



Llywodraeth Cymru
Welsh Government

Welsh Public Sector Net Zero Carbon Reporting Guide

Welsh Government
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Glossary

Activity: an action that leads either directly or indirectly to emissions of greenhouse gases. Examples include combustion of fossil fuels for heat, generation of electricity, transport, treatment of waste and wastewater, and industrial processes. Activity data is the measure of how much of this activity is taking place and has a variety of different units e.g. kWh, passenger kilometres, tonnes of waste etc.

Biomass: plant or animal material, such as forestry by-products or agricultural waste, which is used as a fuel or energy source.

Carbon dioxide equivalent (CO₂e): carbon dioxide equivalent is a measure used to compare the emissions from various greenhouse gases based upon their global warming potential. For example, the global warming potential for methane over 100 years is 25. Therefore 1 tonne of methane released is equivalent to 25 tonnes of CO₂ (measured on a 100-year time horizon). Therefore, CO₂e works as a single 'currency' for greenhouse gases.

Carbon emissions: used as a shorthand to refer to greenhouse gas (GHG) emissions that are included in the Kyoto Treaty. Carbon dioxide is the most common GHG and other gases can be measured in relation to it (see CO₂e).

Carbon leakage: the removal of carbon emission sources from a reporting system through changes in the operational or organisational boundary – the emissions still occur but are not reported by the organisation.

Carbon neutral: the balancing of carbon emissions against carbon removals and/or carbon offsetting with the net result being zero (see also net zero carbon).

Carbon reduction: an activity that reduces carbon emissions compared to a baseline scenario.

Climate change: the large-scale, long-term shift in the planet's weather patterns or average temperatures.

Conversion factor: a numerical ratio to express how to convert from one unit of measurement to another unit e.g. miles to kilometres, but also sometimes used instead of emission factor.

Decarbonisation: usually refers to the electricity sector and refers to reducing the carbon intensity of electricity generated (emissions per kWh) by increasing efficiency of supply or changing the generation fuel mix from fossil fuel to renewables and low carbon sources.

Emission factor: the average emissions of a given GHG for particular activity. Emission factors are also expressed as the average combination of GHGs for a particular activity, usually in units of kgCO₂e. The UK Government publishes an annual set of emissions factors for company reporting.

Fugitive emissions: greenhouse gas emissions which result from the direct release to the atmosphere (often due to leaks) of GHG compounds from various types of equipment and processes.

Global warming: refers to the recent and ongoing rise in global average temperature near Earth's surface. It is caused by increasing concentrations of greenhouse gases in the atmosphere. Global warming is causing climate patterns to change. However, global warming itself represents only one aspect of climate change impacts.

Net zero carbon: the balancing of carbon emissions against carbon removals and/or carbon offsetting with the net result being zero (see also carbon neutral).

Project lifetime: anticipated lifetime of an energy efficiency technology or low carbon behaviour, used to calculate lifetime savings.

Relative Standard Deviation: Standard deviation is a number used to tell how measurements for a group are spread out from the average (mean), or expected value. A low standard deviation means that most of the numbers are close to the average. A high standard deviation means that the numbers are more spread out. A relative standard deviation is a way of expressing the standard deviation as a percentage.

Removals: CO₂ removals refer to a set of techniques that aim to remove CO₂ directly from the atmosphere by either increasing natural sinks for carbon or using geo-engineering to remove the CO₂, with the intent of reducing the atmospheric CO₂ concentration.

Scope: a way of categorising emission sources in relation to the reporting organisation, used as a way of providing transparency in emissions accounting, making it clear the type of emission source and the level of control of the reporting organisation over the source. Three scopes have been defined and are used on a global basis.

Sequestration: a natural or artificial process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form. The uptake of atmospheric carbon by plants and the growth of wood or increase of peat volume are examples of biological sequestration. Also see removals.

Well to Tank emissions factor: A Well-to-Tank emissions factor, also known as upstream or indirect emissions, represents the GHG emissions released into the atmosphere from the production, processing and delivery of a fuel or energy vector, expressed as average emissions per unit of fuel consumed



1 Introduction

In 2017, the Welsh Government set the ambition of achieving a carbon neutral public sector by 2030. In doing so, we recognised the public sector is uniquely placed to influence emissions far more widely than its own, relatively small direct emissions in areas such as transport, energy and land use. As well as tackling the issues of air pollution, this approach can have a positive impact on the local economy by reducing energy costs and by creating investment opportunities for the low carbon economy.

In March 2019, the Welsh Government published *Prosperity for All: A Low Carbon Wales*¹ which includes *Policy 20: Support the public sector to baseline, monitor and report progress towards carbon neutrality*.

Achieving this aim will require, amongst other things:

- › Achieving net zero carbon emissions through actions to reduce emissions and increase the removal of carbon from the atmosphere;
- › Understanding the priorities, costs, stakeholders and wider impacts of actions;
- › Improving understanding of opportunities to implement climate change mitigation;
- › Improving understanding of the role of the public sector in influencing change in the wider society and economic system.



It is intended for the Welsh Public Sector Net Zero Carbon reporting approach to replace and build on the Carbon Reduction Commitment scheme, for which the last reporting year was 2018/19. The approach also delivers against *Policy 19: Welsh Government to consult on options for successor Carbon Reduction Commitment Scheme in summer 2019*.

A list of public bodies who participated in the CRC scheme are found at Appendix A.

This guide details the principles and priorities for the Welsh Public Sector Net Zero Carbon reporting approach (hereafter called the **Welsh Net Zero** reporting approach), its operational and organisational scope and the data which public bodies in Wales will need to assemble in order to fulfil the reporting requirements. A Net Zero Carbon reporting spreadsheet will be published alongside this guide.

This guide details the principles and priorities for the Welsh Public Sector Net Zero Carbon reporting approach (hereafter called the **Welsh Net Zero** reporting approach), its operational and organisational scope and the data which public bodies in Wales will need to assemble in order to fulfil the reporting requirements. A Net Zero Carbon reporting spreadsheet will be published alongside this guide.

The guide was developed by Welsh Government, alongside partners across the public sector in Wales and with the consultants Aether and Carbon Forecast. It was informed by Natural Resources Wales's net carbon status work² and a subsequent commissioned report assessing a range of emissions accounting methods for use in the Welsh public sector³. It follows from a

1. <https://gov.wales/prosperity-all-low-carbon-wales>

2. Jones, A. 2018. Carbon Positive Project Technical Report: Calculating Natural Resources Wales' Net Carbon Status. NRW Evidence Report No: 303, 134pp, Natural Resources Wales, Bangor.
<https://cdn.cyfoethnaturiol.cymru/media/687222/cym-evidence-report-303-carbon-positive-project-technical-report-calculating-nrws-net-carbon-status.pdf>

3. Wharmby, C., Williamson, T. 2019. Advice on emissions accounting and reporting methods to inform Welsh public sector decarbonisation policy delivery. NRW Evidence Report No: 329, 89pp, Natural Resources Wales, Bangor.
<https://cdn.cyfoethnaturiol.cymru/media/689021/assessment-of-accounting-and-reporting-methods-welsh-public-sector-decarbonisation.pdf>

workshop hosted by Welsh Government in Cardiff in October 2019, which helped defined the priorities and scope of the scheme. Additionally, the opinions and comments of organisations who participated in the testing phase have helped form the content and structure of the guide. A list of organisations who contributed to the development of this guide is provided in Appendix B. The Welsh Government would like to thank all those involved for their valuable input.

1.1 Aims

The aim of this guide is to develop a universal guide set of instructions for use by Welsh public bodies, to **estimate baseline emissions, identify priority sources** and to **monitor progress** towards meeting the target collective ambition of a carbon neutral public sector by 2030.

These aims are further elaborated below:

- › **Baseline:** To understand the current situation and levels/quantity of organisational emissions and removals for a consistently drawn boundary. Quantifies the likely emission gap to carbon neutral operations by 2030.
- › **Identify mitigation potential:** An assessment to identify significant sources of emissions enabling organisations and the Welsh Public Sector to prioritise action needed to move to carbon neutral operations by 2030.
- › **Monitor progress:** A need to gather, collate and analyse data to assess whether organisations are on track to achieving their goals of carbon neutrality by 2030.

Organisations should also **report actions** to reduce emissions and move to carbon neutral operations by 2030. This may be in the form of an annual report on progress against a published action plan or a separate document. Given this guide focusses on emissions data reporting it does not prescribe the content or format of the narrative. However, the management data used in collating an emissions report will provide a good basis for the narrative report.

1.2 Structure of this guide

This guide contains the following sections:

Section 2 contains the thirteen reporting principles that inform the Welsh Net Zero reporting approach, and this guide. These were developed in partnership with public bodies in Wales.

Section 3 discusses the basics of emission reporting, including key concepts and an introduction to basic emission calculations and data requirements.

Section 4 looks at uncertainty in carbon reporting and identifies a strategy for estimating uncertainty from different data sources and reporting an estimated total with an expected range.

Section 5 covers the basics of the reporting process, including teams, datasets and timescales.

Section 6 identifies the operational boundary that has been agreed with the Welsh public sector and the organisational boundaries for the various types of organisations.

Section 7 contains detailed instructions for data gathering and emission calculations for estate-based emission sources.

Section 8 contains detailed instructions for data gathering and emission calculations for procurement and service based emission sources.

Section 9 contains useful sources of data for emission factors, conversion factors and benchmarks.

Section 10 describes additional reporting on renewable energy deployment to complement the report on Net Zero status.

Section 11 contains a proposed reporting format for use by Public Bodies.

2 Principles

The Welsh Net Zero reporting approach, and this guide, are informed by a set of thirteen principles. These were initially based on the common principles used to support the GHG Protocol series of standards for GHG reporting⁴, as well as those common to international GHG emissions inventory compilation. They have been amended and extended to fit the requirements of the Welsh Net Zero reporting approach, its overall aims and the needs of its participants.

There are conceivable circumstances in which the principles are either contradictory, or offer differing choices. The principles are set out in order of priority and, where a choice needs to be made between then, the higher ranked one will take precedence. Priority was determined in consultation with public sector organisation representatives.

Table 1: Principles for the Welsh Net Zero reporting approach system

Principle name	Principle description
1. Transparency	Reporting needs to be transparent and clearly state the boundary, methods, data sources, uncertainty and assumptions used for estimation of emissions and removals.
2. Good decision-making	Welsh public sector organisations should focus resources on accurately estimating and reporting on the most important activities. That is those that make the largest contribution, including, but not limited to, those where significant action is targeted. This will ensure that the most relevant opportunities for achieving carbon neutrality are considered with the most care and attention.
3. Consistency	The methodology used to report emissions and removals should be applied consistently over the time period of the ambition, so that changes reported between time periods reflect actual changes to the quantity of emissions or removals, and not changes to the organisation or method. Organisations should ensure that carbon emitting and/or removing activities are not removed from the overall reporting system if an organisation outsources (or otherwise divests) its activities, although they may change “scope” definition as a result. These outsourced activities should still be accounted for in the overall public bodies reporting system, to avoid carbon leakage.
4. Partnership working	The 2030 ambition for the Welsh public sector can only be met by assessing carbon neutrality across the whole sector. Individual organisations do not have individual targets within this overall ambition (although they may have their own internal targets, independent of the overall Welsh public sector ambition) and therefore collaboration, not competition, should be the objective. All the organisations commit to partnership, open and honest communication and supportive networks.

4. <http://ghgprotocol.org/>

Principle name	Principle description
5. Usefulness of data	Data reported should be directly useful for both measuring progress towards meeting the carbon neutral ambition and for the purposes of the reporting organisations. This can include decision making and tracking action and progress. Reported data should also have as wide a use as possible in informing stakeholders (including the public) on progress and ambition, and to support well informed collective decision making across public bodies.
6. Local Economic Growth	A key role for the Welsh public sector is to influence the wider economy through its demand for goods and services and its support for sustainable, low carbon economic growth. The data generated and reported through this approach should support activities to develop and sustain low carbon markets in Wales and to provide evidence for supporting existing and potential future suppliers to those markets.
7. Comparability	The carbon neutral ambition for the Welsh public sector covers the whole sector and therefore organisations need to report based on the same operational and organisational boundaries, adjusted for organisation type, using the same standardised methodology and emission factors. Variations in boundaries and methodology based on organisational or geographical variation should be clearly documented.
8. Completeness	Reporting should include estimates for all emission sources within the agreed organisational and operational boundary for the Welsh public sector, unless the organisation can provide reasonable evidence that the emission source is not relevant for their organisation. For existing emission sources, where activity data are not available, the organisation will follow the provided methodology for estimating activity data, for example, benchmark estimates based on estate size or employee numbers.
9. Proportionate reporting burden	The resources used to estimate emissions and removals should be proportionate to the significance of the source, firstly within the Welsh public sector, and secondly to the individual organisation. Whilst completeness and accuracy are important, organisations must balance the desire for perfect estimates with the required resources. There should be no additional reporting requirements without a reasonable degree of confidence that they will secure proportionate and additional benefits.

Principle name	Principle description
10. Improvement over time	Where possible, organisations should aim to improve the quality of their reporting data over time, within the context of the overall reporting system. Methodologies should only be changed where this results in an improvement in terms of accuracy. This means that, where emissions for significant source have been estimated using simple approximations and benchmarks of activity data, the organisation should aim to improve their methodologies, thus reducing uncertainty and improving accuracy.
11. Accuracy	Organisations should aim to reduce uncertainty in estimates of activity data and to improve the accuracy of reporting. The focus for reducing uncertainty should be on emission sources that are highly uncertain and make up a significant proportion of emissions whilst acknowledging that, for some emission sources, reducing the uncertainty further will be outside of the control of the individual organisation.
12. Maintenance and extension of ambition	If the Welsh public sector were to succeed in meeting net zero emissions as defined within the boundaries of this reporting system before 2030, it will look to go further and extend its ambition. This would include reducing emissions further where possible and seeking new opportunities for removals. The boundaries of this reporting system may also be revised to include emission sources outside the public sector’s direct control and/or resetting its ambition to achieve net removals.
13. Peer review	To strengthen and share knowledge of the reporting system within public sector organisations, reported data should be peer reviewed by another reporting organisation. Consequently, a peer learning community should develop involving all reporting organisations across the public sector.



3 Basics of emission reporting

3.1 Why do we talk about carbon?

There are several different gases that contribute to global climate change. However, this guide focusses on the three key gases that contribute the greatest climate change impact from the perspective of public sector activities. These are:

- › Carbon dioxide (CO₂)
- › Methane (CH₄)
- › Nitrous Oxide (N₂O)

There are other greenhouse gases that are covered by the Kyoto Protocol such as HFCs and CFCs used in air conditioning and refrigeration systems but these make up a very small proportion of the total impact of the Welsh public sector and are better managed through existing environmental management systems, so have been excluded from this guide.

The impact of different gases on the atmosphere is complex and depends on their duration and behaviour in the atmosphere. For example, methane produces 25 times more warming effect than an equivalent amount of carbon dioxide over an equivalent time period.

In order to simplify this complicated situation, data for all GHGs is translated into a single comparable unit, carbon dioxide equivalence, or CO₂e, usually measured in kilogrammes or tonnes. Therefore 1 tonne of CO₂e has the global warming impact of 1 tonne of CO₂ but it can be a mix of any of the 7 Kyoto gases. A tonne of CH₄ is represented by 25 tCO₂e because CH₄ has 25 times the global warming potential of CO₂. The global warming potential (GWP) of N₂O is 298 times that of CO₂. It is important to realise that these GWP index values are not static; as better scientific information becomes available these values can be refined over time. In order to be consistent with UK Government reporting guidance, the GWPs used in the calculation of CO₂e in this guide are based on the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) GWPs representing a 100-year period.

As a shorthand, GHG emissions can be referred to more generally as 'carbon emissions'; this is usually taken to mean carbon dioxide equivalents and can therefore refer to a mixture of GHGs. This terminology is used in this Net Zero Reporting Guide.



3.2 Activity data units, conversion factors and emission factors

The standard approach to calculating carbon emissions from human activity is to multiply units of **activity data** by an **emission factor (EF)**. Thus, the calculation to estimate the quantity of carbon emissions produced by an action can all be summarised as follows:

Activity data x Emission Factor = Carbon emissions

Worked Example

Activity Data

Natural gas consumption in an organisation's operated building: 98,500 kWh

Emission Factor

Gross natural gas EF: 0.18443 kg CO₂e

WTT EF: 0.02391 kg CO₂e

From: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019>

Calculation

1. Multiply kWh by fuel specific EF to get direct emissions
98,500 x 0.18443 = 18,166 kg CO₂e
2. Multiply kWh by fuel specific WTT EF to get indirect emissions
98,500 x 0.02391 = 2,355 kg CO₂e

Total emissions: 18,166 + 2,355 = **20,521 kg CO₂e**

Activity data refers to a measure of the amount of the action. This can be tonnes of fuel used, kilometres travelled, kilowatt hours (kWh) of electricity consumed etc.

Emission factor describes the amount of carbon emissions produced from one unit of an activity. Emission factors are publicly available values, published by the Government, and other sources, that enable us to convert quantities of activity into carbon emissions.

However, both the activity data and the emission factor need to be in the same units. For example, if an emission factor is based on kgCO₂e per kWh of fuel used, the activity data must be given in kWh as well. If the original activity data is given in tonnes, or even in the cost of fuel purchased, this must

first be converted into kWh, before applying the emission factor to estimate the resulting carbon emissions.

Conversion factors are values used to change one set of units to another, by multiplying or dividing. For example, the conversion factor for converting from miles to kilometres is to multiply by 1.609.

In this guide, appropriate units for each emission source have been set. This will require users to undertake conversion of existing units to standard units. The reason for setting standard units is to make it easier to compare similar activities within an organisation e.g. all energy units have been set to kWh, and also to compare consumption between organisations. Relevant conversion factors have been provided in **Section 9.3**.

Finally, it is important to understand that emission factors come in various parts, which represent emissions from different aspects of activities. In total there are four categories of emission factor parts, as shown in **Table 2** but not every emission source has more than one factor that should be used. The activity data needs to be multiplied by all the relevant parts of the emission factor. In **Table 38** there is a suggested format for presenting reported emissions to show these direct and indirect emissions separately. **Table 28** shows which emission factor parts should be included for each emissions source.

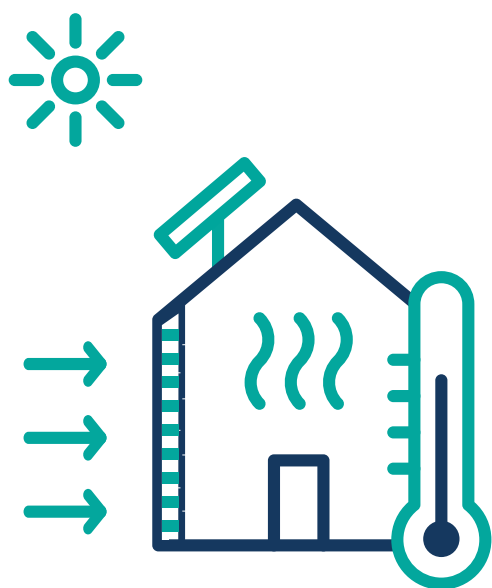
Table 2: The four possible parts of emission factors

Direct emissions	Indirect emissions	Well to Tank	Outside of scopes
Emissions that are released directly by your estate or asset, for example burning fuel in a boiler or combustion of fuel in a vehicle owned by the reporting organisation.	Emissions attributable to the activity but not occurring directly on the estate of the reporting organisation e.g. generation of electricity causes emissions at power stations but the electricity is consumed by the reporting organisation.	Used to account for the upstream emissions associated with extraction, refining and transportation of the fuel sources to an organisation’s site (or asset), prior to combustion.	Used to account for the direct carbon dioxide impact of burning biomass and biofuels. The emissions are labelled ‘outside of scopes’ because the direct impact of these fuels has been determined to be net zero (since the fuel source itself absorbs an equivalent amount of CO ₂ during the growth phase as the amount of CO ₂ released through combustion).



3.3 Who sets the rules for carbon accounting?

The “rules” for carbon accounting ultimately derive from the United Nations Framework Convention on Climate Change and its associated protocols and agreements (such as the Kyoto Protocol or Paris Agreement⁵). These define the targets which national governments are required to ratify and report on. The Intergovernmental Panel on Climate Change (IPCC)⁶ was set up to assess the scientific evidence around climate change and to define a set of standards for GHG accounting and reporting, to ensure that all countries provide information on their emissions on a consistent basis.



However, national governments are only required to report on emissions which occur within their territory. At a sub-national level, it becomes more difficult to clearly define geographical boundaries. Moreover, carbon accounting at the organisation or city level tends to be less about legal compliance and more about providing a full account of the emissions for which that city or organisation is responsible. For example, from the point of view of a single organisation, the

emissions associated with electricity generation won't be physically part of their operation but their activities have a role in increasing or decreasing electricity consumption, and hence the emissions, and as such they should be part of that organisation's “footprint”. This consumption-based approach has become the accepted way to address sub-national carbon accounting.

Furthermore, the Environment (Wales) Act 2016 places a duty on Welsh Ministers to report consumption emissions, given the aim of our policy is to reduce emissions in a globally responsible way. We should not reduce emissions from within our own boundary only to increase emissions elsewhere in the world.

A consumption-based approach makes carbon accounting more complex and there is a huge potential for very different methodologies to be used, making the inter-comparison of different organisations emissions impossible. To address this, various different standards have been produced, for example by the IPCC themselves, British Standards Institute, or organisations such as the Carbon Trust. However, the most widely used set of sub-national carbon accounting standards are those developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) and called the Greenhouse Gas Protocol⁷. The original standard was for corporate accounting, but the suite of standards has been expanded to include standards for cities and individual projects, among others. These standards are free to access and use and have been developed on a collaborative basis with partner organisations. The Welsh Net Zero reporting approach has drawn heavily from the principles and approach used in the GHG Protocol standards, most especially the corporate standard and the US public sector standard⁸. Central to this is the concept of “scopes” which is described in the next section.

5. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>

6. <https://www.ipcc.ch/>

7. <http://ghgprotocol.org/>

8. <http://ghgprotocol.org/corporate-standard>; <http://ghgprotocol.org/public-sector-protocol-0>

3.4 What are scopes?

Scopes are defined by the Greenhouse Gas Protocol for GHG accounting and reporting purposes and are described in Table 3. Dividing emission sources into scopes is a useful way of breaking down the decision-making process as to what should be included within a company, organisation or even city scale emissions inventory. Generally, all carbon accounts include scope 1 and 2 emissions, whereas scope 3 sources might be excluded or only partially included, depending on both the availability of data and the usefulness of its collection. It should be noted that one organisation’s scope 3 emissions are another organisation’s scope 1 or 2. Therefore, when multiple organisations are accounting under the same umbrella target, care must be taken to avoid double or triple counting the same emission source.

For the purposes of the Welsh Net Zero reporting, the scopes concept has been used to support the operational boundary setting process. Scope definitions in Table 3 are taken from the GHG protocol⁶ and therefore include sources that may not be included in the boundary or relevant for Welsh Public Sector organisations. Further information on exclusions is given in Section 6.

Figure 1: Emissions scopes

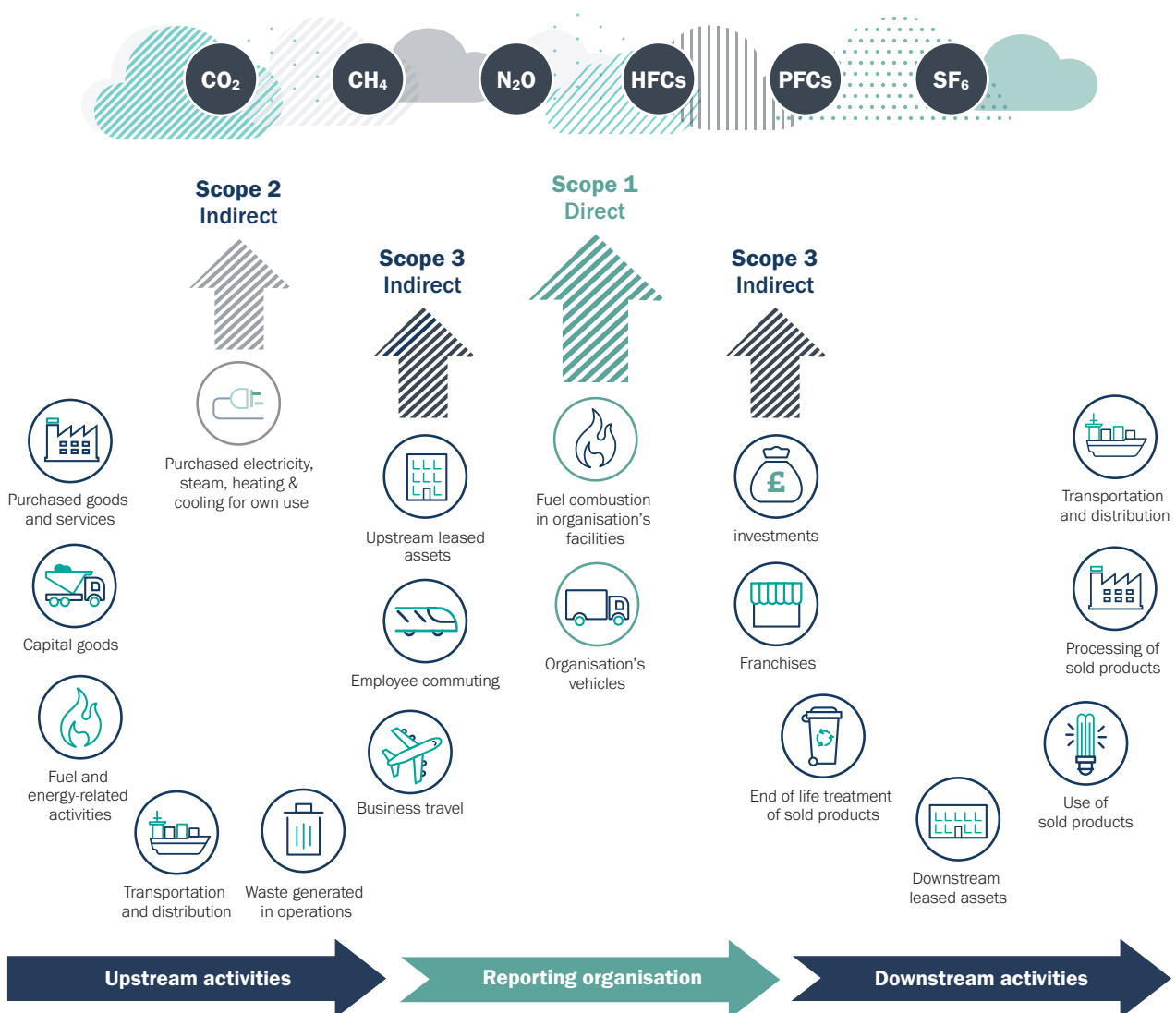


Table 3: Scopes and emission sources from the GHG protocol

Category	Description	Sources
Scope 1: Direct emissions	Emissions from operations that are owned or controlled by the reporting organisation	<ul style="list-style-type: none"> • Generation of heat • Onsite generation of electricity and heat e.g. Combined Heat and Power (CHP) • Physical or chemical processing* • Transportation of employees/goods in company-controlled vehicles • (Fugitive emissions from company-controlled sources)
Scope 2: Indirect emissions from energy	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling generated by a third party and consumed by the reporting organisation	<ul style="list-style-type: none"> • Generation of purchased electricity • Generation of purchased heat or steam • Generation of purchased district heating
Scope 3: Indirect emissions	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting organisations, including both upstream and downstream emissions	<ul style="list-style-type: none"> • Purchased goods and services • Fuel and energy-related upstream activities • Upstream transportation and distribution* • Waste generated in operations • Business travel • Employee commuting • Upstream leased assets • Downstream leased assets* • Downstream transportation and distribution* • Processing of sold products* • End-of-life of sold products* • (Franchises) • (Investments)
Outside of scopes	The emissions of CO ₂ from combustion of fuels made wholly or partially of biogenic material since the fuel source itself absorbs an equivalent amount of CO ₂ during the growth phase	<ul style="list-style-type: none"> • Short cycle carbon emissions from biofuels, blended diesel and petrol, biomass etc.
Land Use, Land Use Change and Forestry (LULUCF)	All removals or emissions from activities from land that release or uptake carbon on the estate of the reporting organisation	<ul style="list-style-type: none"> • Biogenic land-based sequestration or emissions from estate

Note: Sources in brackets () are excluded from Welsh Public Sector Reporting. Sources marked with * have been partially excluded from Welsh Public Sector reporting and organisations should consult the relevant sections of the guidance for further instruction.

4 Uncertainty in carbon reporting

Calculations of carbon emissions always contains uncertainty derived from various different issues: activity data may be incomplete, contain double counted data or be inaccurately measured. There is also inherent uncertainty from the emission factors which are often averaged over many different situations. It is therefore not possible to eliminate all uncertainty from carbon reporting and equally difficult to calculate the degree of uncertainty with absolute accuracy. However, it is important to recognise and estimate the uncertainty resulting from each activity dataset, as this will help organisations understand the largest potential sources of inaccuracy in their overall carbon reporting and develop strategies to minimise the most significant sources of uncertainty under their control (see Principle 11 on accuracy). It also enables more nuanced communication with third parties.

Uncertainty can be estimated using a statistic called **relative standard deviation (RSD)** which measures the variation of the data relative to the size of the mean. Therefore RSD is expressed as a plus or minus percentage of the mean; for example for electricity meters, the uncertainty in measurement is around 3.5%, so if your meter reading is 100 units, the range is estimated at 96.5 to 103.5 kWh.

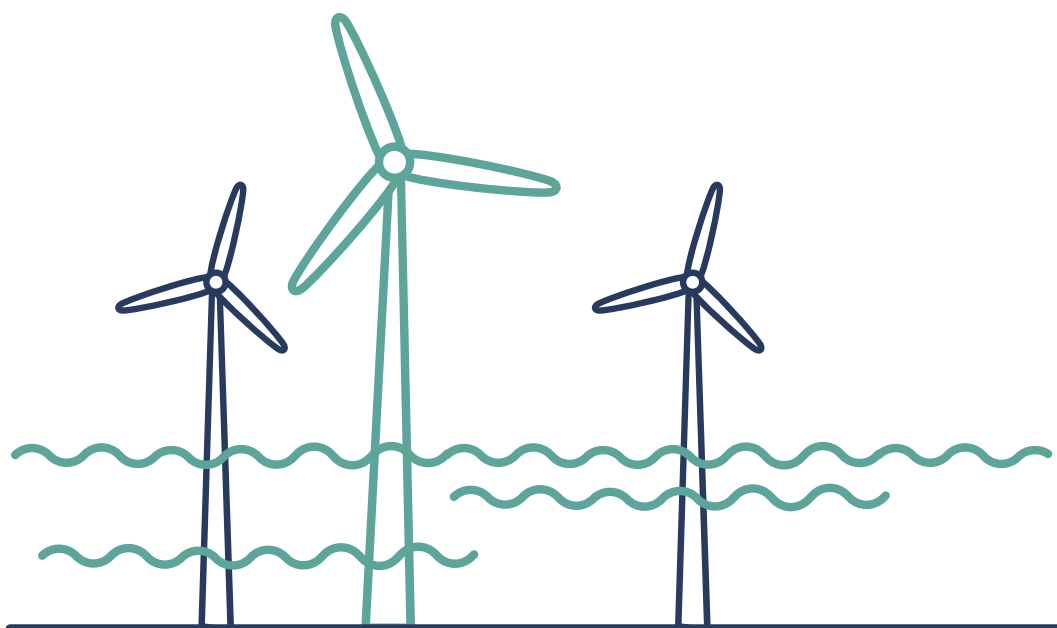
Uncertainty varies across emission sources and with the type of activity data used. The table below provides some estimates of RSD for different data sources, and further RSD estimates are provided in the methodology sections of this guide. However, organisations are also encouraged to consider their specific data and apply more suitable RSD values if there is evidence to support this. RSD values should be reported alongside emission estimates.



Table 4: Relative standard deviations for typical datasets

Emission source	Comment	RSD (+/- %)
Natural gas	Depends whether it based on half-hourly meters or estimated readings	2 to 10
Bulk fuel purchases	Assumed to be less accurate than metered data	5 to 15
Grid electricity	Depends whether it is based on half-hourly meters or estimated readings	2 to 10
Fleet fuel cards	Accuracy similar to metered data	2 to 10
Water meters	Accuracy similar to metered data	2 to 15
Waste	Accuracy limited by data collection method e.g. actual weight or estimated from number of bins	5 to 15
Business travel	Accuracy limited by the data collection method e.g. cost only or cost and distance.	5 to 15
Employee Commuting	Accuracy limited by the data availability and absence of organisation specific survey data	10 to 25

Addressing uncertainty in carbon reporting is an important part of any improvement plan, and is supported by a number of the principles outlined in this guide i.e. accuracy and improvement over time. Whilst activity data may be highly uncertain in some cases, organisations should consider options for improving activity data for subsequent reporting cycles e.g. by discussing reporting requirements with data providers. However, it is important to prioritise categories where the highest levels of uncertainty are combined with the most significant emission sources to ensure efforts are targeted appropriately.



5 Process

5.1 Who needs to be involved?

In order to complete the reporting, a team of individuals from across the organisation will need to be engaged in the process of data gathering, recording and processing. Engagement with these people should start early in the financial year, after the end of the reporting year, to make sure that there is adequate time to collate responses. It is ideal for the group to be established during the reporting year to ensure individuals are all aware of the data requirements and can make adequate arrangements for data availability and collection. The roles are likely to include:

- › Energy manager
- › Sustainability manager
- › Waste Management Officer
- › Head of Procurement
- › Transport/fleet manager
- › Finance/HR department
- › Risk & resilience manager
- › Chief Executive or other member of senior management team

To facilitate efficient data gathering and reporting, some additional organisational arrangements should be established:

- › **Internal memoranda of understanding (MOUs):** while this may appear to be overly formal for an internal data gathering process, MOUs establish what data are required and in what format, when data are needed and who is responsible for it. They also provide a mandate to devote staff time towards data gathering and help protect against disruption caused by staff changes.
- › **Data storage platforms:** while existing file storage systems can be used, it is often advantageous to set up a dedicated data storage system, preferably one that can

be accessed by all data providers, using a cooperative working platform such as Microsoft SharePoint or Teams. Not only does this allow data providers to access previous data, it helps preserve institutional memory in the event of staff changes.

- › **Data users group:** it is helpful to discuss the data needs for the year ahead and experience in gathering data from the past reporting round with all of the data providers and processors. Such a group needn't meet often – once or twice in each reporting cycle should be enough – and the time spent can be invaluable in avoiding problems later on in the process.



5.2 What type of data are required?

Section 7 and **Section 8** of this guide provide details on the precise type of activity data required for the different emission sources and how to estimate emissions from this data using the appropriate factors. The emissions estimation methodologies provide three different methods for each source, and the choice made for each will depend on the data available. These different levels of method are described as Tiers. In each case the Tier 1 is the lowest accuracy, but the data should be easiest to source. The Tier 3 methodology will provide the most accurate information but has a higher data requirement. Tier 2 is an intermediate choice.

In general, the Tier 3 methodology will require data on the actual amount of activity (this might be fuel in litres, kg or kWh or business travel in kilometres), as this gives the most direct connection between activities and emissions. **The preference should always be to use Tier 3 methodologies.**

Tier 2 and 1 use expenditure or other metrics such as floor area to provide an estimate of activity data from which emissions can be calculated. Note that these methods will usually result in a larger estimate of emissions and will tend not reflect the way in which activities can be modified to reduce emissions. However, there may be some small emission sources for which the gathering of Tier 3 data is disproportionate. For such sources, Tier 2 or 1 may be more appropriate.

In recording activity data, the method of collection should also be recorded. For example, was the amount of fuel used based on comprehensive data, or a sample from across the organisation? Is the information from the complete current year, or a partial set from a previous year that has been “scaled up”? Was the data gathering process a one-off exercise which won't be repeatable for future years?

Reported GHG emissions or removals that are not accompanied by a methodological statement showing how they were calculated should not be accepted. The principle of transparency requires that the method of calculation is clear to a third party, including both the activity data and emission factor used.

5.3 Reporting timescales

The Welsh Net Zero reporting approach requires annual data reports to be submitted to the Welsh Government, based on financial years, and all data should apply to the relevant time period. The emission factors used in calculations will be for the calendar year which covers the majority of the period.



Final and complete, peer reviewed data submissions should be made within 3 months of the end of the financial year, with a following 3 months allowed for data review and compilation. The annual report for the whole of the Welsh public sector will be available in the October following the relevant year. The example below shows how these timescales will apply for the 2020/21 financial year.

- › Financial year: 1 April 2020 to 31 March 2021
- › Emission factors used: 2020
- › Final and complete data report by public bodies: 30 June 2021
- › All data review and compilation: 1 July 2021 to 30 September 2021
- › Report publication: October 2021

Experience has shown that it is not sufficient to wait until the end of the financial year to begin the data collection process. It is extremely important that all prospective data providers are aware of what data will be required and in what format at the start of the year, so that the appropriate data collection and recording systems can be set up. It is also helpful to conduct data collection exercises on a quarterly or half yearly basis, to identify and address any barriers to data collection and to spread some of the activity across the year.

5.4 Reporting structure

Reporting structures will be defined by the reporting system developed to support submitting in line with this Net Zero Reporting Guide. The aim of the system will be to deliver regular, accurate and consistent reporting in an approachable format. A standard reporting structure is required to enable data to be aggregated efficiently at a public sector wide level.

A key requirement of the reporting system is to contain standardised terms for source categorisation, fuel categorisation (or equivalent), activity data field, units and emission factors. A proposed structure is given in **Section 11**.

5.5 Peer review process

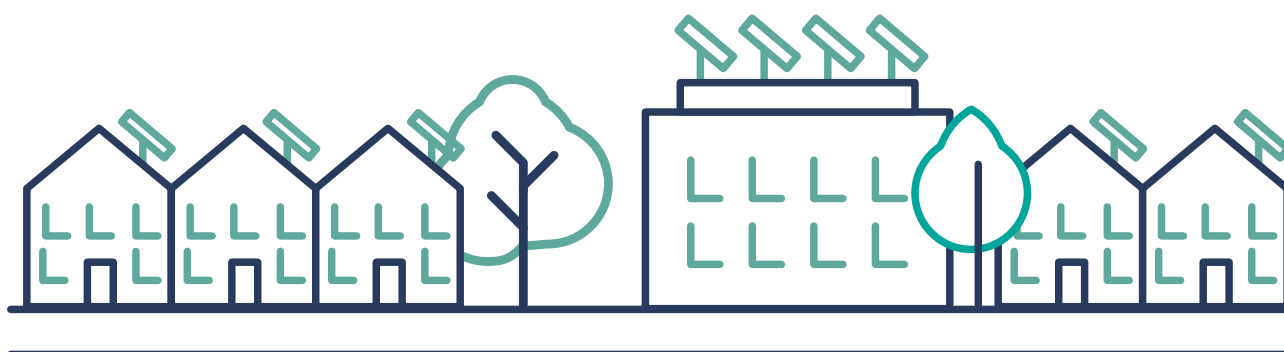
The peer review process is the assessment of an organisational report by another organisation, with the aim of improving the overall accuracy of public sector reporting. Assessment should be made against the principles of transparency, accuracy, completeness, consistency and comparability. A helpful peer review will identify potential issues in reporting for partner organisations to support the improvement in emission estimates. A key benefit for participating

in this process is that knowledge and best practice are shared within the reporting community and this encourages collaboration.

It is assumed that the process developed for reporting in line with the Net Zero Reporting Guide will allow organisations to report transparently on methodologies and activity data sources. It is therefore anticipated that peer review will be performed on officially submitted documents only, avoiding the need to exchange multiple documents (e.g. supporting spreadsheets). The requirements of the process can only be defined once the reporting system is established; however the peer review should aim to answer the following questions:

- › Has the organisation drawn clear organisational boundaries for reporting?
- › Has activity data been transparently documented?
- › Is activity data complete according to the identified relevant emission sources?
- › Are emission estimates realistic?
- › What are the key points to improve the accuracy of reporting?

The Welsh Government will support public bodies to establish peer review networks during the first reporting year.



6 The operational and organisational boundary for Welsh Net Zero

6.1 Introduction

Together, organisational and operational boundaries define which assets, operations and emissions sources are included in the organisational GHG inventory. Setting clear boundaries is a fundamental part of reporting, enabling organisations:

1. be consistent about what is reported;
2. be complete about reporting the emissions for which the public sector is responsible;
3. be transparent about what is included and what is excluded.



6.2 The operational boundary - defining types of emission sources

The operational boundary for Welsh Net Zero reporting (see Table 5) is to be used by all reporting organisations. It was developed collaboratively during a workshop of public body representatives in October 2019.

An operational boundary defines the emission sources that are included in the reporting. Emission sources are divided into three scopes plus a separate category of direct biogenic carbon and a reportable 'outside of scopes' category.

Setting a clear operational boundary defines which emission sources are included in the reporting and which ones are excluded. Organisations are then committed to reporting on these sources, unless they can demonstrate that they are not applicable e.g. the organisation has no upstream leased assets. Where the emissions are thought to occur but there is no activity data available, benchmarks and other methods will be suggested to enable the organisation to approximate the scale of the emissions.

The operational boundary for the Welsh Net Zero reporting is shown in **Table 5**.

Table 5: Source categories included and excluded from the Welsh Net Zero reporting approach

Section	Category	Sources
Included in reporting		
Estate	Buildings	<ul style="list-style-type: none"> • Generation of electricity, heat or steam • Generation and Transmission & Distribution (T&D) of purchased electricity • Generation and T&D of purchased heat or steam • Fuel and energy-related upstream activities (<i>also known as “well to tank” emissions</i>) • Upstream leased assets (<i>only where not included elsewhere in public sector</i>) • Downstream leased assets • Short cycle carbon emissions from biofuels • Water supply and treatment
	Fleet and other mobile equipment	<ul style="list-style-type: none"> • Transportation of employees/goods in company-controlled vehicles • Fuel and energy-related upstream activities (<i>also known as “well to tank” emissions</i>) • Sequestration from owned estate
	Land based emissions and sequestration	<ul style="list-style-type: none"> • Sequestration from owned estate
	Waste generated in operations	<ul style="list-style-type: none"> • Waste generated in operations
Supply Chain	Procurement	<ul style="list-style-type: none"> • Purchased services • Purchased goods
	Business Travel	<ul style="list-style-type: none"> • Employee commuting • Grey fleet • Public Transport • Service Travel
Excluded from reporting		
Exclusions	Not relevant	<ul style="list-style-type: none"> • Physical or chemical processing • Franchises • Downstream transportation and distribution* • Processing of sold products* • End-of-life of sold products*
	Other	<ul style="list-style-type: none"> • Fugitive emissions from company-controlled sources • Upstream transportation and distribution • Investments

* NRW may report significant emissions under these categories at its discretion.

6.3 The organisational boundary defining parts of the organisation that report

An organisational boundary defines which parts of an organisation are included for the purpose of GHG reporting. In the context of Welsh public sector reporting, there are several reasons for wanting to set a consistent organisational boundary:

1. In order to assess whether the public sector is carbon neutral in 2030, a clear definition of what constitutes the public sector organisation's edges (or boundaries) needs to be defined.
2. To make sure that organisations are starting from the same point of effort, the boundary needs to be consistently applied.
3. From a credibility and communication perspective, it is important that the public sees activities typically delivered by the public sector included in the report.

For this reason, a **service-based approach** will be used within the Welsh Net Zero reporting approach to set organisational boundaries. As the activities and operations of organisations across the Welsh public sector vary considerably, this will be defined on a sub-sector basis, taking into account what each sub-sector delivers, and draw the boundary accordingly. Where an individual organisation has outsourced one of the services listed, an alternative methodology for accounting would need to be used to fill in the gap. Where all organisations in a sector have outsourced the activity, the need for inclusion would be assessed.

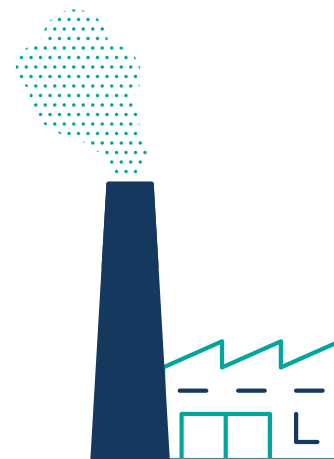
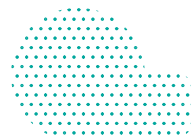


Table 6, below, sets out the list of the services and activities to be included in the organisational boundary for each of the sub-sectors within the Welsh public sector. Please note that this table may not be an exhaustive

list of all of the functions of each organisation type, and should be used as a guide for which further decisions on the organisational boundary can be made.

Table 6: Organisation boundaries for Welsh public sector organisations

Organisation type	Services/activities included	Services/activities excluded
Welsh Government	<ul style="list-style-type: none"> • Corporate and departmental services • Transport infrastructure – operation & maintenance • Administrative estate • Property and land assets (e.g. offices let for economic development purposes) • Cadw 	<ul style="list-style-type: none"> • Visitor travel
Local Authorities	<ul style="list-style-type: none"> • School education • Domestic waste collection and disposal, and street cleansing • Highways and street lighting • Libraries and archives • Environmental and animal health • Electoral administration • Registrar services (births, marriages and deaths) • Trading standards • Social services • Housing and homelessness services (except council housing) • Planning and building control • Licensing services • Benefits administration • Disabled parking permits • Allotments • Play facilities • Conservation and rights of way • Childcare provision • Car parking and parking enforcement • Collection and disposal of trade waste • Flood protection • Burial and cremation services • Sport and leisure services • Economic development and business support • Maritime and coastal services (e.g. slipways, marinas and lifeguards) • Museums, galleries and support for the arts • Parks and gardens • Promotion of tourism • Adult and lifelong learning • Ancillary functions 	<ul style="list-style-type: none"> • Landlord services (i.e. council/social housing) • Public transport

Organisation type	Services/activities included	Services/activities excluded
Health Boards and Trusts	<ul style="list-style-type: none"> • Secondary and tertiary healthcare • Inpatient, outpatient and accident and emergency services • Community hospitals • Specialist hospitals • Corporate services • Service travel (patient transport) 	<ul style="list-style-type: none"> • Primary care services (dentists, GPs, opticians, pharmacies) except where they are under the control of the Health Boards • Patient travel (unless it is provided by the Health Board or Trust) and • Visitor travel
National Park Authorities	<ul style="list-style-type: none"> • Office buildings and visitor centres • Warden services • Maintenance of park services 	<ul style="list-style-type: none"> • Visitor travel
Fire and Rescue Authorities	<ul style="list-style-type: none"> • Fire and rescue services • Fire control • Fire safety • Corporate services 	<ul style="list-style-type: none"> • Deliberately set fires for training purposes
Natural Resources Wales	<ul style="list-style-type: none"> • Environmental regulation (marine, forest, waste industries) • Designation of SSSIs, AONBs, National Parks, National Nature Reserves • Emergency response • Flood risk management and protection • Woodland and National Nature Reserve management • Public education advice • Official consultative and advisory functions • Research and evidence base generation • Corporate services 	
Heritage, sport and education bodies	<ul style="list-style-type: none"> • Educational, sporting and visitor facilities • Site maintenance 	
Universities	<ul style="list-style-type: none"> • Delivery of teaching • Research • Administration and other services • Consultancy activities • Owned or leased residential accommodation and hotel services 	<ul style="list-style-type: none"> • Travel by students from overseas • Campuses outside Wales

6.3.1 Dealing with leased assets

The approach to leased assets is informed by the desire to apply a consistent boundary to organisations in different sub-sectors. Therefore, if one organisation delivers a core service through its own staff and from its owned estate, whereas another organisation has leased estate to a third party who deliver this service on their behalf, the emissions resulting from the delivery of this service both need to be included in the reported emissions of each organisation. However, the methodology for calculating the emissions will depend on the data available. **Figure 2** shows a variety of circumstances of leased assets.

Figure 2: Reporting criteria for leased assets

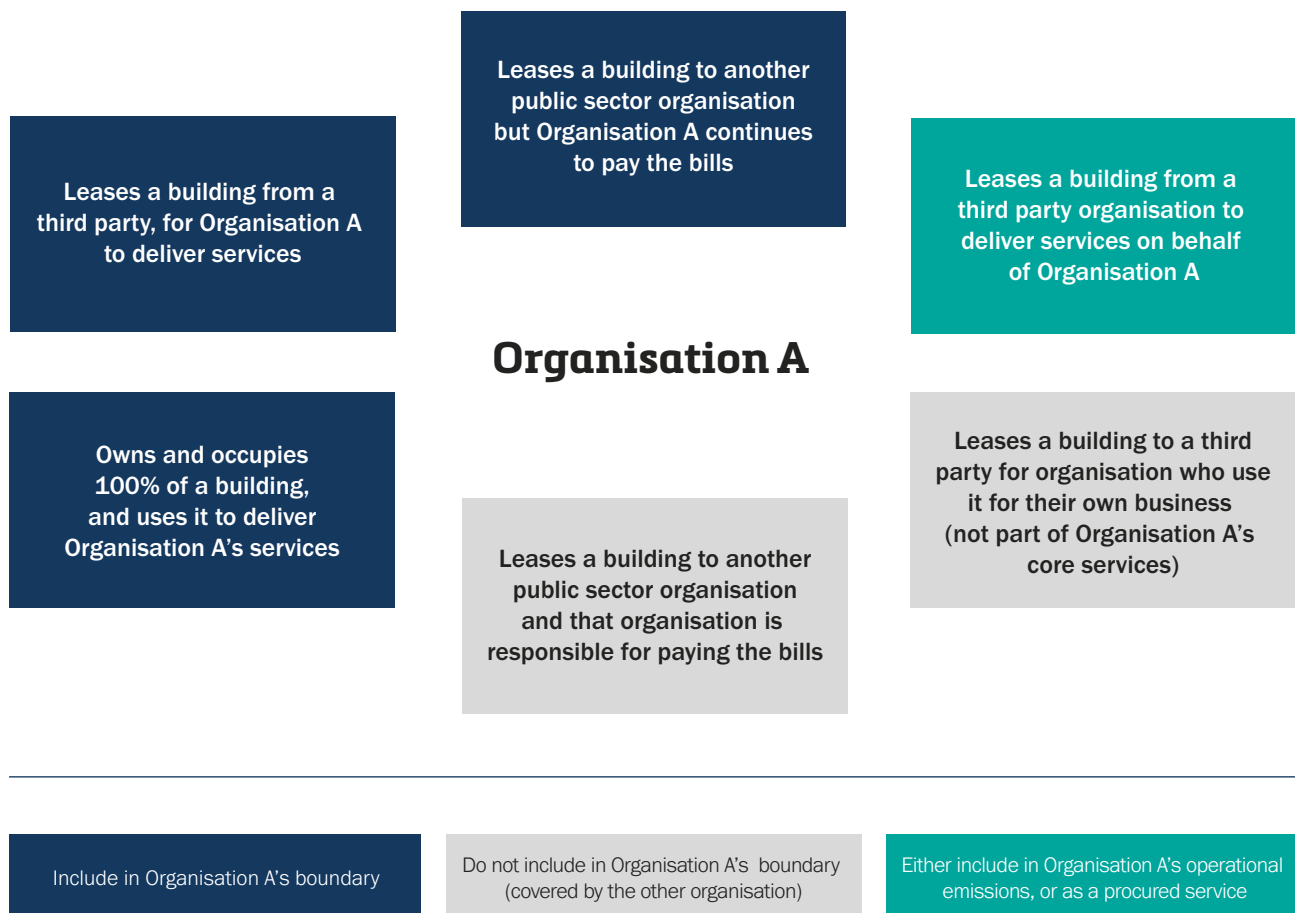


Table 7: Operational control of leased assets.

Situation	Reporting	Exceptions
Organisation as Lessee (leased by the public sector organisation)	Scope 1 & 2	Some organisations may be able to demonstrate that they do not have operational control over a leased asset held under an operating lease. In this case, the organisation may report emissions from the leased asset as scope 3 but must state clearly in its GHG inventory report the reason(s) that operational control is not perceived.
Public sector organisation as Lessor (leased to others)	Scope 3	<p>Some organisations may be able to demonstrate that they do have operational control over an asset leased to another organisation under an operating lease, especially when operational control is not perceived by the lessee. In this case, the lessor may report emissions from fuel combustion as scope 1 and emissions from the use of purchased electricity as scope 2. The lessor must clearly state in the GHG inventory report the reason(s) that operational control is perceived.</p> <p>e.g. if the public sector organisation is still paying the bills, it might be easier to class these as Scope 1 and 2 so they don't have to be separated from the rest of the billed electricity.</p>

When leased assets are vacant, or the organisation pays the bills of communal areas, these should be reported as Scope 1 and 2 emissions in the footprint. When assets are leased out, the rules about whether these should be included or not should be followed.

It is acknowledged that if the reporting organisation does not maintain operational control of a building it may be difficult to

access activity data. If data is unavailable for a leased asset, which according to criteria for reporting illustrated in **Figure 1**, should be included within the scope for reporting, then lower tier methodologies may be used to estimate emissions (see Tier 2 methodology from Section 7.1). Efforts should be made to gather the data required to report in line with the guidance.

7 Data and Methods: Estate

7.1 Buildings

The Welsh Public Sector is responsible for many buildings in a variety of arrangements - as building owner and occupier, as lessee and as lessor. This section is intended to help organisations identify the circumstances under which they should report the emissions resulting from the asset (e.g. fuel use, electricity, water use etc), and when these emissions should be excluded as they are under the operational control of another public body or third party. It is also important in drawing a consistent boundary for the public sector that, as far as possible, the emissions reported represent the functions of the public sector; so where the organisation is sub-contracting delivery of services to a third party while also leasing buildings or assets to that third party to deliver the services, that this is captured somewhere in the footprint.

Buildings are included as part of the organisational boundary if:

- › your organisation owns and occupies the building,
- › your organisation leases the building from an organisation outside the Welsh public sector,
- › your organisation owns the building and leases it to an organisation outside the Welsh public sector to deliver public sector services,
- › your organisation owns the building and leases wholly or partially to another public sector organisation, but you continue to pay the bills (you should confirm with the other organisation that you have included the building in your boundary)

Under the following circumstances, you can exclude a building from your boundary if:

- › Your organisation owns the building but leases it to an organisation outside the Welsh public sector for their own business purposes, for example farm buildings, industrial estates etc.
- › You lease the building from another public sector organisation and they have informed you that they have included the building in their boundary.

Where your organisation pays the fuel bill, specific consumption data in kWh (Tier 3), or a unit convertible to kWh should be a relatively easily available. However, two alternative calculation methods exist, based on expenditure (Tier 2) or the floor area of the building (Tier 1).

7.1.1 Fossil fuels for heating

Standard units for fossil heating fuels = kWh

Space and water heating in buildings can use a variety of different fuel types, each of which has its own characteristics. However, the general approach is to calculate the amount of fuel used, either in kWh or converted to kWh, then multiply the amount by the relevant emission factor for the fuel. All activity data in different units should be converted into kWh using an appropriate conversion factor provided in **Table 27**.

In addition, all heating fuels have indirect emissions associated with the production and transport of the fuel, which are calculated by multiplying the kWh by a Well to Tank (WTT) emission factor.

Natural gas: Natural gas is used as a fuel for boilers providing space and water heating. Consumption is usually measured in kWh but some older and/or smaller assets might have meters that measure consumption in volume based units (m³ or cubic feet).

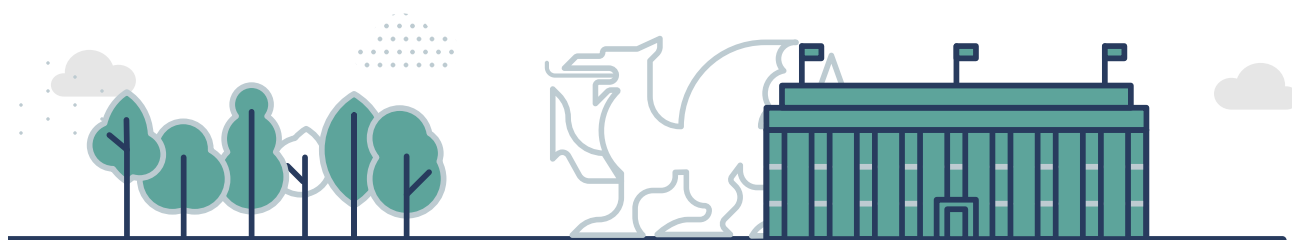
LPG, kerosene, gas oil: Areas that are off the gas grid are likely to use other heating fuels such as kerosene (also called burning oil), liquid petroleum gas (LPG) and gas oil (also known as red diesel). Generally, these fuels are purchased in bulk and stored on site in fuel tanks. Gas oil may also be used in backup generators. This can make annual accounting for consumption slightly more difficult as a large purchase just before year end will distort annual figures. You can choose to report based on either the amount of fuel used in the financial year⁹ or, more simply, fuel purchased in that financial year, whether it has been consumed or not.

Consumption is usually measured in litres or kg. You might also find units of kWh, but this is less common. You should convert into units

of kWh to allow easier comparison with energy consumption of buildings heated with natural gas.

Solid fuel: Solid fuels are used for space and water heating, in particular in areas off the gas grid. Fuels include fossil fuels and fuels derived from fossil fuels, e.g. coal and manufactured solid fuels (MSF), also known as smokeless coal (biofuels are considered in the next section). Generally, solid fuels are purchased in bulk and stored on site, either in mass storage bunkers or bags. This can make annual accounting for consumption slightly more difficult as a large purchase just before year end will distort annual figures. You can choose to report based on either the amount of fuel used in the financial year or, more simply, fuel purchased in that financial year, whether it has been consumed or not.

Purchased solid fuels are usually measured in kg or tonnes. You should convert into units of kWh to allow easier comparison with energy consumption of buildings heated with natural gas.



9. i.e. fuel purchased in this financial year minus the difference between stock held at the end of the previous year and stock held at the end of this year

Table 8: Heating fuels methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Energy unit consumption data	Convert to kWh, if required Multiply kWh by fuel specific EF to get direct emissions Multiply kWh by fuel specific WTT EF to get indirect emissions	+/- 2% if metered, +/- 5% if bulk purchase
Tier 2	Expenditure	Estimate kWh by dividing expenditure (in £) by the unit cost of fuel (in £/kWh) Multiply kWh by fuel specific EF to get direct emissions Multiply kWh by fuel specific WTT EF to get indirect emissions	+/-5%
Tier 1	Building Gross Internal Area (GIA) (m2)	Estimate kWh by multiplying the GIA in m2 by the appropriate energy benchmark for that building use type (Table 30) Multiply kWh by fuel specific EF to get direct emissions Multiply kWh by fuel specific WTT EF to get indirect emissions	+/-10%

7.1.2 Biofuels for heating

Standard units for biofuels = kWh

Bioenergy conversion factors should be used for the combustion of fuels produced from recently living sources (such as trees) at a site or in an asset under the direct control of the reporting organisation. Accounting for the emissions from bioenergy is slightly different from fossil fuels. As for all combustion processes, burning the fuel releases CO₂ but for biofuels this emission is offset by the carbon absorbed while the source plants or tree grew. The direct CO₂ emissions are assumed to be short cycle carbon and therefore are reported separately as ‘outside of scope’. Therefore, for biofuels there are three categories of emissions to be reported:

direct emissions of CH₄ and N₂O (in units of CO₂e), WTT emissions from the fuel supply chain, and the outside of scopes emissions.

Public sector organisations are most likely to be using solid biomass as heating fuels for boilers, or for combined heat and power units. It is also possible that some organisations use biogas from anaerobic digestion as a fuel. Generally, these fuels are purchased in bulk and stored on site. This can make annual accounting for consumption slightly more difficult as a large purchase just before year end will distort annual figures. You can choose to report based on either the amount of fuel used in the financial year or, more simply, fuel purchased in that financial year, whether it is has been consumed or not.

Purchased biomass is usually measured in kg or tonnes. You should convert into units of kWh to allow easier comparison with energy consumption of buildings heated with natural gas, using the conversion factors in **Table 27**.

Table 9: Biofuel methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Biomass consumption data	Convert to kWh, if required Multiply kWh by fuel specific EF to get direct emissions Multiply kWh by fuel specific WTT EF to get indirect emissions Multiply the kWh by the Outside of Scopes factor to get short cycle carbon emissions.	+/- 2%
Tier 2	Expenditure	Estimate kWh by dividing expenditure (in £) by the unit cost of fuel kWh (in £/kWh) Multiply kWh by fuel specific EF to get direct emissions Multiply kWh by fuel specific WTT EF to get indirect emissions Multiply the kWh by the Outside of Scopes factor to get short cycle carbon emissions.	+/-5%
Tier 1	Building Gross Internal Area GIA (m2)	Estimate kWh by multiplying the GIA in m2 by the appropriate energy benchmark for that building use type Multiply kWh by fuel specific EF to get direct emissions Multiply kWh by fuel specific WTT EF to get indirect emissions Multiply the kWh by the Outside of Scopes factor to get short cycle carbon emissions.	+/-10%

7.1.3 Other renewable heat

Some organisations generate heat on site from renewable sources such as solar thermal or heat pumps. Renewable heat output should be reported in kWh with a zero emission factor.

Inputs for renewable heat must be reported separately in line with the fuel used. For example, grid electricity used to drive heat pumps, should be reported under electricity use (see Section 7.1.5). This applies to all sources of renewable heat excluding solar thermal, which has no fuel input.

If you use heat generated by another organisation, you should report this as purchased heat (see Section 7.1.8).

7.1.4 Combined Heat and Power (CHP)

Some organisations generate heat and electricity on site using a CHP plant. These can be powered using a variety of fuels, including natural gas, biogas, biomass etc. From an emissions accounting perspective, you are not required to report the outputs in terms of heat and power but you should report the inputs under the appropriate fuel type. If CHP is powered using renewable fuel sources, such as biogas, the inputs should be reported as per section 7.1.2.

If you export heat or power to another organisation, you will need to determine if that organisation is reporting the emissions within the Welsh public sector, and if so, you can allocate a percentage of the input emissions to another organisation. This will prevent double counting.

7.1.5 Grid electricity

Standard units for grid electricity = kWh

Unless the building has a dedicated power supply, e.g. through an onsite generator, solar panels, etc., all of the electricity used for lighting, power and possibly heating, will be supplied through the national grid. The emissions resulting from the use of grid electricity are indirect e.g. they do not occur directly under the control of your organisation but occur as a result of generation, transmission and distribution of the electricity by a third party.

The emission factor for grid electricity varies more through time than for other fuels and must be reported using the emission factor for the year in which the electricity is consumed. This takes account of the progressive shift in UK electricity generation towards generation from renewable sources (also known as grid decarbonisation). Purchased grid electricity consumption in buildings under your organisation's control is included here, whereas onsite generation through combustion (e.g. diesel powered generator) should be accounted for under the relevant fuel type (see above).



The emission factor for electricity is in four separate parts:

1. The emissions from the generation of grid electricity includes the combustion of all the different fuels that go into the grid mix.
2. There are Well to Tank emissions from the fuel supply chain for the grid generation
3. In order to transmit electricity from the point of generation to the point of use, there is a transmission (high-voltage and distribution (substation to consumer) network; losses occur as the electricity is transmitted and these are included as a T&D emission factor
4. There are further Well to Tank emissions from the fuel supply chain for this grid transmission and distribution losses

Where your organisation pays the electricity bill, it should be a relatively simple job to get consumption data, however, two alternative methods for expenditure or floorspace have been provided below. Consumption is metered and measured in kWh.

If you purchase electricity through a green tariff, you should still account for the electricity at the average grid factor, using the method in the table below. This is because the Welsh Public Sector has agreed to use a locational based approach to accounting; all the renewable electricity in the grid is already accounted for in the average grid factor. If individual organisations account for this green electricity as zero carbon and the grid average also includes it as a zero carbon component, the benefit is being double counted.

The Welsh Government recognises the value of public sector support for the renewables market by purchasing green tariff electricity. *Prosperity for All: A Low Carbon Wales* contains a proposal that 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. You should report your organisation’s choice to purchase all or part of its electricity through a green tariff within your activity report. Further information on this is provided in section 10.

However, due to double-counting, the emission factor use will not be lower in the Welsh Net Zero guide.

If you generate renewable electricity on site, or you purchase renewable electricity from a third party through a private wire (sometimes referred to as ‘behind the meter’) see section 7.1.7.

Table 10: Grid electricity methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	kWh	Multiply kWh by current grid electricity generation EF to get indirect emissions Multiply kWh by current WTT electricity generation EF to get WTT generation emissions Multiply kWh by current grid electricity T&D EF to get indirect T&D emissions Multiply kWh by current WTT electricity T&D EF to get WTT T&D emissions	+/- 2%
Tier 2	Expenditure	Estimate kWh by dividing expenditure (in £) by the unit cost of electricity (in £/kWh) Multiply kWh by current grid electricity generation EF to get indirect emissions Multiply kWh by current WTT electricity generation EF to get WTT generation emissions Multiply kWh by current grid electricity T&D EF to get indirect T&D emissions Multiply kWh by current WTT electricity T&D EF to get WTT T&D emissions	+/-5%
Tier 1	Building Gross Internal Area GIA (m2)	Estimate kWh by multiplying the GIA in m2 by the appropriate energy benchmark for that building use type (Table 30) Multiply kWh by current grid electricity generation EF to get indirect emissions Multiply kWh by current WTT electricity generation EF to get WTT generation emissions Multiply kWh by current grid electricity T&D EF to get indirect T&D emissions Multiply kWh by current WTT electricity T&D EF to get WTT T&D emissions	+/-10%

7.1.6 Street lighting

This category is mainly relevant to Local Authorities. Some other organisations might also have external lighting, but it is unlikely to be separately metered. Street lighting can also include traffic signage and other lit street furniture, and public lighting if billed to the local authority.

The methodology for calculating the emissions from street lighting is the same as for grid electricity. However, if you have separately metered supply for street lighting and other street furniture, this should be reported as a separate line.

7.1.7 Renewable electricity

Standard units for renewable electricity = kWh

Renewable electricity technologies are being used by organisations to generate, and either consume directly, or export electricity to the grid. Many of the smaller scale technologies were supported by the Feed-in Tariff (FIT) scheme, now closed to new applicants since 1 April 2019.

The aim of carbon accounting for renewable electricity in the Welsh Public Sector is to:

1. Ensure that organisations which have invested in renewable generation consumed directly by the organisation receive the carbon benefit of generation.

This is done by applying a zero emission factor to the renewable electricity generated. Emission savings therefore occur as electricity used is zero carbon and assumed to directly displace the requirement for grid electricity, meaning the organisation's scope 2 emissions are reduced.

2. Ensure no double-counting of the benefit of renewable generation.

Double counting is likely to occur when renewable electricity is either exported directly to another organisation (either private or public) or exported to the grid. In the case of export to another organisation, if the organisation who purchases the renewable electricity also purchases the renewable certificate which allows them to claim the credit, they can report the electricity using a zero emission factor. Consequently there is no carbon credit, or 'negative emission', due to the generating organisation and it should be reported as zero.

Where your organisation generates and exports renewable electricity to the grid, it might be expected that a credit is provided back to the organisation, at the same EF as the grid. However, the decarbonisation effect of supplying renewable electricity to the grid is accounted for within the national grid emission factor. This is because once on the grid, renewable electricity is not distinguishable from non-renewable electricity. The resulting grid electricity is a mix of all primary energy sources (renewable and non-renewable) and a single emission factor that accounts for this mix is used for grid electricity. The grid emission factor decreases as more renewable sources connect to the grid, resulting in a decrease in scope 2 emissions for all grid electricity users. Applying an additional carbon benefit to the generating organisation would double count the carbon benefit of this export.

Therefore, there are relatively few scenarios where an organisation can legitimately claim a credit for generating and exporting renewable electricity. Where this does occur, the credit should be reported separately from the overall organisational gross emissions.

The conditions that need to be met before an organisation can claim a credit for generating renewable electricity or heat are:

1. All relevant fuel used to generate the electricity or heat must be fully accounted for in organisation's operational emissions.
2. Any heat or electricity consumed by your own organisation cannot be additionally credited as this generation has displaced requirement for grid electricity or heating fuel.
3. Any heat or electricity exported to a third party who claims it as renewable, with an appropriate emission factor, cannot also be credited by the generating organisation.

Therefore, to be able to claim a credit for renewable generation, you need to demonstrate that no claim of renewable origin is being made elsewhere in the system. If you cannot demonstrate this, the generation and export of renewable heat and electricity should be reported with a zero emissions factor.

The Welsh Government recognises the important role the public sector can play in delivering a range of projects to decarbonise regional energy systems. *Prosperity for All: A Low Carbon Wales* contains a policy to deliver our target of 1 GW of renewable energy capacity in Wales to be locally owned by 2030. You should document your organisation's contribution to this target within your activity report. Further information on this is provided in section 10.

In order to help the Welsh Government track the generation of renewable electricity and heat by public sector organisations, reporting on renewable generation will be required within the Welsh Net Zero reporting approach. Organisations should report the amount of renewable electricity generated per technology and, if known, how much is consumed directly and how much is exported.

As the situation with respect to renewable generation evolves over time, the carbon accounting for this generation will be updated to provide interpretation for new arrangements.



Table 11: Renewable electricity methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	kWh	Multiply kWh of renewable electricity generated by an emission factor of zero.	+/- 2%

7.1.8 Purchased heat or steam

Standard units for purchased heat or steam = kWh

If your organisation purchases heat or steam from another organisation, this should be accounted for as indirect energy emissions. There is a national emission factor for purchased heat and steam but this is an average factor based on an industry average fuel mix for combined heat and power (CHP) based heat and steam. Therefore, if a supplier-specific emission factor is available, which is based on the actual fuel mix and efficiency of the supplier’s specific infrastructure, this should be used in preference to the national factor.

If your provider is another public sector organisation, you can agree between you how the emissions are accounted for. For example if your organisation purchases only a small quantity of unmetered heat from another public sector organisation, it might make sense for the generating organisation to account for all the emissions resulting from fuel used and just make a note that some of the heat is exported to another public sector organisation.

Options for two different situations are provided below:

1. Onsite or adjacent heat and steam – where the generation of the heat and steam occurs close enough to the point of use to assume that the losses during transmission are minimal, both the onsite heat and steam and onsite heat and steam WTT emission factors should be applied.
2. District heat and steam – where generation of the heat and steam occurs at a distance and it is likely that the losses during distribution will be more significant, the district heat and steam indirect and WTT emission factors should be applied, along with the distribution loss and distribution loss WTT emission factors.



Table 12: Onsite heat and steam methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	kWh of onsite heat and steam	<p>Multiply kWh by supplier-provided generation EF calculated from fuel mix and equation set provided in the 2019 government greenhouse gas conversion factors for company reporting; methodology paper for emission factors to get indirect energy emissions.</p> <p>Multiply kWh by supplier provided WTT EF to get WTT emissions.</p>	+/- 5%
Tier 2	kWh of onsite heat and steam	<p>Multiply kWh by current industry average onsite heat and steam generation EF to get indirect energy emissions</p> <p>Multiply kWh by current WTT onsite heat and steam EF to get WTT emissions.</p>	+/- 10%

Table 13: District heat and steam methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	kWh of district heat and steam	<p>Multiply kWh by supplier-provided generation EF calculated from fuel mix and equation set provided in the 2019 government greenhouse gas conversion factors for company reporting; methodology paper for emission factors to get indirect energy emissions.</p> <p>Multiply kWh by supplier provided WTT EF to get WTT emissions</p> <p>Multiply kWh by supplier-provided T&D EF to get T&D emissions</p> <p>Multiply kWh by supplier provided WTT EF to get T&D WTT emissions</p>	+/- 5%
Tier 2	kWh of district heat and steam	<p>Multiply kWh by current industry average district heat and steam generation EF to get indirect energy emissions</p> <p>Multiply kWh by current WTT district heat and steam EF to get WTT emissions</p> <p>Multiply kWh by current distribution – district heat & steam EF to get distribution loss emissions</p> <p>Multiply kWh by current heat and steam distribution WTT EF to get WTT distribution loss emissions</p>	+/- 10%

7.1.9 Water supply and treatment

Standard units for water supply and treatment = m³

There are two parts to the footprint of water use; the supply of clean water and the treatment of wastewater. Both are considered Scope 3 emissions because they are not under the direct control of the supplied organisation. For most organisations, wastewater will not be directly metered, therefore this is estimated in relation to the supply volume. Unless better data are available (e.g. through metered treatment), organisations should assume that 95% of the supply volume goes to treatment.

Compared to electricity and natural gas, water metering is often less widespread and some

organisations will not have complete coverage of sites or access to a full year's data. It is also acknowledged that emissions from water are not usually a large proportion of emissions and therefore approximate annual data is an acceptable level of detail. Temporal or building-based gaps in the dataset can be filled by:

1. Using a mixture of Tier 3 (for sites with metering) and Tier 1 (for sites without metering)
2. Using a daily average to pro rata up to a full time series. It is recommended that in this case, the RSD is increased to reflect the increased uncertainty in the measurement.

Water use is usually measured in units of m³ or litres. You should convert into units of m³.



Table 14: Water supply and treatment methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Metered water consumption data	Convert to m ³ , if required Multiply m ³ by water supply EF to get indirect emissions from supply Multiply 95% of m ³ by water treatment EF to get indirect emissions from treatment	+/- 2%
Tier 2	Expenditure	Estimate m ³ by dividing expenditure (in £) by the unit cost of water (in £/m ³) Multiply estimated m ³ by water supply EF to get indirect emissions from supply Multiply 95% of estimated m ³ by water treatment EF to get indirect emissions from treatment	+/- 5%
Tier 1	Benchmark: staff numbers per building	Estimate m ³ by multiplying the person working days by the appropriate water benchmark (Table 32) Multiply estimated m ³ by water supply EF to get indirect emissions from supply Multiply 95% of estimated m ³ by water treatment EF to get indirect emissions from treatment	+/- 15%

Exceptions to the above methodology:

- 1. Onsite bore holes or rainwater collection system.** Where water is supplied directly from an onsite source, there is no need to account for the water supply, but the water treatment methodology should still be applied.
- 2. Onsite water treatment systems** e.g. reed beds, settlement ponds. Where water is treated directly on site and then released without requirement for further treatment, there is no need to account for the water treatment, but the water supply methodology should still be applied.

7.2 Fleet and other mobile equipment

7.2.1 Diesel, Petrol, LPG, Gas oil (red diesel)

Standard units fleet and equipment fuels = kWh

If your organisation owns or leases vehicles or equipment such as generators or lawnmowers, emissions from the consumption of fuels such as diesel, petrol or other variants. or equipment such as generators or lawnmowers, emissions need to be accounted for consumption of fuels such as diesel, petrol or other variants need to be accounted for.

Table 15: Fleet and equipment fuel uses

Fuel	Variants	Common uses	Usual units
Diesel	Blended forecourt diesel which includes up to 5% biodiesel	Cars, light goods vehicles, heavy goods vehicles	Litres
	100% mineral diesel	Generators and other plant (however, this is more likely to be gas oil)	Litres
Petrol	100% mineral diesel	Cars and some light goods vehicles	Litres
	Blended forecourt petrol which includes up to 5% bioethanol	Some plant and equipment	Litres
LPG	Proportions of butane and propane content can vary	Some vehicles and equipment	Kg
Gas oil	Also referred to as red diesel (it has a lower tax duty and therefore contains red dye for identification).	On-road vehicles such as agricultural and construction vehicles, generators and other plant and equipment. It can also be used as a heating fuel.	Litres

If your organisation has leased or owned electric vehicles that are charged onsite, these should be accounted for using the methodology for grid electricity.

There are two likely sources of data for fleet and equipment fuel use:

1. Data from fuel cards or onsite tanks/pumps
2. Data from the purchasing system.

It is worth being aware that fuel purchases collated from your organisation’s purchasing system might be coded incorrectly and if there is any doubt, it is worth checking back with departments to make sure the fuel is coded accurately.

Accounting for biofuel percentage: Bioenergy is not just a separate fuel category but is increasingly incorporated as a percentage in other fuels e.g. standard forecourt diesel and petrol contain a biofuel component. Where this is the case, the biofuel portion should also be reported Outside of Scopes.

Table 16: Fleet and equipment fuel methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Litres of fuel used	<p>Convert to kWh</p> <p>Multiply kWh by fuel specific EF to get direct emissions</p> <p>Multiply kWh by fuel specific WTT EF to get indirect emissions</p> <p>If fuel contains blended biofuel, multiply the kWh by the Outside of Scope factor to get short cycle carbon emissions.</p>	+/- 2%
Tier 2	Expenditure	<p>Estimate volume/mass units by dividing expenditure (in £) by the volume/mass unit cost of fuel (in £/unit)</p> <p>Convert to kWh</p> <p>Multiply kWh by fuel specific EF to get direct emissions</p> <p>Multiply kWh by fuel specific WTT EF to get indirect emissions</p> <p>If fuel contains blended biofuel, multiply the kWh by the Outside of Scope factor to get short cycle carbon emissions.</p>	+/- 5%
Tier 1	Equipment based	<p>Estimate volume/mass units by multiplying estimated fuel use per hour and number of hours used</p> <p>Convert to kWh</p> <p>Multiply kWh by fuel specific EF to get direct emissions</p> <p>Multiply kWh by fuel specific WTT EF to get indirect emissions</p> <p>If fuel contains blended biofuel, multiply the kWh by the Outside of Scope factor to get short cycle carbon emissions.</p>	+/- 15%

7.3 Land-based emissions and sequestration

In addition to emissions resulting from the combustion of fuels and other processes, organisations with significant land management responsibilities can also estimate the carbon balance of the land area. Different habitat types can be net sinks (absorbing atmospheric carbon and storing it in as biomass) or net sources (producing additional emissions into the atmosphere) depending on the habitat and the land management regime. The GHG Protocol Corporate Standard recognises the need for some organisations to account for sequestered atmospheric carbon to provide a complete and accurate picture of their GHG impacts. There is also an opportunity by the Welsh Public Sector to start proactively managing these resources to maximise their potential for carbon capture and storage.

It is important for the Welsh public sector to assess emissions and removals from land area because for some organisations this might make up a significant proportion of overall impact and the opportunities to reduce emissions or enhance removals would otherwise not be identified. However, for many organisations who own and directly manage very little land-based estate, this section will not be relevant. Therefore, the methodology below is preceded by a scoping exercise to identify the area of land within your organisation's boundary. For organisations with minimal or no managed land assets, this will be the end of the process. For organisations with larger areas, a simple Tier 1 methodology for assessing annual carbon sequestration is provided.

For organisations with significant land areas, and those who can demonstrate active sequestration, there is flexibility for organisation to identify and implement a more detailed and specific methodology such as

following the example in the Carbon Positive report by NRW. For woodland planting where the organisation wants to demonstrate active sequestration, the calculator in the Woodland Carbon Code is a good example of a methodology which can be used to provide documentary evidence of additional sequestered carbon and an auditable methodology for estimating these. The advantage of this methodology is that it will produce a time-specific annual sequestration rate, low to start with but ramping up as the trees grow.

Step 1 – setting a boundary for land-based emissions.

The same principles for setting the boundary for owned and leased assets should be applied to the land assets:

Land area that you own and manage

- › Where your organisation owns and manages land areas, these should be included within your boundary

Land area that you own but do not manage

- › Where your organisation leases land to a private organisation or individual and it is not used for delivering public services, for example tenant farms, it should be excluded from your boundary
- › Where your organisation leases land to a private organisation or individual but it is still used for delivering public services, it should be included within your boundary
- › Where your organisation leases land to another public sector body, the organisation responsible for management of the asset should include it within their boundary (you will need to agree this split with the other organisation)

Land area that you lease

- › Where your organisation leases land from a private organisation or individual, and it is used for delivering public services, it should be included within your boundary
- › Where your organisation leases land from another public sector body, the organisation responsible for management of the asset should include it within their boundary (you will need to agree this split with the other organisation)

Step 2 – scoping exercise for land assets

Since a number of organisations will have little or no land-based assets, while other public bodies will own or lease significant assets, an initial scoping exercise and threshold for further analysis has been set.

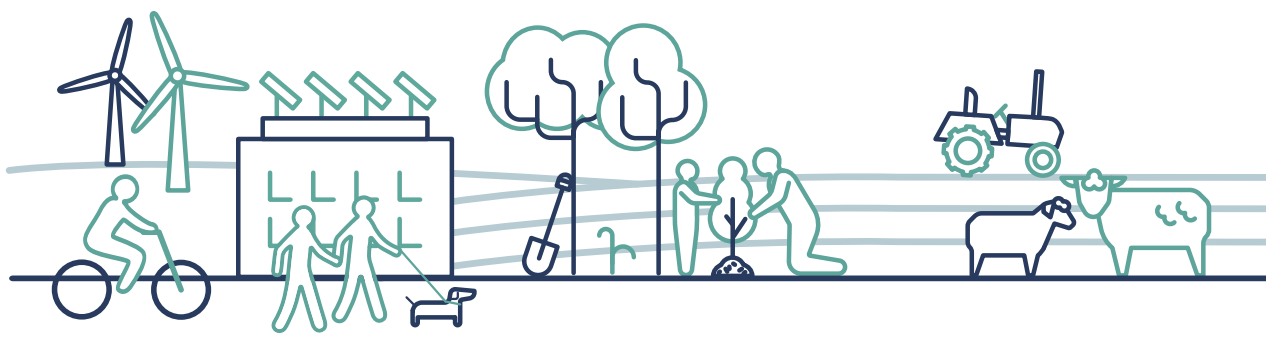
What assets does my organisation own or lease? Information could be available through:

- a. Estates Manager/Department
- b. Audited Accounts
- c. Business Plans
- d. Local Development Plan
- e. Asset Register

Land area for each of the boundary categories listed in step 1 should be entered in the Scoping table in the Land Use section of the Net Zero reporting spreadsheet. This table will give a scoping result depending on the land area entered; for organisations with no land assets, no further action is required; for organisations with minimal land assets, it is recommended that these are managed for biodiversity and recreation (see www.biodiversitywales.org.uk/)

Table 17: Land Use scoping table

Total land area in hectares (ha)	Scoping result
0	No land assets within boundary, no further action required
<10	Minimal land assets within boundary - manage for biodiversity and recreation
>10	Complete Tier 1 methodology table



Step 3 – Tier 1 methodology for Land based assets

Where organisation own or lease and manage more than 10 hectares of land, they are required to complete the Tier 1 methodology table in the Land Use section of the Net Zero reporting spreadsheet. This uses the Carbon Stock Change (CSC) factors from the most recent National Inventory Report for the UK which are applied to a list of 6 land types, described in **Table 18** below. In order to simplify the process, implied carbon stock change factors have been combined for living biomass, dead wood, litter and soils. A negative emission factor indicates that overall carbon is being removed from the atmosphere, whereas a positive emission factor indicates that the land use is likely to be producing net emissions.

Where the land type has changed category within the last 20 years, organisations are asked to enter the previous land type. Where the land type has stayed constant for over 20 years, the category can be held constant. Soil type is either classified as mineral or organic. Organic soils account for approximately 6 % of the UK's total land use area (2019 Common Reporting Format for the UK). Therefore, if the soil type is not known, it should be assumed that the soil is mineral soil. Organic soils, as defined in the IPCC (2006), are found in wetlands or have been drained and converted to other land-use types (e.g., Forest Land, Cropland, Grassland, Settlements). Organic soils are identified on the basis of criteria 1 and 2, or 1 and 3 listed below:

- › Thickness of organic horizon greater than or equal to 10 cm. A horizon of less than 20 cm must have 12 percent or more organic carbon when mixed to a depth of 20 cm.
- › Soils that are never saturated with water for more than a few days must contain more than 20 percent organic carbon by weight (i.e., about 35 percent organic matter).

- › Soils are subject to water saturation episodes and has either:
 - At least 12 percent organic carbon by weight (i.e., about 20 percent organic matter) if the soil has no clay; or
 - At least 18 percent organic carbon by weight (i.e., about 30 percent organic matter) if the soil has 60% or more clay; or
 - An intermediate, proportional amount of organic carbon for intermediate amounts of clay.

Where information on the current land type, soil type, previous land type and area (in ha) are entered into the table, a suggested emission factor will be automatically selected. If no emission factor is available it will select N/A. No emission factors have been included for Wetlands as applying the average CSC for the UK is dominated by land used for peatland extraction which only accounts for a small proportion of the UK's Wetlands.

This is a basic methodology for estimating annual carbon sequestration and emissions from land for the Public Sector in Wales. For organisations with significant land-based resources and/or additional expertise, alternative and more specific methodologies can be developed. An example of a more specific methodology can be found in the Carbon Positive report produced by NRW.

Table 18: Land use types and definitions used in the UK Inventory

Land use type	Definition*
Forest land*	<ul style="list-style-type: none"> • Minimum area of 0.1 hectares; • Minimum width of 20 metres; • Tree crown cover of at least 20 per cent, or the potential to achieve it; • Minimum height of 2 metres, or the potential to achieve it. <p>This definition includes felled areas awaiting restocking and integral open spaces up to 0.5 hectares.</p> <p>All forest areas in the UK can be regarded as managed from the point of view of regulation against deforestation and protection against fire, storms and disease. In general, forest areas are actively managed for landscape, soil protection, habitat conservation, amenity and recreation, which may or may not include active management for wood production.</p>
Cropland	<p>This category includes cropped land, including rice fields, and agro-forestry systems where the vegetation structure falls below the thresholds used for the Forest Land category.</p>
Grassland	<p>This category includes rangelands and pasture land that are not considered Cropland. It also includes systems with woody vegetation and other non-grass vegetation such as herbs and brushes that fall below the threshold values used in the Forest Land category. The category also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastoral systems, consistent with national definitions.</p>
Wetlands	<p>This category includes areas of peat extraction and land that is covered or saturated by water for all or part of the year (e.g., peatlands) and that does not fall into the Forest Land, Cropland, Grassland or Settlements categories. It includes reservoirs as a managed sub-division and natural rivers and lakes as unmanaged sub-divisions.</p>
Settlements	<p>This category includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories. This should be consistent with national definitions.</p>
Other land	<p>This category includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories. It allows the total of identified land areas to match the national area, where data are available. If data are available, countries are encouraged to classify unmanaged lands by the above land-use categories (e.g., into Unmanaged Forest Land, Unmanaged Grassland, and Unmanaged Wetlands). This will improve transparency and enhance the ability to track land-use conversions from specific types of unmanaged lands into the categories above.</p>

* The tree species covered include examples for coniferous species of spruces, pines, firs, larches, cedars, cyresses and all the major temperate and boreal broadleaf tree species. Growth rates in terms of mean annual increment (MAI) of stem volume can be represented in the range from 2 to 30 m³ per hectare per year².

The methodology for land based removals and emissions for the Welsh Public Sector is likely to be under review over the next 2 years. Development of geospatial databases such as Living Wales (a strategic plan for Earth observation in Wales) are likely to lead to improved data resolution and more accurate assessment of carbon stocks and changes, as well as opportunities for the Welsh Public Sector to work jointly to identify and implement carbon sequestration projects.

7.4 Waste generated in operations

Standard units for waste = tonnes

Waste collection deals with end of life destination of different waste streams. For all disposal routes apart from landfill, the emission factors consider only the emissions related to the transport of the waste to an energy recovery or materials reclamation facility; this is in line with GHG Protocol Guidelines. The emissions related to electricity generation from waste or recycled material production are outside the scope of public sector carbon accounting. For landfill alone, the emission factors include collection, transportation and landfill emissions ('gate to grave').

The disposal of waste generated by the organisation is a Scope 3 downstream emission for the purposes of carbon accounting. However, in order to make sure that the emissions from the disposal of waste are not being double-counted by organisations that also provide waste collection services, further explanation of the UK Government Conversion Factors for waste has been provided.

- › If your organisation produces waste from operations and this waste is collected from your premises by a third party organisation, you can follow the instructions for estimating the emissions below in Section 7.4.1
- › If your organisation produces waste from operations and also operates the collection service, you should read Section 7.4.2 below to determine how you should account for the waste disposal while avoiding double-counting

7.4.1 Summary of reporting requirements or waste

Local Authorities

Municipal waste collection and disposal, including street cleansing, and waste produced by a Local Authority's own operations, are within the scope of a local authority's organisational boundary.

If the Local authority runs the waste collection service fleet, the emissions resulting from the transport of waste to recycling, energy recovery, composting and AD are already accounted for in the fleet emissions and therefore do not need to be reported separately. However, if a portion of the waste is landfilled, the waste tonnage to landfill should be reported and the emissions calculated using the emission factors in the UK Government Conversion Factors for Company Reporting. This is because landfilling waste produces additional emissions on top of these produced by the transport of this waste. (There will be a small amount of double counting using this methodology where the transport of the landfilled waste is counted both in the organisation's fleet emissions and the landfill factor which includes both transport and disposal – this is not a significant double count).

If the Local Authority contracts out the waste collection service, they can either account for the emissions by reporting the tonnages of different waste streams and the disposal route and using the appropriate emission factors in the UK Government Conversion Factors for Company Reporting, or they can apply the supply chain emission factor for 'Waste collection, treatment and disposal services; materials recovery services' to the cost of this service. It is additionally noted that if the local authority is able to obtain fuel data for their outsourced waste collection service then they can report emissions as outlined above for Local Authorities who run the waste collection service.

Other public sector organisations

For other public sector organisations, only waste produced in their own operations should be included in their boundary and these organisations can either account for

this using the tonnage of different waste streams and the disposal route (Tier 3) or the less accurate supply chain factor (Tier 1).

7.4.2 Generated waste from operations, no waste collection

Waste can be divided up into different waste streams; for example separated paper or HDPE plastic. However, for the majority of waste streams produced by the public sector, the emission factor does not vary between waste streams. For example, the EF for recycling paper is the same as the factor for recycling municipal waste. Therefore it is recommended that unless your organisation already has disaggregated data on different waste streams and disposal routes, a simpler approach is taken to waste data.

- 1) While there are some emission factors relating to reuse, these are relatively sparse and do not include key waste streams for the public sector such as furniture. Therefore, a decision has been taken to exclude reuse emissions resulting from any transport to the next user – this should incentivise organisations to identify reuse options available for waste streams.
- 2) Total mass of source segregated material for recycling is assigned the factor for commercial and industrial waste recycling, unless it is a construction waste (which is likely to be separately listed by a different waste service provider) or batteries waste.

- 3) Where the disposal route is landfill, a decision should be taken about the average waste composition. If it contains a significant proportion of biodegradable waste, it should be classed as municipal waste to landfill, but if the waste is more similar to business waste composition, it should be classed as commercial and industrial waste to landfill, which has a lower factor.
- 4) Combustion (either energy from waste or incineration). The EF for combustion is the same for all these waste streams, so separate classification is not required.
- 5) The only waste streams that can be composted are those with a high organic content (mainly organic garden waste or organic food and drink waste). The factor for composting is the same for all these waste streams so separate classification is not required.
- 6) The only waste streams that can be anaerobically digested are those with a high organic content (mainly organic garden waste or organic food and drink waste) or the mixed municipal and commercial streams. The factor for anaerobic digestion is the same for all these waste streams so separate classification does not matter.

Data on waste disposal route and weight is likely to be sourced from your organisation’s Environmental Management Systems or through waste transfer notes.

Table 19: Waste methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Tonnes of waste by disposal route	Multiply the waste stream and waste disposal route by the appropriate EF to get indirect emissions from waste collection and disposal.	+/- 2%
Tier 2	Benchmark: staff numbers per building	Estimate tonnes by multiplying the person working days by the appropriate waste benchmark (see Section 10)	+/- 5%

7.4.3 Generated waste from operations, including collection

The UK Government Conversion Factors for Company Reporting has a set of emission factors relating to the disposal of waste. These emission factors are split by waste stream (what is in the waste) and disposal route. An example is shown in Table 20 below for Commercial and industrial waste and Organic mixed food and garden waste. Where the cell contains the text N/A, it means that the combination of the waste stream and disposal route is not possible e.g. mixed food and garden waste cannot be recycled.

Table 20: Types of waste by disposal stream

	Re-use	Recycling Open-loop	Recycling	Combustion	Composting	Landfill	Anarobic digestion
Commercial and industrial waste	N/A	N/A	21.354	21.354	N/A	99.759	10.204
Organic: mixed food and garden waste	N/A	N/A	N/A	21.354	10.204	626.959	10.204

Note: emission factors included in this table are from 2017 and are used for demonstrative purposes only. The most up to date emission factors should be sourced for reporting purposes.

However, the emission factors for waste disposal only represent a small part of the total material production cycle; from the point of waste collection to the point of either disposal in landfill or handing over to a re-processor. Therefore, for the majority of these disposal routes, the emission factor only represents the transport of waste from collection to a reprocessing centre. The estimated distances and vehicle type is modelled on UK average data. For waste to landfill, where neither the material nor the energy content is returned to the system, additional emissions from the decomposition of the waste are added to the emission factor.

Therefore, for Local Authorities who provide waste collection services and have already captures captured the fuel use in their fleet

as direct emissions, there is no need to also account for the emissions of the waste disposal, except in the case of waste to landfill.

In this case, it is recommended that your organisation reports waste data quantities produced from your own operations but does not apply an emission factor to these disposal routes where the transport is accounted for in the fleet emissions. The exception should be waste to landfill where the appropriate emission factor should be applied – there will be a small amount of double counting that occurs for these landfill factors which also contain the transport as well as the decomposition emissions. Notes should be entered into the methodology column to explain the rationale.

8 Data and Methods: Supply Chain

8.1 Procurement

Standard units for procurement = £ expenditure on different categories

The role of public procurement in fostering more sustainable growth is covered in the Sustainable Development Goals (SDG 12.7). No occasion should be missed to guide public procurement expenditure towards efficient low-carbon choices in products, services and public works. Supply chain emissions associated with the procurement of goods and services are categorised as indirect Scope 3 emissions. This includes all upstream emissions from the extraction, production and transportation of goods and services used by the organisation in the reporting year.

For organisations which report procurement data to Atamis¹⁰, outputs from this system may be used in reporting in place of the methodology described below. The equivalent output from Atamis is 'Total CO₂ Emission (Tonnes)' from Category 1.



There are a variety of methodologies for estimating Scope 3 emissions resulting from the supply chain of goods and services. These differ in terms of how specific the approach is to individual suppliers or categories of purchase, with the most specific involving the collation of GHG data for individual goods and services directly from suppliers. Secondary

methods are non-supplier specific and rely on industry average emissions per £ spend on different categories.

In the absence of freely available calculated product footprints for the majority of goods and services, the spend-based approach is the recommended Tier 2 methodology to be used for estimating supply chain emissions.

The recommended supply chain emission factors given in **Section 9.3** are based on a model of the economy, known as the input-output model, which describes in monetary terms how the goods and services produced by different sectors of the economy are used by other sectors to produce their own output. These monetary accounts have been linked to information about the greenhouse gas emissions of different sectors of the economy. By using the input-output model, the industrial emissions have been attributed to final products bought by consumers. The result is an estimate of the total upstream emissions associated with the supply of a particular product group. The categories are based upon the Standard Industrial Classification (SIC)¹¹ used in classifying business establishments and other statistical units by the type of economic activity in which they are engaged.

The supply chain emission factors are expressed on a purchasers' price basis in real terms (i.e. the actual sales price in that year including taxes (VAT) on products and distribution margins). These factors can only be used to produce indicative estimates of the emissions relating to the production of goods and services purchased by your organisation. They represent the average emissions relating to each product group, and the emission factors relating to actual products within the group may be quite different. As a result, estimates will not reflect any efforts made to

10. <https://www.atamis.co.uk/>

11. Office for National Statistics, 2007

reduce emissions through efficiencies in the supply chain e.g. through choosing an energy efficient supplier or working with suppliers to reduce material use. This accounting method does not therefore lend itself to setting targets and measuring emission reduction efforts.

Emission factors for the supply chain are detailed in **Table 29**. It should be noted that calculation of these supply chain spend emission factors was discontinued 2011 and therefore factors will be highly uncertain due to subsequent changes to the structure and emissions intensity of the supply chain. If these factors are updated or another appropriate source of more up to date factors are made available, the recommended methodology will be updated.

In order to avoid double counting by the Welsh Public Sector with other parts of the calculated carbon footprint, **Table 21** contains details of the SIC codes where some sub-categories of spend might need to be removed.

Table 21: Supply chain emission factors for spending on products: kgCO₂e per £

SIC code	Product category	Potential for double-counting
05	Coal, lignite, peat	If you have calculated both the direct and indirect WTT emissions from your organisation's use of fuels, expenditure on these categories should be excluded.
06 & 07	Crude petroleum and natural gas & Metal ores	
19	Coke and refined petroleum products	
35.2-3	Gas distribution	
35.1	Electricity, transmission and distribution	If you have calculated the indirect and WTT emissions from your organisation's electricity generation and T&D losses, expenditure on these categories should be excluded.
36	Natural water; water treatment and supply services	If you have calculated the indirect emissions from your organisation's water supply and water treatment, expenditure on these categories should be excluded.
37	Sewerage services; sewage sludge	
38	Waste collection, treatment and disposal services; materials recovery services	If you have calculated the indirect emissions from your organisation's waste disposal, expenditure on this category should not be included.
49.1-2	Railway transport	These factors relate to transport services for hire or reward (including public transport services), not to emissions from vehicles owned by your organisation (for which estimates of actual fuel use should be used). If you have calculated the indirect and WTT emissions from your organisation's business travel and/or service travel, expenditure on this category should not be included.
49.3-5	Road transport	
50	Water transport	
51	Air transport	

The GHG protocol for company reporting (supplementary guidance on Corporate Value Chain (Scope 3) Accounting and Reporting Standard) splits organisational spend into:

- › **Category 1 - Purchased goods and services**
- › **Category 2 - Capital goods**

In certain cases, there may be ambiguity over whether a purchased product is a capital good (to be reported in Category 2) or a purchased good (to be reported in Category 1). Organisations should follow their own financial accounting procedures to determine whether to account for a purchased product as a capital good in this Category 2 or as a purchased good or service in Category 1.

To prepare the data for applying spend based emission factors that are based on SIC codes, it is likely that there will need to be allocation of spend into these categories. While effort should be made to be consistent about this process, there will always be some uncertainty about the allocation. Reasoning for allocations should be clearly documented.

Table 22: Procurement of capital goods and goods and services

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 1	£ spent by the organisation	Allocate expenditure against SIC codes Multiply £ by the SIC code EF	+/-25%

8.2 Employee Travel

Standard units for business travel = vehicle or passenger km

Emissions associated with business travel in vehicles not owned, operated or leased by your organisation are classed as indirect emissions. This includes travel via employee-owned vehicles for business purposes, hire cars and public transport. Employee commuting is also covered within this section.

8.2.1 Business travel by Private car (grey fleet)

Use of private cars for business purposes is usually captured by your organisation’s expenses system. It is important to check that business mileage is coded consistently and that the expenses system captures all the mileage. The recommended RSD for this data reflects the possible under (or over) reporting of business mileage by staff.

Table 23: Private car (grey fleet) methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Private car expense claims by engine size and fuel	Divide claimed expenses (in £) by standard mileage claim rates (in £ per mile) as set out by HMRC to estimate distance in miles Convert miles to kilometres Multiply kilometres by the EF for the appropriate engine size and fuel	+/- 5%
Tier 2	Private car expense claims for all vehicles	Divide expenses (in £) by standard mileage claim rates (in £ per mile) as set out by HMRC to estimate distance in miles Convert miles to kilometres Multiply kilometres by the EF for average car by fuel (if known) or average car, unknown fuel.	+/- 10%

8.2.2 Business travel using hire vehicles

Information on hire car usage is likely to be held in a different location from expense claims. It might be included as a coded item in the expenses system if staff book hire cars directly and reclaim the cost, or if it is centrally booked, it might appear as spend categorised vehicle hire (or similar) in your organisation's finance system.

Table 24: Hire car methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Hire car cost by engine size and fuel	Divide cost (in £) by average hire cost rates (in £ per mile) Convert miles to kilometres Multiply kilometres by the EF for the appropriate engine size and fuel	+/- 5%
Tier 2	Hire car cost for all vehicles	Divide cost (in £) by average hire cost rates (in £ per mile) Convert miles to kilometres Multiply kilometres by the EF for average car by fuel (if known) or average car, unknown fuel.	+/- 10%

8.2.3 Business travel using public transport

Information about your organisation's public transport (which for the purpose of this reporting can include rail, bus, tram, taxi, air and ferry) for business purposes might be sourced from the expenses system, if staff pay directly for travel and then are reimbursed, or might be provided from the finance system or a travel provider. There could be multiple internal systems that capture expenditure on public transport.

Public transport emission factors are provided in units of passenger kilometres, which represent the emissions allocated to a single passenger in a shared travel mode. In some cases, you will be provided with estimated distance as well as cost of journey. In this case, you can work out a local £/mode km to estimate remaining costs that do not have distance data. If no distance data are available to estimate £/mode km, the benchmark data in **section 9.7** can be used.

In addition to this, it is likely that the coding system for public transport, whether by expenses or finance system, will contain some inaccurately coded items; for example tram travel might be coded as bus travel. In terms of the overall footprint, it is unlikely that further attempt to assign accurate codes will be of benefit, as the impact on the overall footprint is likely to be very low.

Air travel: if possible air travel data should be collected and split by both distance e.g. domestic, short haul, long haul and international, and by class e.g. standard class or business class. Appropriate factors for these difference categories are available.



Table 25: Public transport methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Distance in km or other unit by transport mode	Multiply km by the EF for that mode to get indirect emissions Multiply km by the WTT EF for that mode to get emissions	+/- 5%
Tier 2	Cost through expenses or through finance by transport mode	Estimate a local £/transport mode km or use the benchmark public travel £/km Divide total modal cost in £ by £/km to get an estimate of passenger km travelled Multiply km by the EF for that mode to get indirect emissions Multiply km by the WTT EF for that mode to get indirect emissions	+/- 10%

8.2.4 Service travel

Public Sector organisations are likely to manage travel under some circumstances for those accessing their services e.g. taxi for school pupils. These are not considered to be business travel as it does not include the transport of employees for business purposes.

These emissions should be accounted for if the emissions are under direct control of the organisation, but methodology will differ according to the situations outlined below:

- › If the vehicles are owned, or if the organisation has an operating lease, the vehicles should be considered part of the organisations fleet, the fuel consumption of the vehicles should be accounted for as outlined in **Section 7.2.1**
- › If the organisation contracts service travel to a third party they should be accounted as a subset of goods and services as outlined in **Section 8.1**.

8.2.5 Employee commuting

Commuting is travel to and from an employee’s residence to place of work. Although, there are aspects of these journeys that are not under the full control of organisations e.g. the mode of transport and the commuting distance, organisations can influence it by:

- › Availability of facilities promoting active travel such as secure bicycle parking facilities, showers and lockers
- › Reducing availability of facilities promoting private travel such as employee parking
- › Introducing working practices such as location flexibility so that employees can chose to work in an office closer to their residence

Therefore, during the stakeholder workshop, the Welsh Public Sector made a collective decision to include employee commuting in the Net Zero reporting boundary. It should be noted that this includes:

- › Employed staff travelling from their own residence to their place to work (and not travel that would be reimbursed and counted as business travel)

It does not include:

- › Commuting by service users such as students or patients
- › Commuting by sub-contractors which would be captured under **Section 8.1** Procurement of goods and services.

The data for estimating emissions resulting from commuting is likely to be infrequently collected and potentially to suffer from sampling bias. Therefore the uncertainty bands proposed are quite wide.

Information about commuting distance and mode are most likely to be available from a travel survey of staff. If no travel survey has been undertaken or the survey is a number of years out of date, organisations will need set up a system to collect this data. In the absence of actual information from staff, it is possible to use average distance and mode (See Table 35).

Employee commuting distance should be measured in units of vehicle kilometres or passenger kilometres. Snapshot samples of a week or a month can be scaled up using a standard number of working days in a year.

Table 26: Employee commuting methodology

Methodology level accuracy	Activity data	Methodology	Recommended RSD
Tier 3	Travel survey commuting distance in km by transport mode, multiplied by staff numbers and pro-rated for average working year	Multiply km by the EF for that mode to get indirect emissions Multiply km by the WTT EF for that mode to get WTT emissions	+/- 10%
Tier 1	Average LA commuting distance by mode, multiplied by staff numbers and pro-rated for average working year	Multiply km by the EF for that mode to get indirect emissions Multiply km by the WTT EF for that mode to get WTT emissions	+/- 25%

9 Useful data sources

This section contains useful data sources, or an explanation of where to find the most up to date source, where these are revised on an annual basis.

9.1 Conversion factors to standard units

Table 27 contains conversion factors from common starting units to standard units required for reporting. These are derived from the UK Government GHG Conversion Factors for Company Reporting¹². All fuel values are Gross CV where relevant.

Table 27: Conversion factors to get to standard units

Category	Specific fuel type	Starting unit	Convert to standard unit	Conversion factor (multiply by)
Fuel	Natural gas	m ³	kWh	11.05
Fuel	Gas oil	Litre	kWh	10.74
Fuel	Gas oil	kg	kWh	12.58
Fuel	Diesel (100% mineral)	Litre	kWh	10.63
Fuel	Diesel (average biofuel blend)	Litre	kWh	10.60
Fuel	Petrol (100% mineral)	Litre	kWh	9.61
Fuel	Petrol (average biofuel blend)	Litre	kWh	9.44
Fuel	Burning oil	Litre	kWh	10.30
Fuel	Burning oil	kg	kWh	12.83
Fuel	LPG	Litre	kWh	7.10
Fuel	LPG	kg	kWh	13.69
Fuel	Coal	Tonnes	kWh	7,430
Biofuel	Wood pellets	Tonnes	kWh	5,080
Biofuel	Wood chips	Tonnes	kWh	4,100
Volume	None specific	Cubic feet	litre	0.028
Volume	None specific	Gallon (imperial)	litre	4.546
Volume	None specific	Mega litre (ML)	m ³	1,000
Volume	None specific	Litre	m ³	1,000
Distance	None specific	Mile	Kilometre	1.609
Mass	None specific	kg	Tonnes	0.001
Area	None specific	Acres	Hectares	0.405
Distance	None specific	Mile	Kilometre	1.609

12. UK Government GHG Conversion Factors for Company Reporting. Available at: www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

9.2 Emission factors

The main source of emission factors for GHG emissions reporting in the UK is the annually produced UK Government GHG Conversion Factors for Company Reporting. These can be found at:

www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

These are generally published in June each year and contain factors for fossil fuels, biofuels, grid electricity, waste, water and transport. Given the public sector is reporting for each financial year, the factors from the calendar year in which the greatest proportion of the data falls should be applied (for example, the 2020 factors should be applied to data reporting year 01/04/20 – 31/03/21, the 2019 factors should be applied to data in reporting year 01/04/19 – 31/03/20). The full set of factors is very large so **Table 28** contains worksheet locations for all the emission sources in this guide.

Note: WTT factors are only available in the full dataset of emission factors.

Table 28: Location of emission factors from the UK Government GHG Conversion Factors for Company Reporting

Type	Standard unit	Name of worksheet tab in UK Government GHG Conversion Factors for Company Reporting				Notes
		Direct (kg CO ₂ e)	Indirect (kg CO ₂ e)	Indirect WTT (kg CO ₂ e)	Outside of scopes (kg CO ₂ e)	
Fuels	kWh	Fuels		WTT- fuels	Outside of scopes	Use gross CV figure
Electricity generation	kWh		UK electricity	WTT – UK & overseas elec		Use generation figures
Electricity transmission and distribution (T&D)	kWh		Transmission and distribution	WTT – UK & overseas elec		Use T&D figures
Onsite heat and steam	kWh		Heat and steam	WTT – heat and steam		Use these factors for onsite or adjacent suppliers
District heat and steam	kWh		Heat and steam	WTT – heat and steam		Use these factors if the heat and steam are being supplied through a longer network

Type	Standard unit	Name of worksheet tab in UK Government GHG Conversion Factors for Company Reporting				Notes
		Direct (kg CO ₂ e)	Indirect (kg CO ₂ e)	Indirect WTT (kg CO ₂ e)	Outside of scopes (kg CO ₂ e)	
District heat and steam transmission and distribution	kWh		Transmission and distribution	WTT – heat and steam		
Water supply	m ³		Water supply			
Water treatment	m ³		Water treatment			
Waste	tonnes		Waste disposal			Select waste stream and disposal route
Air travel	Passenger km		Business travel- air	WTT – business travel – air		Use figure with radiative forcing (RF). If possible, split by class, otherwise use average passenger figures
Ferry travel	Foot passenger km or car passenger km		Business travel- sea	WTT – business travel – sea		
Private car/ hire car	km		Business travel- land	WTT – business travel-land		
Bus/tram/ taxi etc.	Passenger km		Business travel- land	WTT – business travel – land		

9.3 Supply Chain Emission Factors

UK Government published emission factors related to UK consumption including factors for indirect emissions from the supply chain¹³. These provide values to estimate kgCO₂e per £ spent across the supply chain, categorised into SIC codes (2007).

Table 29: UK Government factors for indirect emissions from the supply chain

SIC code (SIC 2007)	Product category	CO ₂ e/£2011
01	Agriculture products ²	3.10
02	Forestry products	0.75
03	Fish products ²	0.93
05	Coal, lignite, peat ³	2.97
06 & 07	Crude petroleum and natural gas & Metal ores	0.66
08	Other mining and quarrying products	0.81
09	Mining support services	0.24
10.1	Preserved meat and meat products	1.40
10.2-3	Processed and preserved fish, crustaceans, molluscs, fruit and vegetables	0.97
10.4	Vegetable and animal oils and fats	0.99
10.5	Dairy products	1.82
10.6	Grain mill products, starches and starch products	1.33
10.7	Bakery and farinaceous products	0.78
10.8	Other food products	0.96
10.9	Prepared animal feeds	1.27
11.01-6	Alcoholic beverages	0.74
11.07	Soft drinks	0.60
12	Tobacco products	0.56
13	Textiles	0.96
14	Wearing apparel	0.68
15	Leather products	0.54
16	Wood and wood products	1.02
17	Paper and paper products	1.18
18	Printing and recording services	0.58
19	Coke and refined petroleum products	1.69
20A	Industrial gases, inorganics and fertilisers (all inorganic chemicals) - 20.11/13/15	0.72

13. <https://www.gov.uk/government/statistics/uks-carbon-footprint>

SIC code (SIC 2007)	Product category	CO ₂ e/£2011
20B	Petrochemicals - 20.14/16/17/60	0.69
20C	Dyestuffs, agro-chemicals - 20.12/20	1.02
20.3	Paints, varnishes and similar coatings, printing ink and mastics	1.66
20.4	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	1.44
20.5	Other chemical products	1.57
21	Basic pharmaceutical products and pharmaceutical preparations	0.35
22	Rubber and plastic products	0.96
23 OTHER	Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products - 23.1-4/7-9	2.19
23.5-6	Manufacture of cement, lime, plaster and articles of concrete, cement and plaster	1.27
24.1-3	Basic iron and steel	2.59
24.4-5	Other basic metals and casting	1.56
25 OTHER	Fabricated metal products, excl. machinery and equipment and weapons & ammunition - 25.1-3/25.5-9	0.57
25.4	Weapons and ammunition	0.68
26	Computer, electronic and optical products	0.41
27	Electrical equipment	0.62
28	Machinery and equipment n.e.c.	0.56
29	Motor vehicles, trailers and semi-trailers	0.62
30.1	Ships and boats	0.76
30.3	Air and spacecraft and related machinery	0.59
30 OTHER	Other transport equipment - 30.2/4/9	0.49
31	Furniture	0.64
32	Other manufactured goods	0.45
33.15	Repair and maintenance of ships and boats	0.69
33.16	Repair and maintenance of aircraft and spacecraft	0.56
33 OTHER	Rest of repair; Installation - 33.11-14/17/19/20	0.41
35.1	Electricity, transmission and distribution	3.62
35.2-3	Gas distribution	2.01
36	Natural water; water treatment and supply services	0.57
37	Sewerage services; sewage sludge	0.81

SIC code (SIC 2007)	Product category	CO ₂ e/ £2011
38	Waste collection, treatment and disposal services; materials recovery services	1.36
39	Remediation services and other waste management services	0.27
41-43	Construction	0.37
45	Wholesale and retail trade and repair services of motor vehicles and motorcycles	0.30
46	Wholesale trade services, except of motor vehicles and motorcycles	0.35
47	Retail trade services, except of motor vehicles and motorcycles	0.31
49.1-2	Railway transport	0.56
49.3-5	Road transport	0.78
50	Water transport	1.90
51	Air transport	3.00
52	Warehousing and support services for transportation	0.28
53	Postal and courier services	0.35
55	Accommodation services	0.45
56	Food and beverage serving services	0.40
58	Publishing services	0.23
59-60	Motion picture, video and TV programme production services, sound recording & music publishing & programming and broadcasting services	0.22
61	Telecommunications services	0.32
62	Computer programming, consultancy and related services	0.18
63	Information services	0.18
64	Financial services, except insurance and pension funding	0.15
65.1-3	Insurance, reinsurance and pension funding services, except compulsory social security & Pensions	0.18
66	Services auxiliary to financial services and insurance services	0.15
68.1-2	Real estate services, excluding on a fee or contract basis and imputed rent	0.13
68.2 IMP	Owner-Occupiers' Housing Services	0.11
68.3	Real estate services on a fee or contract basis	0.09
69.1	Legal services	0.10
69.2	Accounting, bookkeeping and auditing services; tax consulting services	0.12
70	Services of head offices; management consulting services	0.17

SIC code (SIC 2007)	Product category	CO ₂ e/£2011
71	Architectural and engineering services; technical testing and analysis services	0.18
72	Scientific research and development services	0.24
73	Advertising and market research services	0.20
74	Other professional, scientific and technical services	0.16
75	Veterinary services	0.20
77	Rental and leasing services	0.23
78	Employment services	0.14
79	Travel agency, tour operator and other reservation services and related services	0.16
80	Security and investigation services	0.24
81	Services to buildings and landscape	0.25
82	Office administrative, office support and other business support services	0.18
84	Public administration and defence services; compulsory social security services	0.27
85	Education services	0.17
86	Human health services	0.25
87-88	Social care services	0.29
90	Creative, arts and entertainment services	0.24
91	Libraries, archives, museums and other cultural services	0.25
92	Gambling and betting services	0.17
93	Sports services and amusement and recreation services	0.29
94	Services furnished by membership organisations	0.15
95	Repair services of computers and personal and household goods	0.22
96	Other personal services	0.27
97	Services of households as employers of domestic personnel	0.04

9.4 Energy use in building benchmarks

The source of building energy benchmarks is a publication by the Chartered Institution of Building Services Engineers (Energy benchmarks, CIBSE TM46: 2008¹⁴). Organisations are free to use alternative sources of benchmark energy data but any data sources should be carefully documented, along with rationale for selection. Further description of the assumptions of space usage, operational schedule and other information is available in the full document.

14. www.metrocommercial.co.uk/images/resources/CIBSE_TM46_Energy%20Benchmarks.pdf

Table 30: Building based benchmarks

Name	Description	Electricity typical benchmark (kWh/m ²)	Fossil-thermal typical benchmark (kWh/m ²)
General office	General office and commercial working areas	95	120
Cultural activities	Museum, art gallery or other public building with normal occupancy	70	200
Swimming pool centre	Swimming pool hall, changing and ancillaries	245	1130
Fitness and health centre	Fitness centre	160	440
Dry sports and leisure facility	Dry sports and leisure facility	95	330
Covered car park	Car park with roof and side walls	20	0
Public buildings with light usage	Light use public and institutional buildings	20	105
Schools and seasonal public buildings	Public buildings nominally used for part of the year	40	150
University campus	University campus	80	240
Clinic	Health centres, clinics and surgeries	70	200
Hospital (clinical and research)	Clinical and research hospital	90	420
Long term residential	Long term residential accommodation	65	420
General accommodation	General accommodation	60	300
Emergency services	Emergency services	70	390
Laboratory or operating theatre	Laboratory or operating theatre	160	160
Public waiting or circulation	Bus or train station, shopping centre mall	30	120
Terminal	Regional transport terminal with concourse	75	200
Workshop	Workshop or open working area (not office)	35	180
Storage facility	Storage warehouse or depot	35	160
Cold storage	Refrigerated warehouse	145	80

9.5 Waste density table

Where your organisation has information on the estimated volume of waste collected rather than the weight, the following density factors can be used to estimate the weight.

Table 31: Density factors for waste

EWC code	Waste type	Density conversion factor (kg per litre)
20 01 01	paper and cardboard	0.2105
20 01 02	glass	0.3332
20 01 08	biodegradable kitchen and canteen waste	0.2
20 01 10	clothes	0.2
20 01 21*	fluorescent tubes and other mercury-containing waste	0.1886
20 01 23*	discarded equipment containing chlorofluorocarbons	0.3037
20 01 36	discarded electrical and electronic equipment other than those mentioned in 20 01 21, 20 01 23 and 20 01 35	0.2131
20 01 34	batteries and accumulators other than those mentioned in 20 01 33	1.35
20 01 38	wood other than that mentioned in 20 01 37	0.1855
20 01 39	plastics	0.14
20 01 40	metals	0.23
20 02 01	biodegradable waste	0.38
20 03 07	bulky waste	0.86
20 03 01	mixed municipal waste	0.26

9.6 Water use and waste benchmarks

The source of building water benchmarks is a publication by the Better Buildings Partnership (2017 Real Estate Environmental Benchmarks: January 2018¹⁵). Organisations are free to use alternative sources of benchmark water data but any data sources should be carefully documented, along with rationale for selection.

Table 32: Water use benchmarks

Name	Good practice benchmark (m ³ /person/working day)	Typical practice benchmark (m ³ /person/working day)
Offices	24	36

Waste benchmarks have been taken from WRAP (Waste & Resources Action Programme) Green Office: A Guide to Running a More Cost-effective and Environmentally Sustainable Office¹⁶.

Table 33: Waste benchmarks

Name	Good practice benchmark (quantity per person per year)
Offices	Less than 200kg

15. www.betterbuildingspartnership.co.uk/sites/default/files/media/attachment/REEB%20Benchmarking%202017_0.pdf

16. https://www.wrap.org.uk/sites/files/wrap/WRAP_Green_Office_Guide.pdf

9.7 Public transport £/passenger km benchmarks

Where only data on total cost by travel mode is available, and in the absence of any more accurate local estimates, the following estimates of £/passenger km can be used to estimate kilometres travelled from spend.

Table 34: Public transport £ benchmarks

Travel mode	£/passenger km	Source
Rail	0.153	Table 12.10 Revenue per passenger kilometre and revenue per passenger journey. Office of Rail and Road. UK Government
Bus	0.13	WRC estimation from Department for Transport and National Statistics – Table BUS0304. https://www.gov.uk/government/statistical-data-sets/buses-statistical-tables-index
Taxi	£1.90	https://www.walesonline.co.uk/news/wales-news/dragon-taxis-cardiff-cost-fares-17767633
Air	-	http://www.webflyer.com/travel/mileage_calculator/ Calculate distance travelled for each of the journeys taken. Option to choose top ten frequent trips and work out an average £/passenger km to apply to remainder.

9.8 Commuting Benchmarks

The average commuting distance in Wales is 9.5 miles/ 15.3 km and the modal split is shown in the table below. Data source: ‘The Car and the Commute: The journey to work in England and Wales’ report by the RAC Foundation¹⁷.

Table 35: Commuting assumptions

Travel mode	% split
Car	64%
Car passenger	6.6%
Taxi/ mini cab	0.4%
Walking	9.5%
Moped/ Motorbike	0.6%
Bus	4.5%
Rail	1.9%
Cycling	1.4%
Work from home	10.4%
Other	0.5%

17 https://www.racfoundation.org/assets/rac_foundation/content/downloadables/car-and-the-commute-web-version.pdf

10 Additional reporting of renewable energy deployment

The Welsh Government supports the Welsh Sector's leadership role in the governance, planning and delivery of regional and local energy plans.

10.1 Avoided emissions

Public Bodies' deployment of renewable electricity projects contribute to a system-wide reduction in greenhouse gas emissions. The Welsh Net Zero reporting approach does not include data on these deployments within the calculation of net zero carbon status, to ensure consistency with internationally recognised protocols and to avoid double-counting. However, we advocate Public Bodies reporting these beneficial activities as additional information, and to **estimate the avoided emissions resulting from them**.

The activities which can be reported within scope of avoided emissions are listed below. These should be reported for developments for which the Public Body has been responsible for developing and delivering and not for investments in schemes which are already generating renewable electricity.

- › excess from integrated renewables which is exported to the grid;
- › stand-alone renewables exported to the grid; and
- › stand-alone renewables sold to any other party e.g. through a Power Purchase Agreement or private wire.

Activity data	Methodology
kWh	Multiply kWh of renewable electricity generated by current grid electricity generation EF.

The same principle can be applied to the generation of renewable heat. However, in order to calculate the avoided emissions there must first be an assessment of the alternative heat source being replaced. For example, the recipient of the heat may otherwise have been combusting natural gas. On the other hand, they may have used electricity (which has a lower EF), coal or oil (which have higher EFs). Once the alternative source has been determined, the emissions factor for that heat source can be applied. If providing heat to more than one user, the alternative source may vary between recipients.

10.2 Local ownership

The Welsh Government has a target of 1 Gigawatt of renewable electricity and heat capacity in Wales to be locally owned by 2030. Public Bodies are encouraged to report their contribution to this target alongside their net zero report. This report may include the deployment of renewables for the Public Body's own use, its contribution to avoided emissions through developing projects and supplying renewable electricity to others, and ownership in pre-existing projects.

For each scheme or development, the following information should be reported:

- › Name of scheme
- › Category e.g. solar PV, onshore wind
- › Total capacity e.g. MW, kW
- › Type of Ownership e.g. sole ownership & operation; partnership with other Public Body/Bodies; partnership with private sector; partnership with the community
- › Percentage of scheme owned (%)
- › Total generation from scheme in reporting period – MWh, kWh
- › Total generation owned by Public Body i.e. percentage owned x total generation
- › Financial benefits i.e. income generated for local use
- › Wider benefits secured by public sector investment in the scheme

10.3 Purchase of renewable tariff electricity

By purchasing renewable electricity, Welsh Public Bodies are creating a market for Welsh renewables. All customers purchasing electricity through the National Procurement Service are on a renewable tariff and are provided with Renewable Energy Guarantees of Origin (REGO) certificates. However, it is not mandatory for Public Bodies to purchase through this channel.

We would encourage you to report on the use of renewable electricity tariffs. You should include data on the amount of electricity purchased through a renewable tariff, the amount of renewable electricity purchased for which you have the REGOs, and the amount purchased through other standard tariffs.

11 Proposed reporting format

While it is anticipated that the reporting format will evolve as the Welsh reporting approach is developed, this section provides an outline content and layout for the information that should be provided. Table 36 details the organisational information that should be reported.

Table 36: Organisational information for reporting

Organisational information	Example
Name of organisation	
Financial year period for reporting	e.g. April 2020 to March 2021
Date of report	June 2021
Audit process	Data and calculations reviewed by Organisation X
Description of the operational boundary	This can be a written description or a diagram
Description of the organisational boundary	This can be a written description or a diagram

There is information that your organisation needs to capture for the purpose of auditing and record keeping but not all this information needs to be reported externally. Table 37 shows the internal data requirements versus external reporting and Table 38 provides a suggested format for external reporting. The number of rows will vary between organisations depending on the number of emissions sources and the number of different methodology tiers required for each emission source. You should use one row per methodology tier and emission source – an example is given for natural gas in the top two rows.

Table 37: Internal data versus external reporting

Internal data	External data
Raw datasets.	Not required
Methodology statement, detailing who in the organisation supplied the different datasets, any processing of the data that was undertaken and conversion factors used to standardise units.	Not required
Record of emission factors, including the source, used to convert activity data to emissions.	Not required
Estimated uncertainty using RSD %; variation from the recommended RSD in this Guide for the relevant methodology tier, or organisation based variations should be documented.	Required
Calculation spreadsheet where conversions and emissions factors are applied to the activity data. There are a lot of useful functions in excel or similar spreadsheet that can automate calculations which help reduce the possibility of human error.	Not required
Summary table where emission sources, consumption data, RSD and emissions per source are listed. You should provide one line per emission source and methodology tier e.g. if you have mostly metered gas data with emissions calculated using Tier 3 method but two buildings where you have no metering and therefore you need to use Tier 1, this should be given as two separate lines because the RSD will be different.	Required. See Table 38 below for suggested format

Table 38: Emission suggested reporting format

Category	Description	Methodology used	Consumption data	Standard consumption data units	RSD estimate (+/- %)	Units of kgCO ₂ e			
						Direct emissions	Indirect emissions	WTT emissions	Outside of Scope
Natural gas	All metered natural gas	Tier 1	1,000,000	kWh	2%	183,850		23,910	
Natural gas	Buildings without metering (benchmark)	Tier 3	50,000	kWh	10%	9,193		1,196	
LPG				kWh					
Kerosene				kWh					
Gas oil				kWh					
Solid fuel				kWh					
Biomass pellets				kWh					
Biomass chips				kWh					
Other biomass				kWh					
Renewable heat				kWh					
Grid electricity - buildings	Generation & T&D losses			kWh					
Grid electricity - streetlighting	Generation & T&D losses			kWh					
Renewable electricity				kWh					
Purchased heat and steam				kWh					
District heat and steam				kWh					
Water supply				m ³					
Water treatment				m ³					
Diesel – biofuel blend	Fleet			kWh					
Diesel – 100% mineral	Equipment			kWh					

Appendix A The CRC Energy Efficiency Scheme

The CRC scheme, which closed following the 2018/19 reporting year, applied to large energy users in the public and private sectors across the UK, including supermarkets, water companies, banks, local authorities and all central government departments. Organisations that met the qualification criteria were required to participate by reporting their emissions and buying allowances for every tonne of carbon they emitted.

The following organisations reported data under the CRC in 2018/19 and are within the scope of the Welsh Net Zero reporting approach:

Local Authorities

Blaenau Gwent County Borough Council	Bridgend County Borough Council
Caerphilly County Borough Council	Cardiff Council
Carmarthenshire County Council	Conwy County Borough Council
Flintshire County Council	Newport City Council
Powys County Council	Rhondda Cynon Taf County Borough Council
Swansea Council	Torfaen County Borough Council
Vale of Glamorgan Council	Wrexham County Borough Council

Health Boards and Trusts

Aneurin Bevan University Health Board	Betsi Cadwaladr University Health Board
Cardiff and Vale University Health Board	Cwm Taf University Health Board
Hywel Dda University Health Board	Swansea Bay University Health Board

Others Public Bodies

National Museum of Wales	The Welsh Government
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The University sector, who we have invited to participate in this reporting regime, were also required to report under the CRC scheme.

Appendix B Partners in developing this guidance document

The following organisations participated in a workshop on 16 October 2019 for representatives from different parts of the Welsh public sector to decide on the principles, priorities and scope for the Welsh Net Zero Reporting Guide.

- › Caerphilly County Borough Council
- › Cardiff Council
- › Carmarthenshire County Council
- › Ceredigion County Council
- › Flintshire County Council
- › Newport County Council
- › Pembrokeshire County Council
- › Torfaen County Borough Council
- › NHS Wales
- › Cardiff University
- › Natural Resources Wales
- › North Wales Fire & Rescue Authority
- › The Office of the Future Generations Commissioner
- › Welsh Local Government Association

A smaller core group of representatives were involved in testing the draft guidance, and a number of other Public Bodies provided comment and suggestion as we developed the guidance.