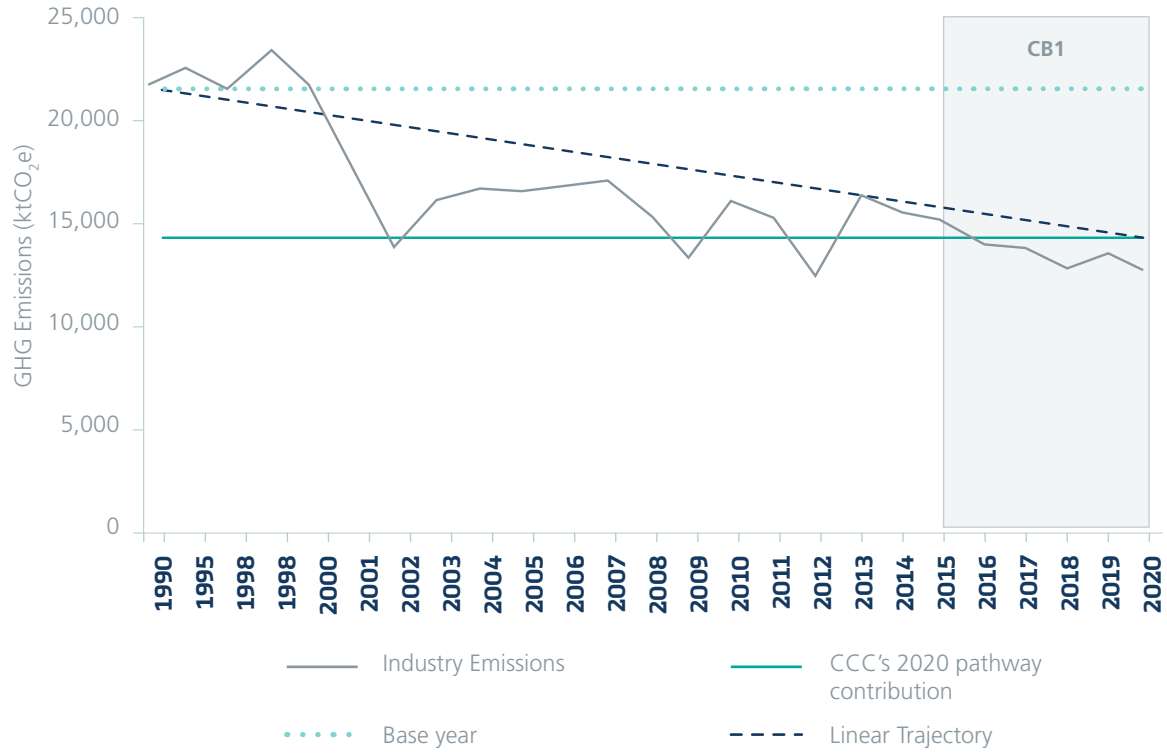
23 Note ETS includes traded emissions from the power sector as well. When looking at emission from the industry sector, traded emissions have decreased by 8%.

Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the Industry sector has been rated green in terms of CB1 progress, and the anticipated contribution to CCC's 2020 pathway has been met. All 3 sub-sector Tier 1 indicators, covering iron and steel, petroleum refining and manufacturing emissions have also been rated green, indicating a reduction in emissions over CB1.

Emissions from the Industry sector have decreased over time, with some fluctuations. **The sector has achieved a 10% decrease in emissions from 2016-2020, with 2020 emissions 41% lower than the base year.** The Industry sector has emitted a total of 67.54 $MtCO_2e$ during the first carbon budget period.

Indicator	Industry Sector GHG Emissions
Code	I1.1
Anticipated contribution to CCC's 2020 pathway	2020 emissions should be 35% lower than the base year
2020 progress	✔ 41% reduction from base year (1990) in 2020
CB1 Progress	G 10% decrease from 2016-2020



Data Source	NAEI GHGI 2020

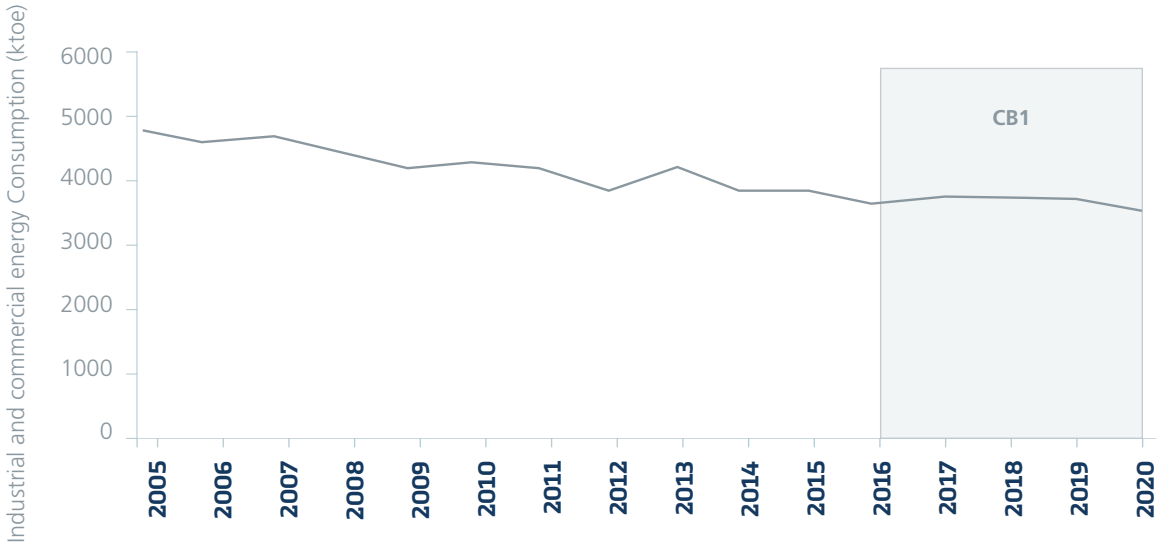
Tier 2 - Activity data

Of the 6 Tier 2 indicators for the industry sector, 4 have been rated green, 1 has been rated amber (i.e., no significant direction of travel observed), and 1 has been rated red.

The high traded-sector share in the Industry sector, means that emissions within the EU/UK ETS have a significant impact on overall trends. Overall verified emissions in the ETS have decreased by 44% during CB1[24], although a large proportion of this is driven by the closure of Aberthaw power station. Total Industry sector energy consumption has declined by 4% over CB1 (excluding the influence of Aberthaw), with reductions in electricity, coal and petroleum consumption. However, Industry sector gas consumption has increased over the CB1 period.

The Tier 2 indicator tracking total industrial and commercial energy consumption is identified as the key indicator for this sector and gives an overview of sector activity.

Indicator	Industrial and commercial energy consumption
Code	I2.2
Desired direction of travel	Decrease
CB1 progress	A 4% decrease from 2016-2020
Progress since 2020	N No data available



Year	2016	2017	2018	2019	2020
Industrial and commercial energy consumption (kilotonnes of oil equivalent, or ktoe)	3,675	3,764	3,757	3,701	3,532

Description of trends	Industrial and commercial energy consumption has displayed an overall decrease over time, despite minor fluctuations. Over the CB1 period, consumption reduced from 3,675 kilotonnes of oil equivalent (ktoe) in 2016 to 3,532 ktoe in 2020 (a reduction of 4%). The majority of this decrease came between 2019 and 2020 (5% reduction).
Data Source	BEIS Sub-national Total Final Energy Consumption

24 Note ETS includes traded emissions from the power sector as well. When looking at emission from the industry sector, traded emissions have decreased by 8%.

Tier 3 and wider information

Of the 5 Tier 3 indicators developed for the Industry sector, 3 could not be rated according to the desired direction of travel (either because data was not available, or because the desired direction of travel was not clear). The 2 indicators that could be rated, regarding Climate Change Agreements (CCA's) were both rated green (i.e., achieving the desired direction of travel over CB1).

Whilst few of these Tier 3 indicators could be rated, the data shows that:

- Many of the policies for the Industry sector are implemented at a UK level and it is key that they play their part in delivery, especially as the Industry sector represents a large proportion of Welsh emissions.
- One mechanism for driving energy efficiency improvement in industrial installations is through the Climate Change Levy (CCL). A total of £690m was received between 2016/17 and 2020/21 from this levy. Climate Change Agreements can be implemented by UK industry to receive a discount on rate of CCL paid. The number of participants in the Climate Change Agreements scheme has increased over the period, totalling 467 in 2020. Decreases in the total carbon emitted by participants can be observed between target periods.
- The Industrial Energy Transformation Fund awarded their first grants in 2021 (outside the time frame for this carbon budget period) but has delivered £3m in funding in 2021 and almost £1m in 2022.
- The Industrial Heat Recovery funding grant scheme launched in 2019 aims to provide grants to encourage waste heat recovery in industrial processes and buildings. Industrial Heat Recovery grants to the value of £207,309 were awarded to Welsh projects in 2019.

The LCDP1 set out 7 Industry sector polices and 3 proposals, of these, 4 policies are tracked directly with Tier 3 indicators, as outlined above. The remaining 3 policies and 3 proposals are tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

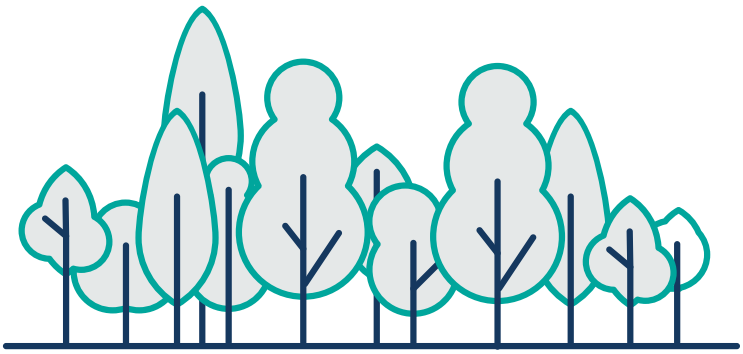
- The onshore petroleum licensing functions were transferred from the UK Government to the Welsh Minister on 1st October 2018. There has been no new licences issued in Wales since this transfer, and it is the policy of the Welsh Government to not commence a new licensing round or otherwise issue licences (except in exceptional circumstance where a licence might be required for safety or academic research purposes, i.e. to make an abandoned mine safe).

- However, there are extant petroleum licences in Wales, issued by the UK Government. In 2018 the Welsh Government inherited 14 such licences, issued between 1996 and 2008. The Welsh Ministers are required to administer these licences in accordance with their model clauses, the general principles of public law, and within the context of devolved policy and legislation. Of the 14 inherited licences, only 6 remain extant. The others being relinquished by the licensee, or terminated by the Welsh Ministers for failure to comply with licence model clauses. Of the remaining 6 extant licences, only one has the necessary planning permission in place for exploratory activities (the planning permissions do not allow for production). Should the licensee seek to drill in accordance with the planning permissions, the consent of the Welsh Ministers, as the petroleum licensing authority in Wales, would be required. Should the Ministers receive an application for consent to drill, any decision will be subject to devolved policy and applicable legislation.

The last well drilled in Wales was completed on 23 March 2012, and produced coal bed methane for a short time. No further wells have been drilled in Wales since 2012. All production in Wales under a petroleum licence ceased in 2012/13. There is currently no petroleum production onshore in Wales.

- Work has been undertaken to explore Carbon Capture, Utilisation, and Storage options in Wales, and to assess technical feasibility including "A Carbon Capture, Utilisation, & Storage Network For Wales" (published 2021) -"CCUS Strategy Sensitivity Analysis: Supplementary Report" (published 2022)[25]
- Training courses on reducing emissions have been provided to the food industry for free, and feasibility studies to show what could be achieved in terms of emission reduction in the food industry (and the associated costs) have been conducted.
- There have been a number of environmental protection projects in relation to Energy Efficiency and Carbon Reduction, continuing on past 2020. For the Financial years 14/15 to 21/22 there have been 4 Energy Efficiency projects accepted at a value of £14.8m and 5 Carbon Reduction Projects with an accepted value of £12.2m.

25 Carbon capture, utilisation, and storage (CCUS) strategy sensitivity analysis: supplementary report | GOV.WALES



Land Use, Land Use Change and Forestry (LULUCF) Sector

The Land Use, Land Use Change and Forestry (LULUCF) sector is the only sector which has the current capability to remove CO_2 from the atmosphere and is currently a net sink of emissions[26]. This means that removals of CO_2 exceed emissions of GHGs in the sector; the emissions of GHGs are dominated by CO_2.

The reporting of emissions for the LULUCF sector has considerably greater uncertainty compared to other sectors. The inventory methodology has been improved overtime to enhance reporting in the sector, and this has led to challenges in directly applying the CCC's original pathways[27] advice to the revised estimates of emissions from this sector. As such, the LCDP1 set the ambition that the LULUCF sector would remain a net sink of GHG emissions. To achieve this the sector's focus was on:

- Increasing tree cover through policies to increase forest, woodland and hedgerow growth;
- Safeguarding and increasing carbon stores in soils and biomass.

The LULUCF sector has delivered a number of programmes such as funding under Glastir Woodland since 2015. A total of £1.38 billion in grants and subsidies was delivered under Glastir between 2016 and 2020 (although it is important to note that only £14.2 million of that funding under Glastir was specifically targeting woodland creation).

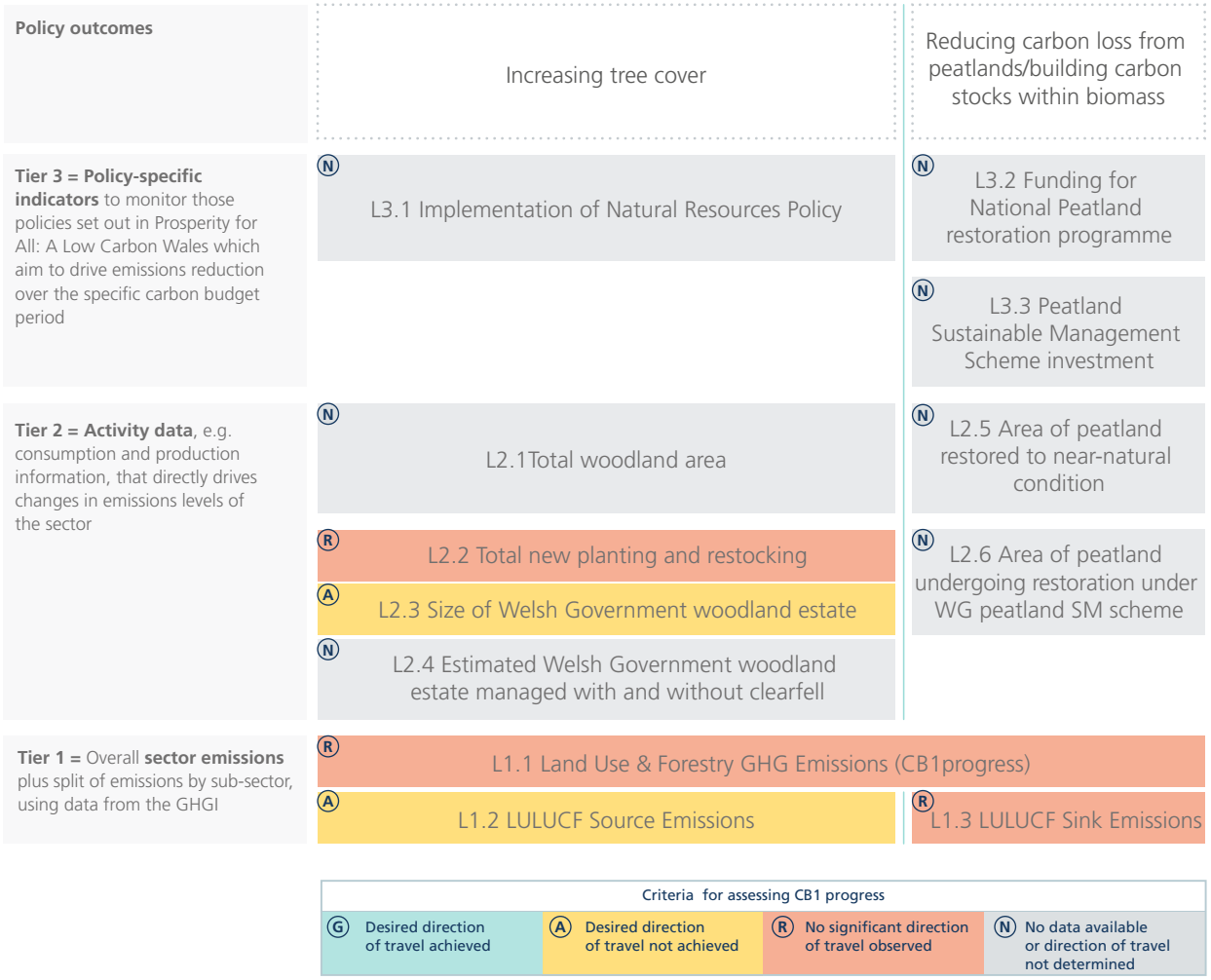
Data availability is a key challenge in the LULUCF sector. Good quality, complete and up-to-date data is collected infrequently and, as such, there is a lack of key datasets to characterise changes in the sector compared to others.

Although there was a decrease in the size of the emissions sink through the CB1 budget period it remained a sink and therefore achieved the anticipated contribution set out in LCDP1.

26 This means that removals of CO2 exceed emissions of GHGs in the sector.
27 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in *Annex 3 - Constructing emissions pathways.* This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Overview of Industry indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.

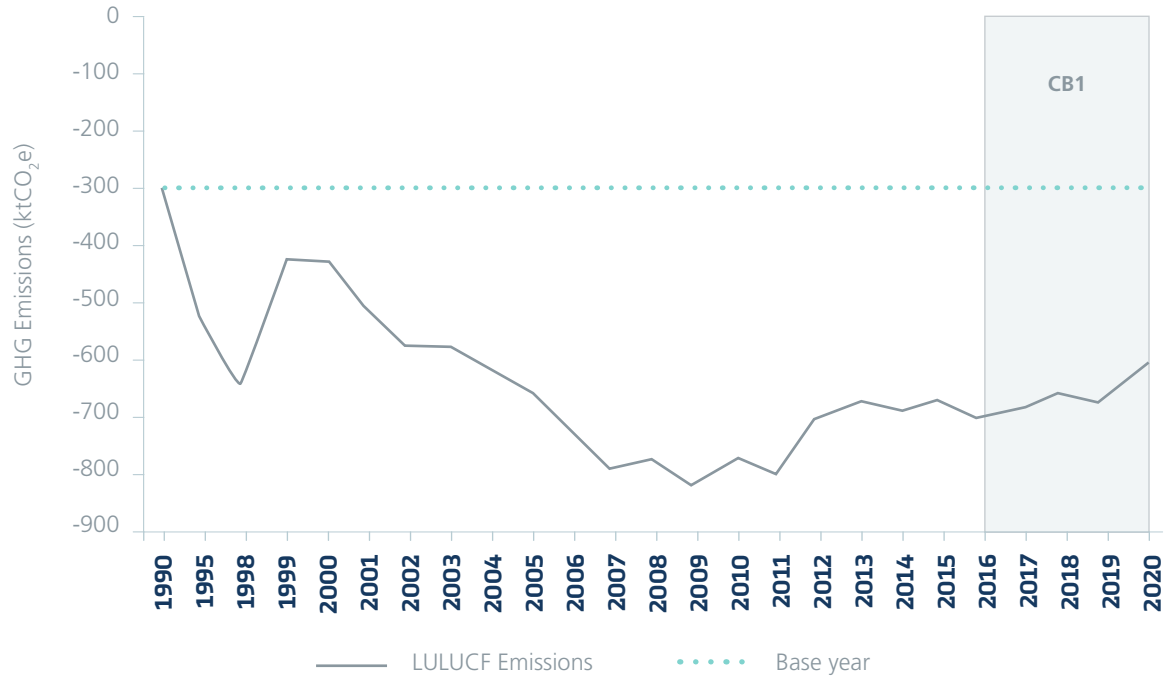


Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the LULUCF sector has been rated red, but the anticipated contribution set out in the LCDP1 has been met, as the sector has remained a net sink of emissions. Net emissions in the LULUCF sector refers to the sum of emissions and removals. Two sub-sector Tier 1 indicators have been identified that split the net emissions into activities that deliver sources and removals. Of these, the emission sources have been rated amber, showing a small reduction and the sum of activities that deliver removals has been rated red, showing a decline in the sink over CB1

Emissions for the LULUCF sector have historically remained a net sink of greenhouse gases. **The LULUCF sector saw a net reduction of the sink provided, reducing 13% from 2016-2020. However, the sector has remained a net sink over the CB1 period with a net removal of 611 $ktCO_2e$ in 2020.**

Indicator	LULUCF Sector GHG Emissions
Code	L1.1
Anticipated contribution to CCC's 2020 pathway	Target to remain a net sink of GHG emissions
2020 progress	✔ LULUCF sector remains a net sink
CB1 Progress	R 13% increase in net emissions between 2016-2020



Data Source	NAEI GHGI 2020

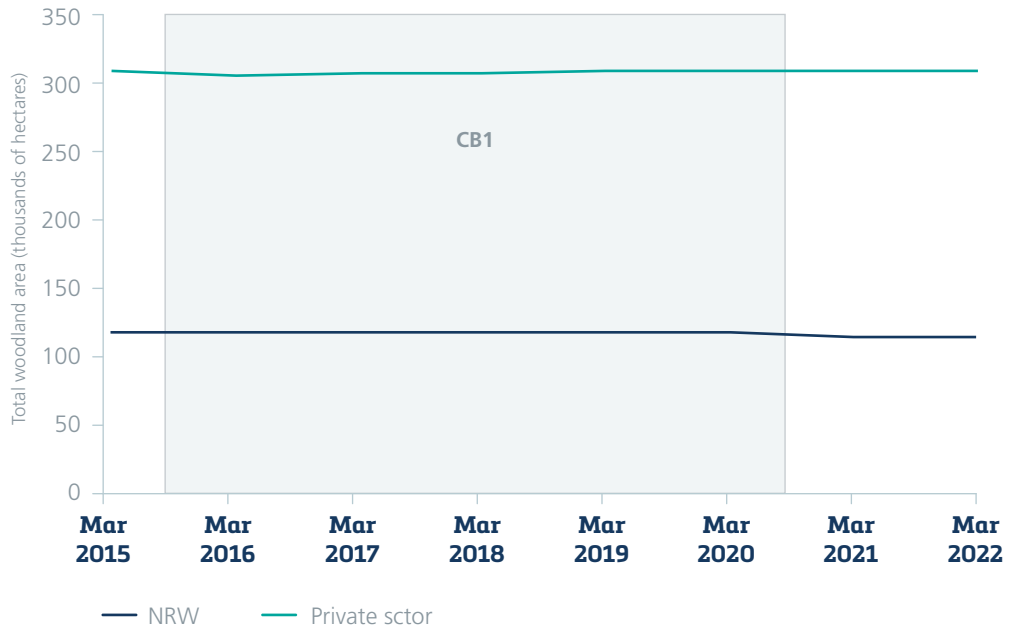
Tier 2 - Activity data

Of the 6 Tier 2 indicators for the LULUCF sector, 1 has been rated red (i.e., desired direction of travel not achieved), 2 have been rated amber (i.e., no significant direction of travel observed), and 3 could not be rated.

LULUCF is a complex sector, and as such, collecting good quality, complete and up-to-date data can be a challenge. As such, data is lacking for this sector compared to others. The activity data from the Land Use sectors shows mixed progress in relation to total woodland, planting and restocking and with a lack of suitable data for peatland.

The Tier 2 indicator tracking total woodland area is identified as the key indicator for this sector and shows there has been a small increase in total estimated woodland area over the CB1 period.

Indicator	Total woodland area
Code	L2.1
Desired direction of travel	Increase
CB1 progress	A 1% increase from 2016 - 2020
Progress since 2020	A 0% change from 2020 - 2021



	NRW [Note 1, 2, 6]	Private sector [Note 3]	Total [Note 4, 5]
	thousands of hectares		
Mar 2015	117	189	306
Mar 2016	117	190	307
Mar 2017	117	191	308
Mar 2018	117	192	309
Mar 2019	117	193	310
Mar 2020	117	193	310
Mar 2021	115	195	310
Mar 2022	115	196	310

Notes:	
1. NRW = Natural Resources Wales	5. The estimates are based on UK data published by FSC and PEFC, supplemented by data from individual certificates and other sources. Where possible, figures are for the woodland area certified, rather than the land area certified.
2. All NRW woodland is certified. The woodland areas are the latest areas from the National Forest Inventory, rather than the areas shown on certificates.	6. Estimates only relate to the Welsh Government Woodland Estate (WGWE). The data representing WGWE in this dataset is based on the National Forest Inventory definition of woodland (NATIONAL FOREST INVENTORY WOODLAND WALES 2017 - data.gov.uk), therefore it only includes productive forest area.
3. Private sector: all other woodland. Includes woodland managed by NRW outside the WGWE, other publicly owned woodland (e.g., owned by local authorities) and privately-owned woodland.	
4. All certified woodland is certified under the Forest Stewardship Council (FSC) scheme or the Programme for the Endorsement of Forest Certification (PEFC) scheme, with many woodlands certified under both schemes.	

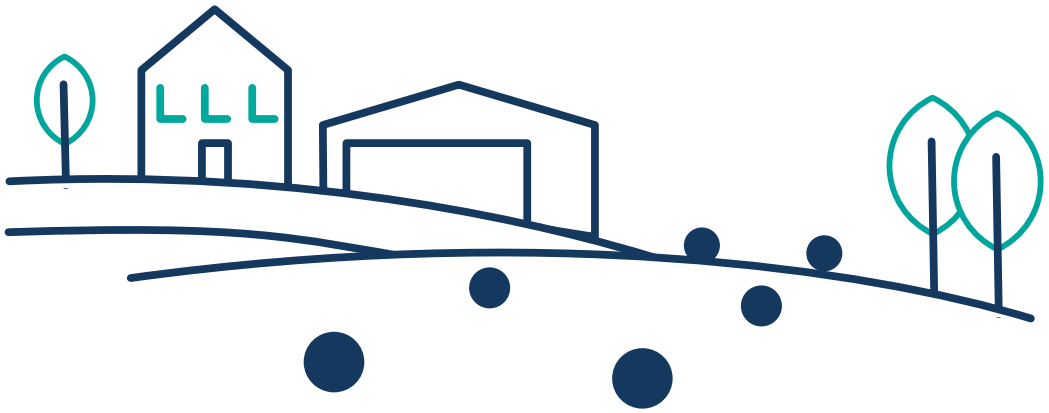
Description of trends	Total woodland area increased slightly between 2015 and 2019 but has remained steady in recent years (2019-2022). Private sector woodland area has increased by around 1 thousand hectares per year between 2015 and 2022. FC/NRW woodland remained constant at 117 thousand hectares until 2021, when 2 thousand hectares were lost. Over the CB1 period (2016-2020) total woodland area increased by 1%.
Data Source	Forestry Statistics – Total woodland area in Wales

Tier 3 and wider information

Of the 5 LULUCF sector polices and 2 proposals, none can currently be tracked with Tier 3 indicators because the necessary data are unavailable. Thus, progress cannot be assessed on any of the three Tier 3 indicators.

Therefore, the sectors policies and proposals are tracked with qualitative data, as quantitative indicators could not be established. This qualitative assessment shows that:

- The main source of funding for woodland creation activity is through the Glastir scheme, which has a Glastir Woodland programme. This implementation indicator is included within the Agriculture sector indicators. A total of £1.38 billion in grants and subsidies was delivered under Glastir between 2016 and 2020 with £14.2million of this allocated to woodlands.
- Implementation of the Natural Resources Policy is ongoing, and the policy will be subject to a full review in 2022. This policy also features in the Net Zero Wales plan for CB2.
- Natural Resources Wales are the regulator for felling licences and the policy regarding the requirement to replant felled areas remains unchanged. Officials will work with NRW to clarify how carbon emissions may be considered.
- Another key intended outcome for the LULUCF sector is to reduce carbon loss from peatlands/building carbon stocks within biomass. However, indicators to track policy implementation under this outcome remain under development. However, the Sustainable Management Scheme (SMS) has supported a number of peatland restoration projects in Wales. The outputs of these projects have included peatland restoration feasibility studies, mapping and surveying of peatlands, dam installation for peatland protection, and peatland restoration implementation.



Agriculture Sector

The Agriculture sector includes emissions from soil, livestock, waste and manure management as well as farm fuel use.

The Agriculture sectors anticipated contribution in the CCC's 2020 pathway[28] shows that for 2020 emissions should be 17% lower than the base year (1990).

To achieve this the sector's focus was on:

- Improved efficiency of livestock production;
- Improved crop and nutrient management; and
- Improved on farm fuel and energy efficiency.

The Agriculture sector has a number of supportive schemes for farmers through the Red Meat Development programme, Dairy improvement Programme, Sustainable Production grant and Farming Connect, although supportive indicator data has not been able to be developed.

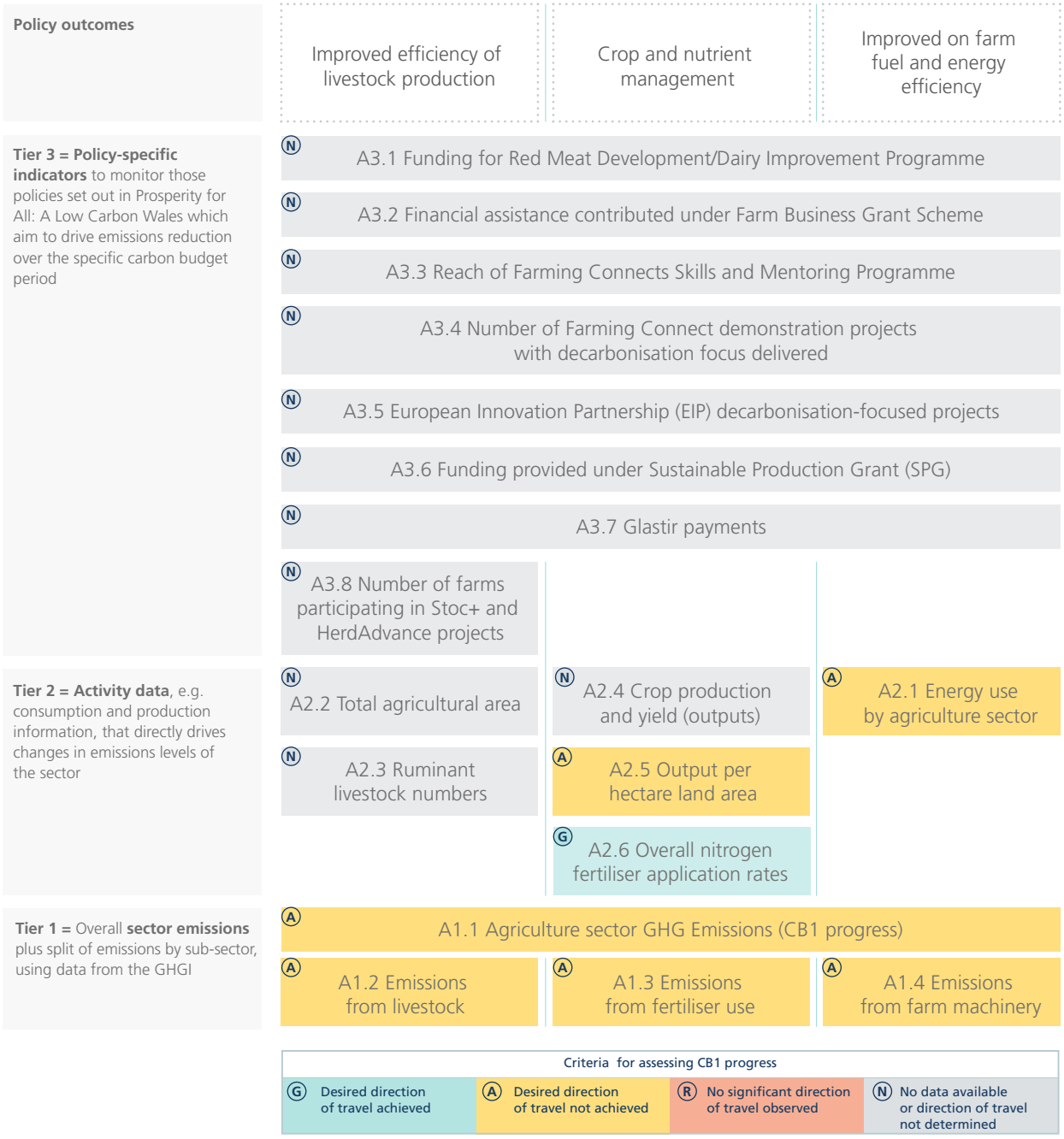
There has been a 6% increase observed in total agricultural area from 2016-2020. When looking at active agriculture land there has been a small decrease in agriculture land area from 2018 to 2020 however output per hectare of land increased by 3%. Ruminant livestock numbers fluctuated over the CB1 period showing an overall decrease of 8% from 2016 to 2020. In addition, average fertiliser application rates have decreased over time, showing an improvement. Energy use by the Agriculture sector has remained broadly stable over the CB1 period.

There has been delivery in some of the key policies, and overall emission emissions have declined over the CB1 period. However, emissions have not declined at the rate anticipated in the CCC's pathway and the anticipated contribution to CCC's 2020 pathway, has not been met.

28 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in *Annex 3 - Constructing emissions pathways*. This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Overview of the Agriculture sector indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.

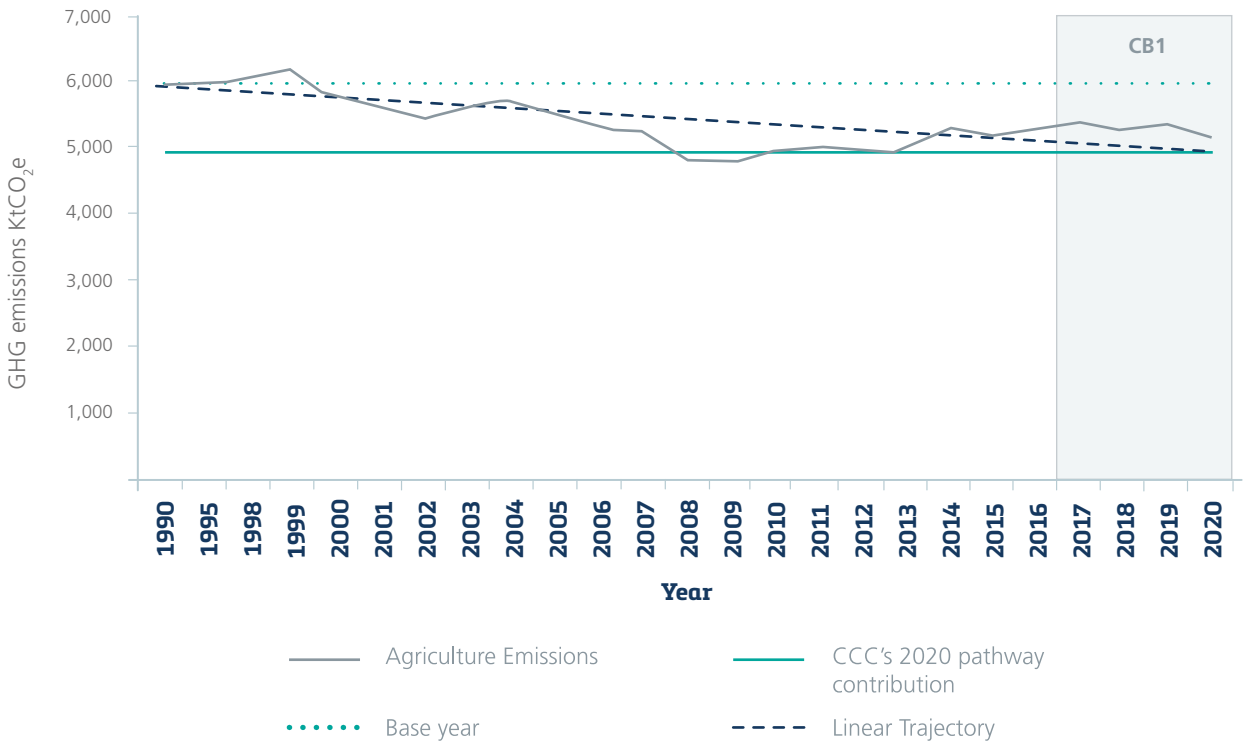


Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the Agriculture sector has been rated amber in terms of CB1 progress, and the anticipated contribution to CCC's 2020 pathway has not been met. All 3 sub-sector Tier 1 indicators, describing emissions from livestock, fertiliser use and farm machinery have been rated amber.

Emissions for the Agriculture sector have decreased overall, with some fluctuations. **The Agriculture sector has achieved a 3% decrease in emissions from 2016-2020, with 2020 emissions 13% lower than the base year.** The Agriculture sector has emitted a total of 26.41 $MtCO_2e$ during the carbon budget period.

Indicator	Agriculture Sector GHG Emissions
Code	A1.1
Anticipated contribution to CCC's 2020 pathway	Emissions should be 17% lower than the base year (1990) (equivalent to 6% lower than 2016)
2020 progress	✖ 13% reduction from base year (1990)
CB1 Progress	A 3% decrease from 2016 to 2020



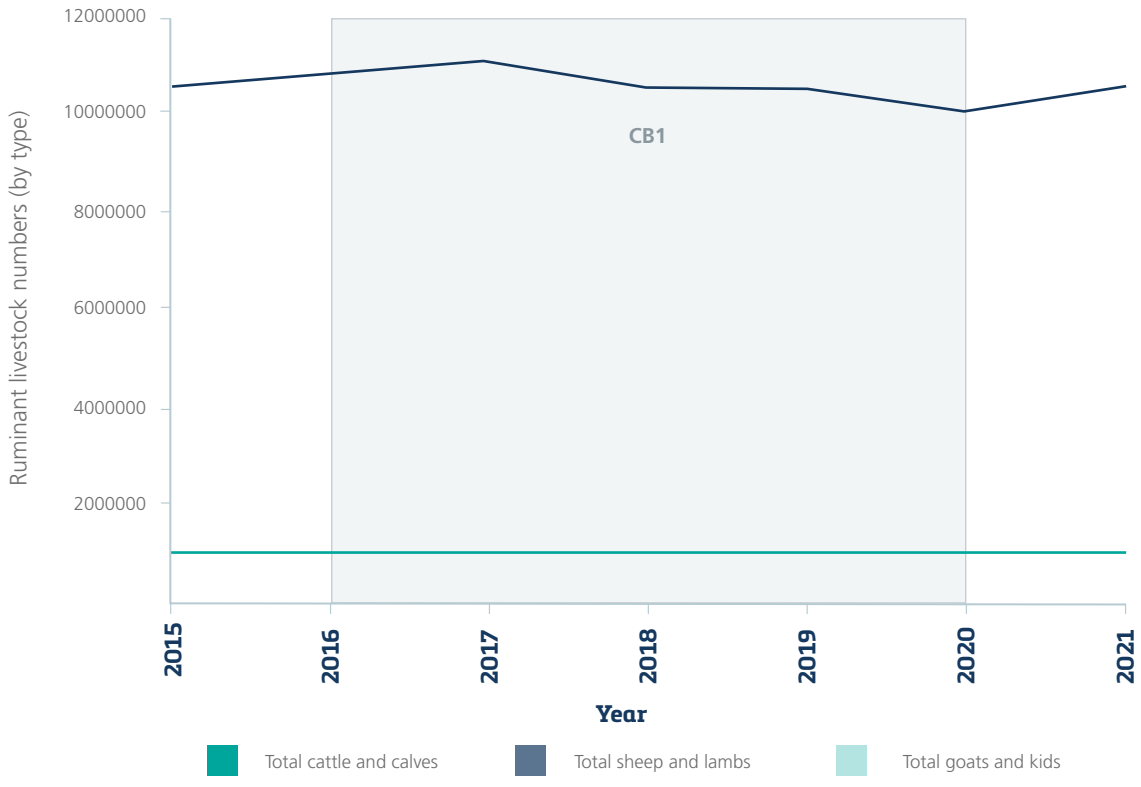
Tier 2 - Activity data

Of the 6 Tier 2 indicators for the Agriculture sector, 1 has been rated green (i.e., achieving the desired direction of travel over CB1), 2 have been rated amber (i.e., no significant direction of travel observed), and 3 could not be rated.

There has been a 6% increase observed in total agricultural area from 2016-2020. When looking at active agriculture land there has been a small decrease in agriculture land area from 2018 to 2020 however output per hectare of land increased by 3%. Ruminant livestock numbers fluctuated over the CB1 period showing an overall decrease of 8% from 2016 to 2020. In addition, average fertiliser application rates have decreased over time , showing an improvement. Energy use by the Agriculture sector has remained broadly stable over the CB1 period.

Livestock enteric emissions (largely from sheep and cattle) are a major source of emissions in the sector and the Tier 2 indicator tracking ruminant livestock numbers is identified and a key indicator for this sector for this reason.

Indicator	Ruminant livestock numbers	
Code	A2.3	
Desired direction of travel	A desired direction of travel has not been allocated for this indicator.	
CB1 progress	N/A	8% decrease from 2016-2020
Progress since 2020	N/A	5% increase from 2020-2021



	Total cattle and calves	Total sheep and lambs	Total goats and kids	Ruminant total
2015	1,118,979	9,503,977	10,132	**10,633,088**
2016	1,134,341	9,810,486	11,928	**10,956,755**
2017	1,137,399	10,037,473	12,308	**11,187,180**
2018	1,134,135	9,530,790	11,844	**10,676,769**
2019	1,119,844	9,533,616	13,022	**10,666,482**
2020	1,122,369	8,989,410	12,181	**10,123,960**
2021	1,128,849	9,464,299	12,551	**10,605,699**

Description of trends	Ruminant livestock numbers fluctuated over the CB1 period, seeing an increase from 2016-2017, then decreases from 2017-2020. In 2020, ruminant livestock numbers had decreased by 8% from 2016. However, numbers rebounded again in 2021, increasing by 5%. It is important to note that livestock numbers may also fluctuate due to reasons not driven by policy – for example, environmental factors in one year might affect fertility in the following year
CB1 progress	Survey of agriculture and horticulture, June 2021

Tier 3 and wider information

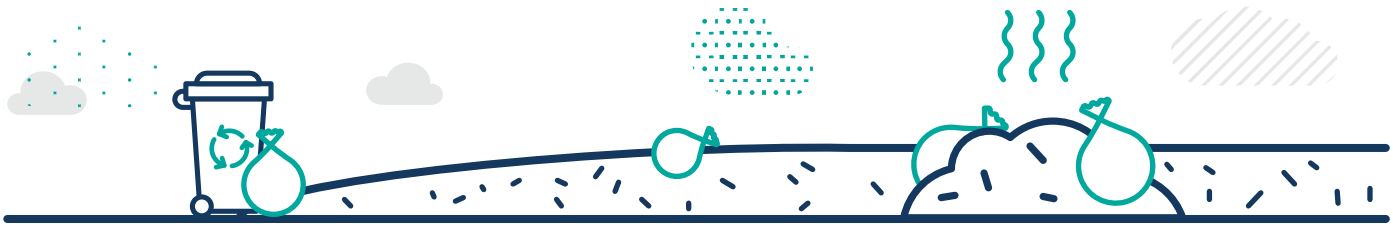
Of the 8 Tier 3 indicators developed for the Agriculture sector, none could be rated according to the desired direction of travel, either because data was not available, or because the desired direction of travel was not clear.

Although few of the Tier 3 indicators could be directly rated the data shows that:

- The Red Meat Development Programme (RMDP) and Dairy Improvement Programme (DIP) aim to improve efficiency of production in the agriculture sector, and together delivered £3.84 million between 2016 and 2020.
- The Red Meat Development Programme (RMDP) aims to equip the red meat sector in Wales for the future. It consists of 3 projections: Stoc+ (targeting animal welfare, sustainability, and efficiency); the Hill Ram Scheme (targeting technology and performance recording in the hill sheep sector); the Welsh Lamb Meat Quality (targeting produce quality). The Stoc+ project has seen 295 registrations since inception in 2018/19.
- The Dairy Improvement Programme (DIP), funded by the Rural Development Programme 2014-2020, aims to improve herd health management and consists of HerdAdvance (targeting health management and disease control) and Strategic Farms (encouraging farmer-to-farmer learning on best practice). The HerdAdvance project has seen a total of 507 participating farms over 2019-2020.
- There are a number of schemes being implemented to support farmers including Farming Connect, a programme which supports farmers to achieve a range of aims (including efficiency, productivity and cost-effective emission reduction), saw a total of 11,311 registrations between 2016 and 2020. In addition, a total of 74 demonstration projects with a decarbonisation focus were delivered by the programme between 2016 and 2020. The Sustainable Production Grant (a grant towards investments in equipment/ machinery which will help famers address nutrient management and water, soil and air quality) delivered almost £13.7 billion in funding over the CB1 period.
- The Glastir scheme gives grants and subsidies for delivery of environmental goods and services aiming to achieve reduction of impacts of climate change within agriculture whilst improving water and air quality through creation, management and restoration of woodland. A number of funding sources exist under Glastir, and between 2016 and 2020 a total of £1.38 billion of payments were made under the scheme.

The LCDP1 set out 7 Agriculture sector polices and 3 proposals, of these, 5 policies are tracked directly with Tier 3 indicators, as outlined above. The remaining 1 policy and 3 proposals are tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

- The Code of Good Agricultural Practice (in place since 2011) provides a voluntary code of practice produced under Section 4 of the Nitrates Directive. Pollution prevention and effective nutrient management are also key objectives of the Glastir scheme. To improve compliance with the Code, a number of schemes and funding support have been available to farms in Wales to improve waste and slurry management practices. Within the Rural Development Programme, several schemes were available to improve land management including the Sustainable Production Grants (SPG) and Farm Business Grant (FBG). This has also been supported by the Glastir Small Grants (GSG).
- Natural Resources Wales (on behalf of Welsh Government) have also worked with dairy farmers to identify pollution risks and communicate good practice. This project has visited 525 farms (32% of total dairy farms) to date, with a total of 426 issues reported to farmers. The Farming Connect scheme's 'Dwr Glan/Clean Water' programme provides 80% funding for advice on soil and nutrient management planning, slurry and farmyard manure management and storage and farm infrastructure.
- The Stoc+ project has been working with farmers and vets to promote proactive flock and herd health management, and to help Wales take a leading role in animal welfare, sustainability and efficiency. By 2020, there were 295 participating farms. There is also the Herd Advance project (2019-2023) which provides financial incentives aimed to help Welsh dairy farmers lift herd profitability and performance by improving disease prevention and control. According to a cost benefit analysis of the project, there have been evidenced reductions in the incidence lameness and mastitis, as well as indications of enhanced awareness of Johne's Disease. These improvements will help drive efficiency in the livestock sector.
- Under the Glastir scheme, version 3.0 of the "Glastir Whole Farm Code Verifiable Standards" were published in 2019. These verifiable standards and guidelines for classification of failures of Glastir set out a suite of requirements for participants and descriptions of breaches. This includes requirements related to agricultural pollution and fertiliser management.
- In 2021, "The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021", applying to the whole of Wales, were published. This document sets out staged requirements for reducing agricultural pollution across Wales.



Waste Sector

The Waste sector includes emissions from waste management activities including landfill sites as well as wastewater treatment.

The Waste sectors anticipated contribution in the CCC's 2020 pathway for 2020 shows that emissions should be 80% lower than the base year (1990)[29]. To achieve this the sector's focus was on:

- Implementing measures to reduce waste emissions from landfill;
- Implementing measures to reduce emissions from wastewater treatment.

The Waste sector has made positive progress in both developing and tracking the implementation of its policies.

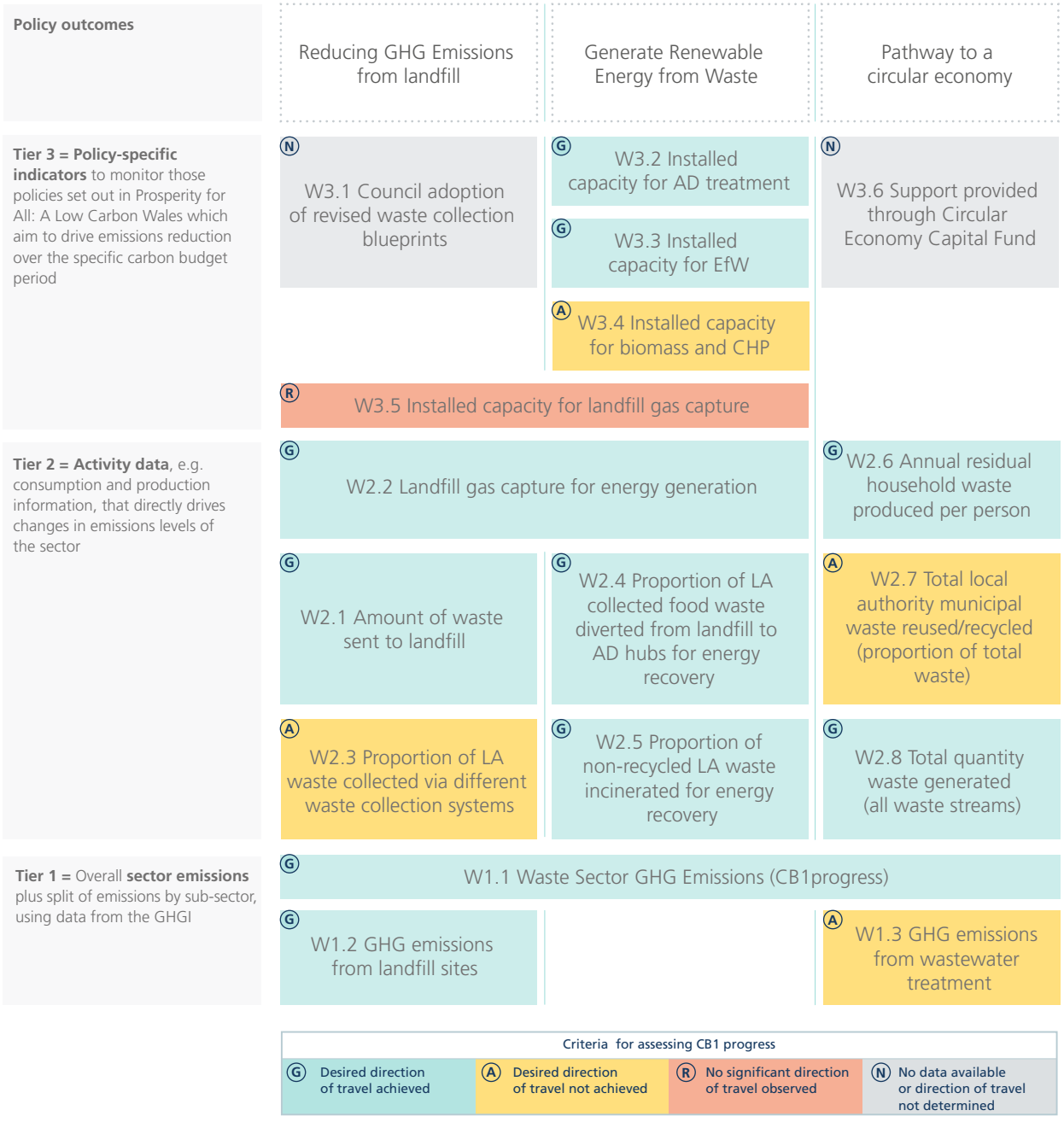
The Tier 2 activity data from the Waste sector shows positive progress in the majority of the indicators.

The key policies and activities in the sector have likely helped to support the overall emission reduction achieved over CB1, where emissions have decreased by 15% from 2016-2020. **However, the anticipated contribution to CCC's 2020 pathway, has not been met.**

29 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in *Annex 3 - Constructing emissions pathways.* This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Overview of the Agriculture sector indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.

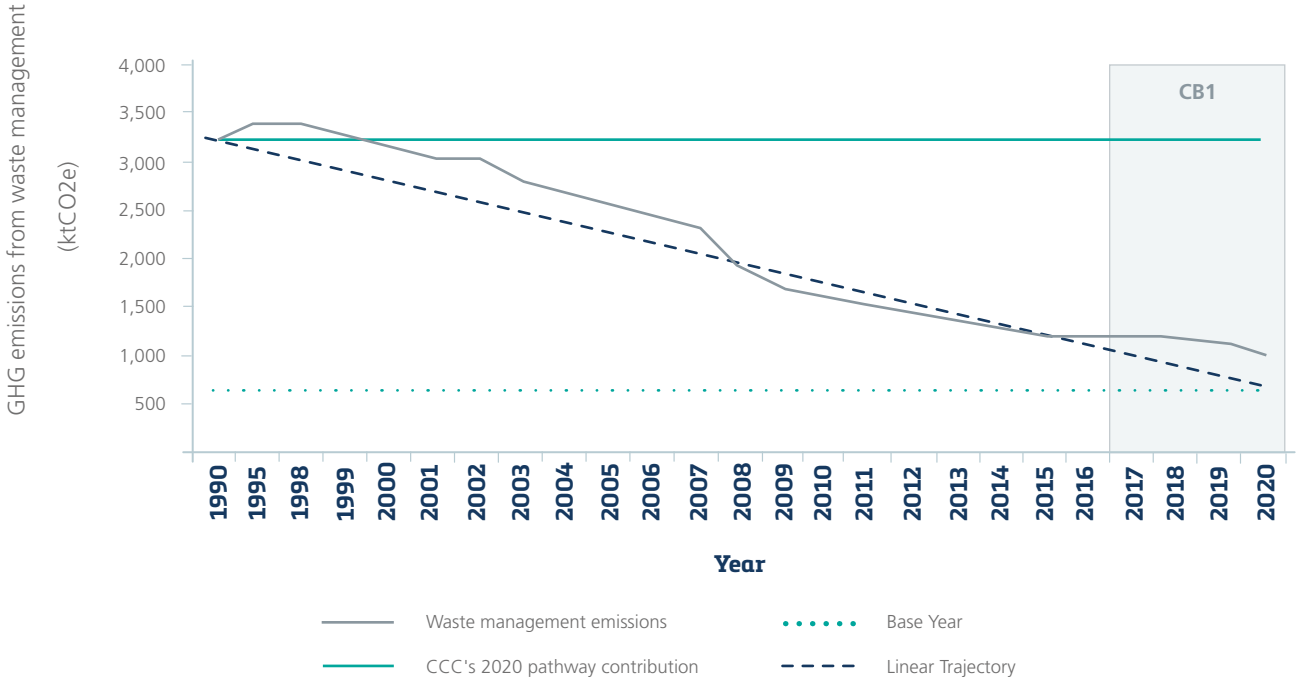


Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the Waste sector has been rated green in terms of CB1 progress, but the anticipated contribution to CCC's 2020 pathway has not been met. This is in part due to inventory improvements which have impacted on the original pathway contribution anticipated by the CCC. Of the 2 sub-sector Tier 1 indicators, emissions from landfill sites are rated green, but emissions from Wastewater treatment are rated amber.

Emissions from the Waste sector have decreased over time. **The Waste sector achieved a 15% decrease in emissions from 2016-2020, with 2020 emissions 68% lower than the base year (1990).** The Waste sector has emitted a total of 5.77MtCO2e during the carbon budget period. However, from **2019 to 2020, there was a 11% decrease in emissions, potentially due to the COVID-19 pandemic.**

Indicator	Waste Sector GHG Emissions
Code	W1.1
Anticipated contribution to CCC's 2020 pathway	2020 emissions should be 80% lower than the base year (1990)
2020 progress	✖ 68% reduction from base year (1990) in 2020
CB1 Progress	G 15% decrease from 2016 to 2020



Data Source	NAEI GHGI 2020

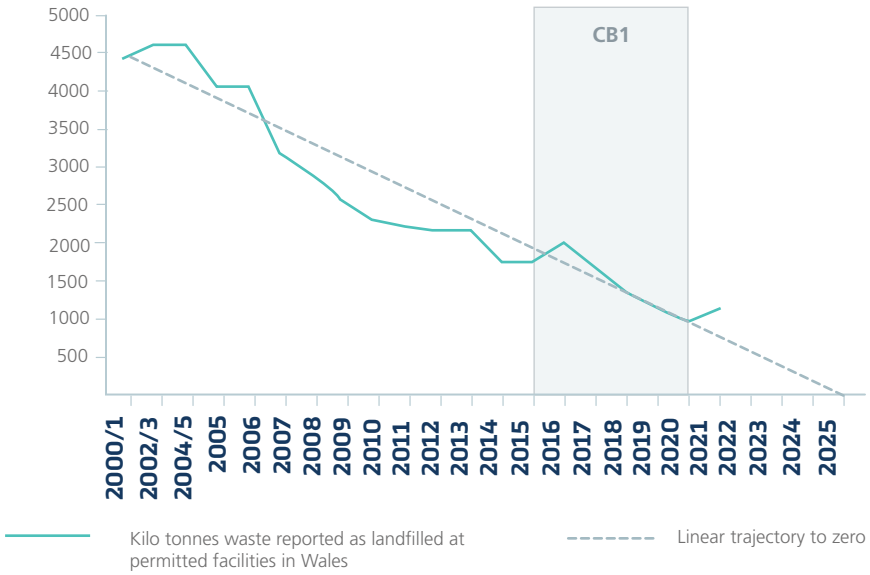
Tier 2 - Activity data

Of the 8 Tier 2 indicators developed for the Waste sector, 6 have been rated green, and 2 have been rated amber.

The Tier 2 activity data from the Waste sector shows positive progress in the majority of the indicators.

The amount of waste sent to landfill is identified as a key Tier 2 indicator for the sector and shows a considerable decrease was achieved over the CB1 period.

Indicator	Amount of waste sent to landfill
Code	W2.1
Desired direction of travel	Decrease
CB1 progress	G 51% decrease from 2016 - 2020
Progress since 2020	R 16% increase from 2020 - 2021



*Note: Calendar years presented here have been converted from financial years

Year	2016	2017	2018	2019	2020	2021
Kilotonnes waste reported as landfilled at permitted facilities in Wales	1,987	1,649	1,333	1,113	979	1,138

Description of trends	There has been an overall decrease in amount of waste reported as landfilled at permitted Welsh facilities since the start of the data series, although there has been some fluctuations. In 2020, waste kilotonnes reported in landfill facilities decreased by 12% since the previous year, however in 2021 waste kilotonnes increase by 16%. The total amount of waste reported as landfilled at permitted facilities in 2020 was 979 kt - this is a 51% decrease from 2016 (over CB1).
Data Source	Landfill data provided directly by Natural Resources Wales (NRW)

Tier 3 and wider information

Of the 6 Tier 3 indicators developed for the Waste sector, 2 were rated green (i.e., achieving the desired direction of travel over CB1), 1 was rated amber (i.e., no significant direction of travel observed), 1 was rated red (i.e., not achieving the desired direction of travel) and 2 could not be rated.

Actions in this area include reducing the amount of waste sent to landfill, encouraging adoption of blueprint waste collection systems (which is the recommended way to collect household waste in Wales to obtain high rate of high-quality recycling), as well as measures to tackle historic landfill emissions and capture landfill gas for energy generation.

- Wales saw a 30% increase in blueprint waste collection systems from 2016-2019. In recent years, but not in 2020, there has been clear improvements in both the amount of landfill gas that is captured for energy generation and the amount of waste sent to landfill.
- An increase in capacity can be observed for some technologies (Energy from Waste plants) but no change in others (biomass and CHP plants).
- The waste sector also aims to move towards a more circular economy, however, the indicators for this outcome remain under development.

The LCDP1 set out 3 Waste sector polices and 1 proposal, all 3 policies are tracked with Tier 3 indicators. The remaining proposals is tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

- Dŵr Cymru Welsh Water have pledged to deliver net zero emissions by 2040, and plans to be 35% energy self-sufficient (including through the use of renewables) by 2025 (and will invest a further £21 million to achieve this over the current regulatory investment period to 2025) and 100% energy self-sufficient by 2050. A budget of over £80 million has been set aside for research and innovation. The company has recently invested £50 million into Cog Moors Wastewater Treatment Works in the Vale of Glamorgan, which will generate clean, green energy from sewage through its Advanced Anaerobic Digestion (AAD) facility.
- Water company Hafren Dyfrdwy has agreed a series of pledges under a "Public Interest Commitment". As part of the commitment, the company has pledged to achieve five goals:
  - Achieve net zero carbon emissions for the sector by 2030;
  - To triple the rate of leakage reduction across the sector by 2030;
  - To make bills affordable as a minimum for all households, with water and sewerage bills more than 5% of their disposable income by 2030, and to develop a strategy to end water poverty;
  - Prevent the equivalent of four billion plastic bottles ending up as waste by 2030; and
  - Be the first sector to achieve 100% commitment to the Social Mobility Pledge.

F-Gas Sector

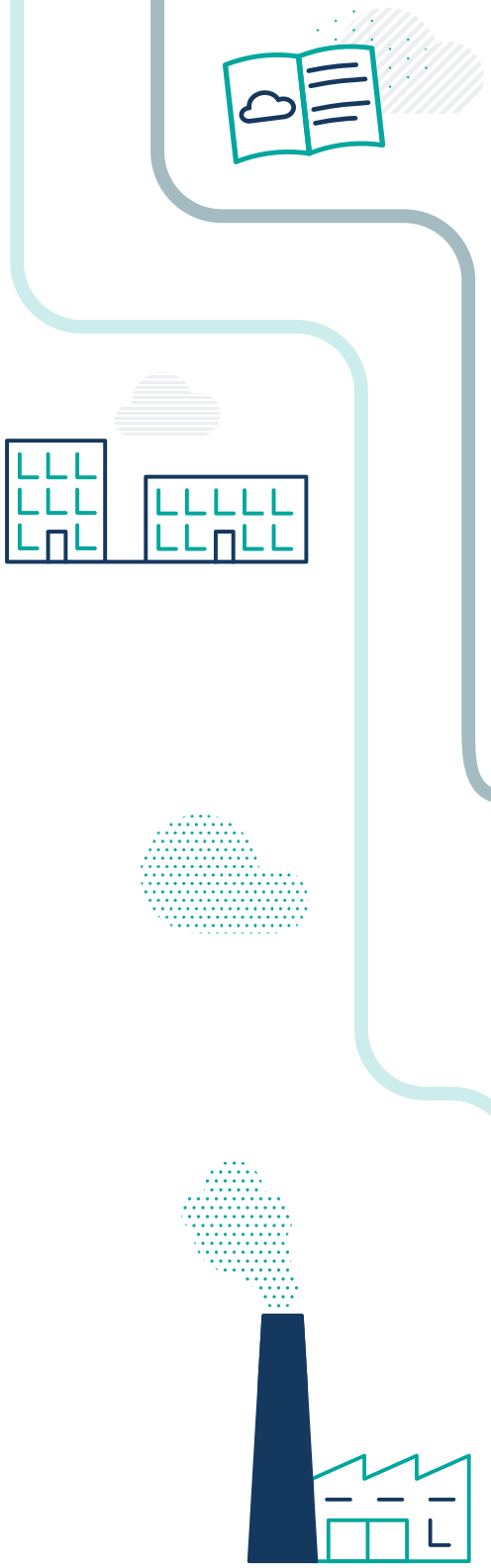
This section summarises the results for the Fluorinated gases (F-gases) sector which includes GHG emissions of Hydroflurocarbons (HFCs), Perfluorocarbons (PFCs), Nitrogen trifluoride (NF3), and Sulfur hexafluoride (SF6). Emissions of these gases in Wales are dominated by emissions linked to refrigeration and air conditioning.

The F Gases sectors anticipated contribution in the CCC's 2020 pathway[30] shows that for 2020 emissions should be no more than 34% higher than the base year (1995). To achieve this the sector's focus was on implementing the 2015 EU F-gas regulation, which includes:

- Reducing the quantities of HFCs that producers and importers are allowed to place on the EU (now UK) market;
- A series of bans on the use of F-gases in new equipment covering cross-cutting areas.

The F Gases sector has reduced emissions by 13% over the CB1 period. However, due to the availability and suitability of data, no Tier 2 or 3 indicators have been selected or developed and progress is measured by qualitative commentary.

Although there has been a decrease in emissions in the carbon budget period **the anticipated contribution to CCC's 2020 pathway has not been met.**



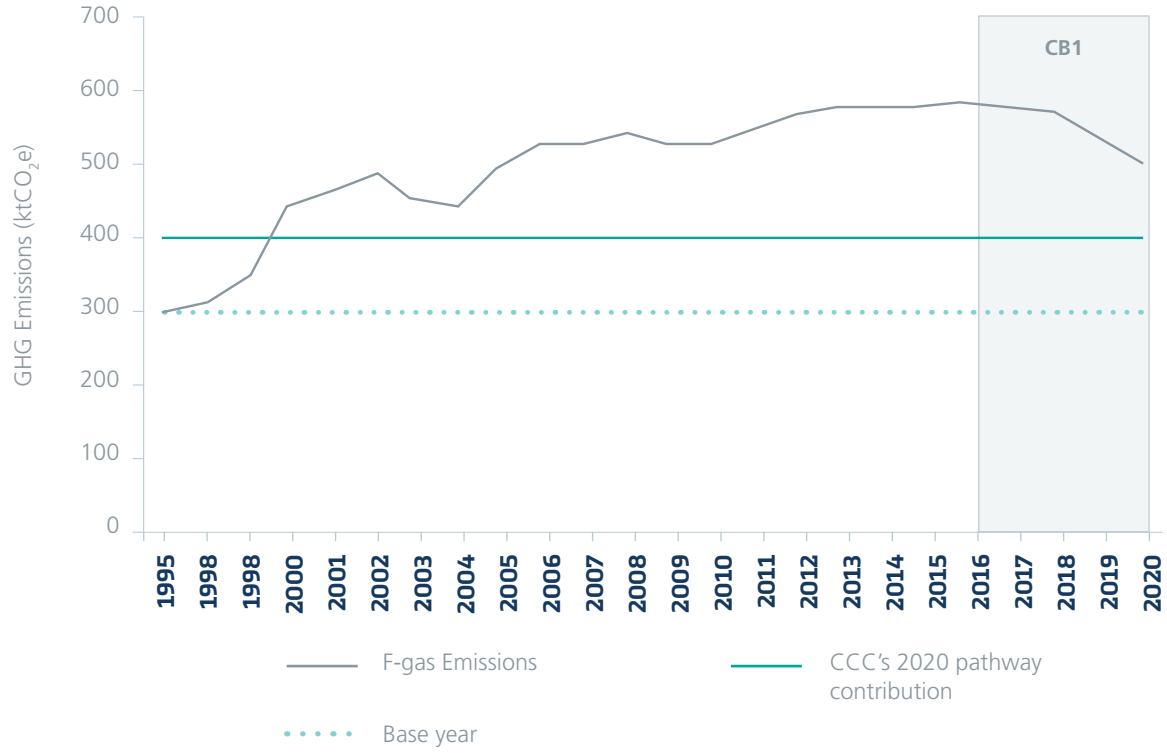
30 Prosperity for all: A Low Carbon Wales sets out how the pathways were constructed in *Annex 3 - Constructing emissions pathways.* This pathway scenario has an 80% emissions reduction from 1990 levels by 2050.

Tier 1 - Overview in relation to CB1 Progress

The Tier 1 indicator for the F-gases sector has been rated green in terms of CB1 progress, with emissions reducing 13% over the CB1 period. However, the anticipated contribution to CCC's 2020 pathway has not been met.

F-gas emissions have generally increased over time (increasing by 70% between 1995 and 2020), but have fallen since 2019. **The sector achieved a 13% decrease in emissions from 2016-2020. Despite this 2020 emissions were 70% higher than the base year, exceeding the 34% increase anticipated by the CCC's pathway.**

Indicator	F-gas Sector GHG Emissions
Code	F1.1
Anticipated contribution to CCC's 2020 pathway	34% higher than the base year (1995)
2020 progress	✖ 70% increase from base year (1995) in 2020
CB1 Progress	G 13% decrease from 2016 to 2020



Data Source	NAEI GHGI 2020

Tier 2, Tier 3 and wider information

Due to the availability and suitability of data, no Tier 2 or 3 indicators have been established and progress is assessed on a qualitative basis. This qualitative assessment shows that the main aim of the policy was to continue implementing the 2015 EU F-gas regulation. The EU F-gas regulation has been retained in UK law, so the desired outcome of this policy has been 'met'. Tracking the implementation and success of this policy in a more granular way is difficult due to a lack of data, but also how F-gases are managed in the UK and Wales. Emission outcomes of F-gas policies are also difficult to track due to the time lag between action on F-gases placed on the market, and release of those F-gases into the atmosphere.

In addition to implementation the 2015 EU F-gas regulation (as outlined by policy 76) and following the UK's exit from the EU, Wales is participating in a GB-wide system; this is to maintain existing F-gas phase-down trajectory to meet obligations under the Montreal Protocol.

In order to further support the smooth running of a GB-wide systems, a Common Framework in relation to Ozone Depleting Substances and F-gas policy has been developed. The provisional Framework sets out how the UK, Scottish and Welsh Governments will manage a GB-wide system as well as how future changes and potential divergence on policy matters are managed. The Framework is implemented by a concordat and will set out the governance arrangements, the decision-making and dispute resolution process, and working arrangements for collaboration and coordination.

Public Sector and Cross-cutting Policies

The first 25 policies and 6 proposals in LCDP1 are cross-cutting actions being undertaken through integrating decarbonisation across government policy and delivery. For the purposes of the performance indicator framework, some of these cross-cutting policies/proposals have been allocated to the public sector.

This section outlines the headline results for Public sector indicators. The Public sector is not a standalone sector in LCDP1 and therefore this sector is slightly different from other sectors within LCDP1 and the performance indicator framework. However, going forward, Public sector is included as a standalone sector in Net Zero Wales, which is the delivery plan for the 2nd carbon budget period (LCDP2).

Direct Public sector emissions, as measured by the Greenhouse Gas Inventory, have reduced by 7% between 2016 and 2020, and achieved a 58% reduction compared to the base year.

Action is being taken across numerous subsectors to achieve these emissions reductions. NHS Wales has seen their estate emissions and carbon footprint decrease over CB1, while schools and communities have seen £1.4 billion in investment between 2014 and 2019 to enable action on climate change. Public sector investment is also driving change in other sectors, with the Welsh Government Energy Service investing £84 million and supported 278 energy efficiency and renewable energy projects between 2018 and 2020.

The broad and overarching nature of the cross-cutting policies and proposals means they are less conducive to being tracked using quantitative indicators. These key policies and activities continue to show the public sector leadership in this area and have supported the overall emission reductions achieved by the Public sector.

Overview of Industry indicator framework

An overview of progress is highlighted below, with the numbered codes corresponding to a specific indicator.

Tier 3 = Policy-specific indicators to monitor those policies set out in Prosperity for All: A Low Carbon Wales which aim to drive emissions reduction over the specific carbon budget period	(N) PS3.1 Welsh Government Energy Service investment	(N) PS3.3 Funding provided to schools and communities to enable action on climate change
	(N) PS2.3 Welsh Government Energy Service projects supported	(N) PS3.4 No. of schools with Green Flag Award
Tier 2 = Activity data, e.g. consumption and production information, that directly drives changes in emissions levels of the sector	(A) PS2.1 Public sector emissions (footprint of public sector organisations)[31]	(G) PS2.3 NHS Wales carbon footprint
	(G) PS2.2 Public sector end-user emissions (electricity and non-electricity fuel use)	(G) PS2.4 NHS estate emissions
Tier 1 = Overall **sector emissions** plus split of emissions by sub-sector, using data from the GHGI	(G) PS1.1 Public Sector GHG Emissions (from GHG inventory)	

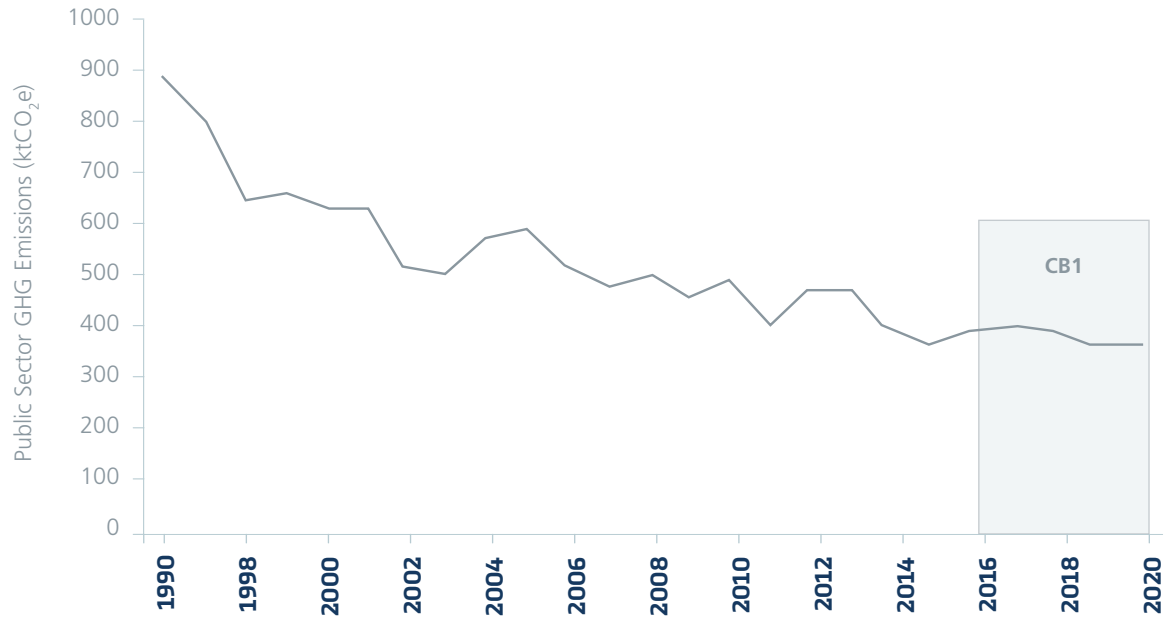
Criteria for assessing CB1 progress			
(G) Desired direction of travel achieved	(A) Desired direction of travel not achieved	(R) No significant direction of travel observed	(N) No data available or direction of travel not determined

Tier 1 - Overview in relation to CB1 Progress

This indicator tracks changes to Public sector greenhouse gas emissions from the Wales GHG inventory. Public sector is also not a specific sector defined in the greenhouse gas (GHG) inventory. Therefore there is no tier 1 indicator defined as there is for other GHG inventory sectors. Emissions from combustion of fuels within Public sector buildings is used as a Tier 1 indicator, but it should be noted that this only includes a small part of public sector emissions and is also included in the Buildings sector. **The Tier 1 indicator for Public sector is presented for information only and care should be taken to ensure these emissions are not double counted alongside those in the buildings sector.**

The Tier 1 indicator for the Public sector has been rated green in terms of CB1 progress and since the base year public sector emissions have steadily decreased. The sector has achieved a 7% emission reduction between 2016- 2020, with 2020 emissions 58% below the base year.

Indicator	Public Sector GHG Emissions	
Code	PS1.1	
Anticipated contribution to CCC's 2020 pathway	N/A	
2020 progress	N/A	58% reduction from base year (1990) in 2020
CB1 Progress	G	7% decrease from 2016 to 2020



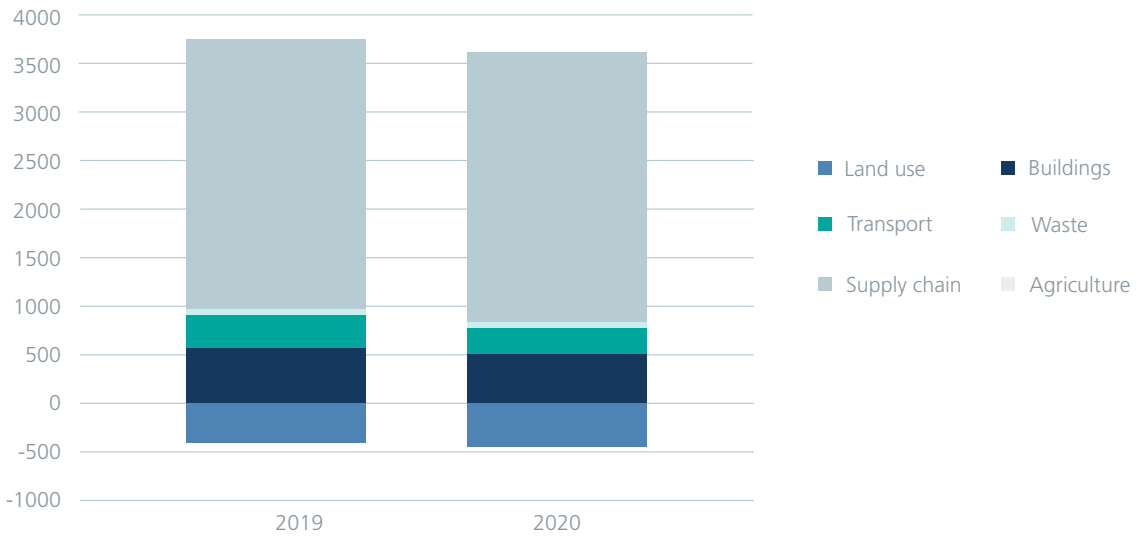
Data Source	NAEI GHGI 2020

Tier 2 - Activity data

Of the 4 Tier 2 indicators developed for the Public sector, 3 have been rated green and 1 has been rated amber.

The key Tier 2 indicator for the Public sector provides a broader consumption footprint assessment of the Public sectors impact on greenhouse gas emissions aligned with the Net Zero public sector target. This indicator gives the most complete picture of public sector emissions in Wales mapping the emissions under the control (both direct and indirect) of the public sector in Wales. Currently, data is only available for two financial years, only one of which is fully within CB1, but going forward, this indicator will be key in tracking public sector performance.

Indicator	Public sector GHG Emissions
Code	PS2.1
Policy link	Policy 20: Support the public sector to baseline, monitor and report progress towards carbon neutrality Policy 24: Continue to reduce emissions in the health sector
Desired direction of travel	Decrease
CB1 progress	A 2% decrease from 2019-2020
Progress since 2020	N No data available



*Note: Calendar years presented here have been converted from financial years

$KtCO_2e$	2019	2020
Agriculture	2.1	2.1
Buildings	581.4	520.9
Transport	301.1	268.1
Waste	66.8	61.9
Supply chain	2,809.7	2,839.3
Land use	-408.4	-413.2
Total	**3,353**	**3,279**

Description of trends	Emissions between 2019 and 2020 decreased slightly, by around 2%. However, there are only two years of data available, trends cannot be explained with certainty. The operational emissions data (i.e. all emissions, excluding supply chain emissions) shows the dominance of buildings within the footprint (56% in 2020, including electricity) and shows the dominance of Local Authorities across many emission types, illustrating their key role in providing a broad range and comprehensive coverage of services in Wales. Universities (though not public sector) and health boards are also significant in relation to electricity and fossil fuel use in buildings and, to a lesser extent, their transport emissions. Transport for Wales makes a large contribution to fleet fuel in 2020, for running rail services. Estimates of the carbon emissions associated with the purchase of goods and services (i.e., supply chain emissions) are large, however limitations of the methodology and data used are clearly outlined in the reporting.
Data Source	Aether report: Welsh Public Sector Net Zero: Data and Recommendations

Tier 3 and wider information

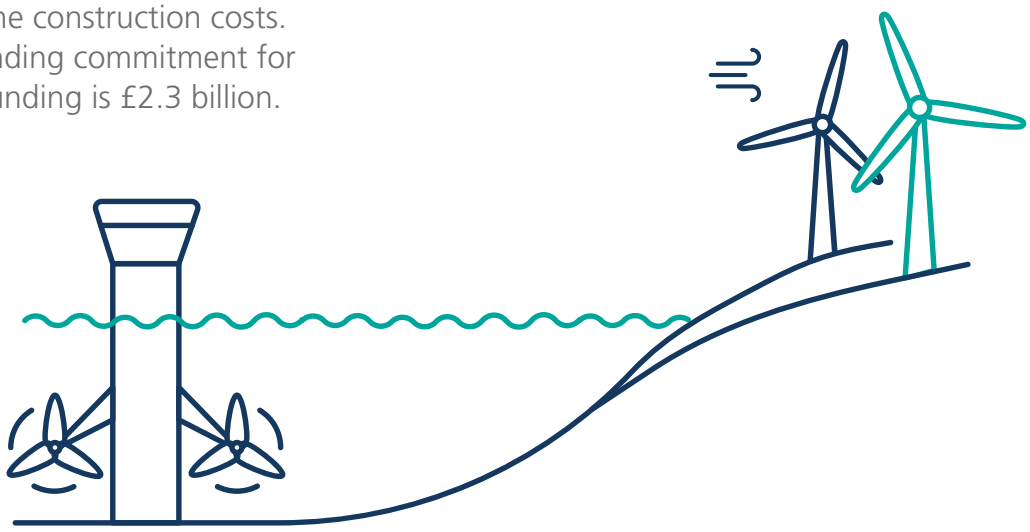
Of the 4 Tier 3 indicators, none could be rated according to the desired direction of travel either because data was not available, or because the desired direction of travel was not clear. The Tier 3 indicators show that:

- Between 2018 (when the Welsh Government Energy Service, or WGES, launched) and 2020, WGES has facilitated £84 million of investment and supported 278 projects, with an additional £34.8 million in investment and 92 projects in 2021. The majority of investment and projects are aimed at delivering energy efficiency measures. WGES is mentioned in other sectors throughout the performance indicators; it is also reported under the public sector as it provides a single point of contact for public bodies and communities seeking to develop energy efficiency or renewable energy schemes.
- Welsh Government have also invested £1.4billion in schools between 2014 and 2019, however a breakdown of the decarbonisation costs of these projects is not available. Within CB1, 795 schools had been awarded a Green Flag Award through Eco-Schools, which is a global programme run in Wales by "Keep Wales Tidy".

The LCDP1 set out 8 public sector polices and 4 proposals, of these, 4 policies are tracked with indicators (2 with Tier 3 indicators, and 2 with Tier 2 indicators). The remaining 5 policies and 4 proposals tracked with qualitative commentary, as quantitative indicators could not be established. This qualitative assessment shows that:

- The CRC scheme has now been replaced by the Streamlined Energy and Carbon Reporting (SECR) regime.
- In May 2021 the Welsh Government published the Welsh Public Sector Net Zero Reporting Guide, which aimed to be a universal guide/ set of instructions for use by Welsh public bodies to estimate baseline emissions. In addition, Welsh Government contracted a consultancy to undertake some work to assess current carbon emissions in the public sector, provide insight into the distribution of emissions across the different parts of the Welsh public sector and identify priority sources for action. The final report also identifies current gaps in information where organisations have not submitted data or have not included emissions from key sectors.

- One district heating project using waste heat has been awarded funding by the UK Government's Heat Network Investment Project in Carbon Budget 1 (Cardiff Viridor) of £7m and this has been supplemented by commitment to a zero-interest loan from Welsh Government of £8.6m. This activity will continue into Carbon Budget 2. The National Development Framework (NDF) identifies 14 priority areas for district heat networks which is shown in this map.
- A Procurement Policy Notice on 'Decarbonisation through procurement - Addressing CO2e in supply chains' was released in December 2021 which advises the Welsh public sector on the actions that can be taken to address emissions in supply chains for purchased goods and services to help them meet the 2030 target for a net zero public sector.
- Future funded projects in the Sustainable Communities for Learning Programme (previously 21st Century Schools Programme) will aim to achieve Net Zero Carbon Operational with an embodied target which will reduce year on year. This is currently funded 100% by Welsh Government, and covers up to 12.5% of the construction costs. The overall funding commitment for this wave of funding is £2.3 billion.
- WGES has been working extensively with the public sector to develop the evidence base to transition the fleet to ultra-low emission vehicles and to reduce the demand, in the form of public sector fleet reviews. At the time of writing LCDP2, the Welsh Government had invested £1.1m in supporting the public sector to purchase electric vehicles and awarded a £6.6m grant to local authorities to support the rollout of electric vehicle charging infrastructure across their estate in 2021-22.
- It is understood that most public sector buildings are on a 'green tariff' where possible. However, this does not mean that the electricity directly supplied to public sector buildings comes from renewable sources; instead, it is grid electricity but purchased through a 'green tariff'.



Policies and proposals by portfolio

As outlined in annex 7 of LCDP1, please see below a list of the policies and proposals by Ministerial Portfolio.

Key: **Main Portfolio** **Associated portfolio**

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
To continue to develop our evidence base around our decarbonisation	Policy								
We will continue to align the carbon and financial budget cycle incrementally	Policy								
Welsh Government to commission RSPs to review current skills gaps and shortages across regional priority sectors that support the decarbonisation agenda. This would form an element of their funding contract from April 2019	Policy								
Establishment of a Task and Finish Group to scope out innovation need	Policy								
Planning Policy Wales	Policy								
National Development Framework	Policy								
Wales Marine Plan	Policy								
We will take an integrated approach to tackling emissions through the policies set out in the Clean Air Plan, the Low Carbon Delivery Plan and other associated strategic cross government plans	Policy								

Key: Main Portfolio Associated portfolio

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Maximising the innovation opportunities presented by moving towards a more a circular economy	Policy								
Energy Systems Planning	Policy								
Welsh Government Energy Service and Smart Living	Policy								
Work with key partners to expand and refocus education around decarbonisation and promote co benefits to health and well being for current and future generations	Policy								
Work with partners to help understand how to transform individual lifestyles and systems of governance for a sustainable, low carbon future	Policy								
The Establishment of a climate just advisory group in 2019	Proposal								
We will host an Annual Decarbonisation Conference to discuss progress and generate new ideas	Policy								
Provide funding to enable action on climate change in school and communities	Policy								
Economic Action Plan	Policy								

Key: Main Portfolio Associated portfolio

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Provide fruit, shade and fuel trees for the entire Mount Elgon region, Uganda by 2030	Policy								
Ensure our new International Strategy is founded on sustainability with a decarbonisation as a key part, working with other like-minded States and Regions and through our engagement with international networks and organisations	Policy								
Design a public communications campaign to encourage people to use their cars less	Proposal								
Welsh Government to consult on options for successor Carbon Reduction Commitment Scheme in Summer 2019	Policy								
Support the public sector to baseline, monitor and report progress towards carbon neutrality	Policy								
Provide continued support to identify, develop and invest in district heat systems	Policy								
Value Wales to promote and encourage carbon reduction through procurement	Policy								

Key: Main Portfolio Associated portfolio

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Development of a Decarbonisation Dashboard to baseline emissions	Proposal								
All new cars and light goods vehicles in the Public Sector fleet are ultra low emission by 2025 and where practicably possible, all heavy goods are ultra low emission by 2030	Proposal								
Public Sector buildings should be supplied with renewable electricity by 2020, or as soon as contractually able and, where practicably possible, are supplied with low-carbon heat by 2030	Proposal								
Continue to reducing emissions in the health sector	Policy								
Continue to drive low carbon schools through 21st Century Schools	Policy								
Continue to promote and market tourism in Wales in a sustainable way	Policy								
Commission research to gain a better understanding of Welsh public sector investment profiles to stimulate discussion about future investment strategies	Proposal								

Key: Main Portfolio Associated portfolio

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Energy Consenting, Planning and Permitting	Policy								
Remove barriers to consenting for storage	Policy								
Phase out of Unabated Coal	Policy								
Develop a Policy on Combustion of Fuels for Power	Policy								
EU Emissions Trading Scheme	Policy								
Delivery of Renewable Energy Targets	Policy								
Wales Waste Strategy 'Towards Zero Waste'	Policy								
Developing Routes to Market for Renewable Technologies	Policy								
Increased local ownership of energy generation	Policy								
Maximise Welsh benefit from major infrastructure projects in Wales	Policy								
Energy Innovation	Policy								
Market regulation and investment	Policy								
Explore potential for investment and new approaches to energy	Proposal								

Key: **Main Portfolio** **Associated portfolio**

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Funding and Delivery of our Warm Homes Programme	Policy								
Raising standards through our Welsh Housing Quality Standards	Policy								
Improving our Evidence-base around residential retrofit programme	Proposal								
Setting higher energy efficiency standards for new builds through reviewing Building Regulations Part L (Conservation of Fuel and Power)	Policy								
Driving innovation through our Innovative Housing Programme	Policy								
Funding more efficient buildings through our Sustainable buildings funding policy	Policy								
Reducing emissions from listed buildings and scheduled monuments	Policy								
Developing Innovative construction techniques to reduce and meet the energy demand within buildings and increasing the use of sustainable materials	Proposal								
Providing advice and support through Business Wales	Policy								
Scope out the challenges and opportunities around low-carbon heat	Proposal								
Increase the use of Waste Heat and low carbon heat	Proposal								

Key: Main Portfolio Associated portfolio

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Piloting Smart Flexible and Digitalised System to reduce demand	Policy								
Incentivising energy efficiency of homes through our Help to Buy Wales	Policy								
Working to achieve a modal shift from car dependency to sustainable forms of transport	Proposal								
Increasing Active Travel	Policy								
Significantly increasing modal share of active travel for short journeys	Proposal								
Increasing travel by rail through investment	Policy								
Increasing travel by bus	Policy								
Using planning policy to promote sustainable travel and reduce the need to travel	Policy								
Increasing the proportion of vehicles which are electric and ultra low emission	Proposal								
Plan for and invest in EV charging infrastructure	Policy								
Aiming to reduce the carbon footprint of buses to zero by 2028	Policy								
Aim to reduce the carbon footprint of Taxis and Private Hire Vehicles to zero by 2028	Policy								

Key: Main Portfolio Associated portfolio

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Piloting activity to promote the use of zero and ultra low emission road vehicles	Proposal		Main Portfolio						
Promote the decarbonisation of private sector fleets in Wales	Proposal		Main Portfolio						
Reduce Transport Emission	Policy	Associated portfolio	Associated portfolio						Main Portfolio
EU Emissions Trading Scheme	Policy	Associated portfolio	Associated portfolio						Main Portfolio
Carbon price Floor	Policy	Associated portfolio	Associated portfolio						Main Portfolio
Climate Change Levy & Climate Change Agreements	Policy	Associated portfolio	Associated portfolio						Main Portfolio
Industrial Emission Reduction Support beyond 2020 for Carbon Intensive Businesses	Proposal		Main Portfolio						
Energy Efficiency Scheme – UK Government	Policy								Main Portfolio
Industry Led Decarbonisation Group	Proposal		Main Portfolio						
Onshore Petroleum Extraction	Policy		Main Portfolio						Main Portfolio
Industrial Heat Recovery	Policy	Associated portfolio	Main Portfolio						Main Portfolio
Carbon Capture Utilisation and Storage	Policy		Main Portfolio						
Commission an independent economic and technical feasibility study on carbon capture use and storage (CCUS)	Proposal		Main Portfolio						

Key: **Main Portfolio** **Associated portfolio**

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Food and Drink Action Plan – Towards Sustainable Growth	Policy								
Implementing Natural Resources Policy	Policy								
Woodland Strategy for Wales	Policy								
Felling licences	Policy								
Welsh Government woodland estate	Policy								
Increase tree planting to at least 2,000 hectares per year, aiming to increase this to 4,000 hectares	Proposal								
Identify preferred areas for tree planting	Proposal								
Peatlands for the Future	Policy								
Red Meat Development Programme	Policy								
Animal Health and Welfare Framework	Policy								
Farming Connect Programme	Policy								
Farm Business Grant	Policy								
We will work with the farming sector to help drive efficiency	Proposal								
Provide post-Brexit support in the form of a land management programme that contains a public goods element and an economic resilience element	Proposal								

Key: **Main Portfolio** **Associated portfolio**

Action	Policy or Proposal	Environment, Energy and Rural Affairs	Economy and Transport	Housing and Local Government	Finance	Education	Health and Social Services	International Relations and the Welsh Language	UK/EU
Regulations to reduce agricultural pollution	Proposal								
Nitrate Vulnerable Zone	Policy								
Reduce Greenhouse gas emissions from landfill	Policy								
Generate Renewable Energy from waste	Policy								
Transposing the Circular Economy Package	Policy								
Exploring the opportunities provided by the water sector in reducing emissions	Proposal								
Implementing the 2015 EU F-gas regulation	Policy								

Part 3: Net Wales Emissions Account (NWEA) Calculations

The information contained in this part of the statement is derived from the Welsh Greenhouse Gas emissions statistics 1990-2020, as published in the re-issue on the 20th September 2022[32].

Unless otherwise stated, all figures in this section are stated in kilotonnes of carbon dioxide equivalent ($ktCO_2e$). This is as standard international way of reporting total greenhouse gas emissions which permits the comparison of different gases on a common basis. This is achieved by multiplying the emissions of each gas by a factor (Global Warming Potential) which reflects the impact on global warming the gas has relative to that of carbon dioxide. The global warming potential (GWP) of a gas is a standard international measure and this progress statement, and the 1990-2020 GHGI on which it is based, adopt the GWP's published in the IPCC's fourth Assessment Report 4 (AR4).

In line with the Climate Change (International Aviation and International Shipping) (Wales) Regulations 2018, the emissions data presented includes Wales share of International Aviation and International Shipping emissions.

Table 1 describes Welsh Emissions, Welsh Removals and Net Welsh Emissions in relation to the interim target year 2020.

Greenhouse Gas	Estimated Welsh emissions ($Kt\ CO_2e$)	Welsh Removals from the LULUCF[33] sector ($Kt\ CO_2e$)	Net Welsh Emissions Total ($Kt\ CO_2e$)
Carbon Dioxide	28,486.51	-1960.21	26,526.31
Methane	5,083.66	0.00	5,083.66
Nitrous Oxide	1,498.41	0.00	1,498.41
Hydrofluorocarbons	474.85	0.00	474.85
Nitrogen Trifluoride	0.02	0.00	0.02
Sulphur Hexafluoride	25.13	0.00	25.13
Perfluorocarbons	3.97	0.00	3.97
Total	**35,573**	**-1,960**	**33,612**

Table 1: 2020 Welsh greenhouse gas emissions, removals and Net Welsh Emissions covering the 2020 interim target year. Reported as $ktCO_2e$ on an AR4 GWP basis. Note, the LULUCF[33] sector comprises both emissions and removals. All sources reported at the IPPC category level are included in the Welsh emissions total, and all removals at the IPCC category level are reported in the Welsh removals total.

32 The Welsh Greenhouse Gas Inventory provides a modelled estimate of Welsh GHG emissions compiled in line with international carbon reporting practice. The Welsh GHGI data was originally published on 17/06/2022, but subsequently updated on 20/09/2022 to correct a data error. This publication uses the updated data throughout. Welsh Greenhouse Gas Inventory Statistics are published annually, typically in June, and approximately two years in arrears, at Report: Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2020 - NAEI, UK (beis.gov.uk).

33 LULUCF refers to the Land use, Land use change, and Forestry sector.

The GHGI data provided in Table 1 indicates that Net Welsh Emissions (NWE) for the year 2020 were 33,612 $ktCO_2e$.

In addition, Welsh Government need to establish the NWE for the full budget period from 2016 to 2020. Carbon Budget 1 Net Welsh Emissions are calculated by summing the annual emissions and removals for each year of the budget period.

Table 2 describes the Net Welsh Emissions for Carbon Budget 1.

Greenhouse Gas	Estimated Welsh emissions (Kt CO_2e)	EstimatedWelsh Removals from the LULUCF sector (Kt CO_2e)	Net Welsh Emissions Total (Kt CO_2e)
Carbon Dioxide	172,923.24	-10,138.09	162,785.16
Methane	26,418.01	0.00	26,418.01
Nitrous Oxide	7,741.46	0.00	7,741.46
Hydrofluorocarbons	2,608.56	0.00	2,608.56
Nitrogen Trifluoride	0.09	0.00	0.09
Sulphur Hexafluoride	142.64	0.00	142.64
Perfluorocarbons	21.79	0.00	21.79
Total	**209,856**	**-10,138**	**199,718**

Table 2: Aggregate 2016 to 2020 Welsh greenhouse gas emissions, removals and Net Welsh Emissions covering Carbon Budget 1. Reported as ktCO2e on an AR4 GWP basis. Note, the LULUCF sector comprises both emissions and removals. All sources reported at the IPPC category level are included in the Welsh emissions total, and all removals at the IPCC category level are reported in the Welsh removals total.

The GHGI data provided in Table 2 indicates that Net Welsh Emissions (NWE) for Carbon Budget 1 totalled 199,718 $ktCO_2e$.

The Net Welsh Emissions Account

In-line with the provisions of the Environment (Wales) Act, Welsh Ministers have agreed that **zero** Carbon Units will be credited to the Net Welsh Emissions Account. This means that international offsets will not be used for compliance with the Welsh targets and budget covered by this statement.

As a result, the Net Welsh Emissions Account is unchanged from the previously stated data for Net Welsh Emissions.

Table 3 provides the detail of the Net Welsh Emissions Account calculation.

	Net Welsh Emissions (total) (Kt CO_2e)	Offsets (carbon Unts) (Kt CO_2e)	Net Welsh Emissions Account (total) (Kt CO_2e)
2020 Interim target year	33,612.34	0.00	**33,612.34**
Carbon Budget 1	199,717.70	0.00	**199,717.70**

Table 3: Calculation of the Net Welsh Emission Account for the 2020 interim target year and for Carbon Budget 1.

The data provided in Table 3 indicates that the final Net Welsh Emissions Account (NWEA) for Carbon Budget 1 totalled 199,718 $ktCO_2e$. The final Net Welsh Emissions Account for the interim target year of 2020 were 33,612 $ktCO_2e$.

Calculating the 2020 interim target

The Climate Change (Interim Emissions Targets) (Wales) Regulations 2018 specify that the maximum amount for the Net Welsh Emissions Account for 2020 is 27% lower than the baseline. No adjustments are permitted to the level of the interim target and therefore using the 1990-2020 GHGI data for the base year, the percentage target is converted to a total limit of greenhouse gases on a $ktCO_2e$ basis, as described in Table 4.

Table 4 describes the conversation of 2020 interim target

Estimated 1990 base year emissions[34] (Kt CO_2e)	2020 Interim target percentage reduction(%)	Offsets (carbon Unts) (Kt CO_2e)
55,307.34	27 %	40,374.36

Table 4 describes the conversion of the 2020 interim target from an average percentage reduction target to a target level of greenhouse gases on a $ktCO_2e$ basis.

34 The Welsh Greenhouse Gas Inventory provides a modelled estimate of Welsh GHG emissions compiled in line with international carbon reporting practice. The Welsh GHGI data was originally published on 17/06/2022, but subsequently updated on 20/09/2022 to correct a data error. This publication uses the updated data throughout. Welsh Greenhouse Gas Inventory Statistics are published annually, typically in June, and approximately two years in arrears, at Report: Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2020 - NAEI, UK (beis.gov.uk). The baseline year is 1990 or 1995, depending on the gas – see section 38 of the Act.

Calculating Carbon Budget 1

In order to assess performance for Carbon Budget 1 it is necessary to establish the final level of the carbon budget limit. As originally specified in regulation, Carbon Budget 1 is limited to an average of 23% lower than the baseline. The 1990-2020 GHGI data specifies the emissions for the base year and enables the percentage budget limit to be converted to a total limit of greenhouse gases on a $ktCO_2e$ basis, as described in Table 5.

Table 5 describes the conversion of Carbon Budget 1

Estimated 1990 base year emissions[34] (Kt CO_2e)	Carbon Budget 1 average percentage reduction (%)	Average emissions in Carbon Budget 1 (per year) (Kt CO_2e)	Total budget limit for Carbon Budget 1 period (Kt CO_2e)
55,307.34	23 %	42,586.65	212,933.25

Table 5 describes the conversion of Carbon Budget 1 from an average percentage reduction target to a total limit of greenhouse gases on a ktCO2e basis.

This initial carbon budget limit is now adjusted to account for any carry forward or borrowing that is specified between Carbon Budget 1 and Carbon Budget 2, as described in Table 6.

Table 6 describes the carry forward and borrowing adjustments

Total budget limit for carbon budget 1 period ($ktCO_2e$)	Amount borrowed from CB2 ($ktCO_2e$)[35]	Amount of overperformance available to carry forward to CB2 ($ktCO_2e$)	Amount of overperformance carried forward forward to CB2 ($ktCO_2e$)	FINAL Carbon Budget 1 Limit ($ktCO_2e$)
212,933.25	0	13,215.55	0	212,933.25

Table 6 describes the carry forward and borrowing adjustments made to the regulated Carbon Budget 1 limit.

Welsh Ministers have taken the decision not to borrow any budget from CB2 and therefore no adjustment for borrowing is required.

In addition, Welsh Ministers have agreed not to carry forward any overperformance from CB1 into CB2, and so no adjustment for carry forward is required in CB1.

Table 6 provides the calculations relating to the carbon budget limit and following the Welsh Ministers decisions no adjustment is required to the budget limit specified in regulation. Therefore, the Carbon Budget 1 limit for Wales is 212,933 $ktCO_2e$.

35 The maximum amount that can be borrowed is 1% of CB2 which is 1,742.18 $ktCO_2e$. CB2 is set as 37% of base year (1990) emissions which is 174,218.11 $ktCO_2e$.

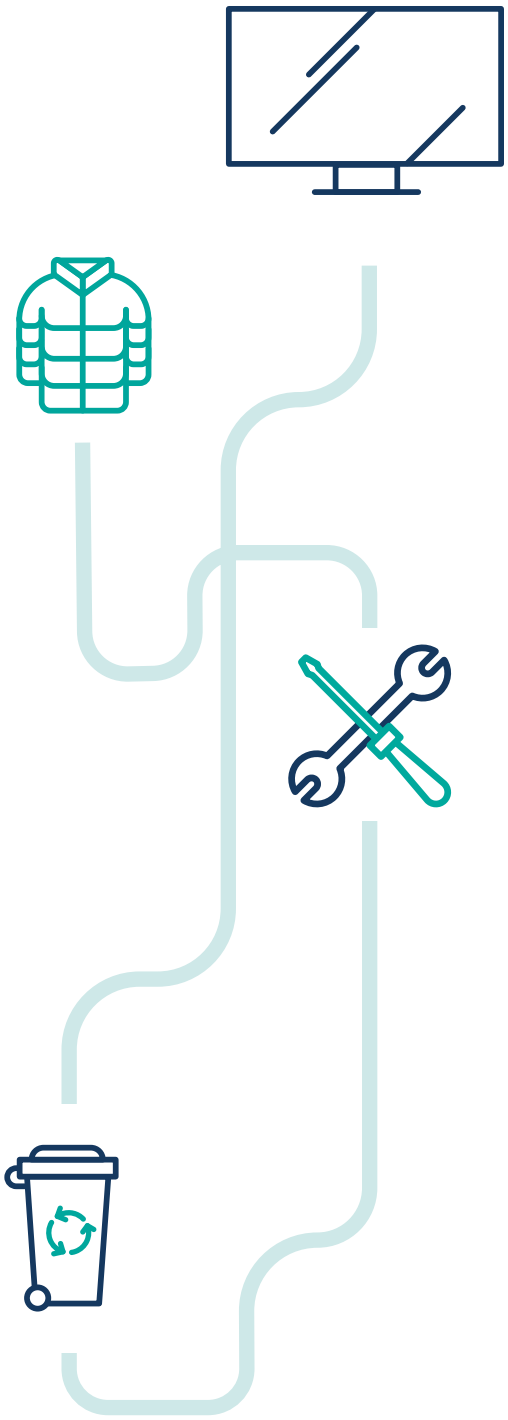
Part 4: Next Steps and future updates

This is the Welsh Government's first statement looking back on the progress made during CB1.

The Welsh Government has built on the publication of its first plan, publishing Net Zero Wales in 2021 which set out the actions Wales is taking in the second carbon budget (CB2), covering the budgetary period 2021-2025.

The Welsh Government will continue to build and refine its evidence base, improving the Monitoring, Reporting and Verification (MRV) system ahead of the second statement due in 2027 looking at progress made over CB2.

The Welsh Government will publish an update to annex A in 2023 once the 2020 data is received from the University of Leeds.



Annex A: Wales's consumption emissions footprint

Carbon budget (CB) 1 period and longer-term trends

What are consumption emissions?

This report presents estimates of Wales's consumptions emissions footprint for the period 2001 to 2019. Consumption emissions describe the emissions directly produced by Welsh households (including heating and driving, for example), emissions that occur within the UK to produce goods and services consumed in Wales, and 'imported' emissions that occur in other countries to produce goods and services consumed in Wales. The consumption footprint is also known as the carbon footprint.

Consumption emissions measurements differ from that of territorial emissions. Territorial emissions are defined as emissions that take place within national territories and offshore areas over which a country has jurisdiction and are the basis of which Welsh Governments GHGs are often reported on. Differences between the emissions inventories can be seen in the Methodology section in Table 7.

How are consumption emissions calculated?

Consumption emissions for the UK have been calculated by the University of Leeds based on an established methodology and the best available data at a UK-level. They have calculated estimates for Wales by using the UK estimates and adjusting through the use of household survey data for Wales. Data for Wales should therefore be treated as an indicative estimate. Limitations include:

- The ability to estimate GHG emissions from products originating from other countries has higher uncertainty inherently than emissions calculated on a territorial basis. Welsh Governments formal statutory targets remain focussed on statistics reported on a territorial basis for Wales, providing much greater certainty.
- The Wales estimate has been scaled from the UK estimates using survey data with a limited sample size
- The consumption emissions methodology does not account for emissions associated with land use change, for example deforestation.

Please see the Accuracy section for further information on limitations.

However, the consumption emissions estimation can still aid in providing a basis for discussion around future policy development and in identifying macro issues and trends. These could then be further explored through more detailed work and analysis.

Why is the Welsh Government reporting on Wales's consumption emissions footprint?

Wales has a global responsibility to not only consider the emissions it produces but also the emissions from the goods and services it consumes. The Environment (Wales) Act 2016 introduced a statutory obligation to assess the GHG emissions associated with the consumption and use of goods and services in Wales, whether produced in Wales, or elsewhere. The Act stated that the carbon budget progress report must include:

(a) an estimate of the total amount of Welsh consumer emissions for the budgetary period to which the statement relates, and
(b) an explanation of how the Welsh Ministers have calculated the estimate.

This report provides data for one of the 50 national well-being indicators.

Greenhouse gas emissions (GHGs) are often reported on a territorial basis. Welsh Governments statutory emissions targets and carbon budgets are related to measurement of these territorial emissions as mentioned above. However, estimating Wales's consumption emissions footprint provides a clearer picture of its total emissions on a global scale. It allows emissions to be allocated to the final consumers of products, and therefore takes into account its contribution to GHG emissions both nationally and internationally.

It is also important to measure Welsh consumption emissions because action to reduce emissions in Wales could potentially lead to increased emissions in other parts of the world. Welsh Government uses these two ways of accounting for its emissions as national indicators in making progress towards the seven well-being goals. Overseas production may not have the same environmental or social standards as Wales, so there are potential additional risks to the environment and communities of those countries. This does not accord with Welsh Governments commitments in the Well-being of Future Generations (Wales) Act to be a globally responsible Wales. Therefore, when reducing its emissions, it will consider a number of wider issues to avoid "carbon leakage". Measuring its consumption emissions helps think about how to discourage the offshoring of emissions that could occur as a result of production moving abroad. For instance, activities Ministers committed to support in the Welsh Governments Programme for Government, such as repair cafés, re-use hubs and bike repair facilities help to reuse products rather than importing new ones.

What is included in this estimate?

The consumption footprint includes the seven main greenhouse gases (GHGs) including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), nitrogen trifluoride (NF_3) and sulphur hexafluoride (SF_6). The emissions are given in million tonnes of CO_2 equivalent[36] throughout this report ($MtCO_2e$).

The data timeframe for Wales's footprint begins in 2001 due to availability of the Living Costs and Food Survey. Data

36 Carbon dioxide equivalent (CO2e) allows comparison of different GHGs by converting them to equivalent levels of carbon dioxide based on their global warming potential over a set number of years. Global warming potential refers to the strength of the molecule in contributing to the warming effect, as well as how long it persists in the atmosphere.

covering the full timeframe of availability (2001-2019) as well as the Carbon Budget (CB) 1 period are presented here as and when appropriate. This is to allow consideration for emissions changes throughout CB periods as well as illustrate long-term changes in emissions. CB 1 refers to the years 2016 through to 2020. However, for the purposes of this report, CB 1 period covers 2016-2019 as it has not been possible to estimate 2020 due to wider data publication timelines. An estimate for the 2020 consumption emissions footprint will be available in Spring 2023 and published as an annex to this report.

The key points drawn from analysis of the emissions estimate can be seen in the box below:

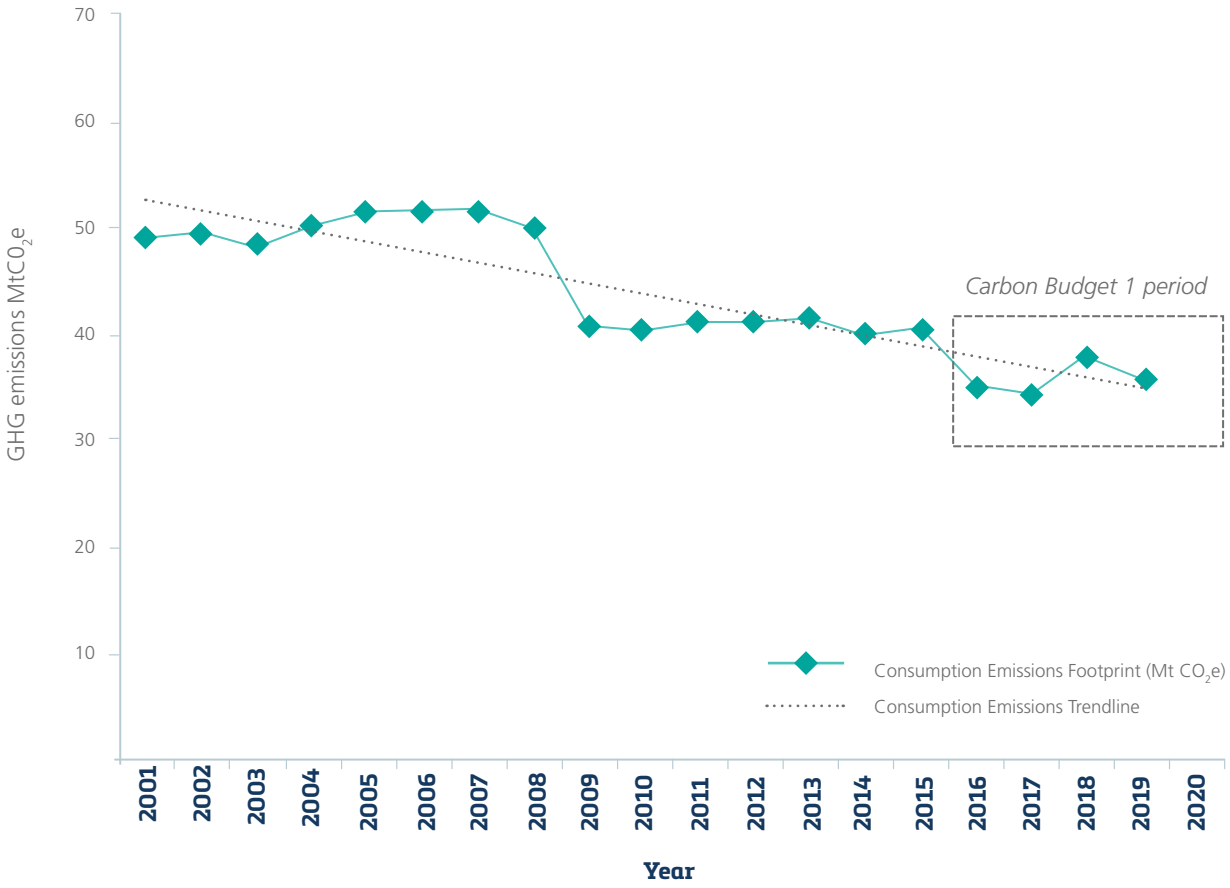
Key Points

The consumption emissions estimate indicates that:

- During the available CB1 years, emissions fluctuated slightly with an overall increase of approximately 2% between 2016 and 2019.
- Between 2001 and 2019, Wales's consumption footprint decreased by ~ 27% from 48.9 $MtCO_2e$ to 35.7 $MtCO_2e$.
- Emissions embedded within imported goods and services (consumed in Wales but produced overseas) remained the key source of Wales's consumption emissions throughout the available data time period.
- When considering emissions from 2001 to 2019 related to households specifically, housing and furniture, followed by transport, were the end uses associated with the greatest emissions.
- Wales's territorial and consumption emissions both dropped since 2001, with territorial emissions being higher for a large part of the time period. This could be associated with Wales having a higher traded share (e.g., heavy industry) than other UK nations.

Consumption Emissions Footprint Results

Figure 4: Wales's Consumption Footprint (2001-2019) $MtCO_2e$



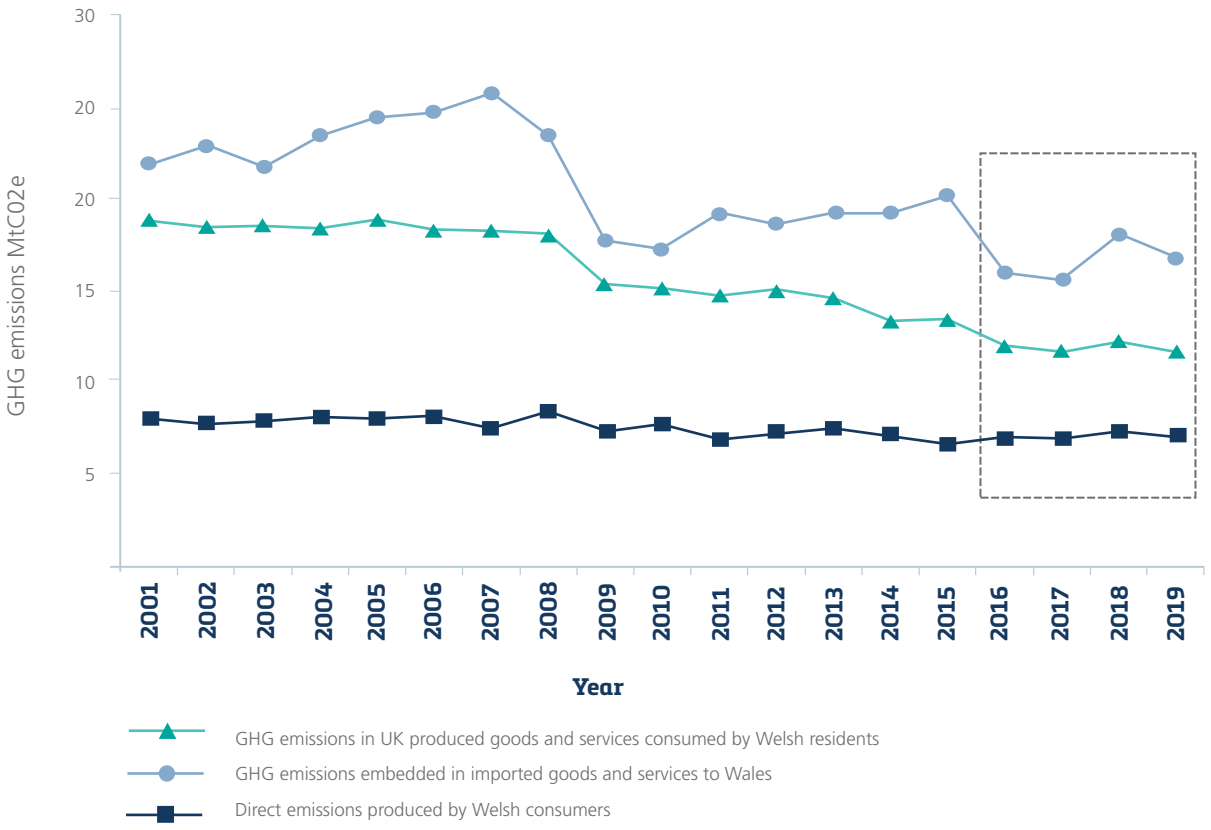
Summary

- Between 2001 and 2019, the data indicates that Wales's consumption footprint has decreased by ~27% from 48.9 $MtCO_2e$ to 35.7$MtCO_2e$.
- Overall, the consumption emissions estimate has shown a general downward trend since 2001.
- Emissions appeared to peak in 2005 and then again in 2007 at around 51.6 $MtCO_2e$ in both years. Emissions then dropped quite significantly in 2009 coinciding with the recession, before remaining broadly stable then dropping again in 2016. There was then an increase between 2017 and 2018 followed by another small decrease in 2019.
- Over the period for which data estimates are available for Carbon Budget 1 (CB1), a slight increase was shown of 2% from approximately 35.1 $MtCO_2e$ to 35.7 $MtCO_2e$. However, emissions for the period remained below those estimated for 2015 and all previous years back to 2001.
- 2018 saw the highest CB1 consumption emissions estimate at 37.9 $MtCO_2e$ and 2017 the lowest at 34.3 $MtCO_2e$.

Analysis of Wales's consumption footprint

Emissions sources

Figure 5: Main sources of consumption emissions in Wales 2001-2019 (with available CB data highlighted)



The overall emissions estimate can be split into three different groups:

- emissions embedded within imported goods and services, consumed in Wales but produced overseas
- emissions embedded within goods and services, consumed in Wales and produced within the UK.
- emissions produced directly by Welsh households and not embedded within a good or service, including household heating and private transport.

- Emissions embedded in imported goods and services comprise the biggest portion of consumption emissions within the model and have decreased by 23% since 2001. Imports are discussed further in the next section (Fig. 6.)
- Emissions embedded in UK-produced goods and services form the next greatest portion with emissions peaking at approximately 19 MtCO2e in 2005 but overall decreasing since 2001 (by ~38%).

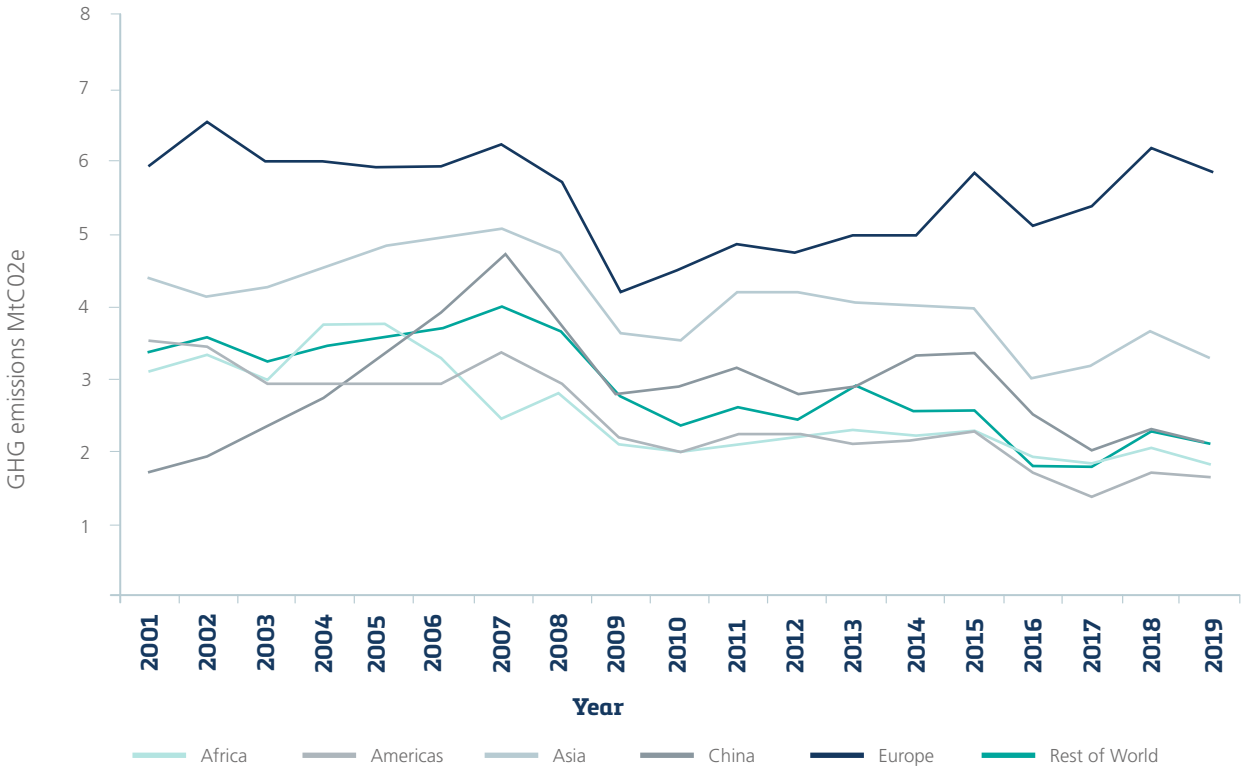
- Direct emissions produced by Welsh households had the smallest contribution to emissions totals, fluctuating slightly year on year. Overall, direct emissions decreased around 12% between 2001 and 2019.
- During the available CB period (2016 – 2019), emissions embedded in UK-produced goods and services as well as direct emissions saw little change (a decrease of approximately 2% and increase of 1% respectively).

More change was seen in emissions related to imported goods and services, which saw a 5% increase overall and peaked in 2018 at approximately 18.1 $MtCO_2e$.

- The CB period peak in emissions seen in 2018 (Fig.4) appears driven by an increase in import-related emissions. These increased 16% between 2017 and 2018, whereas emissions from both UK-produced goods and direct emissions increased ~5%.

Emissions source regions

Figure 6: Source region of Wales' import-related consumption emissions 2001-2019



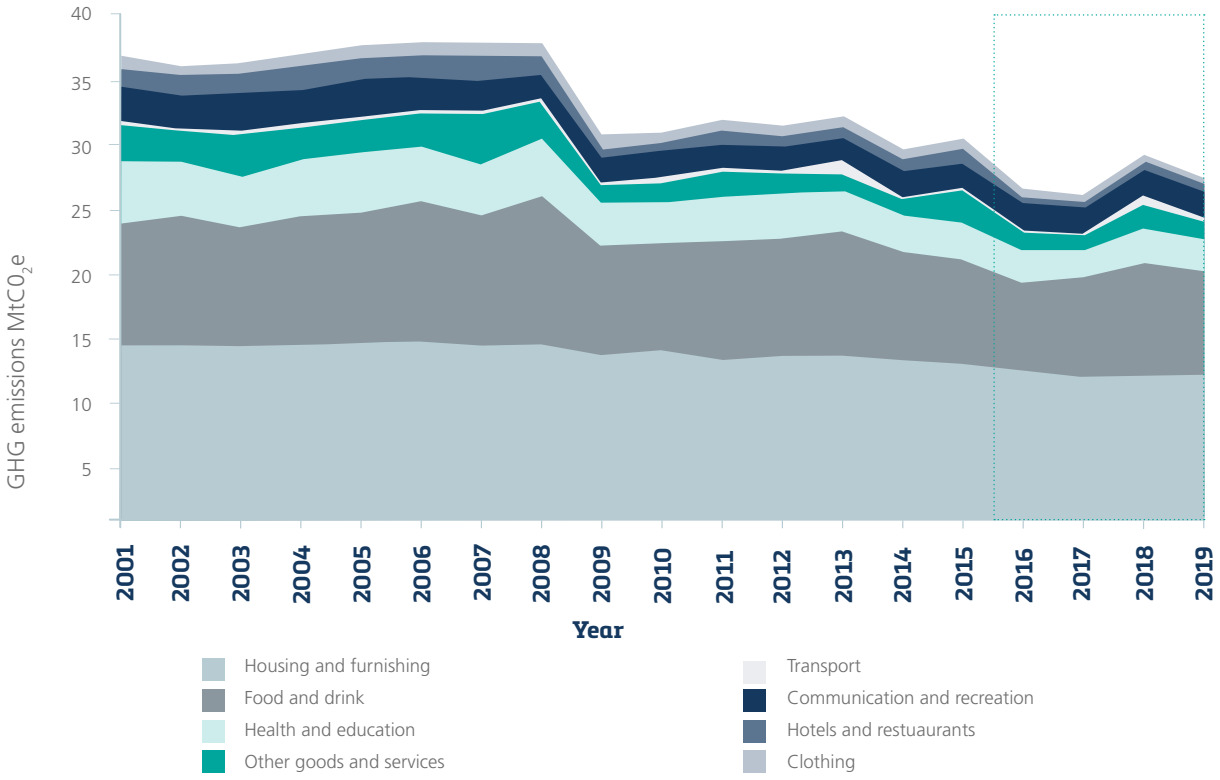
*Due to the way regions were combined within the model, the country categories displayed here may not include all countries within the named continent. See the Methodology section for an explanation and reference to a full list of included countries.

Overall, the data indicates that Europe is the source of most imported emissions. Emissions fluctuated between approximately 5.9 and 6.5 MtCO2e between 2001 and 2007 before dropping sharply after 2008 to a low of 4.2 MtCO2e in 2009. They have since increased gradually since 2009 meaning there has been little overall change between 2001 and 2019, with emissions dropping <1% (5.9 MtCO2e vs. 5.9 MtCO2e).

China appeared to be the only source region of imported emissions to have seen an overall estimated increase between 2001 and 2019 (~23%). Emissions increased sharply between 2001 and 2007, peaking at approximately 4.7 MtCO2e before dropping until 2009. Emissions estimates related to imports from all other regions have decreased since 2001 with Africa dropping around 41%, Americas 53%, Asia 25% and Rest of World 38%.

During the CB period, emissions fluctuated from each source region. China, Africa and the Americas saw a decrease and Europe, Asia and Rest of World all had an increase (all <20%).

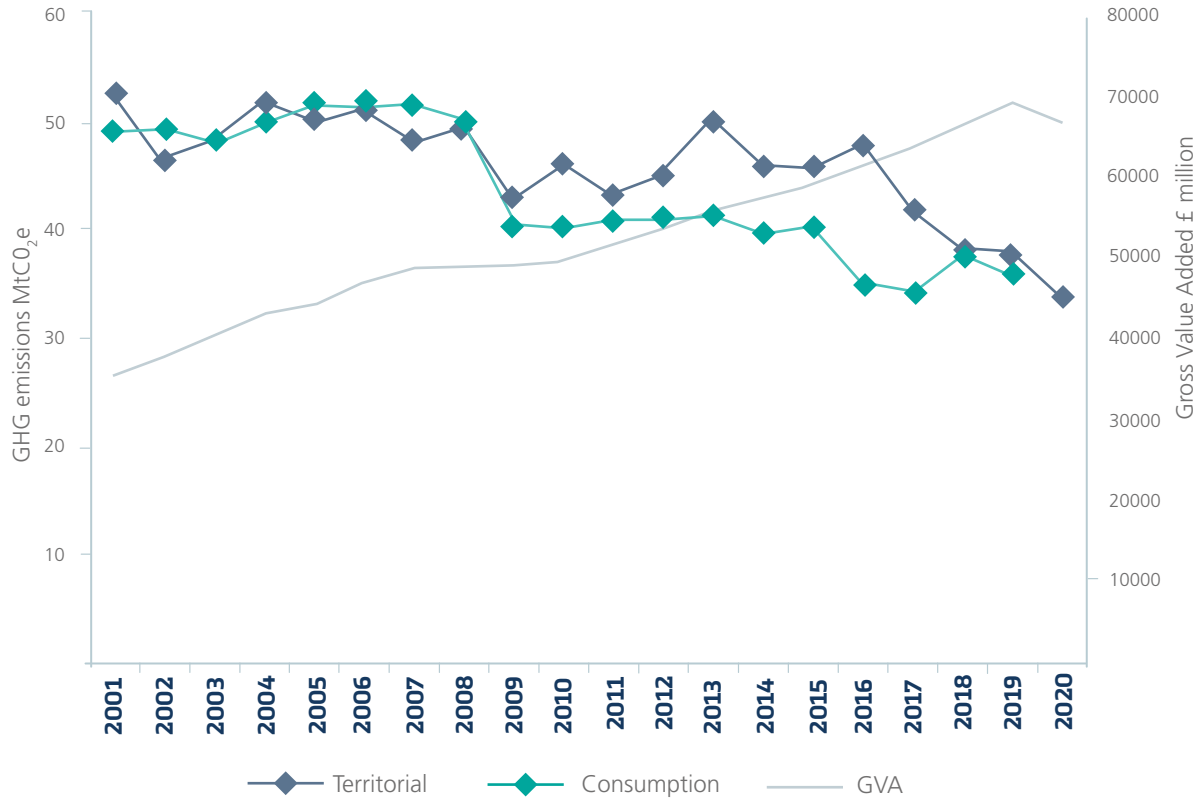
Figure 7: Emissions by end use (related to households only and excluding emissions related to local/central government, non-profit organisations and gross fixed capital expenditure) 2001 - 2019



Overall, emissions related to households accounted for approximately 75% of the total consumption emissions footprint and analysis of the data indicated:

- Since 2001, the data indicates that emissions have declined from all household end uses combined with a steep drop seen in 2008-2009. Emissions then slightly increased to 2013 before declining again, peaking slightly in 2015 and then 2018.
- In general, the proportion of emissions from each end use category remained fairly stable between 2001 and 2019. However, emissions from transport have generally increased as a proportion of the total going from around 24% to 34%, whereas emissions from housing and furnishing have decreased from around 38% to 33%.
- Emissions related to all end use categories have decreased since 2001, except health and education (increasing from 0.2 $MtCO_2e$ to 0.4 $MtCO_2e$) and transport (remaining around the same with a <1% increase).
- During the CB period (2016-2019), emissions related to housing and furnishing fluctuated between 30-36% of the total. Transport fluctuated between 29-35%, food and drink between 12-14%, communication and recreation around ~8% of the total and hotels and restaurants at 5-6% of the total. Other goods and services comprised ~4% of the total consistently between 2016 and 2019, with clothing and health and education fluctuating between ~1% and 3%. Categories did not change much in share over CB1, although it can be noted that transport increased in share over the period while housing and furniture decreased.

Figure 8: Wales territorial and consumption emissions 2001-2019 alongside gross value added (GVA)



*Territorial emissions are presented in CO_2e as per IPCC Fifth Assessment Report values

A comparison of the territorial and consumption emissions estimates indicated (differences between the emissions inventories can be seen in the Methodology section, in Table 7):

- Territorial and consumption emissions tracked relatively closely from 2001 until 2008. Since then, territorial emissions have been higher until 2018 when their values were relatively similar (approximately 38.3 $MtCO_2e$ territorial emissions vs. 37.9 $MtCO_2e$ consumption emissions). They then diverged again in 2019. An estimation of consumption emissions is not yet available for 2020, but territorial emissions saw a significant drop coinciding with the COVID-19 pandemic.
- Overall, emissions estimates on both a territorial and consumption basis appear to have decreased at a similar rate between 2001 and 2019 (approximately 28% and 27% respectively).
- Both territorial and consumption emissions dropping indicates that emissions associated with Wales are being reduced and not offshored; though this is not definitive and does not guarantee future trends will be the same. Wales must continue to work to reduce emissions across all metrics.
- Gross Value Added (GVA)[39] is a measure of the value generated by any unit engaged in production and the contributions of individual sectors to gross domestic product. It is measured in current prices, which means that increases over time reflect inflation as well as real growth. While emissions from both calculations have decreased across the available period GVA on average has increased substantially, indicating that total economic output has not reduced alongside emissions.
- Consumption emissions being lower than territorial is unusual in comparison to the rest of the UK where consumption emissions are typically higher[37],[38]. This could potentially be due to Wales having a higher share of the traded sector (e.g., heavy industry) than the UK average.
- Over the CB1 period, GVA has continued to grow with the exception of a sharp decrease in 2020 related to the economic impact of the COVID-19 pandemic. At the same time, territorial emissions appeared to decline steeply reducing by around 30% between 2016 and 2020 (although 2020 will have been impacted by COVID-19). It is possible that some of this decline could have arisen due to offshoring. However, it appears unlikely to have been driven entirely by offshoring, as consumption emissions estimates have not changed significantly between 2016 and 2019 (latest available year of data), increasing slightly by 2% over this period. GVA increasing across the same period (by approximately 8%) implies again that emissions reductions have not come at a cost to total economic output. From wider statistics, the reduction in territorial emissions appears driven more by decarbonisation of energy generation.

37 Carbon footprint for the UK and England to 2019 - GOV.UK (www.gov.uk)
38 Scotland's Carbon Footprint 1998 – 2018 (www.gov.scot)
39 Gross Value Added (gov.wales)

Methodology

Introduction

Consumption-based emission calculations allow emissions to be allocated to the consumers of a country and conceptually can be thought of as consumption equals production minus exports plus imports. Consumption-based emissions do not have to be reported officially by any country, but they are increasingly estimated by researchers. The methodology used here to calculate the consumption emissions footprint for Wales was developed by the University of Leeds (UoL).

Input-output models are used by environmental researchers to link the environmental impacts associated with production processes with the consumption of products. The footprint here is calculated using a multi-regional input output (MRIO) model, which allows consideration of global trade flows rather than those within a single country. The model considers emissions embodied in trade both in to and out of the UK and links the flows of goods and services described in monetary terms, with the GHGs generated in the process of production. This methodology was chosen as it is the most sophisticated model currently available for the UK and is used to calculate the UK, Wales, Scotland and England footprints. A simplified representation of the emissions inventories included within the consumption footprint (in comparison to the territorial estimate) is shown in Table 7.

Table 7: Types of emissions inventories included in the UK territorial and consumption accounts.

Green indicates inclusion and red indicates exclusion. RoW= rest of world.

Emissions from...	UK Territorial	UK Consumption
industries owned by UK, located in UK making products consumed by UK		
industries owned by UK, located in UK making products consumed by RoW		
industries owned by RoW, located in UK making products consumed by UK		
industries owned by RoW, located in UK making products consumed by RoW		
industries owned by UK, located in RoW making products consumed by UK		
industries owned by UK, located in RoW making products consumed by RoW		
industries owned by RoW, located in RoW making products consumed by UK		
industries owned by RoW, located in RoW making products consumed by RoW		
bunker aviation & shipping owned by UK and used by UK residents		
bunker aviation & shipping owned by RoW and used by UK residents		
bunker aviation & shipping owned by UK and used by RoW residents		
bunker aviation & shipping owned by RoW and used by RoW residents		
UK citizens' activities within UK territory		
RoW citizens' activities within UK territory		
UK citizens' activities within RoW territory		
RoW citizens' activities within RoW territory		
land use, land use change and forestry		

The model is unable to distinguish Wales as a production region in the model, therefore the Welsh footprint includes:

- UK industrial emissions, producing products in UK and consumed by Wales.
- UK industrial emissions, exported to RoW for further production but finally consumed by Wales.
- RoW industrial emissions, producing products in RoW and consumed by Wales.
- RoW industrial emissions, exported to UK for further production but finally consumed by Wales.

Data requirements

A UK carbon footprint model needs to be able to measure the impact of UK consumption of products considering domestic and foreign supply chains involved in production. This means the MRIO table needs to have information about flows of products from abroad to both UK intermediate and final demand. The most accurate representation of the UK consumption-based account would need to measure the flow of products from every country and understand the emissions intensities associated with each industry in every country. However, in terms of practicality, aggregating trader partner countries is preferable. The UK MRIO database contains 16 regions: the UK, Brazil, Russia, India, China, South Africa, the USA, Japan, the rest of the EU, the rest of Europe, the rest of the OECD, the rest of Africa, the rest of Americas, the rest of Asia and Oceania and the Middle East.

UoL utilises a variety of data sources to produce the footprint, including UK Supply and Use Tables provided by the Office for National Statistics (ONS), UK Environmental Accounts and EXIOBASE. EXIOBASE v3.8.2, produced by the NTNU, TNO, SERI, Universiteit Leiden, WU and 2.-0 LCA Consultants, is an MRIO database encompassing data for 49 regions of the world for the years 1995-2016 and provides the data within the model for other nations. A full breakdown of data sources is seen in Table 8.

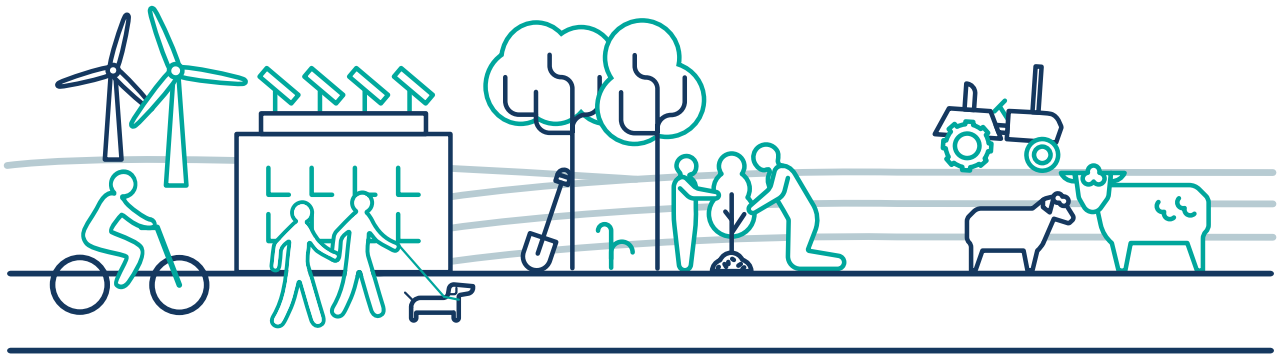


Table 8: Data sources for the UKMRIO database

Data type	Source
UK Supply table showing supply of goods and services (for both UK consumption and export) by UK industry	ONS
UK Use table showing goods and services used (both domestic and imported) by UK industry	ONS
UK Final Demand showing final consumption of goods and services (both domestic and imported) by UK households, Government, Capital Investment and Other.	ONS
UK Value Added table	ONS
Data showing proportion of UK intermediate and final demand that is from imports – the Analytical tables are used for this	ONS
UK environmental accounts by industry: GHG emissions, CO2 emissions, Energy Use, Water, Materials	ONS / BEIS / EXIOBASE
Portion of UK imports to intermediate and final demand by source region	EXIOBASE
Supply table of Rest of World regions	EXIOBASE
Use table of Rest of World regions	EXIOBASE
Final demand of Rest or World regions	EXIOBASE
Environmental accounts of Rest of World regions	EXIOBASE

A number of steps and data manipulations are then carried out to process the data and produce the footprint.

This description is a brief summary of the model. However, a full description of the model structure and where data is used within it can be accessed at:

› UK_consumption_account_methodology_accessible_v2.pdf (publishing.service.gov.uk)

The above report also contains a full breakdown of the country grouping used within the modelling, as referenced under Figure 6 above. Within this report, Rest of World includes Russia and Rest of the OECD categories, Americas includes USA, Brazil and Rest of Americas, Asia includes India, Rest of Asia and Rest of Middle East and Africa includes South Africa and Rest of Africa.

Scaling to Wales

To determine the Welsh consumption footprint, it is necessary to calculate what proportion of the total UK spend Wales is responsible for, for each consumption item contained in the database. For example, if Wales spends 30% of the total UK spend on Clothing, it receives 30% of the total UK footprint associated with clothing demand. In order to do this, it is necessary to know total consumption of each good or service within Wales or to have an average expenditure profile for Wales, which can then be multiplied by the number of residents.

To estimate Welsh emissions associated with domestic consumption of gas and electricity, UoL use the 'Regional and local authority consumption statistics' produced by UK Government, which give estimates of gas and electricity consumption at the regional (NUTS1) and Local Authority levels for Great Britain for the years 2005-2019. The data is then converted into proportions and trend projections are used to project the data back to 2001. For estimates of household spend profiles, household consumption data from the Living Costs and Food Survey is used. The survey is produced by ONS and collects a sample of around 6,000 UK households and is used to provide information on retail price indices, National Account estimates of household expenditure, the effect of taxes and benefits, and trends in nutrition. In addition, it provides information on household spend on over 300 different product types (coded by the European Standard Classification of Individual Consumption by Purpose (COICOP)). UoL construct an average spend profile for households in Wales, multiply this by the number of Welsh households and calculate the portion of spend by each product that Wales is responsible for in order to disaggregate the total UK footprint. This method ensures that the sum of the regions equals the total footprint.

Data publication issue

As mentioned previously, it has not been possible to calculate the footprint for the entire budget period. This is due to availability of statistics that UoL use within the model to calculate the footprint. There will therefore be an update to this annex in 2023 once the data is received from Leeds that includes the 2020 footprint.

Quality Information

Accuracy

The statistics here are based on a variety of assumptions and therefore cannot be taken as definitive numbers. Any model has a level of inherent uncertainty, which can be attributed to variability within model parameters. GHG emissions from products originating from other countries are more difficult to estimate than emissions estimated on a territorial basis. The results are therefore not considered as robust as territorial estimates.

There is potential uncertainty within the methodology regarding the scaling of the UK footprint to Welsh households using the Living Costs and Food Survey. This is due to a limited sample size within the survey, which may not fully capture Welsh consumption patterns and household expenditure. This method also assumes that each region consumes domestic and imported products in the same proportions. For example, it is assumed that households in England consume the same proportion of Brazilian beef products as households in Wales, which may not be a true reflection. The ideal approach would necessitate the construction of a multiregional input-output model where Wales is an individual region, with its own use tables. However, this type of data is not currently collected.

Welsh Government have embarked on a 3-year programme of work to produce supply and use and analytical input output tables for Wales. It is hoped that these tables being available on a Wales-specific level will enhance the quality of carbon footprint estimates going forward. Additionally, the methodology to calculate consumption emissions used here does not account for emissions associated with land-use change, for example deforestation, that may occur in other countries due to production of goods consumed in Wales. However, work is currently underway as part of a package of works for the Global Footprint Milestone to explore estimates of tropical deforestation caused by Welsh consumption and the GHG emissions associated with that deforestation.

Revisions

Results across the historical timeframe are updated annually, to ensure inclusion of methodological improvements and data updates.

Comparability

Other reports related to this release include consumption emissions estimates for the UK, England and Scotland. These are produced via a similar methodology:

- The UK and England footprints: Carbon footprint for the UK and England to 2019 - GOV.UK (www.gov.uk)
- Scotland's footprint: Scotland's Carbon Footprint 1998 – 2018 (www.gov.scot)

National Indicator

The Well-being of Future Generations Act 2015 is about improving the social, economic, environmental and cultural wellbeing of Wales. The Act puts in place seven wellbeing goals for Wales. These are for a more equal, prosperous, resilient, healthier and globally responsible Wales, with cohesive communities and a vibrant culture and thriving Welsh language. Under section (10)(1) of the Act, the Welsh Ministers must (a) publish indicators ("national indicators") that must be applied for the purpose of measuring progress towards the achievement of the wellbeing goals, and (b) lay a copy of the national indicators before Senedd Cymru. Information on the indicators, along with narratives for each of the well-being goals and associated technical information is available in the Wellbeing of Wales report. This data estimate provides information related to the National Indicator number 42: Emissions of greenhouse gases attributed to the consumption of global goods and services in Wales.

Acknowledgements

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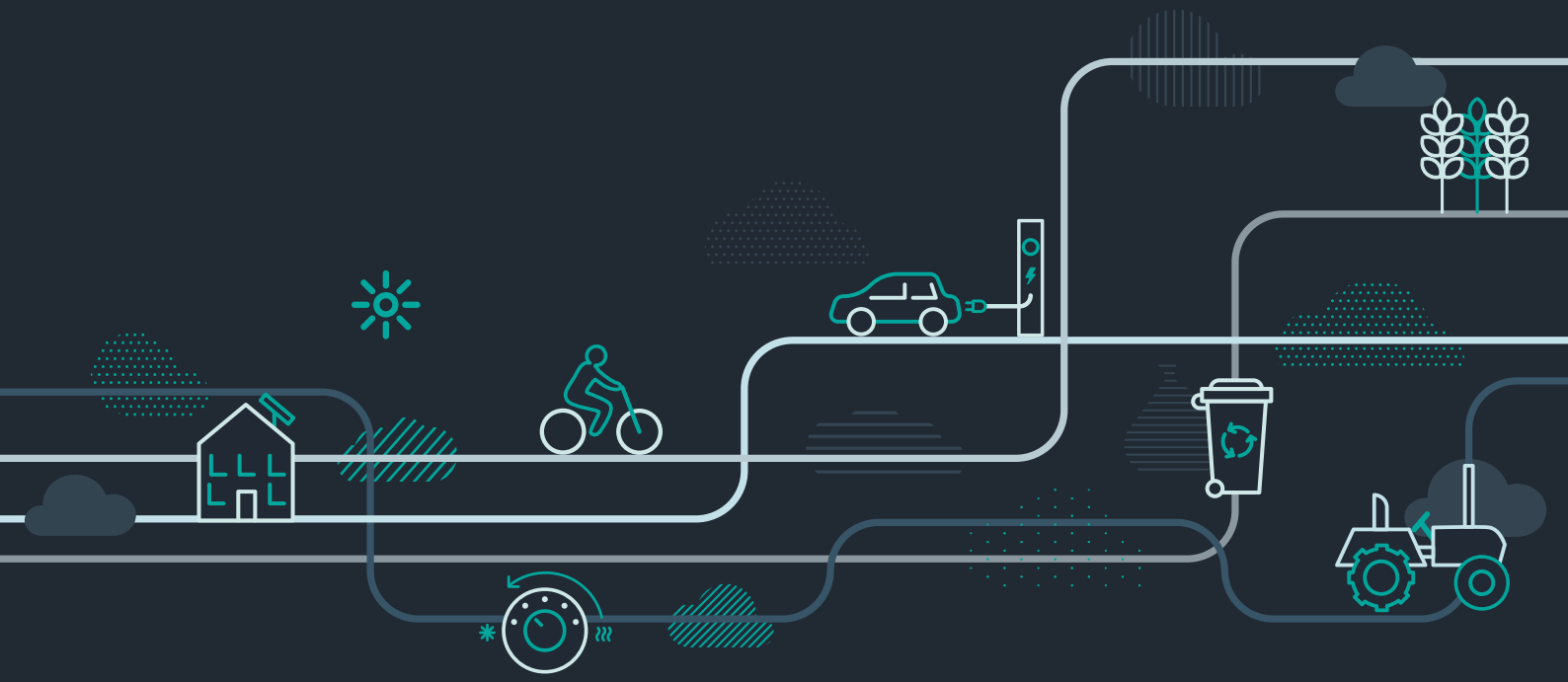
Llywodraeth Cymru
Welsh Government



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