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West Devon Borough Council organisational carbon footprint Achieving net zero by 2030

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Kilworthy Park, Tiverton

Management Summary

West Devon Borough (WDBC) declared a climate change and biodiversity emergency in May 2019 and in its Climate Change and Biodiversity Strategy the council commits to reduce its organisational carbon emissions to net-zero by 2030. The definition of "net zero" in this context includes all greenhouse gas (GHG) emissions arising from WDBC's direct activities (termed Scope 1 and 2) and from other indirect activities including its supply chains (termed Scope 3), which together result in the Council's gross GHG emissions. Deducting the emissions mitigated through the export of low carbon energy and land use change gives net GHG emissions. This assessment develops an understanding of the measures needed to achieve net GHG emissions as close to zero as practicable by 2030 and estimates the remaining net emissions which require carbon offsets.

An update of WDBC's GHG footprint from that undertaken in 2019/19 shows a 47% fall from 4,555 t CO_2e to 2,396 t CO_2e in 2002/21. Direct (Scope 1 and 2) emissions have fallen 61% from 2018/19. The reduction is largely due to the outsourcing of waste collection. However, despite the transfer of these emissions to the indirect category (Scope 3), changes to procurement spend data collection, and perhaps underlying changes to spend itself, have seen indirect emissions fall by 61%. Nonetheless, indirect emissions still represent 76% of WDBC's emissions in 2020/21.

The assessment uses six emissions sectors: non-domestic buildings, transport, procurement, F gases and waste, renewable energy, and land use change / afforestation. In each sector it then provides a number of potential measures to reduce emissions ranging from straightforward energy efficiency to far more challenging and potentially contentious solutions. It is important to note that these are not a pre-determined trajectory, but a combination of aggressive carbon reduction measures across all sectors that provide a set of options to pursue the net zero ambition.

In 2020/21 the council's non-domestic building stock emitted 616 t CO_2e (26%). However, the emissions from the leisure centres in particular are likely to be artificially low due to the Covid pandemic and so a "bounceback" effect was therefore included with the assumption that energy consumption from the leisure centres returned to pre-Covid levels by substituting in consumption data from the 2018/19 footprint. This increased emissions by 54% to 1,133 t CO_2e. Leisure centres are the most significant buildings within the estate, comprising 64% of all emissions. Overall, gas use in buildings is the most significant source of emissions, responsible for 65% of all building emissions. Projections suggest that by 2025 the rise in GHG emissions from an increase in building use post-Covid will bw mitigated by grid decarbonisation, energy efficiency and more significantly through the installation of heat pumps at some leisure centres. By 2030 a further package of similar measure see emissions fall to 172 t CO_2e, an 72% reduction from 2020/21.

Analysis of the council's transport shows emissions of 741 t CO_2e in 2020/21 (26%). The footprint for the road vehicle fleet operated by WDBC totalled 32 t CO_2e (4%). An additional 20 t CO_2e (3%) is attributable to portable machinery (tractors, mowers and small petrol-powered agricultural tools). Indirect emissions, which include the waste fleet, business travel and commuting, total 689 t CO_2e (93%) with the waste fleet contributing 633 t CO_2e (85%). Electrification drives the projected reductions to transport emissions, the majority of which occur between 2025 and 2030. The projections show overall transport emissions falling to 96 t CO_2e, an 87% reduction from 2020/21.

Spend based estimates suggest that indirect emissions from the goods and services WDBC bought in 2020/21 is the largest source of emissions (43% or 1,038 t CO_2e). Spending, and therefore emissions are split across a wide range of categories. Waste contractor, Sparling recycling, is the greatest source of emissions at 236 t CO_2e. Projections suggest a reduction in the emissions from procurement from 1,038 to 658 t CO_2e in 2030 (-37%) as a result of improving data capture, working directly with suppliers, and using greenhouse gas emissions as part of the selection process for new suppliers with the aim of decarbonising these contracts at least as fast as the UK's general decarbonisation trajectory.

Emissions from WDDC's own waste disposal and use of F gases are currently small (1.6 t CO_2e in 2020/21). The majority (1.5 t CO_2e in 2020/21) occur through refrigerant leakage. Projections suggest that by adopting low and zero emission refrigerants emission fall by 91% to 0.1 t CO_2e in 2030.

Exported renewable energy and changes to land use through afforestation are deducted from WDBC's gross emissions. WDBC has a 7 kW photovoltaic (PV) array on the roof of Kilworthy Park that generates approximately 6.4 MWh per annum. This generation represents 4% of the building's electricity use and achieves 1.5 t CO_2e of avoided GHG emissions. The Okehampton Business Centre has a 6 kW wind turbine and a biomass boiler that generate an estimated 9 MWh of electricity and 50 MWh of heat respectively. The wind turbine provides approximately 20% of the building's electricity (with a minimal amount being exported, typically 0.1 MWh per annum) and achieves 2.1 t CO_2e of avoided and offset GHG emissions. WDBC intends to install PV on the roofs of leisure centres in Tavistock and Okehampton. Once the systems are installed they provide a total capacity of 270 kWp generating 229 MWh of electricity per annum. When first installed a total of 178 MWh is estimated to be used at the leisure centres with the remaining 52 MWh being exported. Installation of PV at the Okehampton leisure centre before 2025 increases the total export of renewable electricity to 46 MWh resulting in offset emission of -6.2 t CO_2e 2025. Subsequently, despite the installation of PV at Tavistock leisure centre between 2025 and 2030, the reduction in the grid emission factors in 2030 leads to a fall in offset emissions to -3.2 t CO_2e in 2030. The planting of broadleaf trees over 7 ha (42%) of WDBC's amenity greenspace between now and 2030 is projected to offset -50 t CO_2e in 2030.

The combination of aggressive carbon reduction measures included in the projections indicate the potential to reduce 2020/21 net emissions from 2,396 t CO_2e to 872 t CO_2e, a fall of 64%. While all sectors need attention, key direct emission reduction measures include the phasing out of gas use in council building stock and the electrification of the vehicle fleet.

Indirect emissions from procurement dominate the residual 2030 emissions (72%). Excluding procurement, residual emissions fall 84%, from 1,358 t CO_2e to 214 t CO_2e, with transport the largest remaining emitter (84%). Offset of these 2030 emissions through the purchase of Pending Issuance Units (PIU) for UK Woodland Carbon Units, assuming an average cost of £13.50 per t CO_2e, would cost £13k with procurement and £3k per year without with annual payments thereafter. Alternatively, afforestation with 78 ha of coniferous tree planting between now and 2030 offsets residual emissions with procurement and 18 ha offsets residual emissions without procurement.

Achieving net zero, whether nationally, locally or organisationally requires broad action cross all sectors. The projections for WDBC show that delivering net zero in a timeframe as tight as 2030 is challenging. Annual assessment of the council's GHG emissions to identify the changes that have taken place each year will enable the evaluation and updating of the actions required to deliver net zero.

Contents

1 Introduction

West Devon Borough Council (WDBC) declared a climate change and biodiversity emergency in May 2019 and, in its Climate Change and Biodiversity Strategy[1], the council commits to reduce its organisational carbon emissions to net-zero by 2030. The Centre for Energy and the Environment (CEE) at the University of Exeter was commissioned by WDBC to assess the potential to achieve this commitment.

The definition of "net zero" in this context includes all greenhouse gas (GHG) emissions arising from WDBC's direct activities (termed Scope 1 and 2) and from other indirect activities including its supply chains (termed Scope 3), which together result in the Council's gross GHG emissions. Deducting the emissions mitigated through the export of low carbon energy and land use change gives net GHG emissions. The aim is to achieve net GHG emissions as close to zero as practicable by 2030. Remaining net emissions require carbon offsets. The objective is to achieve net zero with as little reliance on offsets as is practicable.

The approach taken is to update WDBC's carbon footprint from the assessment made in 2018/19 (Section 2), and assess the potential to reduce these emissions across seven sectors: non-domestic buildings, transport, procurement, F gases and waste, renewable energy and land use change / afforestation (Sections 3 to 8).

The assessment of carbon reduction potential in each sector includes:

- appraisal of central government policy,
- input from discussions with WDBC service leads and other officers in relevant departments and
- consultation with key WDBC documents and data sources.

The sector assessments are desk based, as there was no scope for detailed site visits or audits. However, the use of improved data and methodologies to develop a more detailed evaluation of emissions for each sector feeds back into the updated footprint. These changes inevitably lead to adjustments in the 2020/21 footprint when compared to 2018/19.

Each sector assessment provides a number of potential measures to reduce emissions ranging from straightforward energy efficiency to far more challenging and potentially contentious solutions. It is important to note that these are not a pre-determined trajectory, but a combination of highly aggressive carbon reduction measures across all sectors that provide a set of options to pursue the net zero ambition.

2 WDBC's current carbon footprint

WDBC's carbon footprint for the 2020/21 financial year (1st April 2020 to 31st March 2021) follows the same approach as the 2018/19 footprint[a]. The footprint is prepared in accordance with Chapter 3 of HM Government 2019, *Environmental Reporting Guidelines*[2] with a financial control approach taken to organisational boundaries. The guidelines require the classification of GHG emissions into three groups or Scopes:

> Scope 1 (direct emissions from owned sources), including combustion of fuel in boilers in council owned buildings for heating and hot water, refrigerant leaks from council equipment and fuel in council vehicles.
>
> Scope 2 (indirect emissions from generation of purchased electricity) which covers all electricity use across the council's services
>
> Scope 3 (other indirect) including GHG emissions embodied in all material and services bought by the council, business travel, grey fleet use and commuting, waste disposal, etc..

Calculations generally involve combining activity data with emission factors[3] to estimate emissions across a range of categories. Activity data includes specific information from each category considered, for example the amount of energy used in a building, or fuel used in a vehicle. It is vital that this data is collected to accurately assess the carbon footprint initially, and to track progress over time. In some cases, the availability of data is good but in others, there is scope to improve data collection processes to align with the objective of measuring and reducing GHG emissions.

The footprint categories are derived from simplified Government guidance (based on the old National Indicator 185[4]) that result in 11 categories across the three scopes. In many cases specific issues are split across multiple categories e.g. "transport" sits within "owned transport" (for the combustion of fuel in vehicles owned by WDBC), "purchased materials and fuel" (for Well to Tank [WTT]) emissions, and "transport related activities" (for commuting and travel in vehicles not owned by WDBC).

The calculation of emissions from WDBC's Scope 2 electricity consumption uses the published carbon intensity of the national electricity grid[b]. The carbon intensity of the grid has declined significantly in recent years. The Climate Change Committee (CCC) forecasts that significant falls in grid intensity will continue as increasing amounts of renewable and low carbon energy comes onto the system (See Figure 1)[5].

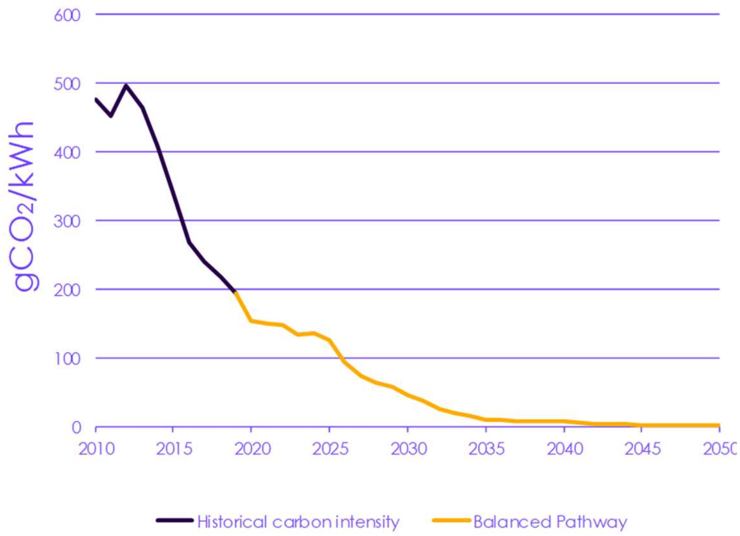


Figure 1: UK electricity grid carbon intensity (source CCC Sixth Carbon Budget)

[a] A footprint was not formally produced for 2019/20 due to disruptions caused by the Covid-19 pandemic
[b] For a discussion of alternative Scope 2 GHG accounting methods see Appendix 1.

For 2020/21, total emissions are 2,396 t CO_2e. Figure 2, which uses the categories in the guidance[c], shows 2020/21 compared to the 2018/19 footprint (4,555 t CO_2e).

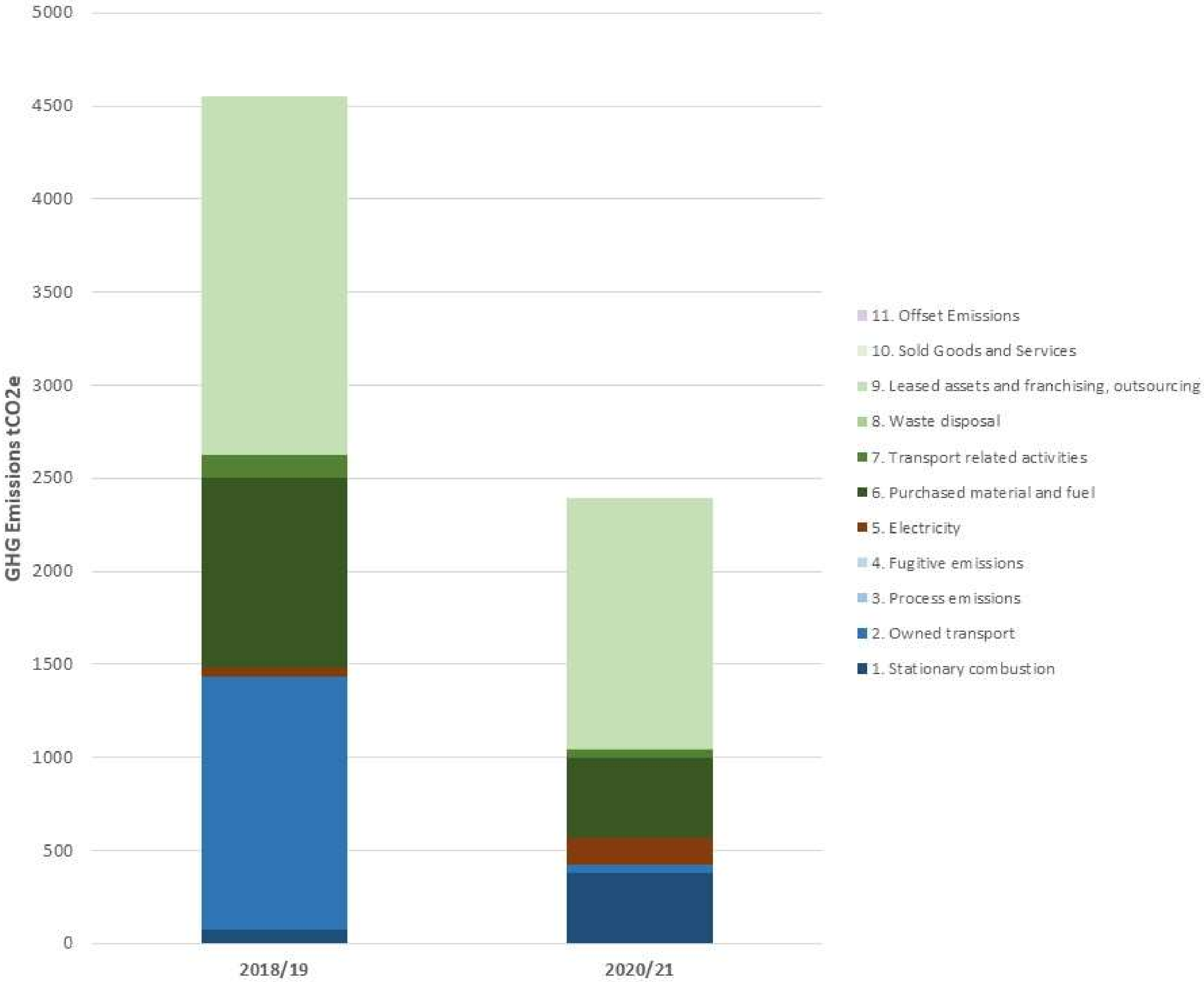


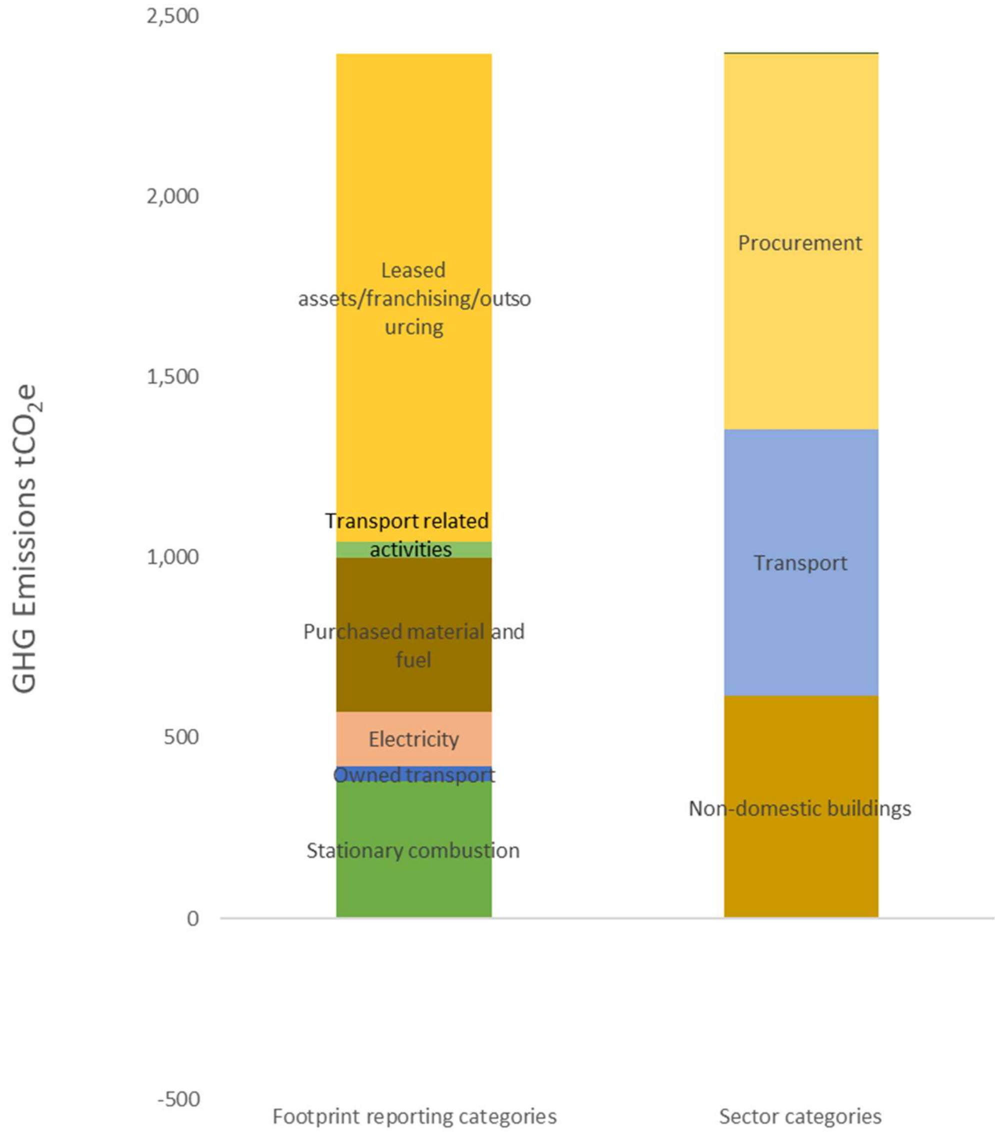
Figure 2: WDBC's GHG emissions by footprint reporting category for 2018/19 and 2020/21 showing Scope 1 (blue) Scope 2 (red) and Scope 3 (green)

Total emission have fallen 47% between 2018/9 and 2020/21 from 4,555 tCO_2e to 2,396 tCO_2e. Direct (Scope 1 and 2) emissions have fallen 61% from 2018/19 largely due to the outsourcing of waste collection and, despite the transfer of these emissions to the indirect category (Scope 3), changes to procurement spend data collection and perhaps underlying changes to spend itself have also seen indirect emissions fall by 61%. None the less, indirect emissions represent 76% of WDBC's emissions in 2020/21.

To provide more clarity, the 11 categories included in the footprint table (see Appendix 2) were re-mapped into 5 sector categories for this report. Figure 3 shows the breakdown of emissions by footprint category and report sector category.

[c] The guidance "leased assets/franchising/outsourcing" category is, in WDBC's case, populated with the embodied GHG emissions in procured services

The sections following discuss details of emissions within each sector category, with the addition of a land use change and afforestation sector that projects future emissions offset by tree planning in WDBC greenspace.



	Footprint reporting categories	Sector categories
Renewable energy (export) & offset		0
F gas and waste		2
Procurement		1,038
Transport		741
Non-domestic buildings		616
Offset emissions	0	
Sold goods and services	0	
Leased assets/franchising/outsourcing	1,351	
Waste disposal	0	
Transport related activities	44	
Purchased material and fuel	428	
Electricity	151	
Fugitive emissions	1	
Process emissions	0	
Owned transport	42	
Stationary combustion	378	

Figure 3: WDBC's footprint in 2020/21 organised by category as annually reported (left), and by category as considered in this report (right)

3 Non-domestic buildings

3.1 Detailed sector summary

The 2020/21 footprint shows GHG emissions of 616 t CO_2e from non-domestic buildings. However, the emissions from the leisure centres in particular are likely to be artificially low due to coinciding with Covid and so a "bounceback" effect was included with the assumption that energy consumption from the leisure centres returned to pre-Covid levels by substituting in consumption data from the 2018/19 footprint. This increased emissions by 54% to 1,133 tCO_2e, of which 29% are associated with electricity consumption, and most of the remainder from gas (there is a very small amount of LPG and biomass). Emissions are based on the following sources of data:

- Own metering data: Metered energy consumption data for gas and electricity for the period April 2020 to March 2021 was available for the main offices at Kilworth Park, and a further 5 tenanted sites. The Tavy Business Centre was heated by LPG, and the Okehampton Business Centre used LPG and biomass.
- Metered data from leisure centre operators: Energy data (gas and electricity) for leisure centres that are owned by the council but operated under long contracts was available from the operator.
- Estimates based on floor area of buildings that are rented out. The council owns a number of sites that are rented out. In general no energy consumption was available (although not in all cases; where data was available it was used). For these sites, the total area of each building was taken, together with the closest description of its use (e.g., office, workshop, warehouse, retail), and estimates for energy consumption were obtained using the benchmark values for these categories provided in CIBSE TM46[6]. This approach is likely to have a high degree of uncertainty; actual consumption will depend on the building itself and its occupants.

The data shows that leisure centres are the most significant buildings within the estate, comprising 65% of all emissions. In addition, where gas is used in buildings these are a significant source of emissions, with gas use responsible for 65% of all emission. The emissions broken down by asset and as a split of electricity and fossil fuel in Figure 4 and Figure 5 respectively.

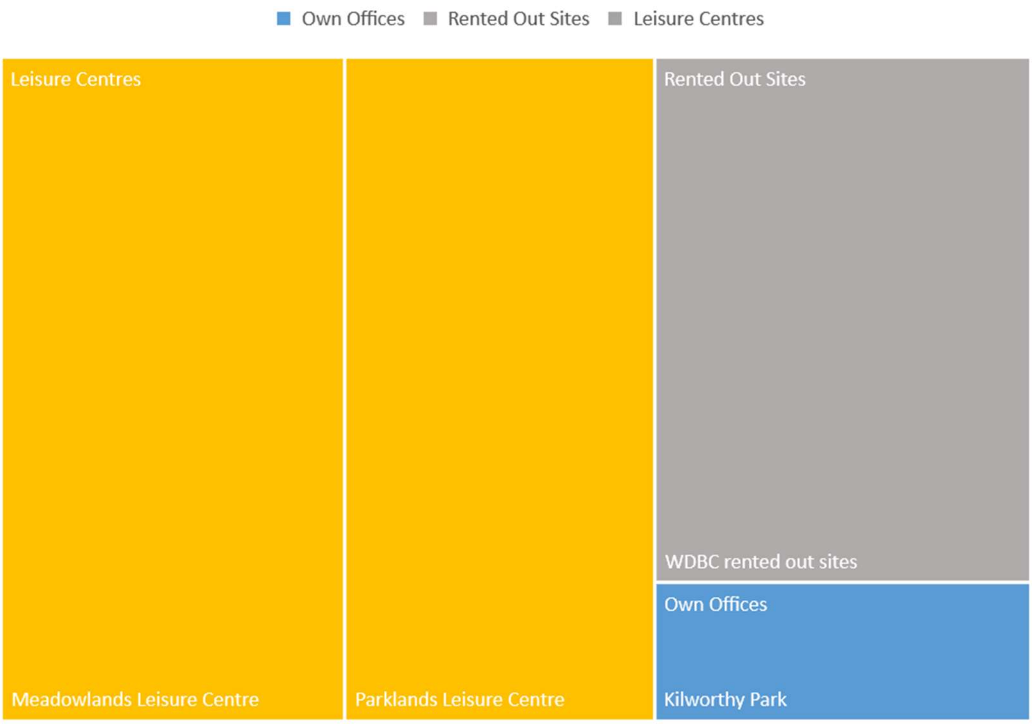


Figure 4: Breakdown of GHG emissions from non-domestic buildings by category

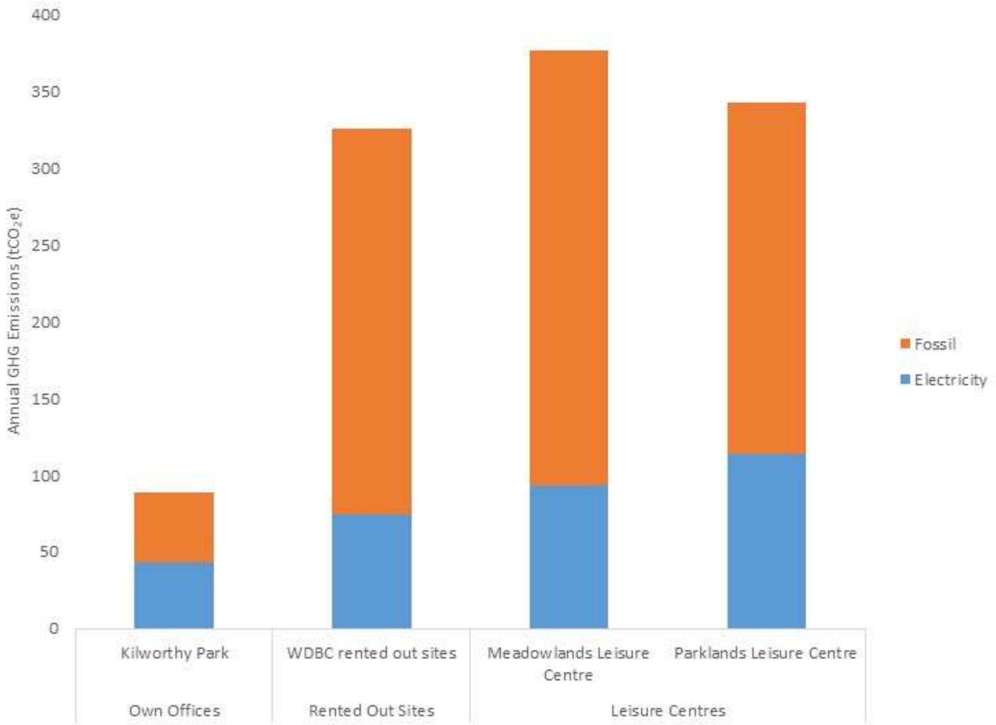


Figure 5: Split of GHG emissions by category for electricity and fossil fuel

3.2 National Policy Framework

The high-level assumptions and projections for non-domestic buildings at a national level are as follows:

- The decarbonisation of the electricity grid will reduce emissions from consumption of electricity in non-domestic buildings.
- The CCC Net Zero Technical Report[7] assumes a 25% reduction in heat demand in non-domestic buildings by 2050, though clarity was not given as to how this might occur. The remaining heat decarbonises using low carbon heat networks (46% of the demand) and heat pumps (the remaining 54%). It also assumes the electrification of non-heat uses of gas and oil (e.g. catering), and a 21% reduction in electricity demand from non-heat uses (e.g. lighting) due to energy efficiency.
- The CCC Sixth Carbon Budget[8] report assumes a 26% reduction in energy consumption in 2030 compared to the CCC's 2018 baseline (based on the application of findings from the Building Energy Efficiency Survey (BEES) study). The CCC applied several measures (building controls, fabric, carbon and energy management, lighting, refrigeration, swimming pools, heating, and hot water) across non-domestic buildings in different sectors whilst excluding other more expensive measures (humidification, small appliances, ventilation, air conditioning and cooling, and building services distribution systems) and those associated with replacement of heat sources. These were handled separately by assuming that non-domestic buildings are switched from gas and oil heating (where applicable) to a mix of heat pumps (65% in 2050), district heating (32%), hydrogen boilers (5%) and direct electric heating (1%). The CCC has not included biomass boilers as a replacement technology for public or commercial buildings "as a matter of principle". Nationally, the CCC project non-traded (i.e. direct) emissions from non-domestic buildings will fall from 20.4 Mt CO_2e in 2020 to 13.8 Mt CO2e in 2030 (a 33% reduction) through a combination of energy efficiency and fuel switching, though some of this will be shifted to traded emissions (i.e. electricity).
- The CCC 2021 Progress Report[9] states for non-residential energy efficiency and behaviour change that "commitments of 20% efficiency savings in business and 50% reduction of public emissions by 2032 are in line with the CCC pathway. Policy proposals only cover private-rented and larger buildings to date and there is little evidence for reduced energy demand at present".

3.3 Opportunities

The factors and opportunities identified for decarbonising non-domestic buildings are as follows.

3.3.1 Decarbonisation of electricity

National policy projections decrease the carbon intensity of electricity delivered through the grid. The consumption of electricity is included in the footprint under both Scope 2 (from the generation of electricity in power stations, wind farms etc.) and Scope 3 (from losses associated with Transmission and Distribution [T&D] and the Well to Tank [WTT] overhead applied to both Scope 2 and T&D emission factors). In 2020 the Scope 2 electricity factor used in the footprint was 0.233 kg CO_2e/kWh. The emission factors produced by government for company reporting lag the actual values by 2 years and so in 2030 (the 2030/31 footprint), the actual 2028 emission factor will apply when WDBC reports its carbon footprint. The CCC 6th Carbon budget projects this to be 0.065 kg CO_2e/kWh (a 72% reduction on the current value). Projections for T&D and WTT emission factors are not published. Analysis of the most recent four years of emission factors show that the T&D factor has fallen by a similar amount to the generation factor and, while the WTT factors have been falling at a similar rate until 2021, they increased significantly this year due to a method change applied by government. The approach taken here (in all sectors) has been to assume the ratio of WTT emissions to direct emissions from the most recent year is the same in 2030, and therefore the total Scope 2 and 3 emission factor for electricity would be 0.089 kg CO_2e/kWh (down from 0.288 kg CO_2e/kWh). This effectively means under a "do nothing" approach, emissions from any electricity consumption will fall by 71% between the most recent year of data and 2030.

The installation of renewable generation (e.g. PV panels) which produces electricity that is consumed on site provides carbon free operational energy and financial savings from the date it is commissioned. Grid decarbonisation means that early installation leads to the greater carbon savings. However, in the long term, the improvement in the grid emission factor reduces the potential for renewable generation to offset gross emissions[d]. In conversation with BEIS, an alternative (and more conservative) approach could be to keep Scope 3 electricity emission factors constant at the most recent values (2021). This results in a total 2030 emission factor of 0.144 kg CO_2e/kWh, (a 50% reduction on the 2020/21 total emission factor), which is 62% higher than the value assumed, and a 50% reduction on the 2020/21 footprint.

3.3.2 Change in assets (speculative)

Changes to the building asset list (either by the construction of new buildings, or the disposal of existing ones) has the potential to either increase or decrease emissions from this sector. No information was available regarding changes to the estate so this has not been modelled. It is worth noting that, for example, there may be potential to rationalise assets in conjunction with changing trends such as home-working and thereby reduce emissions.

3.3.3 Decarbonising Heat

Given the decarbonisation of the electricity network, shifting to lower carbon alternatives to onsite fossil fuel combustion will be necessary to achieve net zero carbon targets. Potential options include:

- Heat pumps: Air source heat pumps (ASHP) and ground source heat pumps (GSHP) absorb heat in the external air or ground respectively for use within buildings. Low carbon grid electricity means that by 2030 heat pumps are a significantly lower carbon option. Their efficiency (known as the Coefficient of Performance [CoP]) improves as the temperature difference between inside (supply temperatures) and outside decreases, which in practical terms means they are most effective in well insulated buildings with low temperature (large emitter) heating systems. Retrofitting heat pumps into poorly insulated buildings equipped with higher temperature systems is likely to lead to low efficiencies and high running costs. An economic comparison between heating with gas boilers and heat pumps will depend of the difference between gas and electricity prices combined with the efficiencies of the appliances. Recently the price of electricity has been about 4.3 times greater than gas.

[d] For renewable energy generation it is assumed that only the Scope 2 factor is applied, as it is assumed T&D is accounted for by the final users of any grid electricity, and renewable energy has no associate WTT emissions. Associated embodied emissions impact emissions through Procurement.

Assuming the current efficiency of a gas system is 80%, the CoP of a heat pump would need to be at least 3.4 for the operational energy cost of a HP to be no higher than gas. Experience has shown that seasonal CoPs above 3 can be difficult to achieve. In addition, heat pumps (and especially GSHPs) are significantly more expensive than gas boilers. Replacing gas boilers with heat pumps is currently challenging both from a technical and economic perspective.

- Direct electric heating: As with heat pumps, by 2030 direct electric heating should be a significantly lower carbon option than gas heating (though higher than heat pumps). However, whilst panel heaters are cheaper than heat pump systems, running costs are several times higher. Direct electric heating is therefore not included.
- District Heating (DH): District heating is a method for distributing heat produced in a centralised location (at an energy centre). Historically heat generation is from gas, often with Combined Heat and Power (CHP). However, as the electricity grid has decarbonised the carbon benefit of this approach has eroded, especially as the distribution of heat in insulated pipes results in system losses. Where there is a local low carbon source of heat then DH can still be a viable low carbon option for replacing gas heating in buildings. However, it is not thought that there are suitable local heat sources in the district, and so DH is therefore not included.
- Hydrogen: Nationally, there are decarbonisation pathways that envisage the use of hydrogen as a replacement or partial replacement of natural gas in centralised infrastructure. As this is highly uncertain and unlikely to materialise prior to 2030, it is not included.
- Biomass: The CCC des include the use of biomass boilers in public or commercial buildings as "biomass resources could be better used as part of engineered removals or in other sectors where alternatives are limited". In practise, experience with biomass boilers has shown that they are difficult to retrofit and run successfully in commercial buildings.

From the above, heat pumps are taken to be the preferred option and are included in the buildings within the estate with the highest emissions from gas use. It is assumed that the leisure centres, Kilworthy Park, and then any other site that is heated by gas are switched over to heat pumps. The assumed efficiency improvement was taken as the average that was modelled for planned leisure centre projects in South Hams.

The heat scenario envisaged is an indication of the potential for carbon reduction. There are significant technical and financial barriers to achieving it in practice; each site needs detailed appraisal.

3.3.4 General Energy Efficiency

Greenhouse gas emissions from WDBC's buildings can be reduced by using less energy in those buildings, either by reducing the demand for energy (for example by improving insulation) and/or by delivering that energy in a more efficient way (for example with more efficient systems and controls). No data was available about the current condition of each building within the estate. As such, a headline simple assumption was applied that assumed a 20% general improvement in efficiency by 2030. This saving was equally apportioned to the pre- and post-2025 period.

3.3.5 Renewable Energy

Section gives a schedule of potential implementation of building scale PV across the estate and assesses the proportion that is exported (and so classified as an offset in that section), together with the amount that is self-consumed and therefore results in the avoided import of grid electricity. Self-consumption is included on an individual building basis within this section of the analysis.

3.4 Target for 2030

Projections suggest a reduction in the emissions from non-domestic buildings from 616 tCO_2e in 2020/21 (or a peak of 1,133 tCO_2e when considering the Covid bounceback) to 172 tCO_2e in 2030 (-85%). The projections are based on:

- The continuing decarbonisation of the electricity grid, which results in a windfall carbon reduction for all current electricity consumption and provides incentive to switch from natural gas to electric solutions.

- The replacement of gas heating initially in some leisure centres, and then in all buildings in the estate that currently use gas. Recent experience from other local authorities indicates there may be technical and financial barriers to implementing this.
- A very generalised assumption for improvements in energy efficiency that may result in reduced energy demand across the estate.
- The inclusion of PV on a number of buildings as described in Section 7. The potential for carbon reduction from this measure is relatively low and falls over time as the wider electricity network decarbonises.

Figure 6 shows projected emissions from non-domestic buildings for WDBC in 2020, 2025 and 2030.

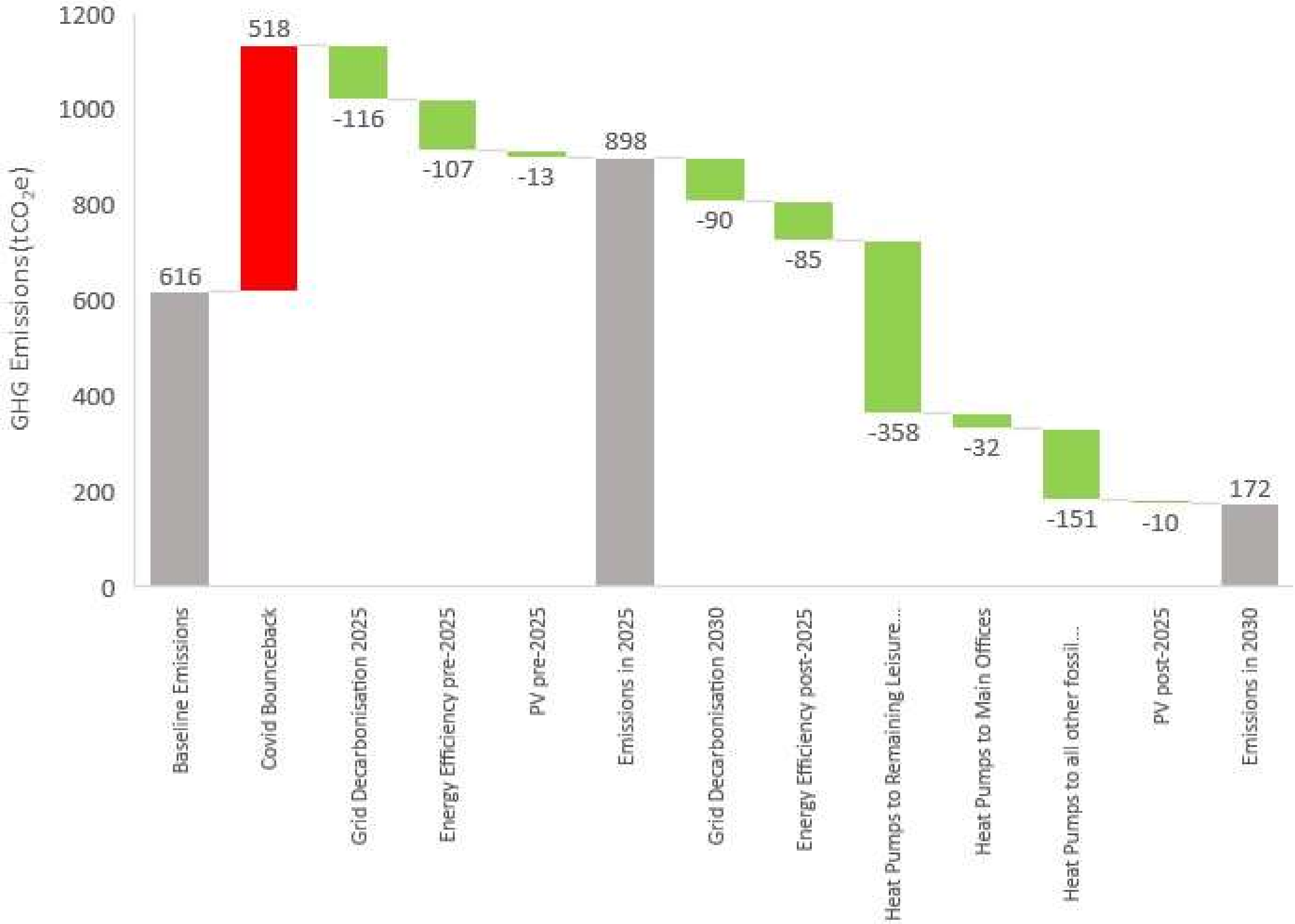


Figure 6: Measures to reduce non-domestic building emissions to 2025 and 2030 (including WTT emissions)

4 Transport

4.1 Detailed sector summary

Emissions from transport[e] totalled 741 t CO_2e. Direct (Scope 1) transport GHG emissions arise from vehicles and other machinery[f] owned or rented by the Council. Indirect transport emissions come from contracted vehicles (the waste fleet), employee business travel (the "grey fleet", employee vehicles used for work and claimed on expenses) and staff commuting, and from well-to-tank emissions of fuel used in any vehicle. Figure 7 shows the breakdown of transport sector emissions.

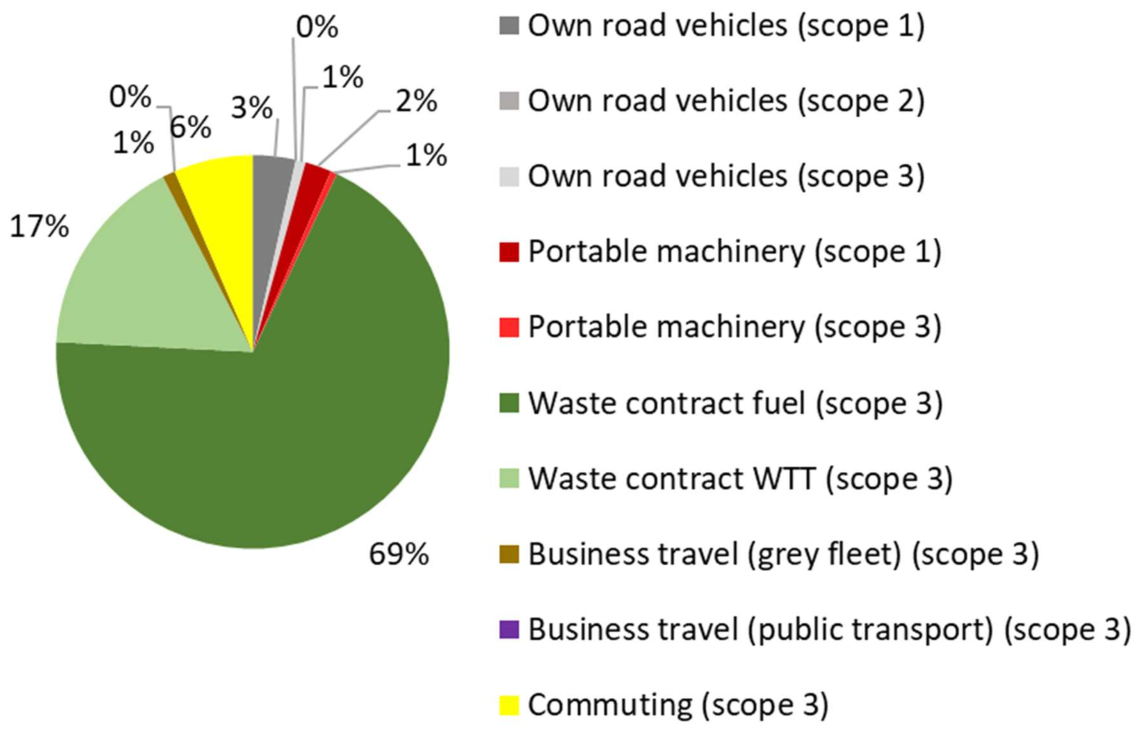


Figure 7. Composition of GHG emissions from the transport sector for WDDC.

4.1.1 Direct emission from transport

The footprint for the road vehicle fleet operated by WDBC totalled 32 t CO_2e including well to tank emissions. This figure, which is taken from the Transport Decarbonisation Report produced by the Energy Saving Trust[10], is based on annual vehicle mileage in 2021/22, official vehicle emission factors and a real-world driving uplift. CEE's own analysis for the previous year based on fuel data and an approximate percentage split between South Hams and West Devon districts returned a similar value of 29 t CO_2e. In addition, from CEE's own analysis (2020/2021) an additional 20 t CO_2e is attributable to portable machinery (tractors, mowers and small petrol-powered agricultural tools).

Direct emissions are those over which the Council has most control. Given the uncertainties over indirect emissions, these should be the focus of initial efforts to reduce transport emissions.

[e] Based on the latest available data: 2021/22 for the road vehicle fleet operated by WDBC and the contracted refuse collection service; 2020/21 for the grey fleet (including staff commuting), and 2018/19 for portable machinery.

[f] Portable machinery used by the Public & Green Spaces team is included in transport emissions

4.1.2 Indirect emissions from transport

WDBC's indirect transport emissions come from contracted vehicles (the waste fleet), business travel, mileage undertaken in staff vehicles on council business (so-called "grey fleet" miles) and staff communing.

The council has contracted out its waste collection services to FCC Environmental. The Energy Saving Trust analysis did not estimate emissions for these vehicles; pro-rating emissions (on the basis of numbers of vehicles operated) from the South Hams District Council value would return 633 t CO_2e for 2021/22 including well to tank emissions. This is similar to CEE's own estimate of 664 t CO_2e for the previous year. This source accounts for the vast majority of transport emissions (about 85%), and therefore merits particular attention when seeking opportunities to reduce emissions.

The Energy Saving Trust estimated grey fleet emissions as 12 t CO_2e in 2021/22 including well to tank emissions, on the basis of mileage and a typical car emission factor. The CEE's own estimate for the previous year is considerably lower at 8 t CO_2e. The difference is likely due to a resurgence in business travel after the Covid-19 pandemic. Grey fleet emissions in 2020/21 showed a 74% reduction on 2018/19 as a result of the Covid-19 pandemic persistantly increasing homeworking and online meetings.

Commuting emissions for 2018/19 were estimated on the basis of employee's place of residence and the nearest council office, assuming 50% agile working (on average each employee makes 2.5 commuting round trips per week). For 2020/21 this assumption has been revised on the advice of the council to assume 80% working from home and 20% commuting (i.e. on average one commuting round trip per week). After further adjustment to account for an increase in staff numbers by 1% this results in a 62% reduction in commuting emissions from 125 t CO_2e in 2018/19 to 48 t CO_2e in 2020/21.

Post Covid, the extent to which normal staff travel patterns will resume is unclear making estimation of future indirect emissions difficult. Although council meetings have returned to physical events (with councillors and lead officers expected to attend in person), it is assumed that office-based staff will continue to work from home four days per week[g].

Business travel by air, rail and taxi gave rise to virtually zero emissions in 2020/21, from an already negligible 0.1 t CO_2e in 2018/19. Again the reduction is attributable to the Covid-19 pandemic.

4.2 National policy framework

In the Sixth Carbon Budget the CCC's balanced pathway projects:

- 9% of car miles can be reduced (e.g. through increased home-working) or shifted to lower-carbon modes (such as walking, cycling and public transport) by 2035.
- High take-up of electric vehicles (EVs) with new conventional cars, vans and plug-in hybrids unavailable by 2032 at the latest.
- The roll-out of zero-emission HGVs accelerates to reach nearly 100% of sales by 2040.
- Continuing vehicle efficiency improvements.
- A reduction of 3% in van miles by 2035 through measures such as micro-consolidation centres.
- HGV logistics measures to reduce miles driven by lorries.
- All sales of new buses are zero-carbon by 2035.
- Diesel trains are phased out by 2040.

The Government has set 2030 as the date when the sale of new petrol and diesel vehicles should stop, with all new cars and vans being fully zero emission at the tailpipe in 2035. It is also proposing that the sale of new diesel HGVs should end in 2040.

[g] More recent evidence suggests 3 or 4 days per week may be more appropriate going forward

4.3 Opportunities

4.3.1 WDBC fleet (including contracted waste vehicles)

The main source of WDBC transport emissions is from essential cleansing and public and green space services. The Energy Saving Trust report considers the replacement of refuse collection vehicles with battery-electric variants. A number of suitable vehicles are now available and the analysis implies[h] that a reduction in annual GHG of about 327 t CO_2e from 400 t would result from switching all refuse collection vehicles to battery-electric types. This results in residual emissions of 73 t CO_2e. Electrification of the *entire* South Hams and West Devon fleet (including the South Hams waste contract) is said to give rise to residual annual emissions of 62 t CO_2e in 2030. This infers that the emissions reduction calculated by the Energy Saving Trust is based on the current UK grid electricity emission factor (212.33 g CO_2/kW h), whereas the emissions estimate for 2030 is based on a reduced UK grid electricity emission factor of 50 g CO_2/kW h[i].

Most of the remaining fleet consists of light goods vehicles (3.5 tonne gross weight or less). These consist of small or medium sized vans, for which viable battery-electric alternatives are available. Based on the Energy Saving Trust report, it is estimated that switching these vehicles to battery electric would reduce annual GHG emissions by 69 t CO_2e[j].

Battery-electric alternatives are limited for heavy goods vehicles (exceeding 3.5 t gross weight) with refuse collection vehicles being an exception where there are relatively established options available. Vehicles in this category in the fleet include 4.5 t road sweepers and 7.5 t trucks used for emptying litter bins. Battery electric vehicles are starting to become available in this size range and the Energy Saving Trust expect them to be readily available well before 2030; they foresee only niche roles for hydrogen fuel cell vehicles and highlight significant issues surrounding the claimed sustainability of hydrotreated vegetable oil as a drop-in low carbon replacement for diesel in internal combustion engines.

Other vehicles that the Energy Saving Trust identify as not yet having readily available battery electric alternatives are small pickup trucks and agricultural machinery. A small pickup truck is expected to become available within the next two years. Small electric tractors are now available, as are mowers in a variety of sizes and other portable machinery. Battery alternatives may not yet offer sufficient power or run time to substitute for petrol-operated machinery. It has been assumed that that battery electric portable machinery could reduce energy consumption by 70% compared to petrol-engined counterparts[k] and the CCC Balanced Net Zero Pathway assumption of 50 g CO_2/ kWh for electricity in 2030 has been applied. On this basis, electrification of all portable machinery would result in a 95% reduction in annual GHG emissions to about 1.0 t CO_2e.

The following assumptions have been applied to the final carbon descent scenario presented in this report:

- Vehicles of 3.5 t gross weight or less: battery electric alternatives are readily available. Linear replacement of 12.5% of the fleet per annum will result in complete electrification by 2030.
- Vehicles exceeding 3.5 t gross weight: battery electric alternatives are emerging. Linear replacement of the fleet to 2025 is halved to 6.25% per annum, compensated for by more rapid replacement from 2025 to 2030, resulting in complete electrification by 2030.
- One-quarter of portable machinery (on the basis of fuel consumed) will be replaced by battery powered tools by 2030, the remainder continuing to be petrol-powered.

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[h] Pro rata from the SHDC waste contract on the basis of total vehicles (of all types) operated under contract.

[i] Based on commentary following Table 3-1 in reference 10; the report does not explicitly state which grid emission factors are used in calculations.

[j] Savings from the electrification of South Hams and West Devon light goods vehicles of 210 t CO_2e with about 33% of baseline non-refuse collection vehicle emissions attributable to West Devon.

[k] Taken from reference 10 when comparing internal combustion and battery electric vehicles. An internal combustion engine is about 20% efficient, so this implies that a battery electric vehicle is 67% efficient. Applying the ratio to the amount of fuel consumed implies that the efficiency of the remainder of the tool (or hull and propeller of the ferry) remain unchanged.

4.3.2 Indirect transport

The council has less control over non-waste contract indirect transport emissions, particularly commuting which accounts for the vast majority of indirect emissions. Policy on business travel (included under procurement in Section 5) and grey fleet miles can encourage or mandate the use of low and zero carbon travel alternatives. Purchase of electric vehicles for commuting can be encouraged by the council providing electric vehicle charging points and dedicating parking spaces to electric vehicles. Even greater emphasis should be placed on active travel modes for commuting, including walking, cycling and e-bikes, and use of public transport. Uptake of these alternatives can be encouraged through infrastructure provision (shower facilities, cycle storage and e-bike charging). Car clubs (utilising electric vehicles) can be a viable alternative serving the needs of both commuting and business travel during the day.

The Energy Saving Trust report does not forecast future emissions from the grey fleet. Taking CCC Balanced Net Zero Pathway assumptions of 35% fleet penetration of battery electric cars in 2030 and an electricity emission factor of 50 g CO_2/ kWh implies a 32% reduction in grey fleet emissions, reducing emissions from business mileage reported by the Energy Saving Trust to 8 t CO_2e, and the CEE's figure to 5 t CO_2e. 96% of the residual emissions are attributable to internal combustion cars remaining in the fleet. Therefore, if uptake of battery electric cars could be incentivised to achieve a level of uptake above the national average, greater reductions in emissions would be possible. With a fully electrified vehicle fleet emissions would be reduced by 93% from the baseline.

The same decarbonisation assumptions can be applied to commuting, reducing emissions from 48 t CO_2e in 2020/21 to 33t CO_2e in 2030 with 35% fleet penetration of electric vehicles, or to 3 t CO_2e with a fully electrified fleet.

Baseline GHG emissions from public transport used for business travel are very low (75 kg CO_2e in 2018/19); measures to reduce emissions from this source have therefore not been included in the analysis.

The following assumptions have been applied to the final carbon descent scenario presented in this report:

- Grey fleet mileage by councillors initially returns to pre-Covid (2018/19) levels, increasing emissions by 14 t CO_2e compared to the baseline.
- One-half of the reduction in grey fleet mileage by other staff from 2018/19 to 2020/21 is retained, increasing emissions by 3 t CO_2e.
- One-half of the reduction in business travel by air, rail and taxi from 2018/19 to 2020/21 is retained, increasing emissions negligibly.
- Baseline commuting travel has been assumed to remain at 2020/21 levels (80% home working).
- Vehicle mileage for both grey fleet business travel and commuting are subsequently reduced by 3% to 2025 and by a further 3% (of the baseline pre-Covid mileage) by 2030. This is similar in magnitude to the mileage reduction envisaged by the CCC.
- Electrification of vehicles used for commuting and business mileage follows the CCC projections, with battery electric vehicles accounting for 9% of the vehicle fleet in 2025 and 35% of the fleet in 2030.

4.4 Target for 2030

Complete electrification of the WDBC fleet including vehicles operated under the waste contract but excluding portable machinery, grey fleet mileage and commuting is estimated from numbers in the Energy Saving Trust report to result in residual emissions of about 34 t CO_2e[l] in 2030. Adding on the residual emissions discussed above for items not included in the Energy Saving Trust analysis:

- 1.0 t CO_2e for power tools if completely switched to electric and

[l] From a total of 62 t reported for South Hams and West Devon's own fleets, and vehicles operating on the South Hams waste contract. An estimated 3% of this is from WDBC non-waste contract fleet vehicles. A further 32 t is estimated pro-rata from vehicle numbers to arise from vehicles operating on the West Devon waste contract.

- 16 t CO_2e for business travel (including public transport use) and 31 t CO_2e for commuting travel, assuming 35% fleet penetration of electric cars,

would result in total residual emissions of 82 t CO_2e in 2030, a reduction of 89% from the baseline. Alternatively, if a fully electrified car fleet is assumed for grey fleet emissions, residual emissions would be reduced to 40 t CO_2e, a reduction of 95% from the baseline.

More conservative assumptions have been adopted in the carbon descent scenario presented below:

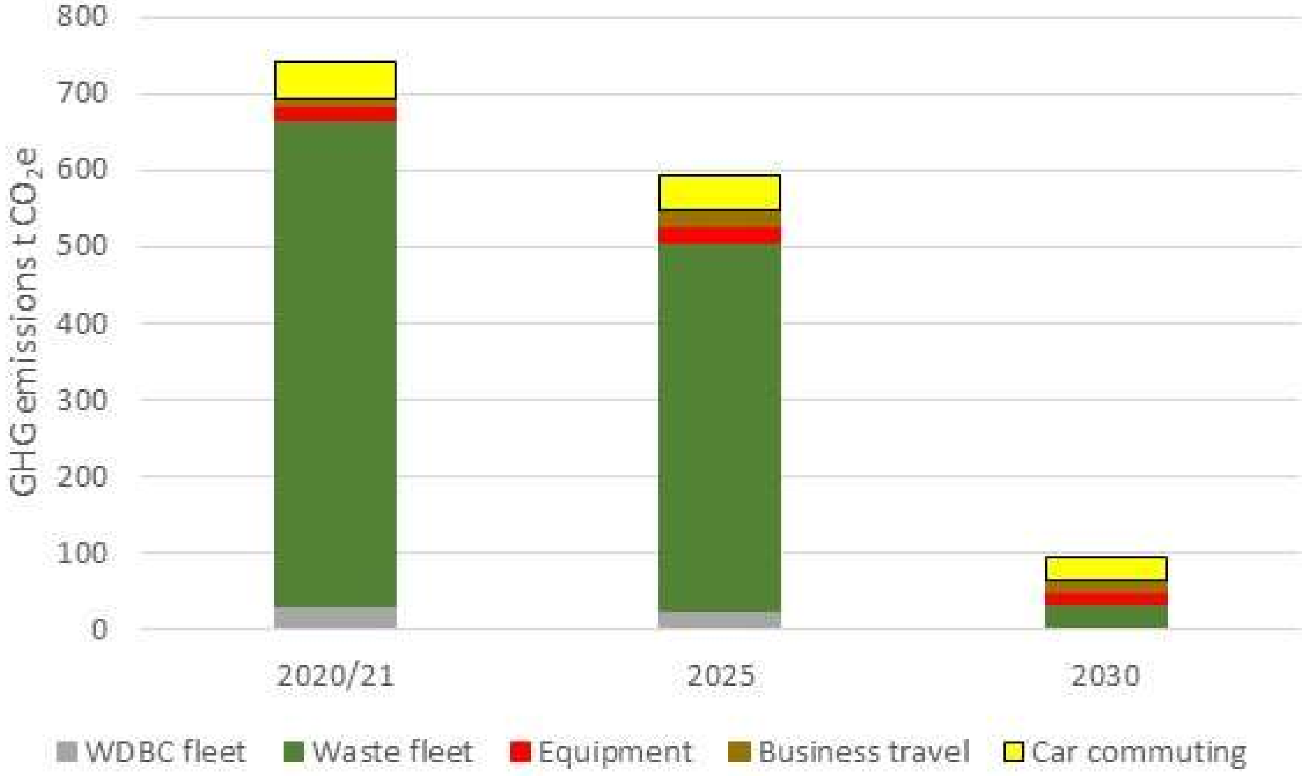
- only 25% of power tools are switched to electric, the remainder remaining petrol-powered.

Applying these assumptions results in a 20% reduction in annual GHG emissions by 2025 and a further 84% reduction of the 2025 value by 2030, giving an overall reduction of 87% to 96 t CO_2e in 2030, as shown in Figure 9.

Table 1 and Figure 8 show projected transport emissions for WDBC in 2020, 2025 and 2030.

Table 1: WDBC transport emissions in 2020, 2025 and 2030 (including WTT emissions).

Category	2020/21 t CO_2e	2025 t CO_2e	2030 t CO_2e	2020 %	2025 %	2030 %
WDBC fleet	32.1	24.5	1.6	4%	4%	2%
Waste fleet	632.6	482.0	32.3	85%	81%	34%
Equipment	20.0	20.0	15.2	3%	3%	16%
Grey fleet (business travel)	7.8	22.7	16.1	1%	4%	17%
Car commuting	48.2	43.3	30.6	7%	7%	32%
Total	740.6	592.5	95.8			
% change from 2020/21		-20%	-87%			



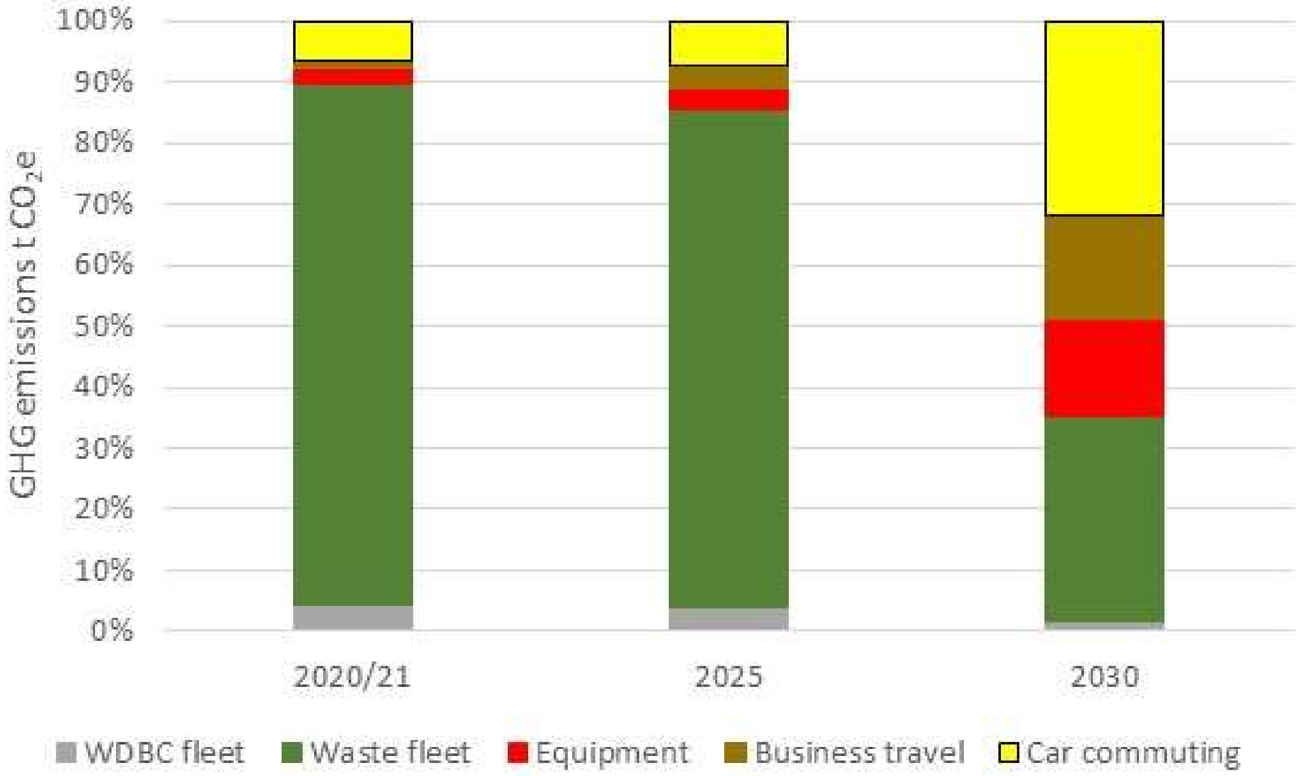


Figure 8: WDBC transport emissions in 2020, 2025 and 2030 (including WTT emissions) in absolute and percentage terms.

Figure 9 shows how transport sector measures impact WDBC's projected transport emissions in 2020, 2025 and 2030.

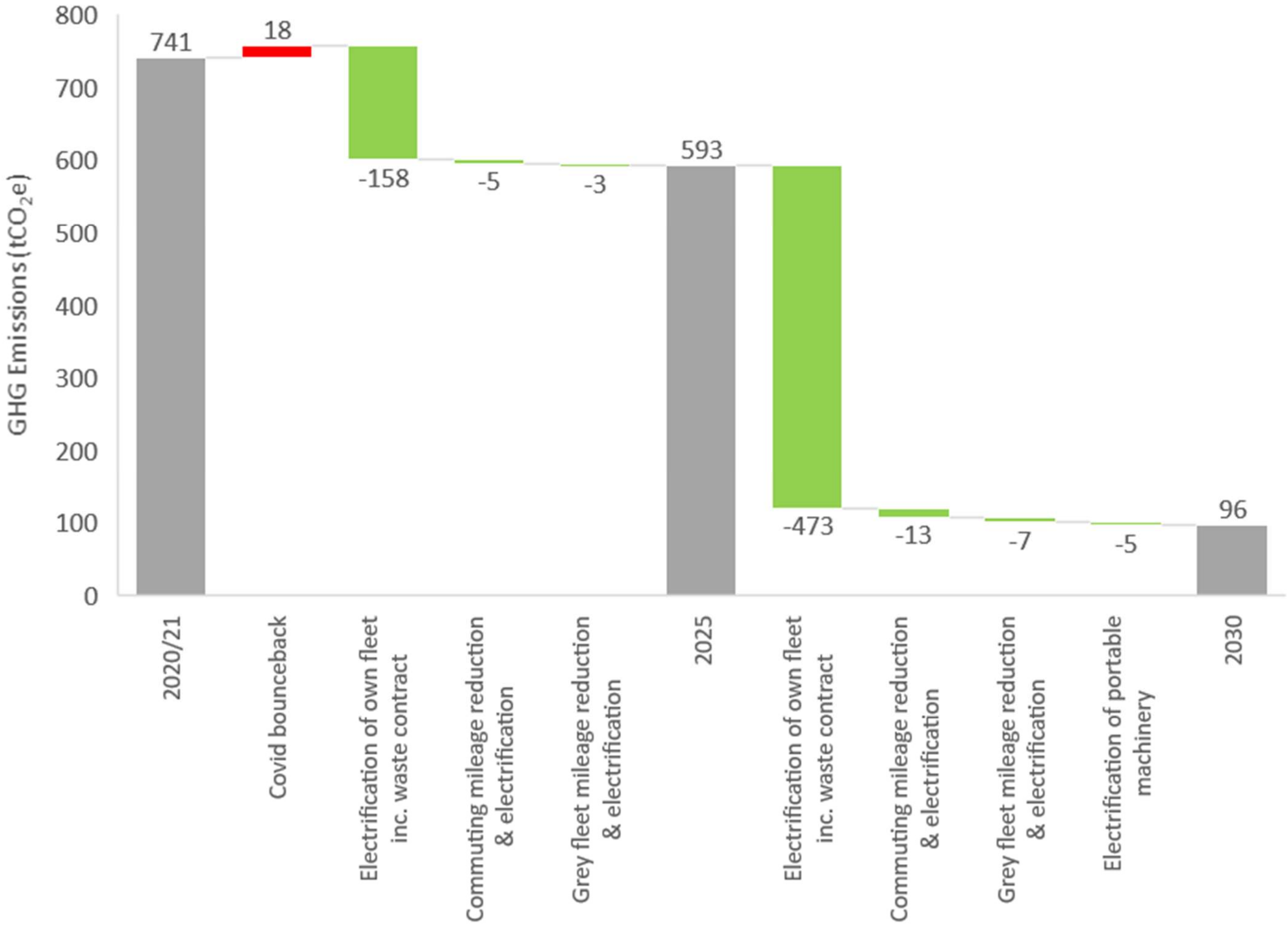


Figure 9. Measures to reduce WDBC transport emissions to 2025 and 2030 (including WTT emissions).

5 Procurement

5.1 Detailed sector summary

Emissions from procurement are a significant part of WDBC's footprint but are difficult to quantify with any degree of confidence. The most accurate means of quantifying emissions from procurement would be for suppliers of goods and services to provide specifically calculated emissions for each contract. However as this is not currently common, instead emissions from "procurement" (which span a broad range of activities and include capital and revenue spend) are estimated by multiplying the spend within a category (based on Standard Industrial Classification [SIC] code) by an associated emission factor (kgCO_2e/£ spent). The most up to date of those emission factors available are from the UK and England's carbon footprint to 2019[11].

To establish the spend within each category an analysis of the most recent annual spend data (2021/22) was undertaken. This was done jointly for the data from WDBC and South Hams District Council (SHDC) as the source of the data was the same and many of the suppliers are common to both authorities. In total, the dataset included 62,177 individual transactions totalling £106 million (31% of which was from WBDC). For each transaction, the amount, date, and cost code (from a list of about 6,000 which included a high-level description) were available. This data was sequentially filtered to remove items of spend that were not within the scope of emissions from purchased goods and services as follows:

- Suppliers that have been included in the footprint elsewhere were manually removed, for example waste contractor FCC (included separately under transport) and all energy suppliers (where they could be identified using standard searches).
- Suppliers for services which were out of scope were excluded by searching for terms within the supplier codes. This included categories such as paying for temporary staff through agencies and distributing money e.g., to parish councils for them to spend, or other transactions where the authority was just acting as a point of distribution for example any grants connected to Covid, and housing benefit costs.
- Some transactions were manually added back in, for example although FCC was scoped out, interrogation of spend with them included that spent on "plant and vehicles" and as this was not included under transport in Section 4.
- The suppliers were ranked by total spend, and a SIC code was manually assigned to each of these suppliers based on the general description of the goods or services provided within the transactions.
- In general, only one SIC code was assigned to each supplier, though in a few cases where spend was significant this was manually broken down further, for example Devon County Council was allocated as "public administration and defence", thought spend on waste was category allocated to the SIC category "waste collection treatment and disposal services; materials recovery services".
- This manual allocation was undertaken for all suppliers with a combined spend across both authorities of £50,000 or over which captured 71% of the total spend and 164 suppliers in total (or 89 suppliers that were "included" once the filtering described above was implemented).
- The remaining suppliers was classified as "not-allocated" and totalled 1,314 included suppliers.
- A specific emission factor was assigned to suppliers where a SIC category had been allocated and the emissions were then calculated by multiplying the spend by the emission factor. From these, an average weighted emission factor was calculated by dividing the total emissions from these suppliers by the total spend. This factor was then applied to all the non-allocated suppliers.

The filtering reduced the total relevant spend to £4.3 million (13% of the initial total spend) which resulted in 1,038 tCO_2e across 2,652 transactions. These emissions were split across a wide range of categories. A breakdown of emissions by category is shown in Figure 10 and Table 2.

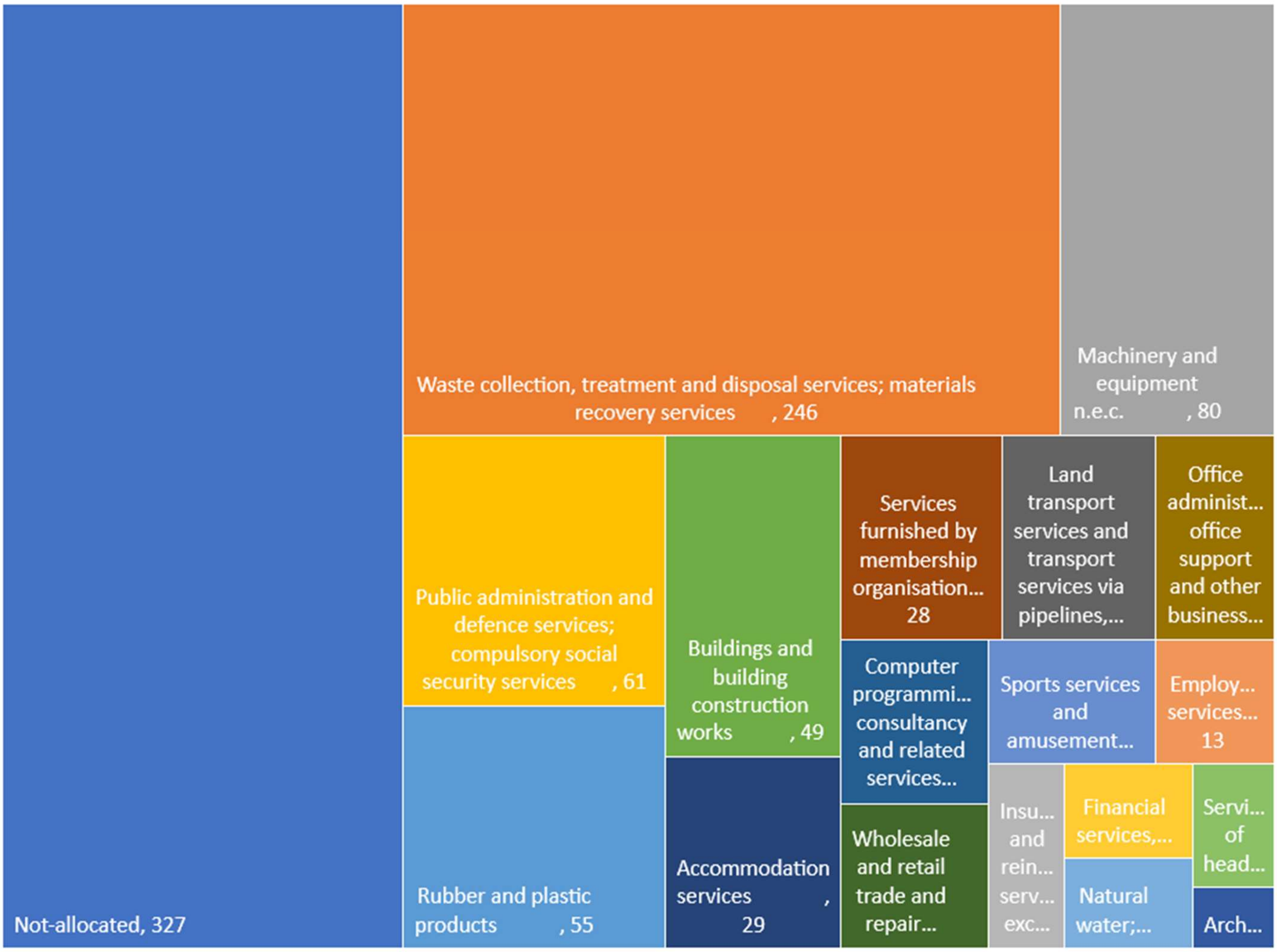


Figure 10: Breakdown of procurement emissions by category

Table 2: Breakdown of procurement emissions by category

Category	Total Spend	Number of Transactions	Total GHG (tCO_2e)	% of total tCO_2e	Cumulative % tCO_2e	Average tCO_2e/transaction
Not-allocated	£1,520,690	1725	327	31%	31%	0.2
Waste collection, treatment and disposal services; materials recovery services	£179,172	28	246	24%	55%	8.8
Machinery and equipment n.e.c.	£178,445	40	80	8%	63%	2.0
Public administration and defence services; compulsory social security services	£507,495	235	61	6%	69%	0.3
Rubber and plastic products	£92,896	8	55	5%	74%	6.8
Buildings and building construction works	£202,555	29	49	5%	79%	1.7
Accommodation services	£116,958	27	29	3%	82%	1.1
Services furnished by membership organisations	£296,011	11	28	3%	84%	2.6
Land transport services and transport services via pipelines, excluding rail transport	£51,995	1	27	3%	87%	27.0
Office administrative, office support and other business support services	£163,024	51	21	2%	89%	0.4
Computer programming, consultancy and related services	£207,442	126	21	2%	91%	0.2
Wholesale and retail trade and repair services of motor vehicles and motorcycles	£118,265	42	18	2%	93%	0.4
Sports services and amusement and recreation services	£115,102	64	18	2%	94%	0.3
Employment services	£95,964	68	13	1%	96%	0.2
Insurance and reinsurance services, except compulsory social security	£176,248	15	12	1%	97%	0.8
Financial services, except insurance and pension funding	£149,597	46	10	1%	98%	0.2
Natural water; water treatment and supply services	£45,996	63	10	1%	99%	0.2
Services of head offices; management consulting services	£84,330	7	9	1%	100%	1.3
Architectural and engineering services; technical testing and analysis services	£27,326	66	4	0%	100%	0.1
Grand Total	*£4,329,512*	*2652*	*1038*	*100%*	*100%*	*0.4*

In total, 10 out of 422 suppliers were associated with 50% of the emissions. Sparling recycling were the greatest source of emissions at 236 tCO_2e. A breakdown of emissions by supplier is shown in Figure 11 and Table 3.

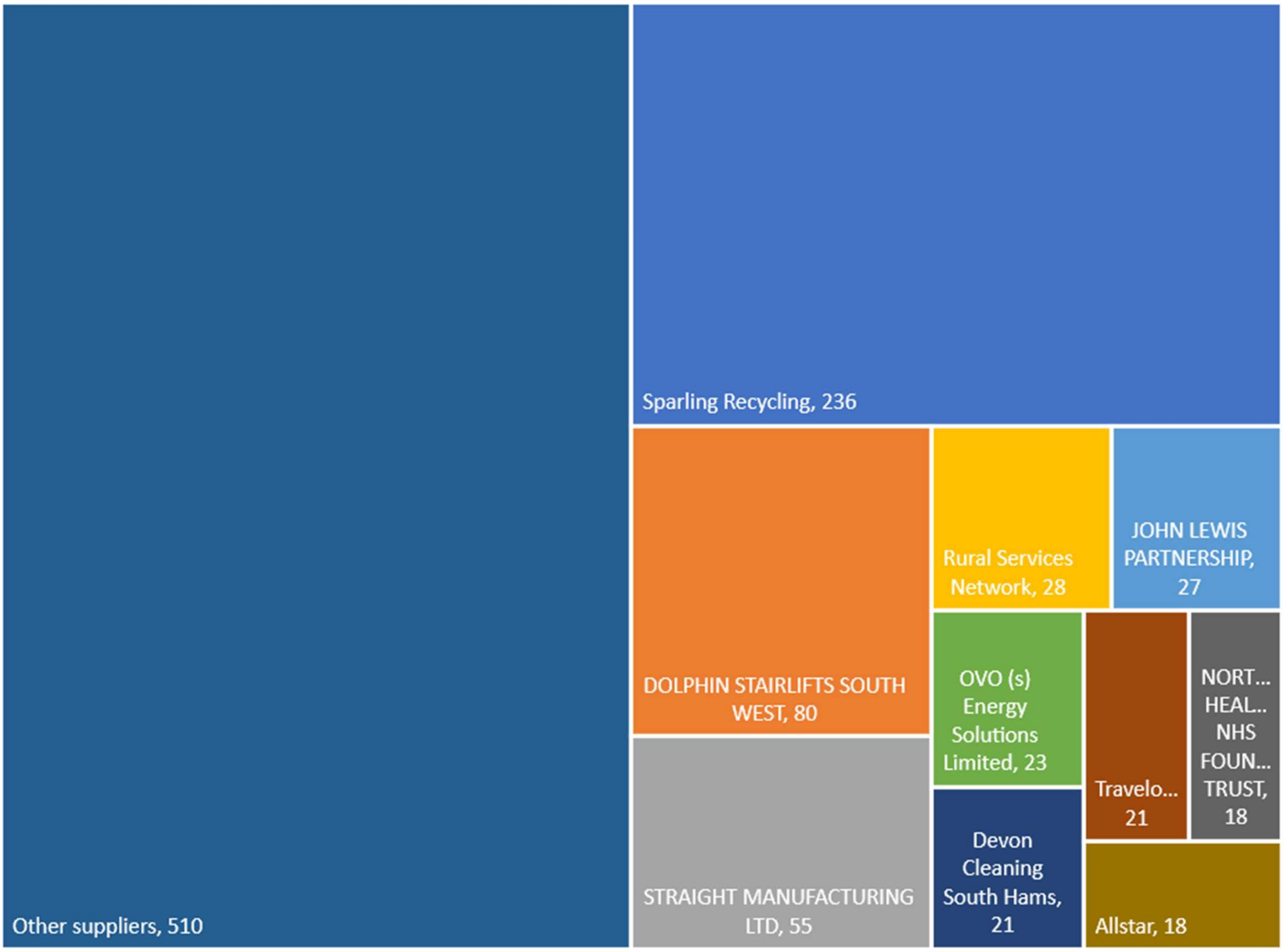


Figure 11: Breakdown of procurement emissions by supplier

Table 3: Breakdown of procurement emissions by supplier covering 50% of procurement emissions

Supplier	Total GHG (tCO_2e)	% of total tCO_2e	Cumulative % tCO_2e	Number of Transactions	Average tCO_2e/transaction
Sparling Recycling	236	23%	23%	21	11
Dolphin Stairlifts South West	80	8%	30%	40	2
Straight Manufacturing Ltd	55	5%	36%	8	7
Rural Services Network	28	3%	38%	11	3
John Lewis Partnership	27	3%	41%	1	27
OVO (s) Energy Solutions Limited	23	2%	43%	4	6
Devon Cleaning South Hams	21	2%	45%	51	0
Travelodge	21	2%	47%	18	1
Northumbria Healthcare NHS Foundation Trust	18	2%	49%	42	0
Allstar	18	2%	51%	98	0
Other suppliers	*510*	*49%*	*100%*	*2358*	*0.2*

5.2 National policy framework

Current national policy does not address directly WDDC's procurement activities. However, there are several indirect policy areas that should improve data quality and emissions reduction including:

- Major contracts to Central Government requiring quantification of carbon impact. Whilst this will not directly affect WDBC, the policy is helpful in readying supply chains more generally.
- The SECR (Streamlined Energy and Carbon Reporting) regulations now require large companies[m] to disclose their annual greenhouse gas emissions and intensity ratio (e.g., kg CO_2/£ spent). This should enable much more specific information to be available from those suppliers, in addition to providing incentive to those suppliers to reduce those emissions year on year.
- The greenhouse gas aspects of Building Regulations for new buildings have to date focussed on operational energy performance, and even the proposed "Future Homes Standard" changes planned for 2025 will still only consider operational emissions. However, there is a growing realisation of the need to include embodied emissions, and there are several emerging guidelines that cover embodied emissions being adopted in local planning policy, notably in London through the "London Energy Transformation Initiative" (LETI)[n]. As this issue gains prominence, consultants and contractors will have higher levels of readiness to measure and reduce embodied emissions from construction projects.
- Whilst the kg CO_2/£ spent emission factors are unreliable, there are an increasing number of private sector organisations who are developing products and services that aim to plug this gap, and it is expected that these should be more widely available over the period to SH's planned decarbonisation.
- The general decarbonisation of the UK and global economies should have knock-on effects on all procurement by WDBC. For example, all WDBC's suppliers will benefit from the reducing carbon intensity of the electricity grid, just as WDBC is.

5.3 Opportunities

5.3.1 Improve data capture

At present, the quality of procurement GHG emissions data is poor, as is the default condition for organisations nationally. To improve data capture so that year-on-year quantification of procurement emissions are both meaningful and provide incentives for ongoing reduction, it is recommended that all suppliers for new contracts exceeding £50,000 should be required to state the associated greenhouse gas emissions with that contract for each financial year as well as commitments and plans to decarbonise those emissions. For large organisations, this information should be readily available due to their obligations under the SECR regulations. Small and medium organisations should be encouraged to provide similar information as part of their own commitments to mitigate climate change. Where this is not available, as a minimum suppliers should provide the corresponding sector for spend to minimise the effort and error associated with manual allocation, and this information be recorded in procurement records.

5.3.2 Follow circular economy principles

Where a need for new goods and services is demonstrated, it is important to follow circular economy principles to minimise environmental impact. Figure 12 compares a linear and circular approach. Following a hierarchy of repair, reuse, remanufacture, and recycle, goods are involved in one less part of the value chain each time, leading to significantly reduced environmental impact. It is important that, as per the recommendation to improve data capture, circular economy decisions are taken with good quality data, i.e. from the suppliers. Failure to do so may result in simply looking to spend the lowest amount possible (as this returns the lowest emissions using the simple spend method), when sometimes solutions with higher upfront costs have lower lifecycle emissions (and potentially overall costs too). Greenhouse gas emissions should be a determining factor alongside cost and quality considerations when awarding

[m] Turnover more than £36 million, balance sheet over £18 million, or more than 250 employees.
[n] https://www.leti.london/

new contracts. It is recognised that it is not straightforward to do this for existing contracts, but by 2030 most contracts in place will be new.

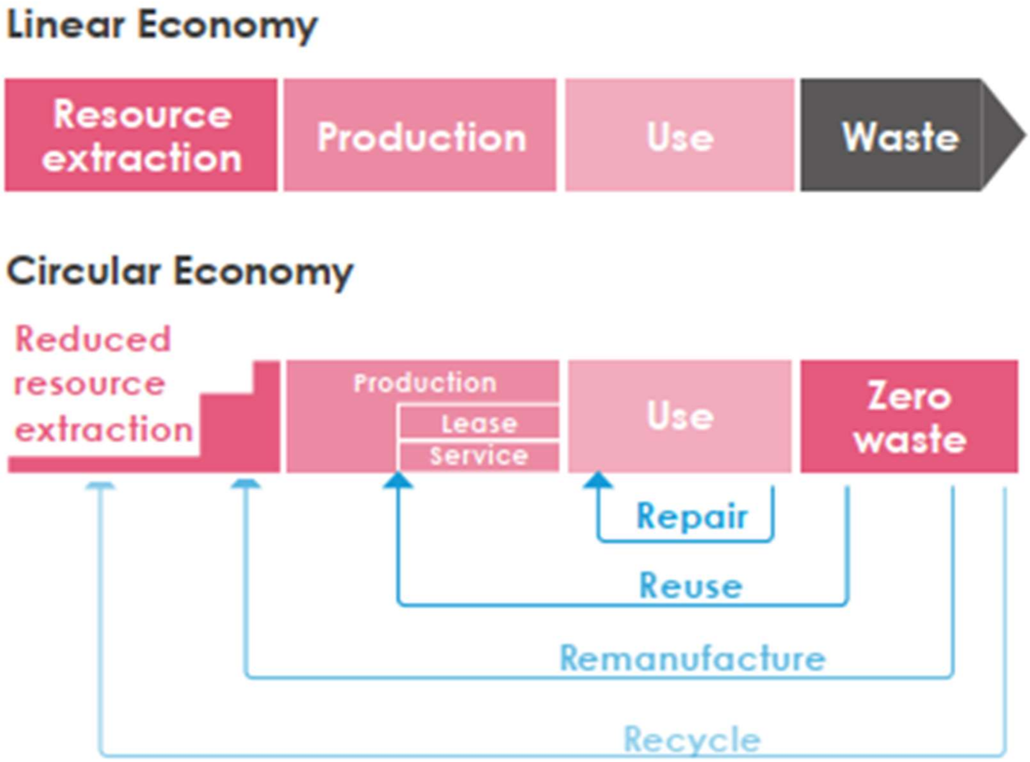


Figure 12: Circular Economy Principles, compared to existing Linear Economy (Source LETI [12])

For most sectors or products and services there are no specific standards that can be applied to set targets or requirements through procurement. A notable exception to this is the construction of new buildings exception where LETI have produced benchmarks for different building types which for example range from 100 kg CO_2e/m^2 for A++ home to 1,200 for a G rated home. It is much less easy to specify targets for other parts of the council's procurement. Suppliers in the UK will benefit from wider decarbonisation such as the falling carbon intensity of electricity supply and other measures that organisations across the economy will be taking to reduce emissions. Where supply chains rely on global trade (more likely with the provision of goods than services), then there may be equivalent carbon reduction activity in those countries of origin, but this is harder to account for. The assumption we make in the analysis here is that emissions from all contracts fall in the same proportion as the CCC identify in their Sixth Carbon Budget report to 2030. There is clearly a much higher chance of this being realised in practice if the council obligates suppliers to provide contract specific emissions data and uses this in the contract selection process.

5.4 Target for 2030

Projections suggest a reduction in the emissions from procurement from 1,038 to 658 tCO_2e in 2030 (-37%). The projections are based on:

- Improving data capture, as an enabling measure that will both improve the accuracy of the footprint and provide the foundations for incentivising suppliers to reduce their emissions.
- Start working directly with suppliers, especially those where most money is spent, to see how the GHG emissions associated with those contracts could be reduced.
- Using greenhouse gas emissions as part of the selection process for new suppliers capturing all contracts (not just Construction), with the aim of decarbonising these contracts at least as fast as the UK's general decarbonisation trajectory.

Figure 13Error! Reference source not found. shows projected emissions from procurement for WDBC in 2020, 2025 and 2030.

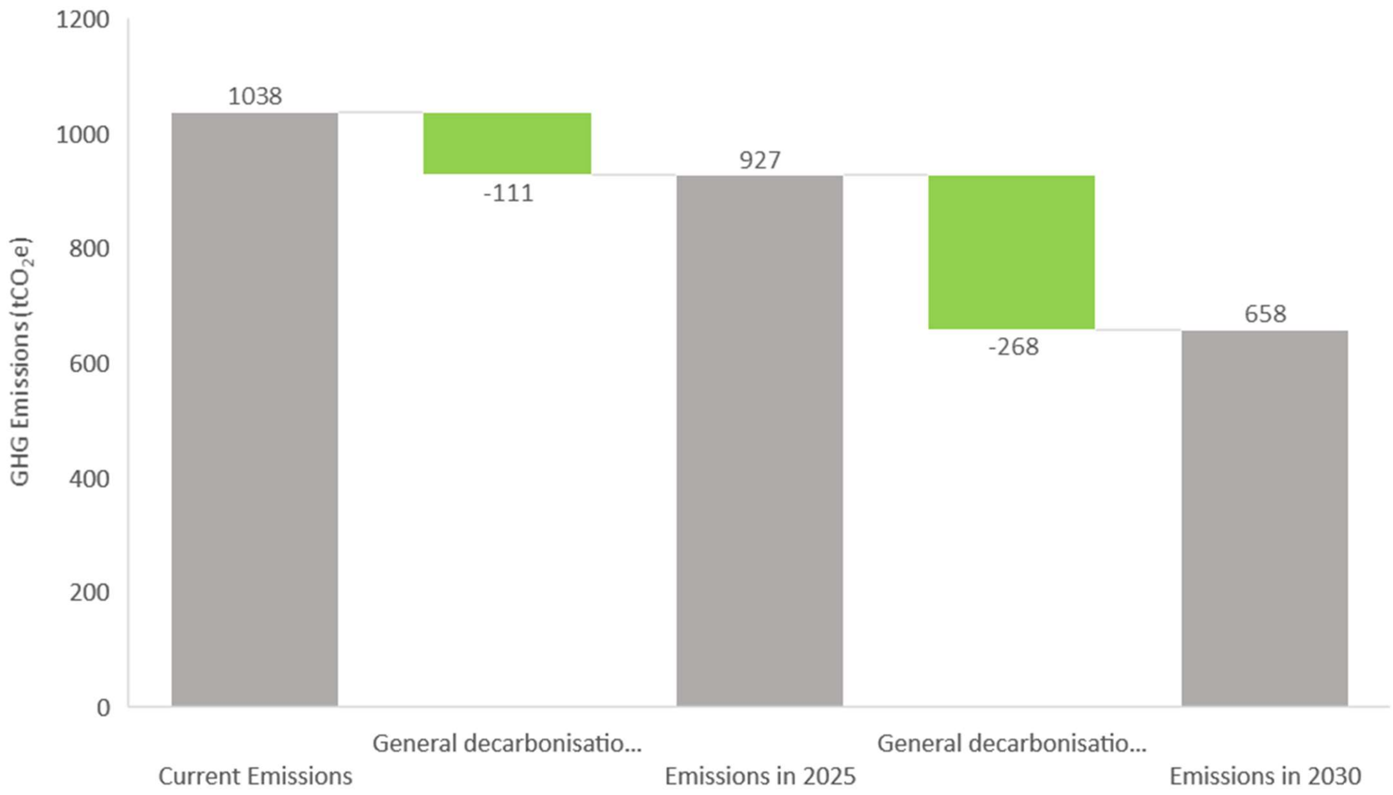


Figure 13: Measures to reduce WDBC procurement emissions to 2025 and 2030

6 F gas and waste

6.1 Detailed sector summary

This section only considers WDBC's own waste and F-gas emissions, not the waste it collects or the F-gas emitted in the borough.

The Council makes provision for recycling in its offices at Kilworth Park, which is taken as the only source of the Council's waste. Waste comprises recyclates and general mixed waste. Data on general waste collection is available for the waste contractor (Biffa) for the period June 2021 to May 2022. Total waste collected during the period was 7.3 tonnes of which 50% is estimated to be from Kilworthy Park (3.7 tpa)[o]. Disposal at EFW is assumed.. The recycling collection contractor estimates that the quantity of recyclates is 3.3tpa[p]. The quantities of waste recoded may be lower than prior years due to Covid-19 and more extensive home working during the period of measurement implying a potential for some bounce back in subsequent years. Waste emissions total 0.1 tCO_2e.

WDBC's only source of F gas emissions is from a small amount (59 kW) of air conditioning at Kilworthy Park. The total refrigerant charge of these units is approximately 25.2kg[q]. Assuming a refrigerant mix of R410A and R470C (50/50) and a 3% refrigerant leakage rate[r] gives GHG emissions of 1.5tCO_2e.

6.2 National policy framework

National waste policy primarily addresses municipal waste rather than waste generated by organisations which is classified as commercial and industrial (C&I) waste.

In the Sixth Carbon Budget, where waste forms 6% of baseline GHG emissions in 2020, the CCC's Balanced Net Zero Pathway calls for:

- Waste prevention and reduction including a 50 % reduction in edible waste by 2030 (vs 2007)
- Increased recycling rates to above 70% (currently households 45% and C&I ~55%)
- Installation of carbon capture and storage at EfW plants
- Improved landfill methane capture, banning biodegradable waste from 2025 and ceasing landfill by 2040
- Waste water and composting improvements

National data on commercial and industrial (C&I) waste, which makes up the majority of UK waste, is very poor. Publication of C&I arisings data is sporadic (every 2-3 years) and composition and recycling data is not collected. The Government's recent Net Zero Strategy[13] does not refer to C&I waste.

Emissions factors for most wastes are low with the recycling and EfW disposal for all categories of waste (refuse, electrical, metal, plastic and paper) assigned a factor of 21.3 kg CO_2e/tonne. Higher factors are assigned to landfill of C&I refuse (458 kg CO_2e/tonne). Avoiding landfill is important. Factors for anaerobic digestion are lower at 10.0 kg CO_2e/tonne.

The same is not true for F gases, some of which (Sulphur hexafluoride [SF6]) have emission factors 22,800 times that of CO_2. Regulation is the main tool for national reductions in F gas emissions. Current regulations require a range of measures to reduce emissions, including controls on what gases are on the market, product bans, leak checks and mandatory certification for handlers of F gases. The regulations target a 79% reduction in consumption from 2015 levels by 2030. F gas regulations are currently under review with the potential that the revised regulations may go further.

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[o] The remainder is from the Okehampton and Tavy Business Parks where the tenants generate the waste.
[p] Based on 100kg to 150 kg collected fortnightly.
[q] Email Adam Williams 9 August 2022
[r] From DEFRA Environmental Reporting Guidelines

6.3 Opportunities

Once the Council's corporate waste leaves its premises it enters a policy vacuum. This argues for strong action on waste prevention, reduction and recycling in-house. The first priority is to obtain accurate waste data. Waste data may be available from the Council's waste collection contractor. Alternatively, estimates require records of the numbers of containers and collection frequencies. The aim should be for an annual WDBC waste report that includes:

- A full list of the sites that generate WDBC's waste
- Tonnes per annum of each category of wasted collected from each site
- A breakdown of categories by weight (e.g. paper, glass, aluminium, plastics, general waste composition, WEEE, aggregates, hazardous etc.)
- The final destination of the waste reported (e.g. 30% re-used , 50% recycled, 10% incinerated with energy recovery, 10% to landfill)
- The above will form a base year against which targets can be set to measure the effect of waste prevention activities and recycling initiatives.

In the absence of this data it is not possible to identify specific opportunities for emission reduction. However, the high emissions factor for landfill emphasises the immediate attraction of using a contractor that can guarantee no waste going to landfill.

The recommended approach to F gases is contained in Annex C of the Government's Environmental Reporting Guidelines, which provide the recommended method for assessing emissions. This requires an inventory of refrigeration, air conditioning and heat pump equipment that records for each item: the refrigerant type, the charge capacity and the time in use during the reporting period. A comprehensive survey of WDBC's assets is required to collect the information which can them be used to plan an F gas reduction programme.

Looking ahead, good record keeping will be essential, as the installation of new air conditioning and heat pumps could lead to an increase in F gas emissions. Currently the GWP of R32 is about one third of the currently commonly used R410a and it will be important to specify lower or near zero GWP refrigerants for any future air conditioning and heat pump installations in WDBC's buildings to minimise or remove any F-gas impact.

6.4 Target for 2030

Projections in the emissions from waste and F gas are assumed to reduce emissions from 1.6 tCO_2e in to 0.2 in 2030 (-91%).

As reliable information on the amount of WDBC's waste and F gases is not currently available, the immediate target is to accurately quantify WDBC's own waste volumes and the Council's full inventory of F gas.

Projections of GHG emissions are based on:

-
- No future changes in waste tonnage
-
- All existing F gas appliances with high GWP F gas will be replaced or recharged with R32 before 2025
- Any air conditioning or heat pumps deployed in WDBC's non-domestic buildings post 2025 have near zero GWP refrigerants eliminating future F-gas emissions

Figure 14 shows projected emissions from the waste and F gas sector to 2030.

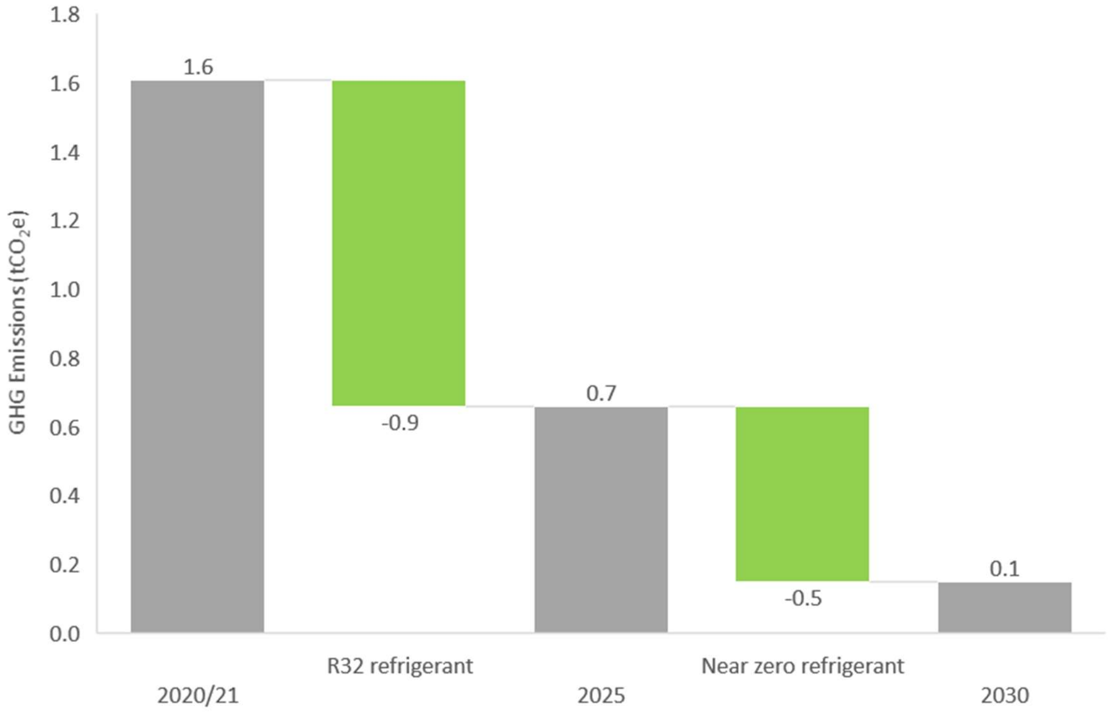


Figure 14: WDBC's projected emissions from the waste and F gas sector in 2020, 2025 and 2030

7 Renewable energy

7.1 Detailed sector summary

WDBC has a 7kW PV array on the roof of Kilworthy Park that generates approximately 6.4MWh. This generation represents 4% of the building's electricity use and achieves 1.5 tCO_2e of avoided GHG emissions.

The Okehampton Business Centre has a 6kW wind turbine and a biomass boiler that generate an estimated 9 MWh of electricity[s] and 50 MWh of heat respectively[t]. Renewable heat is included under buildings in Section 3 above. The wind turbine provides approximately 20% of the building's electricity (with a minimal amount being exported, typically 0.1MWh) and achieves 2.1 tCO_2e of avoided and offset GHG emissions.

New renewable electricity installations are likely to use PV technology. The efficiency of PV panels deteriorates over time with most manufacturers providing a guarantee that the panel will retain 80% of its generating capacity after 20 years of service. This equates to an annual decrease of $\sqrt[20]{0.8} = 0.989$ for each year of operation. This factor is included in projections of PV generation.

The continuing fall in grid electricity emission factors means that future offsets will gradually reduce. In 2030 the grid emission factor is projected to have fallen from the current 0.233 kg CO_2e/kWh to 0.065 kg CO_2e/kWh so, while renewable electricity generation with a business case will continue to be financially attractive and resource effective, its role in offsetting carbon emission reductions in other sectors will decline.

7.2 National policy framework

National policy no longer incentivises the installation of PV which must be justified on its own business case and, while the Sixth Carbon Budget discusses the role of ground mounted PV in contributing to the electricity system, building-based PV, because of its relatively small scale in a national context, is not referred to.

7.3 Opportunities

7.3.1 Leisure centre PV

WDBC intends to install PV on the roofs of leisure centres in Tavistock and Okehampton[u]. Table 4 shows the capacity and estimated generation achieved by the proposed installations.

Site	Location	Size of PV system kWp	Electricity consumed onsite[v] kWh	PV own use[w] kWh	PV export kWh	Total PV generation kWh
Meadowlands Leisure Centre	Tavistock	92	102,402	68,704	5,500	74,204
Parklands Leisure Centre	Okehampton	177	138,502	108,967	46,219	155,186
Total		270	240,904	177,671	51,719	229,390

Table 4: Proposed WDBC leisure centre PV programme

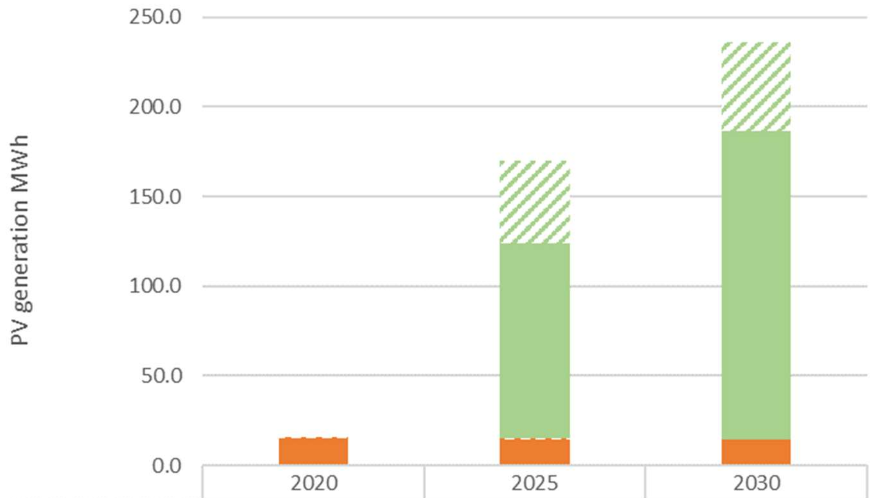
Once the systems are installed they provide a total capacity of 270 kWp generating 229 MWh of electricity. When first installed a total of 178 MWh is estimated to be used at the leisure centres with the remaining 52 MWh being exported.

[s] Based on Kingspan KW6 reference annual energy at 5m/s wind speed
[t] Calculated from fuel use data
[u] PV capacity and generation data in email from Adam Williams 14 July 2022
[v] 2020/21 electricity consumption data which is assumed to be used evenly over the year
[w] Monthly PV generation profile for own use and export calculations from PV GIS

The assumption is made that the systems at the Parklands leisure centre is installed before 2025 with the remaining array at Meadowlands installed by 2030.

7.3.2 PV summary

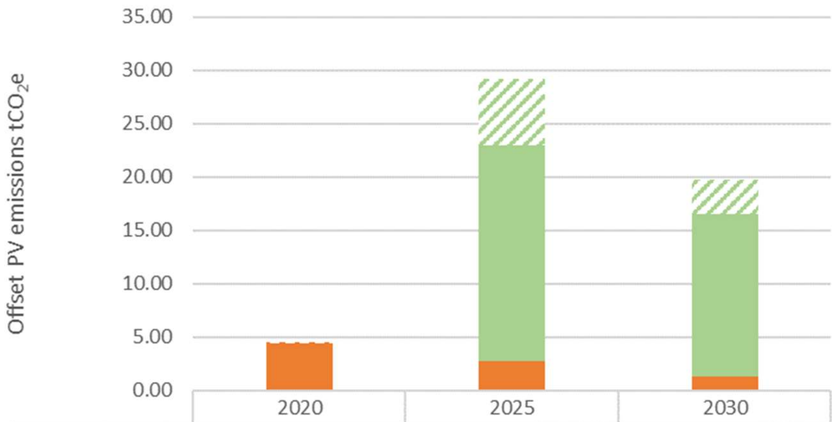
Figure 15 shows the estimated own use and export generation from WDBC's PV to 2030 categorised into existing and future build.



	2020	2025	2030
Future export	0.0	46.2	49.2
Future own use	0.0	109.0	171.8
Existing export	0.1	0.1	0.1
Existing own use	15.2	14.9	14.5

Figure 15: Projections of WDBC's current and future PV generation

GHG emissions offset through own use and export of domestic PV generation is summarised in Figure 16.



	2020	2025	2030
Future export	0.0	6.2	3.2
Future own use	0.0	20.1	15.3
Existing export	0.0	0.0	0.0
Existing own use	4.39	2.75	1.29

Figure 16: Projections of GHG emissions offset[x] by WDBC's PV generation

Note that own use PV generation is deducted from electricity consumption at the site where the generation is situated.

[x] Note that own use of PV generation is deducted from electricity use and export emissions provide offset credit

7.4 Target for 2030

Projections suggest an increase in the reduction in emissions due to the export of renewable energy to -3.2 tCO_2e in 2030.

Installation of PV at the Okehampton leisure centre before 2025 increases the total export of renewable electricity to 46 MWh resulting in offset emission of -6.2 tCO_2e 2025. Subsequently, despite the installation of PV at Tavistock leisure centre between 2025 and 2030, the reduction in the gird emission factors in 2030 leads to a fall in offset emissions.

Figure 17 shows projected emissions abatement from PV in 2020, 2025 and 2030.

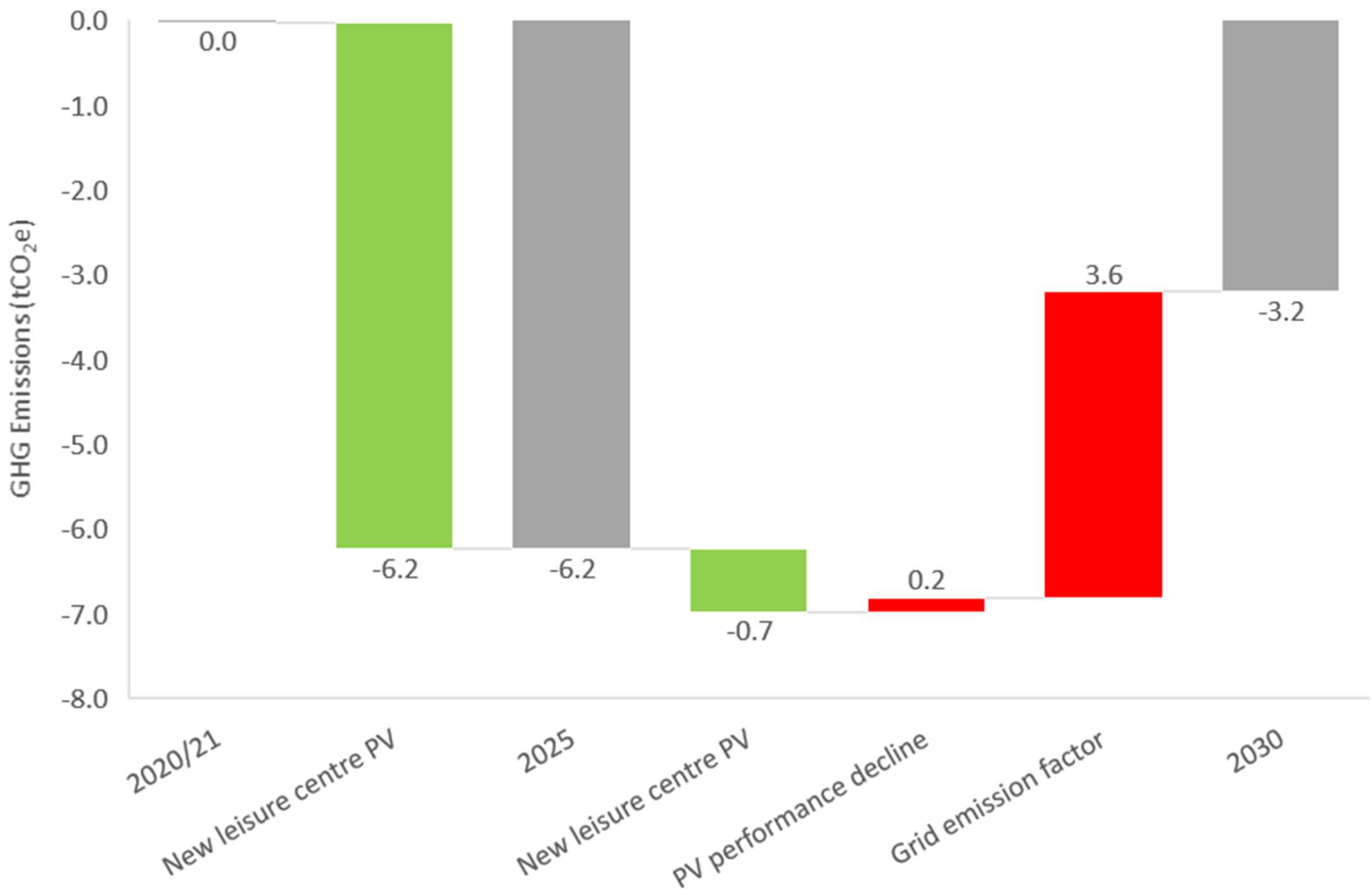


Figure 17: Measures to increase WDBC PV export offset emissions to 2025 and 2030

8 Land use change - afforestation

8.1 Detailed sector summary

Land use is not included as part of WDBC's footprint as the assumtion is made that the use of WDBC's land does not change significanlty from its current use.

Evaluation of the offset potential is based on data from the Sixth Carbon Budget, which provides GHG savings from planting different types of biomass (see Figure 18).

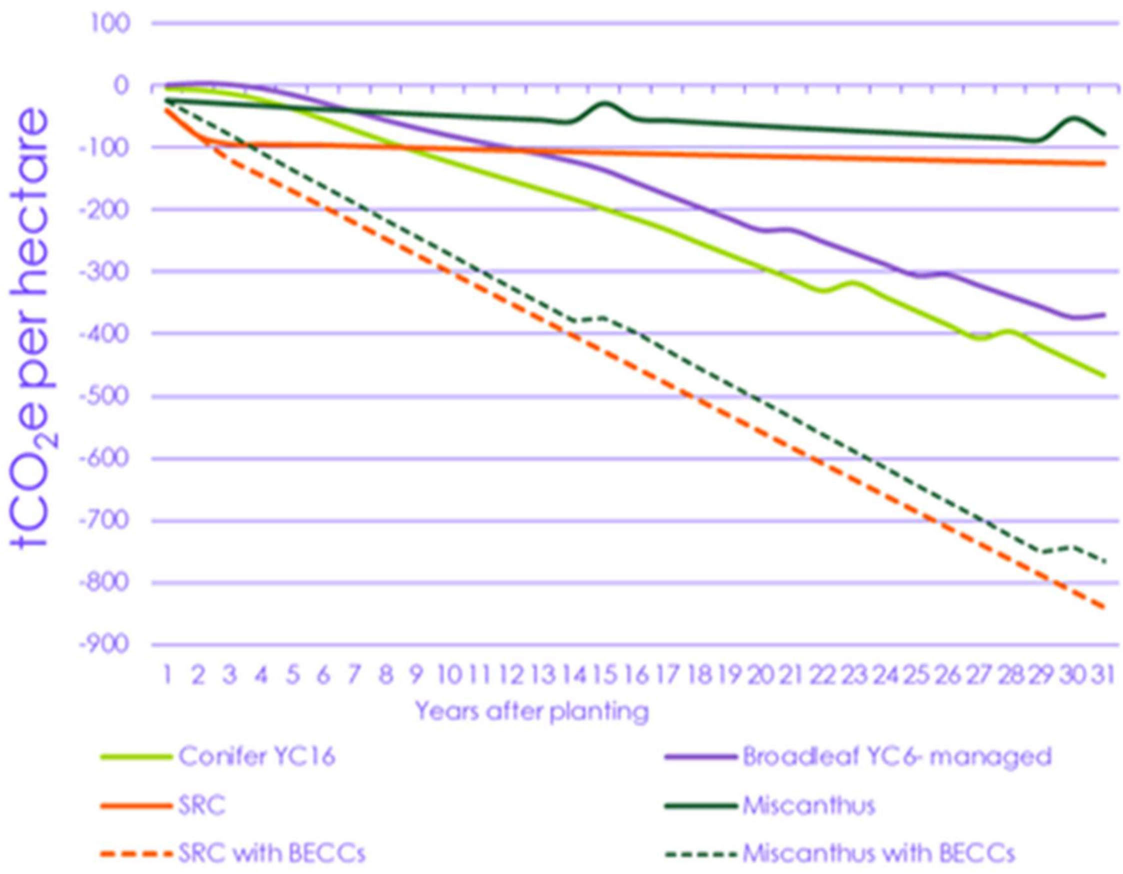


Figure 18 GHG savings from planting different types of biomass (source CCC)

8.2 National policy framework

National policy initiatives for tree planting include:

- The 2016 Woodland Carbon Fund for England, which provides £19 million for woodland planting and maintenance.
- The £640 million Nature for Climate Fund announced in the 2020 budget, part of which will deliver the Government's manifesto commitment to plant 30,000 hectares per year of new woodland in the UK by 2025.
- DEFRA's Woodland Carbon Guarantee scheme, which is designed to increase private sector investment.

8.3 Opportunities

Evidence prepared for the Joint Local Plan[14] classifies areas of open space in the borough. Potential areas identified as suitable for afforestation are limited to parts of "amenity greenspace" of which WDBC owns 9.5 ha. In addition, there are some 6.4ha of land without public access identified for tree planting giving a total of 15.9 ha. WDBC currently plans to plant some 0.2 ha of the amenity greenspace plus the 6.4ha of land without public access, a total of 6.6ha (or 42% of the total) with predominantly broadleaf trees[y].

Figure 19 and Figure 20 show the GHG offset achieved from planting different proportions of the greenspace with broadleaf trees and conifers respectively. Planting is assumes to take place evenly over the years between 2022 and 2030.

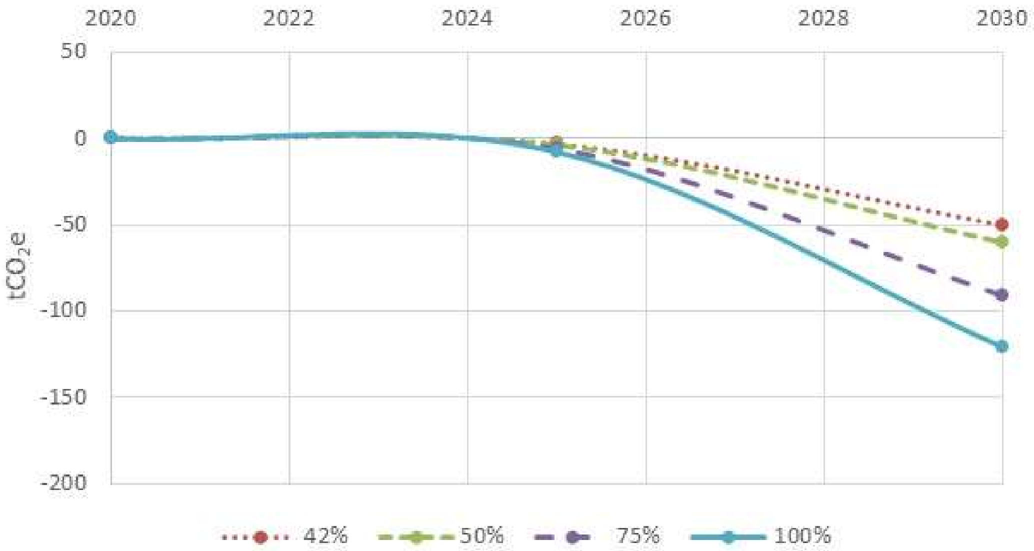


Figure 19: GHG offset from planting varying proportions of WDBC amenity greenspace and land without public access with broadleaf trees

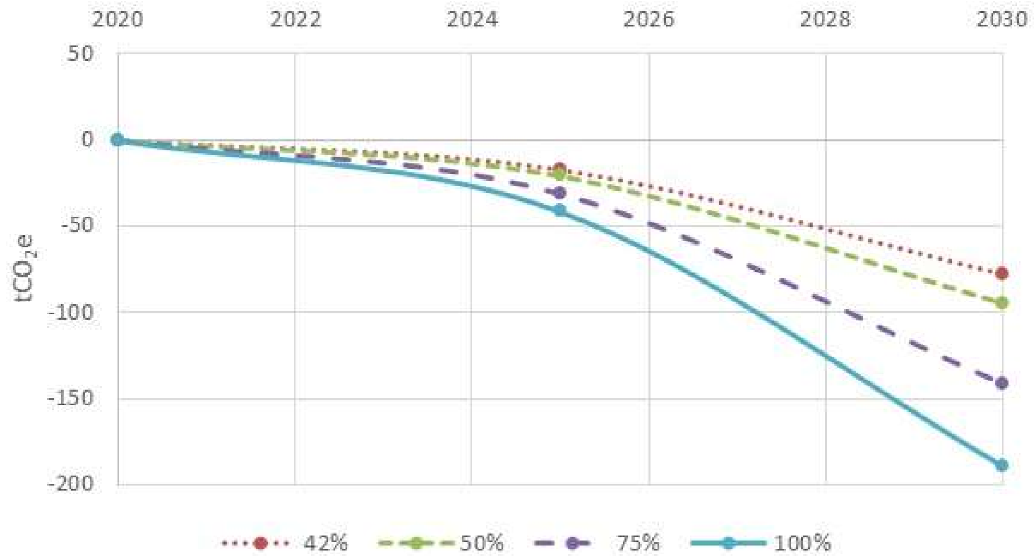


Figure 20: GHG offset from planting varying proportions of WDBC amenity greenspace and land without public access with conifers

[y] From email correspondence with Rob Sekula on 14th July 2022

Current plans to plant 6.6ha with broadleaf trees are estimated to achieve a GHG reduction of 3 tCO_2e by 2025 and 50 tCO_2e by 2030.

8.4 Target for 2030

Projections suggest a reduction in the emissions due to afforestation of 3 tCO_2e by 2025 and 50 tCO_2e by 2030. The projections are based on 42% (6.6 ha) of WDBC's amenity greenspace being planted with broadleaf woodland between 2022 and 2030. A planting density of 2,000 trees/ha means the addition of 13,200 trees by 2030.

Figure 21 shows the projected WDBC GHG emissions offset by afforestation in 2002, 2025 and 2030.

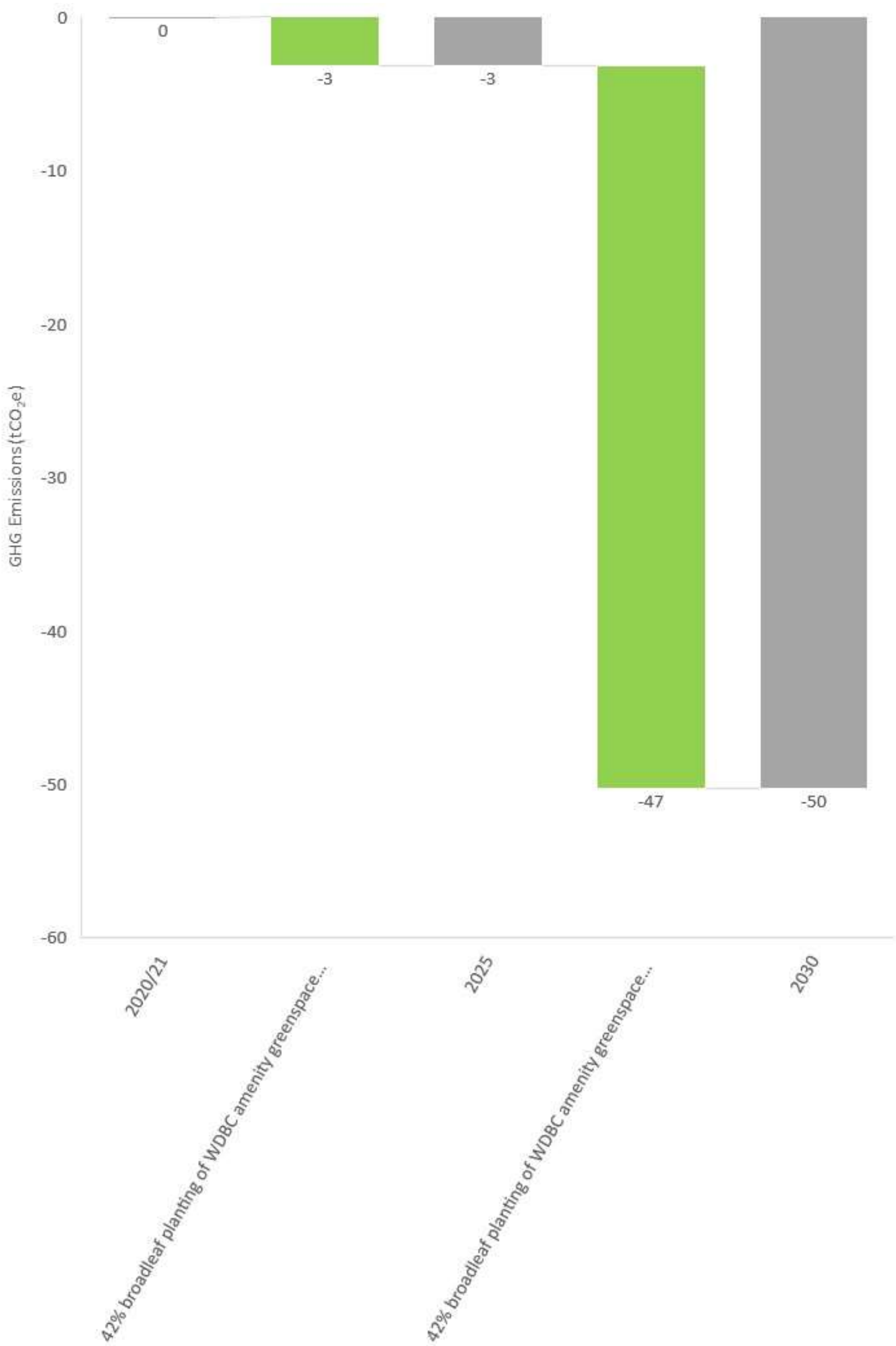


Figure 21: Afforestation measures to offset emissions to 2025 and 2030

9 All sectors

Table 5 gives a summary of WDBC's GHG emissions for 2020/21 and projections for 2025 and 2030 across all sectors.

Sector	2020/21 t CO_2e	2025 t CO_2e	2030 t CO_2e	Trend
Non domestic	616	898	172	
Transport	741	593	96	
Procurement	1,038	927	658	
F-gas and waste	2	1	0	
Renewables	0	-6	-3	
LUC afforestation	0	-3	-50	
Total	2,396	2,408	873	

Table 5: Sector emissions projection summary for WDBC

Overall, the projections suggest a reduction in emissions from 3,962 to 872 tCO_2e in 2030 (64%). Figure 22 shows the projected emissions for all sectors for 2020, 2025 and 2030.

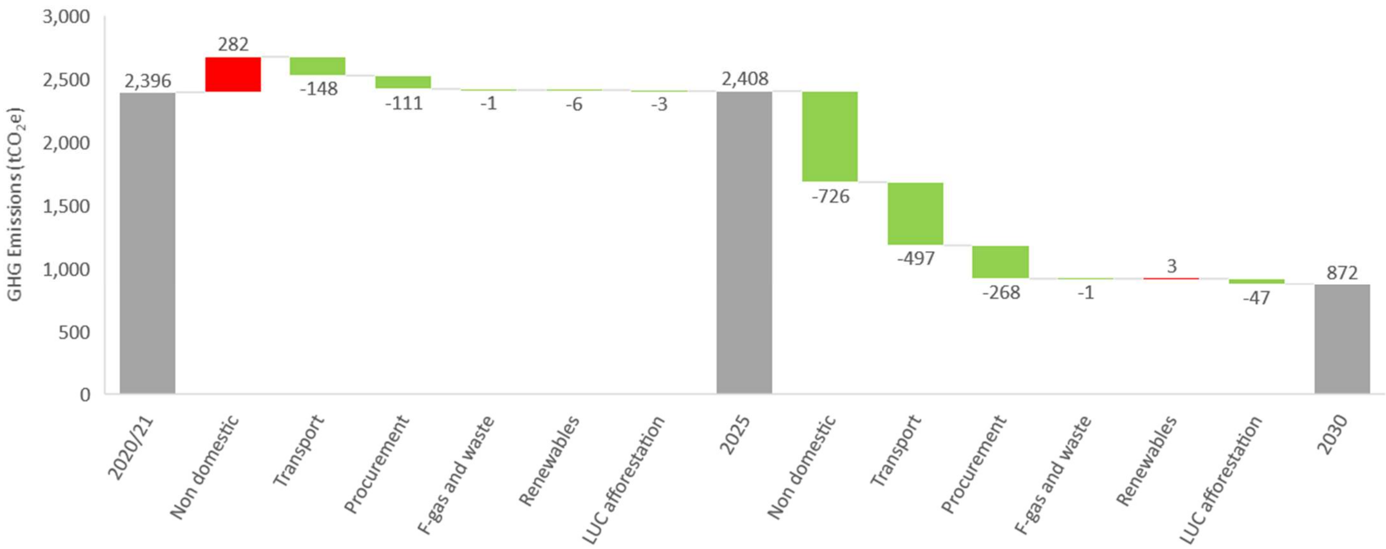


Figure 22: Projected emission for all sectors for 2020, 2025 and 2030

Procurement of goods and services, the sector the council perhaps has least control over, accounts for 43% of emissions in 2020 rising to 71% in 2030[z].

The dominance of Scope 3 emissions in the procurement sector must not distract attention from the emissions in other sectors where the Council has the ability to make progress. Figure 23 summarises emissions, in absolute and percentage terms, for all sectors and all sectors less procurement. These graphics highlight the potential for progress in non-domestic buildings and transport.

[z] Emission percentages in this section exclude offset emission sectors

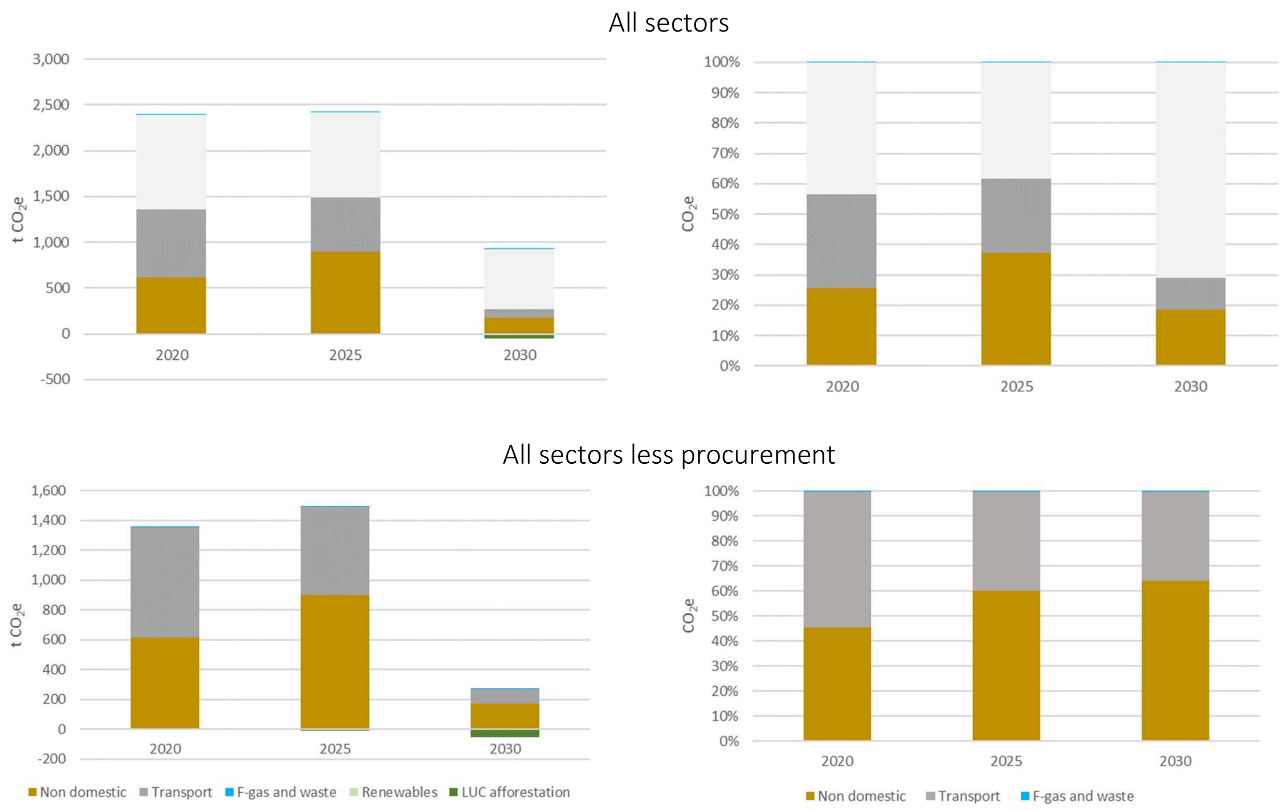


Figure 23: Absolute and percentage GHG emissions by sector for 2020, 2025 and 2030 for all sectors and all sectors less procurement (negative sectors not included in percentage graphs)

10 Conclusions

The improved data and detailed methodologies in this study, combined with changes in activity levels, have significantly affected the 2020/21 footprint. Direct (Scope 1 and 2) emissions have fallen 61% from 2018/19 largely due to the outsourcing of waste collection and, despite the transfer of these emissions to the indirect category (Scope 3), changes to procurement spend data collection and underlying changes to spend itself have also seen indirect emissions fall by 41%. Total emission have therefore fallen 47% between 2018/9 and 2020/21 from 4,555 tCO_2e to 2,396 tCO_2e.

Indirect emissions represent 76% of WDBC's emissions in 2020/21. Indirect emissions are inevitably those over which WDBC has least control and, while it is important to take steps to influence indirect emissions, this should not overly divert attention from reducing direct emissions where the Council is in control.

The combination of highly aggressive carbon reduction measures included in the projections indicate the potential to reduce 2020/21 net emissions from 2,396 t CO_2e to 872 t CO_2e a reduction of 64%. While all sectors need attention, key direct emission reduction measures include the phasing out of gas use in council building stock and the electrification of the vehicle fleet. Indirect emissions from procurement dominate the residual 2030 emissions (71%). Excluding procurement, residual emissions fall 84% from 1,358 t CO_2e to 215 t CO_2e with buildings the largest remaining emitter (64%).

Offset of residual emissions through the purchase of Pending Issuance Units (PIU) for UK Woodland Carbon Units (see Appendix 3), assuming an average cost of £13.5 per t CO_2e, would cost £13k with procurement and £3k without. Alternatively, based on the land use change analysis in Section 8, direct coniferous tree planting between now and 2030 of 78 ha offsets residual emission with procurement and or 18 ha offsets residual emissions without procurement.

Annual assessment of the council's GHG emissions to identify the changes that have taken place each year will enable the evaluation and updating of the actions required to deliver net zero.

Achieving net zero, whether nationally, locally or organisationally requires broad action cross all sectors. The projections for WDBC show that delivering net zero in a timeframe as tight as 2030 is challenging.

Appendix 1: Scope 2 (purchased electricity) GHG accounting methods

The method used for calculation Scope 2 (purchased electricity) emissions in this report follows the UK Government Environmental Reporting Guidelines[1] and adopts the GHG Conversion Factors for Company Reporting[2].

The Corporate Accounting and Reporting Standard issued by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI)(see https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf) gives two alternative GHG accounting methods for Scope 2:

> Location-based
>
> The location-based method reflects the average emissions intensity of the electricity grids on which energy consumption occurs using grid-average emission factor data (as per the approach adopted in this report). The location-based approach socialises the benefit or renewable energy to all electricity consumers on the grid.
>
> Market-based
>
> The market-based method allows any type of contractual agreement, which ensures the reporting organisation pays for the same amount of renewable electricity as it consumes in a given year, to attribute its electricity emissions to zero. The market-based approach give priority access to renewable energy to those with contracts to acquire it.

To be mutually consistent in a single grid area, such as the UK, the UK grid emissions factor would need to be calculated excluding the renewable energy acquired under market-based agreements. This is not the case and therefore, on a national basis, the emissions reduction from renewables connected to the grid is, to the extent UK organisations are using the market-based method, being taken twice. Consequently, the templates provided in the UK Environmental Reporting Guidelines state that it is mandatory to report location-based Scope 2 emissions. Duplicate market-based reporting is optional.

WDBC's electricity supplier provides ring fenced Renewable Energy Guarantee of Origin (REGO) certification for the power it purchases which it states "will not be allocated or counted against any other claim". Using the market based method in the WBSC and WRI standard this would allow WDBC to account for its Scope 2 electricity as zero emissions. This could also be show alongside the location-based emissions under the UK guidelines.

A briefing note for the CCC[15] expresses concerns about the market-based method and the use of REGOs. It states that the method does not guarantee that an organisation acquiring renewable energy is actually reducing emissions within the wider system as contracts do not specify that new renewable generation needs to occur as a result of the procurement contract, concluding that "in the UK, there is limited potential for independent procurement to actually lead to new generation" i.e. there is no additionality. On REGOs the document concludes that "the REGO system and, overall, the green tariff system cannot be considered as a support system to drive new renewable generation. For this reason, green tariffs rarely create additionality – meaning, they rarely lead to any decarbonisation of the system."

It should be noted that under the when reporting under Environmental Reporting Guidelines using the market-based method, organisations are restricted in reporting offsets from exported own renewable generation that would have the effect of creating overall negative emissions from electricity.

Appendix 2: West Devon Borough Council GHG emissions by scope in tonnes CO_2e

No.	Category	2018/19	2020/21
SCOPE 1: Direct GHG emissions and removals		**1435.2**	**421.8**
1. Stationary combustion		*73.3*	*378.4*
1	Kilworthy Park	37.0	39.5
1	WDBC rented out sites	36.3	216.5
1	Meadowlands Leisure Centre	0.0	41.9
1	Parklands Leisure Centre	0.0	80.6
2. Owned transport		*1361.9*	*42.0*
2	Fuel in own vehicles from forecourts	1345.9	0.0
2	Mobile Machinery	16.0	16.0
2	Owned fleet (EST analysis)	0.0	26.0
3. Process emissions		*0.0*	*0.0*
3	Not applicable	0.0	0.0
4. Fugitive emissions		*0.0*	*1.5*
4	Air conditioning refrigerant leaks	0.0	1.5
SCOPE 2: Energy GHG indirect emissions		**51.0**	**151.1**
5. Electricity		*51.0*	*151.1*
5	Kilworthy Park	33.3	34.5
5	WDBC rented out sites	17.7	60.3
5	Meadowlands Leisure Centre	0.0	23.9
5	Parklands Leisure Centre	0.0	32.3
5	Owned fleet (EST analysis)	0.0	0.1
SCOPE 3: Other indirect GHG emissions		**3068.9**	**1822.9**
6. Purchased material and fuel		*1017.1*	*427.7*
6	Well to Tank Emissions fuels	376.4	231.2
6	Procured Goods	640.7	196.5
7. Transport related activities		*123.8*	*44.5*
7	Commuting	100.0	38.3
7	Councillor mileage	12.6	0.5
7	Car travel/parking/ferry/toll expenses	11.1	5.6
7	Air Travel	0.0	0.0
7	Rail Fares	0.1	0.0
7	Taxi Fares	0.0	0.0
8. Waste disposal		*0.0*	*0.1*
8	General waste (landfill)	0.0	0.1
8	Recyclates (closed loop)	0.0	0.1
9. Leased assets and franchising, outsourcing		*1928.0*	*1350.6*
9	Contracted waste fleet (EST analysis)	498.4	509.3
9	Procured services balance	1429.7	841.3
10. Sold Goods and Services		*0.0*	*0.0*
10	Not applicable	0.0	0.0
TOTAL GROSS FOOTPRINT (SCOPES 1, 2 and 3)		**4555.1**	**2395.8**
11. Offset Emissions		*0.0*	*0.0*
11	Exported renewable energy	0.0	0.0
11	Purchased carbon credits	0.0	0.0
TOTAL NET FOOTPRINT (SCOPES 1, 2 and 3 and Offsets)		**4555.1**	**2395.8**

Appendix 3: Purchase of carbon offsets

Offsetting can be used where GHG reductions can be achieved more practically or cost effectively from external sources, or where emissions are otherwise unavoidable. However, the effectiveness of carbon offsetting relies on the availability of high quality schemes to reduce carbon emissions.

Definitions of 'Good Quality' criteria for carbon offset projects are provided in Government guidance on environmental reporting[aa] where the following criteria are highlighted:

- Additionality – projects must demonstrate that the carbon saving would not have happened without the finance provided by selling credits. This would exclude projects that might be required under legislation or for compliance against legally binding targets.
- Avoiding leakage –projects must not cause an increase in carbon emissions elsewhere, the effects of leakage may be experienced either in upstream or downstream emissions and must be accounted for.
- Permanence – projects must address the risk of becoming impermanent, the loss of forest through disease or fire for example, would be expected to demonstrate actions to minimise and replace losses.
- Validation and verification - independent verification must come from an accredited, independent third party. Those looking to purchase credits should carry out due diligence to check projects are implemented according to the prescribed methodology and monitored to quantify emissions reductions.
- Timing – carbon credits should be ex-post i.e. they must only be issued once the emissions reduction has been achieved.
- Avoiding double counting – a registry of credits awarded and cancelled must be maintained to avoid double counting, this includes double counting against existing and mandatory targets.
- Transparency – registry information should be publicly-available and include project details, quantification methodology, validation and verification procedures, credit ownership and date of retirement of credits.

Carbon Offsets that are Kyoto Protocol Compliant will have met all these criteria, be fully traceable and will have been verified by the United Nations. Examples include the Clean Development Mechanism (CDM)[bb], the Joint Implementation (JI)[cc] and European Union Allowances (EUA) which are traded through the EU Emissions Trading Scheme (EU ETS)[dd].

Carbon credits from Voluntary Emission Reductions (VER) schemes that are not Kyoto Protocol compliant should provide full documentation showing how the above criteria were met. Organisations that provide VER schemes include:

- The Gold Standard[ee], established in 2003 by the World Wildlife Fund (WWF) and other international NGOs to develop projects that reduced carbon emissions while maintaining high levels of environmental integrity and contributing to sustainable development goals
- The Verified Carbon Standard (VCS)[ff] developed by the Climate Group and International Emissions Trading Association (IETA)

Projects offered under the Gold Standard are all based in developing countries and the cost of offsetting each tonne of carbon varies between projects. Community based energy efficiency projects are available at 12 to 25 USD/tonne (8.5 to 17.6 GBP/tonne). These usually consist of cooking stove projects with some biogas and water projects. Other projects are focussed on land use and nature based activities such as community forests, reforestation and biodiversity and cost in the region of 18 to 34 USD/tonne (12.7 to 24.0 GBP/tonne). Renewable energy projects featuring wind, hydroelectric,

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[aa] www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance

[bb] https://unfccc.int/process-and-meetings/the-kyoto-protocol/mechanisms-under-the-kyoto-protocol/the-clean-development-mechanism

[cc] https://unfccc.int/process/the-kyoto-protocol/mechanisms/joint-implementation

[dd] https://ec.europa.eu/clima/policies/ets_en

[ee] https://www.goldstandard.org/

[ff] https://verra.org/project/vcs-program/

solar and biomass in India, Brazil, Indonesia and Honduras are 10 to 15 USD/tonne (7.0 to 10.6 GBP/tonne). A single waste management project aimed at plastic recycling in Romania is 47 USD/tonne (33.1 GBP/tonne).

Projects that reduce UK territorial emissions are mostly based around tree planting and woodland and the most established scheme for woodland projects is the Woodland Carbon Code[gg] (although there is an emerging scheme for peatland restoration). Credits from verified projects are referred to as Woodland Carbon Units (WCU) and can be used to report against UK based emissions. It is also possible to purchase a Pending Issuance Unit (PIU) which is the carbon equivalent of a promissory note to deliver a carbon saving in the future. PIUs are based on anticipated carbon sequestration and, as such are not guaranteed, so they cannot be used for official reporting purposes.

[gg] https://woodlandcarboncode.org.uk/

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[1] WDBC, West Devon Borough Council Climate Change and Biodiversity Strategy, 2020

[2] HM Government, Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance, 2019.

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[15] Terri Willis, Corporate procurement of renewable energy: Implications and considerations, 2020, https://www.thWDBCc.org.uk/wp-content/uploads/2020/12/Corporate-Procurement-of-Renewable-Energy-Implications-and-Considerations-Terri-Wills.pdf