West Bletchley Council

Carbon Footprint and Energy Audit

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Introduction & Executive Summary

This report has been produced following a commission from Lisa Emmanuel, Environmental Projects Officer at the Council in support of a Climate Emergency Framework, with the aim of helping to set targets for emissions reductions and identifying areas where cost-effective action may be taken. It has been undertaken in two linked stages:

Part 1 calculated an estimated carbon footprint for West Bletchley Council, over the two financial years 2018-19 and 2019-20. Data was mainly collated from supplier invoices (gas, electricity and water), but supported but other records relating to mileage claims. The report is supported by a spreadsheet containing data extracted from these invoices and other records to build up the footprint in a format that should allow updates by West Bletchley Council staff members in future years.

West Bletchley Council was responsible for around 24.6tCO_2e of scope 1 & 2 emissions (direct fuel use, including electricity) in 2019-20, a reduction of around 8% from the preceding year.

Part 2 undertook a brief energy audit, focusing on the two main buildings and the way in which they are used. Conscious of budgetary constraints, it has focused on the following areas:

- Behavioural activities, requiring little or no financial investment, and including procurement
- Energy efficiency measures, split between low-cost short-term actions, and those with higher costs
- Renewable energy

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Part I: Carbon Footprint Report

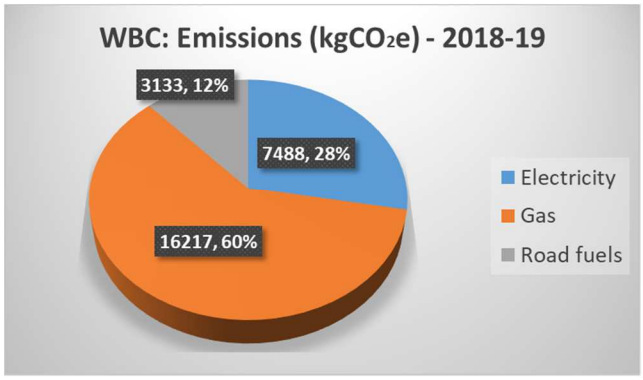
Executive Summary

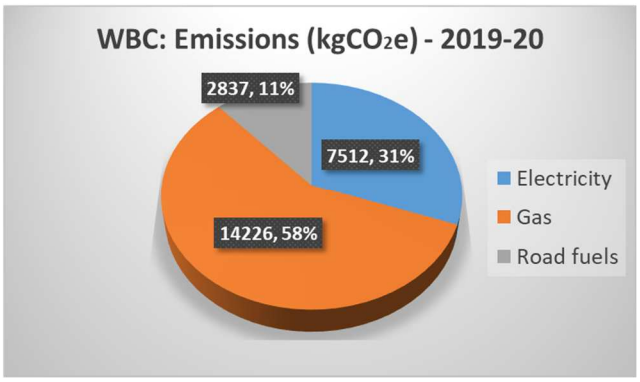
This Part of the work has calculated an estimated carbon footprint for the Greenhouse Gas (GHG) emissions attributable to the operations of West Bletchley Council.

The headline figures are that West Bletchley Council was responsible for around 24.6tCO_2e of scope 1 & 2 emissions (direct fuel use, including electricity) in 2019-20, a reduction of around 8% from the preceding year. A substantial fall in emissions attributable to direct combustion of gas (for heating and hot water) and road fuels was partly offset in a slight rise in emissions from electricity consumption, which in turn reflected a substantial increase in its use at the 221 Whaddon Way offices:

West Bletchley Council Carbon Dioxide Equivalent		2018-19	2019-20	Change
Electricity	kgCO_2e	7488	7512	0.3%
Gas	kgCO_2e	16217	14226	-12.3%
Road fuels	kgCO_2e	3133	2837	-9.4%
TOTAL CO_2 equivalent	**tCO_2e**	**26.8**	**24.6**	**-8.4%**

These may be shown as:

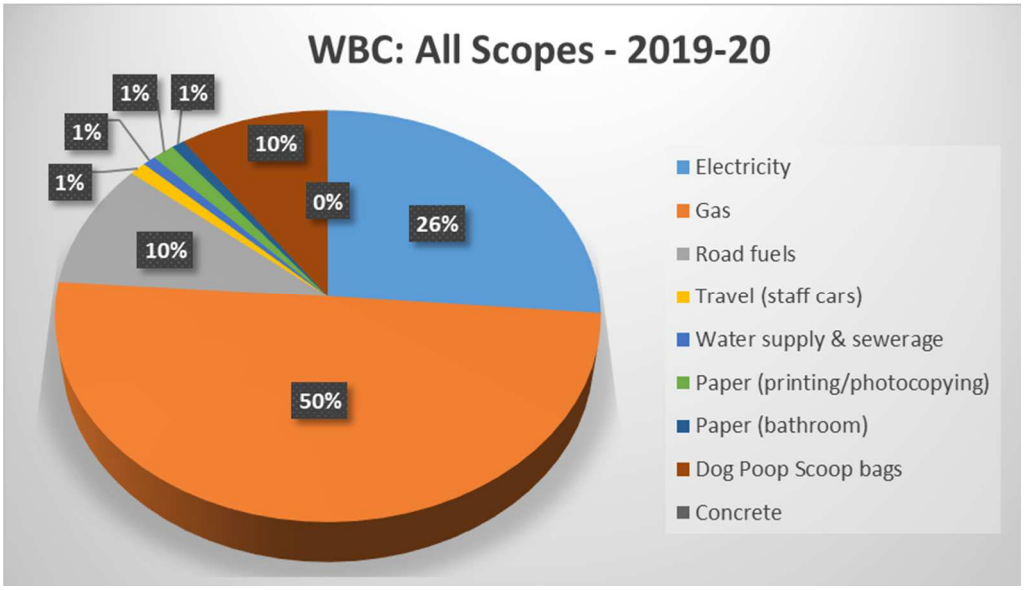




Measurable Indirect (Scope 3) emissions for 2019-20 are estimated to add a further 4tCO_2e. Unusually the largest contributor to this number is not staff travel on council business or water use, which are typically the cases for public sector bodies like West Bletchley Council – but the purchase of dog poop bags, which contributed more than half the Scope 3 emissions:

Selected Indirect emissions (Scope 3)		2019-20
Travel (staff cars)	kgCO_2e	307
Water supply & sewerage	kgCO_2e	240
Paper (printing/photocopying)	kgCO_2e	409
Paper (bathroom)	kgCO_2e	240
Dog Poop Scoop bags	kgCO_2e	2760
Concrete	kgCO_2e	13
Other (see text)		
TOTAL	**tCO_2e**	**4.0**

Adding these to the current year scope 1 and 2 emissions gives the proportions:



What does this mean?

The total emissions from direct energy use (Scopes 1 and 2) come to around 24.6 tCO_2e in 2019-20. By way of comparison, the average UK household is responsible for 14.1 tCO_2e (data from the CCC Fifth carbon report, although this will have fallen since its publication due to decarbonisation of electricity), so WBC's emissions are roughly the same as two average households. (Given that there are two buildings, both of a broadly large domestic size, using domestic-type heating systems, this is not unreasonable.) Total UK public sector emissions for 2019 are provisionally estimated by BEIS at 8.0 million tCO_2e, so WBC's contribution is negligible at around 0.0003% of the public sector total – but this is somewhat meaningless given the range and extent of other public sector activities.

A more sensible comparison would be to focus on just the two buildings, 221 Whaddon Way and the Frank Moran Centre. Their gas & electricity emissions are (2019-20) are 13.4 and 7.6 tCO_2e respectively. Putting these back into energy units gives around 65,500 and 38,300 kWh; with respective floor areas of 321m^2 and 162m^2, gives annual consumptions of around 204kWh/m^2 and 236kWh/m^2. Comparing these to the – admittedly somewhat outdated – benchmarks in ECG19 for naturally ventilated (office) buildings of 205kWh/m^2 (2000), both sites use more energy than they should, as both benefit from having a recently installed high efficiency boiler. Whaddon Way's performance may be in part due to its built form, as a sprawling single storey building with a large external wall area, but as noted below, it also increased its electricity use significantly in 2019-20. Both sites have a large hall, with a high volume needing heating compared to the floor area.

Basis of Calculation

In line with the recommendations of UK Government for organisational reporting, all direct emissions from energy use (gas and road fuels – often known as Scope 1) and indirect emissions from electricity use (Scope 2) are reported, along with selected indirect emissions (Scope 3) where the council can exert some control over them and sufficiently robust data is available. In practice, Scope 3 figures are only estimated for 2019-20. The work was undertaken broadly in line with the international standard ISO 14064-1:2018 "Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals", as well as the WRI Greenhouse Gas Protocol. Conversion factors from energy use to the equivalent Greenhouse Gas (GHG) emissions expressed in tonnes of carbon dioxide equivalent (tCO_2e) are taken from the 2020 edition of the BEIS/Defra workbook "UK Government GHG Conversion Factors for Company Reporting" (published 9 June 2020).

Setting Targets

West Bletchley Council has recognised the current Climate Emergency resulting from excessive GHG emissions globally, and so wishes to minimise its own contribution. Its Sustainable Environmental Policy, revised in July 2020, includes commitments to installing energy saving measures on its premises, where reasonable, using sustainable energy sources, where possible, supporting renewable energy and zero-carbon homes in its review of planning applications, and providing training & information for staff and councillors on climate change.

The Full Council has adopted a policy of achieving carbon neutrality by 2030. It is recommended that this is supported by establishing interim milestones for absolute emissions reductions taking into account replacement cycles for capital items such as boilers and vehicles, as well as considering how to balance residual emissions through measures such as the purchase of "green" electricity, offsetting, or "insetting", as discussed below.

One problem with any targets for a small organisation, like WBC, is that there are only a limited number of steps than can be taken, so any changes are likely to progress in steps, rather than as a smooth annual improvement. One solution commonly applied is purchasing offsets to make up any shortfall – however these should only be seen as a temporary measure and not as a long term substitution for taking positive action to reduce emissions at source. Offsets are a complex area, with numerous certification bodies, and are generally implemented outside the UK, as Government discourages domestic offsets being counted towards carbon savings owing to double counting at the national allocation level. Despite this, there are domestic UK offsets available through the Woodland Carbon Code, and some organisations with spare land are again considering tree-planting as a form of "carbon inset".

Another common approach is to purchase "green" energy – usually electricity that has been matched with generation from renewable energy sources, such as wind or photovoltaics. This is itself fraught with difficulties – customers need to be assured that the green energy is not just an allocation of existing supplies but contributes to carbon reductions or the development of new zero carbon sources (additionality), and may wish to limit types of renewable energy (excluding older hydro-electric schemes, or those outside the UK, for example). However, the largest barrier is that for reporting under the BEIS/Defra guidelines, bought-in renewable electricity has to be given the same carbon factor as the UK grid average electricity: only that generated and used onsite can be allotted zero emissions.

Assuming then that offsets and green energy are not used in the calculations, targets should take into account incremental savings that may be made through actions such as better housekeeping or behaviour changes, and then to look at specific measures that may make step changes.

Part 2 consider potential measures following the energy review, and in summary includes:

- Building fabric improvements (especially adding insulation)
- Heating and lighting controls improvements
- Putting solar electric panels (PV) onto building roofs – both buildings have considerable roof areas facing Southwest, and 221 Whaddon Way has some Southeastern ones, too
- Switching to electric vans at the next replacement cycle, and installing EV charging points outside 221 Whaddon Way and in the Frank Moran centre car park, that could be shared with staff or visitors.

In the longer term there may be opportunities for replacing gas boilers with heat pumps, but the Whaddon Way one is only recently installed and Frank Moran's is only 4 years old.

Detailed Footprint calculations

Components of Carbon Footprint

The elements of the footprint, as summarised above are calculated as:

West Bletchley Council
Carbon Footprint Calculations
Emissions from direct energy use (Scopes 1 and 2)

			2018-19	2019-20	Change %
Adjusted Consumption	Unit	Note			
Electricity	kWh	1	27003	29670	9.9%
Gas	kWh	1	88209	77370	-12.3%
Petrol	litres	2, 8			
Diesel	litres	2	1207.8	1114.4	-7.7%
Conversion factor applied					
Electricity		3, 4	0.2773	0.25319	
Gas		3, 5	0.18385	0.18387	
Petrol		3, 6	2.20904	2.16802	
Diesel		3, 6	2.59411	2.54603	
Carbon Dioxide Equivalent					
Electricity	$kgCO_2e$		7488	7512	0.3%
Gas	$kgCO_2e$		16217	14226	-12.3%
Road fuels	$kgCO_2e$		3133	2837	-9.4%
TOTAL CO2 equivalent	tCO_2e	7	26.84	24.58	-8.4%
Selected Indirect emissions (Scope 3)					
Travel (staff cars)	$kgCO_2e$		n/a	307	
Water supply & sewerage	$kgCO_2e$	2	359	240	-33.2%
Paper (printing/photocopying)	$kgCO_2e$		n/a	409	
Paper (bathroom)	$kgCO_2e$		n/a	240	
Dog Poop Scoop bags	$kgCO_2e$		n/a	2760	
Concrete	$kgCO_2e$		n/a	13	
Other					
	tCO_2e		0.36	3.97	

An overview of consumption is included in the introduction and a more detailed discussion on each main source is included below. Some of the points raised in the compilation notes are expanded further in the more detailed discussion sections.

Compilation Notes

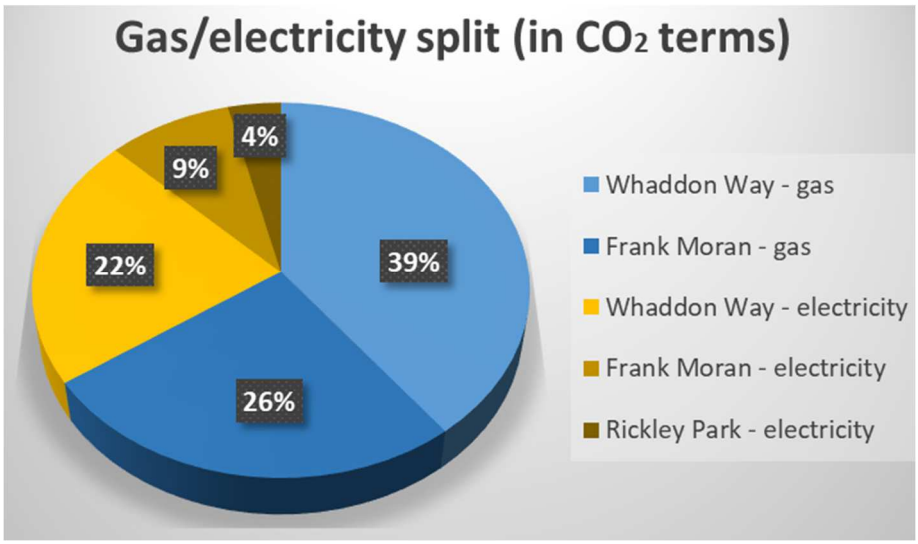
1. Electricity and gas data is taken from supplier invoices. Where these span a year end, data has been interpolated to ensure a like for like comparison between years.
2. Volumes are converted from payments, based on Experian Catalist monthly UK price data to Dec 2019; IBECCS data for 2020.
3. BEIS/Defra corporate reporting data; always latest data, so conversion factors used for 2019/20 are based on 2018 data and 2018/19 factors use 2017 data.

4. Grid average electricity factors include all GHG gases, imports and grid losses, to reflect a typical UK mains supply. Supplier or regional variations, including green supplies, are not allowable under the BEIS/Defra methodology.
5. Natural gas is calculated on a Gross CV basis (consistent with calorific value on bills), but excludes WTT (well to tank) energy associated with production and distribution.
6. Average biodiesel or regular unleaded petrol forecourt blends (currently B7 or E5), not on a WTT basis (so omitting energy used in production, shipping, refining and distribution).
7. Totals are reported in tonnes due to the level of uncertainty.
8. Inadequate data was available for to clearly separate petrol van usage from diesel. Diesel factors are used as being marginally more conservative an assumption – this is discussed below.

Direct energy use – gas and electricity

Building and external lighting energy consumption and carbon equivalents are:

By location		2018-19 kWh	2019-20 kWh	Change	2018-19 $kgCO_2e$	2019-20 $kgCO_2e$	Change
221 Whaddon Way							
Electricity		12798	18817	47.0%	3549	4764	34.2%
Gas		55017	46706	-15.1%	10115	8588	-15.1%
	Total	67815	65523	-3.4%	13664	13352	-2.3%
Frank Moran Centre							
Electricity		9596	7608	-20.7%	2661	1926	-27.6%
Gas		33192	30664	-7.6%	6102	5638	-7.6%
	Total	42789	38272	-10.6%	8763	7564	-13.7%
Rickley Park							
Electricity		4608	3245	-29.6%	1278	822	-35.7%
TOTAL all sites		**115212**	**107040**	**-7.1%**	**23705**	**21738**	**-8.3%**



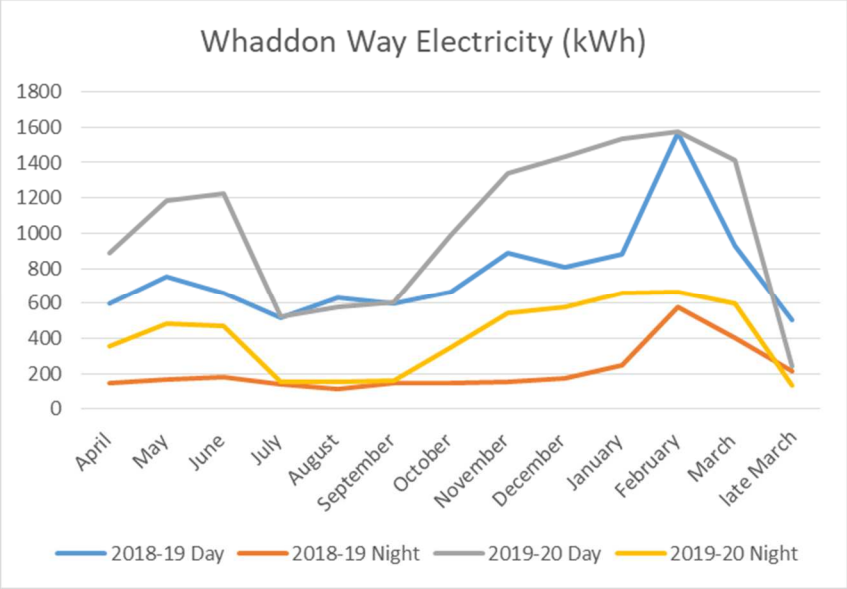
In both years, just over 90% of the emissions attributable to direct energy use came from the buildings and external lighting on the three main sites (the data for 2019-20 expressed in CO_2 equivalents is shown right); within the total just under two-thirds came from gas consumption. Only 221 Whaddon Way has a display energy certificate (DEC). This relates to the 2017-18 year and shows carbon emissions of around 17 tonnes. The higher figure reflects real savings made since then with the installation of a new higher efficiency boiler, as well as the wider trend of the carbon intensity of electricity falling.

All consumption and emissions are falling with the exception of electricity use in Whaddon Way. On a monthly basis, that energy consumption data is:

221 Whaddon Way			**2018-19**			**2019-20**
Electricity use (kWh)	Day	Night	**Total**	Day	Night	**Total**
April (from 1st only)	595	145	**740**	886	358	**1244**
May	755	167	**922**	1182	480	**1662**
June	659	180	**839**	1227	467	**1694**
July	517	140	**657**	523	152	**675**
August	629	112	**741**	575	154	**729**
September	596	144	**740**	603	158	**761**
October	666	149	**815**	990	349	**1339**
November	886	153	**1039**	1338	547	**1885**
December	808	172	**980**	1435	578	**2013**
January	879	245	**1124**	1536	660	**2196**
February	1568	581	**2149**	1573	664	**2237**
March	930	405	**1335**	1410	598	**2008**
March (from April bill)	505	212	**717**	244	130	**374**
TOTAL	**9993**	**2805**	**12798**	**13522**	**5295**	**18817**

In each year, the April bills are apportioned between the correct accounting period by the energy supplier; generally the consumption is to a date between 23rd and 25th of the month named are based upon actual, not estimated, bills. The final part month runs from 19 to 31 March 2020, and is low owing to lockdown.

This is shown graphically to highlight the increase in consumption from September 2019 (right). It is suggested that enquiries should be made as to whether there is a business reason for this increase (eg. longer working hours), or whether it is something about the way the office is being used. As consumption for the final part period falls back below the prior year, it suggests that the cause is something that is actively happening, and not an uncontrolled background use of energy that would continue during lockdown.



Gas consumption, and electricity consumption data for the other two sites (Frank Moran Centre and Rickley Park), is only billed quarterly, and based on either customer readings or estimated bills. To enable better management, it is recommended that the smart meters should be installed, and readings taken monthly.

As gas and electricity use is the largest overall contributor to WBC's carbon footprint, it is natural to target this area for reductions first.

Direct energy use – road fuels

The final component of Scope 1 emissions is energy used in vehicles owned or controlled (leased) by the organisation. In the case of West Bletchley Council this is limited to two vans, initially diesel-powered; one of which was replaced by a petrol van during 2019-20.

Data has been summarised from fuel bills, but these did not quote either the volume of fuel purchased, or the price per litre paid, or in some cases the fuel type or vehicle. As a result, fuel volumes have been estimated based upon UK average diesel price data, which may not accurately represent pump discounts if bought locally at Tesco or Asda – as such it is likely to slightly underestimate volumes used. No attempt has been made to adjust for varying fuel levels in the tank at the period end, but these would be unlikely to a material difference to CO_2 emissions estimates.

Currently, it is assumed that all fuel used was diesel. However, the replacement petrol Ford Transit van acquired in autumn 2019 showed a mileage of 2369 in July 2020. Making very broad assumptions about the distance driven before 31 March 2020, the likely miles per gallon and costs per litre, and factoring these into the spreadsheet, the net effect might be to lower total estimated emissions from vans for 2018-19 from 2,837kgCO_2e to 2,728kgCO_2e. This falls as the carbon content of petrol per pound spent on the fuel is slightly lower than for diesel (and is not based on the carbon emitted per mile driven). This difference is not material and within the error bounds of the current cost-based methodology.

It is recommended that fuel records showing volumes used for each fuel (and associated mileage) are kept in future.

In the longer term, WBC may wish to consider switching to electric vans when the next one falls due for replacement. Although the choice is currently very limited (with only a Nissan model widely available and the Vauxhall e-Vivaro due imminently), it is understood that all main van manufacturers have a range of models due to be launched in right hand drive models for the UK market within the next 12 months. Vans currently appear to drive no more than around 4,000 miles per annum, so charging could easily be done overnight using a relatively low speed charger that should be not vastly expensive, and could potentially be made available to visitors or staff during the day.

Selected Indirect emissions (Scope 3)

When computing an organisational footprint, all indirect emissions are optional, but organisations are encouraged to include as many as they have robust data for, and – in particular – to include sources where there may be substitution for direct energy use, such as transport. Water consumption, as it is metered, is also frequently included. This calculation includes both these, and has selected some further items where a reasonable quantification can be made and the result is likely to be material to the overall footprint.

Travel (staff cars)

This is the only Scope 3 travel for which data is available – any use of public transport (eg. by rail to London) has been omitted. Data was available for mileage from 13 vehicles in 2019-20; as a conservative assumption – with one exception – all were assumed to be petrol unless indicated as diesel. (The exception was a Range Rover which was designated as unknown). Cars were grouped into three size categories: small (1.4l or less), large (2.0l or more) and medium (everything else).

	Mileage claimed	Emissions **kgCO_2e**
Total 2019-20 (13 vehicles)	1202.5	306.9

Overall mileage was modest, so the total staff travel emissions represent just over 1% of organisational emissions. Even if there were occasional rail trips to London or elsewhere, it is unlikely that they would make a material impact to the overall footprint.

Staff travel to work mileage, which can be included in Scope 3 emissions is not included.

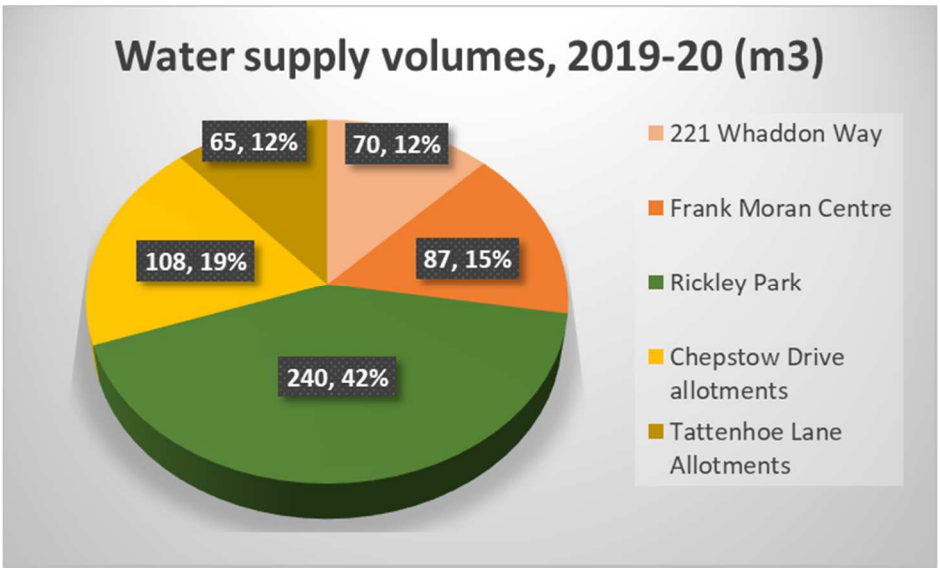
Emissions associated with park users (parking in the car park adjacent to Rickley Park) have not been estimated either, but it is unlikely that people would regularly drive long distances to the facility, and these too can be omitted on grounds on immateriality.

Water & sewerage emissions

Unlike gas or electricity, these are usually computed regionally, based on the supply company – in the case of Bletchley, Anglian Water (trading as Wave). This approach is more valid, as there is no national grid for water, and the pattern of collection and distribution varies significantly based on the topography of the region.

West Bletchley Council is unusual in that it has allotments that have a mains water supply but no mains drainage, and so lack a sewerage charge (or the associated emissions with waste water disposal). Quarterly bill data, including apportionment between financial years where necessary, is given in detail on the spreadsheet, but can be summarised here as:

	2018-19		**2019-20**	
	Water	Sewerage	Water	Sewerage
Volumes (cubic metres)	845	543	570	357
Conversion factor	*0.257*	*0.262*	*0.257*	*0.262*
Emissions ($kgCO_2e$)	217.2	142.3	146.5	93.6
Combined Emissions	**359 $kgCO_2e$**		**240 $kgCO_2e$**	



The significant fall, of one third, looks impressive, but is based on what may be an anomalous figure for Whaddon Way in September 2018. This was an actual reading after an estimate, and it's not clear if there had been a series of estimates that had led to the reading playing catch-up or whether there was a real problem (a leak) that was subsequently fixed.

Office Paper

Despite having a policy of using electronic communication and avoiding printing whenever possible, WBC still purchases significant amounts of office paper for printing and photocopying.

Paper (printing/photocopying)	Qty	gsm	Weight	Factor	***$kgCO_2e$***
Sheets purchased A4	22000	80	109.77	3.73	**409.4**

It is assumed that all paper is standard quality white A4 copy paper, not from recycled sources; 80gsm is the standard specification, but UK office paper can vary from a "budget" paper at 70gsm to high quality paper at up to 120gsm. Calculations excluded energy used by the copier (part of the overall metered use) and in printing supplies.

Paper (Bathroom)

The assumptions made here are:

Paper (bathroom)	Rolls	Sheets/ roll	Area/sheet m^2	Factor g/sheet	***kgCO₂e***
Toilet Rolls - recycled paper	440	220	0.01275	1.1	106.5
Toilet Rolls - regular paper				1.8	0.0
Hand towels - recycled paper		10000	0.05405	4.66	46.6
Blue wiping paper	48	324	0.06475	5.59	86.9
TOTAL					**240.0**

Exact data on emissions is, as with most other Scope 3 sources, subject to a wide range of estimates and competing claims: the toilet paper figures are derived from 2009 data relating to Tesco own-brand toilet rolls from the all too short period when they participated in a now defunct Carbon Trust labelling scheme. Data for other bathroom paper types is derived from these (see the spreadsheet for full details of calculations); there are numerous unsubstantiated claims made on the relative efficacy and efficiency of paper towels versus hand dryers, largely provided by the hand dryer industry. These generally electric favour hand dryers (and increasingly so as the UK electricity supply decarbonises), although may not take into account any carbon capture benefits from paper growing trees that then end up sequestered in landfill. However, the calculated annual emissions in the table above for hand towels (47kgCO_2e) are relatively low – roughly equivalent to those of 20 litres of petrol.

Dog poop scoop bags

These showed a surprisingly large footprint, surpassed only by gas, electricity and (just) road fuels:

Dog Poop Scoop bags	Quantity	Box size	Box weight kg	Factor /kg	***kgCO₂e***
HDPE oxo-degradable, 180x280x380mm	400000	2000	6	2.3	**2760**

Although this figure initially appears very high, 400,000 bags weigh 1.2 tonnes (including packaging). The weight is taken from the vendor's website and includes cardboard box (less than 600g) and bags, but the footprint factor for cardboard is not dissimilar. Again, purely for comparison, 1,114 litres of diesel weighs around 925kg, so the dog bags weigh around 30% more than the fuel purchased by the Council.

The factor used is based on HDPE with prodegradant additive (most likely TDPA from EPI); manufacturing is assumed to be in China with seaborne shipping to the UK. More than half the emissions come from the production of the raw material (HDPE) with smaller components from manufacturing, shipping and end of life disposal – this final element is open to additional uncertainty as the material is unlikely to be separated from the content. JRB Enterprises were contacted by email to confirm some of this data, but sent a slightly ambiguous response confirming the bags were oxo-degradable but linking to a fact sheet about oxo-biodegradable bags: this may be due to the planned withdrawal of the former (which leave micro-plastic grains in the soil).

Concrete

Globally concrete (and in particular the cement used in it) is estimated to be responsible for around 8% of CO_2 emissions. West Bletchley Council's use was limited to purchase of a small number of bags of dry ready mix; emissions from water added are accounted for elsewhere.

Concrete	Qty	Bag	Factor	***kgCO₂e***
(dry) mix bags of ready mix concrete from B&Q	5	20kg	0.129	**12.9**

This is so low as to be negligible. Although global emissions are huge, the volumes used in the construction industry are similarly huge and 5 bags – most likely used for securing a few posts – are insignificant.

Other Scope 3 sources – not quantified

Service user emissions (equivalent to customer or product emissions for a company) were mentioned under travel above and are unlikely to be significant.

The list of 2019-20 purchases reveals a typical variety of small purchases, none of which are likely to be significant and many of which will occur only infrequently. Items that might have slightly higher associated emissions include "26 cans of paint (various)" and "7 steel storage units".

The list also includes "2 x AdBlue" which will be a recurring purchase to dose the exhaust emissions of the diesel van. AdBlue® has a relatively low carbon footprint itself – it is 67.5% water and 32.5% urea – and although there are emissions associated with its packaging and transport, with the quantities purchased by WBC these will be tiny. Moreover, AdBlue converts exhaust emissions of nitrous oxide (N_2O), which is a gas that contributes to global warming, to nitrogen (which does not), and on a net calculation basis is claimed to reduce emissions compared to vans using diesel without AdBlue.

Looking forward to 2020-21 there will be one large, non-recurring source of emissions – the resurfacing of all the paths in Rickley Park. It is suggested that although these could be quantified, they are omitted from any targets or tracking of long-term trends.

Conclusion

West Bletchley Council has adequate records to be able to compute an organisational carbon footprint in line with Defra/BEIS guidelines; more detailed records of fuel purchased would improve the quality of the estimates. Its baseline data may be taken from the table below:

West Bletchley Council Carbon Dioxide Equivalent	2018-19 tCO_2e	2019-20 tCO_2e	Change
Scope 1: Gas	16.2	14.2	-12.3%
Scope 1: Road fuels	3.1	2.8	-9.4%
Scope 2: Electricity	7.4	7.5	0.3%
SUBTOTAL Scopes 1/2	**26.8**	**24.6**	**-8.4%**
Scope 3: Selected sources	n/a	4.0	
TOTAL FOOTPRINT		**28.6**	

Areas of potential concern include:

- the underlying growth of electricity consumption between the two years, especially in Whaddon Way, which is largely masked by a fall in the Defra/BEIS conversion factor
- the absolute level of gas consumption in Whaddon Way.

When setting a trajectory towards net zero, the council may wish to consider:

- short term savings through behavioural changes and purchasing decisions
- opportunities for upgrading building fabric (eg. insulation)
- longer term changes, including potential for photovoltaics and heat pumps
- electrification of vans when they fall due for replacement
- "insetting" opportunities through tree planting on council managed property.

These are discussed further in part 2 below.

Part 2: Energy Audit

Following the initial footprint calculation, a short energy audit visit was undertaken, visiting the two main buildings (Frank Moran Centre and 221 Whaddon Way).

Key Building Characteristics

	221 Whaddon Way	Frank Moran centre
Built Form	Single storey, irregularly shaped	Single storey – half of rectangle (shared building with playgroup)
Construction	1960s (?)	1990s with 2016 extension to front
Floor area	321m^2	162m^2
Rooms	Hall (council chamber) Open plan office Seven meeting/store rooms M/F toilets, plus 2 small toilets	Resource Centre Hall with attached kitchen Two small meeting rooms M/F toilets
Walls	Cavity – probably unfilled	Cavity – filled (on construction)
Glazing	Double, mainly 12mm air gap	Double, 20mm air gap extension; Double, 6mm air gap original building
Roof	Pitched tiled; various orientations (SW & NE marginally most common) Rockwool insulation (50-100mm) at rear; Glass fibre (150mm in theory) at front; Uncertain over hall	Shallow pitch; corrugated system; SW and NE facing Spray foam insulation to underside of roof – ca25mm
Roof lights	12 Velux windows (6 square, 6 narrow)	None
Draught lobby	No – lobby open to main open office	Yes
Heating system	Worcester Bosch 47kW Gas condensing boiler (2018) Seasonal 93% efficient	Glowworm Betacom 28 24.5kW Gas condensing boiler (2016) Seasonal 89.2% efficient
DHW	From gas boiler	From gas boiler
Controls	Timer, two thermostats (zones); TRVs (mainly Drayton TRV4)	Analogue Timer, stat; TRVs
Secondary heating	Informal use of igenix IG2600 2kW oil filled radiators	n/a
Lighting	Mix of T8 fluorescent (lesser used areas) and LEDs (strips & uplighters)	Mainly LED strips
Appliances	Photocopier/printer; various kitchen items incl. microwave; small fridge; power tools	Photocopier/printer; large gas range; 2 fridge/freezers; 1 fridge; hot water urn; lincat hot water boiler; toasters, etc.

The Whaddon Way building is similar in construction to a domestic bungalow, but has an unusual floor plan, straggling from the front to rear of the plot, and the Council chamber is distinctly non-domestic in scale. This layout is inherently inefficient as the external surface area (roof, walls and floor) is unusually high in compared to the usable floor area – exacerbated further by the space given over to circulation (the rear corridor) and toilets. Although the building appears to date from the 1960s, it is uncertain whether it has been extended at any time, or whether it was initially built as seen: it is understood that at one time it was used as a doctors' surgery.

The Frank Moran centre is more recently constructed and had an extension added to the front of the building in 2016 – at the same time as the new boiler was installed. Also single storey, its roof is a single skin profiled metal roof. Both buildings have sealed unit double glazing with various air gaps, ranging from narrow (ca4mm) on the older parts of the Frank Moran centre to 20mm on the front extension.

Both buildings are heated by a quasi-domestic central heating system, using a modern high efficiency gas condensing boiler supplying radiators fitted with thermostatic radiator valves (TRVs), centrally controlled by timers and thermostats. Hot water supply for toilet basins and sinks comes from the boilers. Whaddon Way operates on a two zone system, with a portable radio thermostat located in the main office augmenting a fixed thermostat in the corridor. Both systems are adequate for their purpose, although it is possible that replacing some of the older TRVs may marginally improve system performance (see under energy efficiency section below). Some radiators are boxed in – this tends to slightly affect their performance – mainly through making them less responsive, but in all such cases the TRV sensors were fitted outside the boxing.

The recommendations below are split into three sections:

- no-cost or very low-cost behavioural measures, including possible changes to procurement and record keeping;
- basic energy efficiency improvements
- higher cost measures, mainly around renewable energy or with long payback periods.

All recommendations are generic rather specific, and for physical measures it is recommended that three quotations from a member of a recognised trade association are obtained before commissioning the work. Although most affect direct energy use, and hence are likely to lead to cost savings as well, those marked as "scope 3 only" are likely only to impact the wider carbon footprint.

No cost or low-cost measures

Optimise existing loft insulation (Whaddon Way)

The existing insulation above the main office has become uneven, with some small areas becoming bare. Although the overall thickness is acceptable (not outstanding) this could result in cold spots in the office below and reduces its overall effectiveness:

Ideally this should be relaid completely, but someone (wearing suitable protective equipment) could also redistribute some of the worst areas.

It was also noted that neither loft hatch was insulated, and both lacked any form of draughtstripping around the edge. A rectangle of insulation material, preferably bagged and stapled to the top surface of the hatch, together with inexpensive compression draughtstrip round the lip, would remove an obvious cold spot on the ceiling.

Review heating settings and secondary heating use (Whaddon Way)

The significant increase in energy use between the two years' electricity and gas bills has been noted above. One possible reason is that there may have been an increase in the use of portable electric heaters;

each uses 2kW when switched on and is not being limited by its inbuilt thermostat. Although these can be useful for providing a short term boost in a small area, they are expensive to run, and should not be necessary under day to day conditions. As there was also an increase in night units used, it may be that some were being left on 24/7 – if this is the case and it was done to get the office up to an acceptable temperature first thing in the morning, it would be worth looking at the setting times on the main central heating system. The settings on the two zonal thermostats should also be reviewed, to ensure that heat is available where needed within the office.

The thermostatic radiator valves (TRVs) should also be checked periodically, to ensure that they are responding to changes in temperature and are not "stuck" in an on or off position.

It may also be with looking at desk layouts and seating plans, to see if any desks (or staff susceptible to cold spots) are in areas subject to draughts that could be mitigated. As the reception desk is open to the lobby, it may be worth looking at if there are ways this could be partially screened, without creating an unwelcoming feeling for visitors.

Review employee engagement

With the recent appointment of an environmental projects officer, this would be an ideal time to review employee engagement (and, to be honest, I am sure this is already happening). Given the relatively small number of employees in total, scope is somewhat limited, but it could include:

- appointing an energy champion for each building
- displaying energy consumption for the past 3 months on the office noticeboard (and this would require taking monthly, manual readings at Frank Moran)
- organising a competition between the two buildings as to which can make the greatest savings

SSE will provide, without charge, a non-domestic smart meter for all three sites which should help keep a closer eye on electricity use. They will also provide an online reporting package called Clarity, that may help track energy consumption on an ongoing basis.

Review Purchasing and Procurement policy (scope 3)

It is understood that purchasing is undertaken on an "ad hoc" basis, with irregular and often small deliveries requested from suppliers. While the emissions associated with delivery vans for items of stationery, etc. are not recorded, these could be minimised by keeping to a more regular ordering cycle; this might also minimise delivery charges.

Any review should also look at the goods purchased – including the origins of plant materials for the parks, use of recycled or sustainable materials for office supplies, with an eye to keeping indirect emissions as low as possible.

The large scope 3 emissions associated with the dog waste bags has been discussed in Part 1 – more detail on the process is included in an Appendix. Although it might be superficially attractive to eliminate the scope 3 emissions (and not insignificant costs) associated with providing dog waste bags to residents, on environmental grounds this would probably not be recommended, as it might lead to more use of non-biodegradable bags by residents in the waste stream, and in simple emissions terms would simply move the responsibility from the Council to those residents.

Ongoing record keeping (scope 3)

Allied to procurement, there were no details apparent for volumes of fuel purchased, or distance travelled, by the vans – records were restricted to cost. Keeping records on a simple spreadsheet should enable greater control of energy consumption, although there is no evidence that any fuel is being used for non-council business. Distances driven would not generally justify measures such as driver-training courses.

Basic energy efficiency improvement measures

Improve Loft Insulation

The need to relay or redistribute the insulation above the main office at Whaddon Way has been noted above.

Insulation to the rear of Whaddon Way is Rockwool, laid neatly between the joists (*right*), but only to a depth of around 50mm – it may have been more initially, but in that case has become compressed. Adding a minimum 100mm additional insulation to bring up to the top of the joists, and then, preferably, a cross layer where there is no boarding, would significantly reduce heat losses through this part of the building. Owing to the large ceiling area over rooms with limited use, payback periods would be longer than normal for insulation measures, but should still be in the range of 5-10 years.

The situation in Frank Moran is very different, as insulating foam has been sprayed directly into the underside of the profiled metal roof. This should generally be adequate, but a quick review at a randomly chosen location revealed that there might be small gaps where the foam has not penetrated (highlighted in the photo *below left* above the office, probably from the part extended in 2016), and there may also be thermal bridging between uninsulated support beams and the main roof (*below right*, taken above the main hall, not the office):

One possible approach may be to hire a drone with a small thermal imaging camera, and photograph (or video) the top surface of the roof on a very cold winter day when the building is being heated, to see if – and where – there are apparent thermal bridges allowing heat to escape. Despite the apparent flaws in the insulation, it may be that the total heat loses are insignificant (or could be stemmed by simply adding a little additional sprayed insulation or even mastic).

Cavity Wall Insulation (Whaddon Way)

221 Whaddon Way will have initially been built with unfilled cavity walls. From an external inspection, there is no evidence that cavity wall insulation has been retrofitted – if done, there are usually small tell-tale marks in the mortar where insulation material has been blown through. It is recommended to find a local trusted installer registered with CIGA, the Cavity Insulation Guarantee Agency, be found to perform a check on this (which will typically require drilling a small hole into the wall and looking at the cavity through an endoscope) with a view to quoting on adding such insulation. Costs should be acceptable as the form of the building should avoid need for scaffolding, although the wall area needing to be treated is high in relation to the internal floor area.

Lighting controls (Whaddon Way)

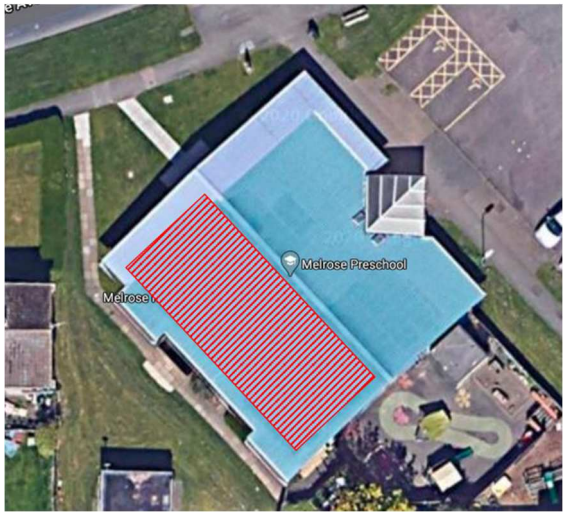
It was noted that a number of lights were on in Whaddon Way at the time of the visit, including some in the main office above circulation areas and next to Velux roof lights. Although they utilise low energy LED strips, it would be worth monitoring this, and giving consideration to their switching arrangements – for example by ensuring that can be switched separately from those over the desks nearer the reception area. If switching is to be modified, the ones at the rear (towards the kitchen) could potentially be linked to a motion sensor or daylight monitor. Corridor lights, which were correctly switched off at the time of the visit, could also be linked to motion sensors – there are emergency lights in place (and on) that would permit the main lights to be so controlled.

It is also suggested that the external lighting be reviewed. At the time of the visit, it was uncertain whether these are left on all night, or what type of bulbs are used – as most appear to be conventional lights, rather than floodlights, they could be fitted with LEDs (assuming that they have not been done so to date). It may also be possible for them to be placed on a timer or with a daylight sensor, depending in part on security requirements.

Higher cost measures – renewables and energy efficiency

Adding photovoltaic panels

Both sites have considerable areas of SW facing roof, not subject to overshading. These are likely to be suitable for the addition of photovoltaic (PV) panels that will generate electricity during sunny spells – for each kilowatt-peak of panel installed, at the available orientations (SW – below) and roof inclinations (Frank Moran is only a shallow angle), annual output of around 750-800kWh would be expected. Owing to the Velux skylights, providing it could bear the load, the Frank Moran centre would be more appropriate.



Feed-in tariffs are no longer available for new PV installations, so simple payback periods have crept up to around 15 to 20 years – which is still well within panel lifetimes (although inverters may need to be replaced during this period). Maintenance costs are low, and in the UK panels do not generally need to be cleaned – the costs of doing so exceed the slight reduction in performance from any build up of dirt on the surface, and rain tends to keep them reasonably clean.

Care would need to be taken to ensure the weight of the panels could be borne by the flatter roof at Frank Moran, as well as the lift generated by airflow over the panels. Any fixing system, which would presumably need to penetrate the profiled roof material, would need to be designed carefully to avoid the risk of leaks as well as not creating thermal bridging to the heated space below. Competent installers, registered with the Solar Trade Association, should be able to confirm suitability.

It is understood that WBC is in discussions with Wolverton Community Energy about opportunities for PV, and these are encouraged as a way of financing the upgrades.

Upgrading vans & installation of EV charging point

When the next van is due for replacement, it is recommended that an electric van (EV) be selected. As noted in Part 1, there are currently few models available on the UK market but this is likely to change rapidly (see Appendix 1; almost all have ranges between charges that are adequate for WBC). Currently vans can benefit from a grant of up to the lower of 20% of the cost or £8,000). A van would also benefit from the installation of a dedicated charge point – this could be a fast charger, of up to 22kW, and need not be a rapid charger (50kW plus), as vans could be charged overnight. Any charger could also be made available for staff or visitors to use during the day, subject to a billing system. WBC could fund the charging point itself, although there are some chargepoint providers who will install and maintain units, such as Engenie – although they tend to prefer to install publicly accessible rapid 50kW units in order to get the customer throughput: this would be likely to require an upgrade to the building's electrical connections, incurring additional costs.

Chargepoints could, of course, be installed before switching the council's own vans to electric power; either Whaddon Way or the Frank Moran centre parking areas could accept a chargepoint.

If future charging is to be restricted to the two vans, then a slow (domestic-type) charging system may also be possible, with overnight charging at around 3 to 6kW.

Glazing (Frank Moran)

Generally, glazing units appeared to be of reasonable quality with reasonable air gaps. The one exception are the windows in the main hall at Frank Moran which date from when the building was first constructed and have a very narrow (probably 4mm) air gap. Energy savings through replacing these would not justify the cost of doing so, but this should be kept in mind as a long-term upgrade, especially if the use of the hall changed to more intensive occupation.

Replacement of heating boilers

Falling very much into the category of doing in the future, not now, in the long term (post 2030) when the boilers fall due for replacement, they will most likely need to be replaced by heat pumps. Both locations have sufficient land around them to make trench-based ground source heat pumps a viable option in preference to air source heat pumps.

Carbon Insetting

As a final measure, West Bletchley Council may wish to consider "insetting" – planting trees on land under its control or management. This is seen as a preferable alternative to offsetting, where organisations or individuals purchase tradable certificates showing that carbon emissions have been reduced, usually internationally. (The UK government does not recognise use of domestic offsets for measures undertaken in the country as they would be double counted at the national inventory GHG accounting level.)

WBC has had contact with Earthwatch Europe about its Tiny Forest concept claiming:

- 600 native trees planted in a tennis court size plot.
- Up to 30 times denser than conventional tree plantings per hectare of land.

- Up to 10 times faster growing than regular forests due to the planting & management methods.
- A new dense green space with low management requirements, becoming maintenance free after three years.
- Chemical and fertiliser free forest that sustains itself once established, and supports local biodiversity.
- An associated programme of community engagement.

Earthwatch calculate that an average Tiny Forest can absorb a net 0.4 to 0.65tCO_2 after four years.

The Woodland Trust also work with councils to enable tree planting schemes. On a slightly larger scale, they are encouraging the development of Community Woodlands, where councils provide land and finance for tree planting, but the actual development is done in partnership with the local community.

Either approach would simultaneously reduce the Council's carbon footprint and provide an additional amenity for its residents.

Summary Table of Measures

Measure	Location	Cost	Savings	Payback
Optimise existing loft insulation	WW	Very low	Low	Under 1 year
Loft hatch insulation & draughtstripping	WW	Very low	Low	Under 1 year
Review heating settings and secondary heating use	WW	None	Low/medium	Immediate
Check operation of TRVs/rebalance system	Both	Very low	Low	Under 1 year
Employee engagement	Both	None	Low/medium	Immediate
Install non-domestic smart meter	FM	None	Very low	Immediate
Review Purchasing and Procurement policy	Scope 3	None	Uncertain	Immediate
Ongoing record keeping	Scope 3	Very low	Very low	n/a
Improve Loft Insulation	WW	Medium	Medium	2-5 years
Check/patch underroof spray foam insulation	FM	Low	Low/medium	2-5 years
Cavity Wall Insulation	WW	Medium	Medium	3-8 years
Lighting controls	WW	Medium	Low	3-8 years
External lighting review	WW	Low	None/medium	<5 years
Adding photovoltaic panels	Both	High	Medium/high	10-20 years
Upgrading vans	Scope 3	High	Medium/high	5-8 years
Installation of EV charging point	Both	High	Uncertain	Varies
Glazing to main hall	FM	High	Low	>25 years
Replacement of heating boilers	Both	High	Medium	>10 years
Carbon Insetting	Scope 3	High?	Uncertain	Varies

All data in the above table for physical measures assume typical commercial (professional) costs, with the exception of the loft hatch insulation.

Appendix 1: Electric Vans on, or forthcoming, UK market

Comparison of official electric van driving range:

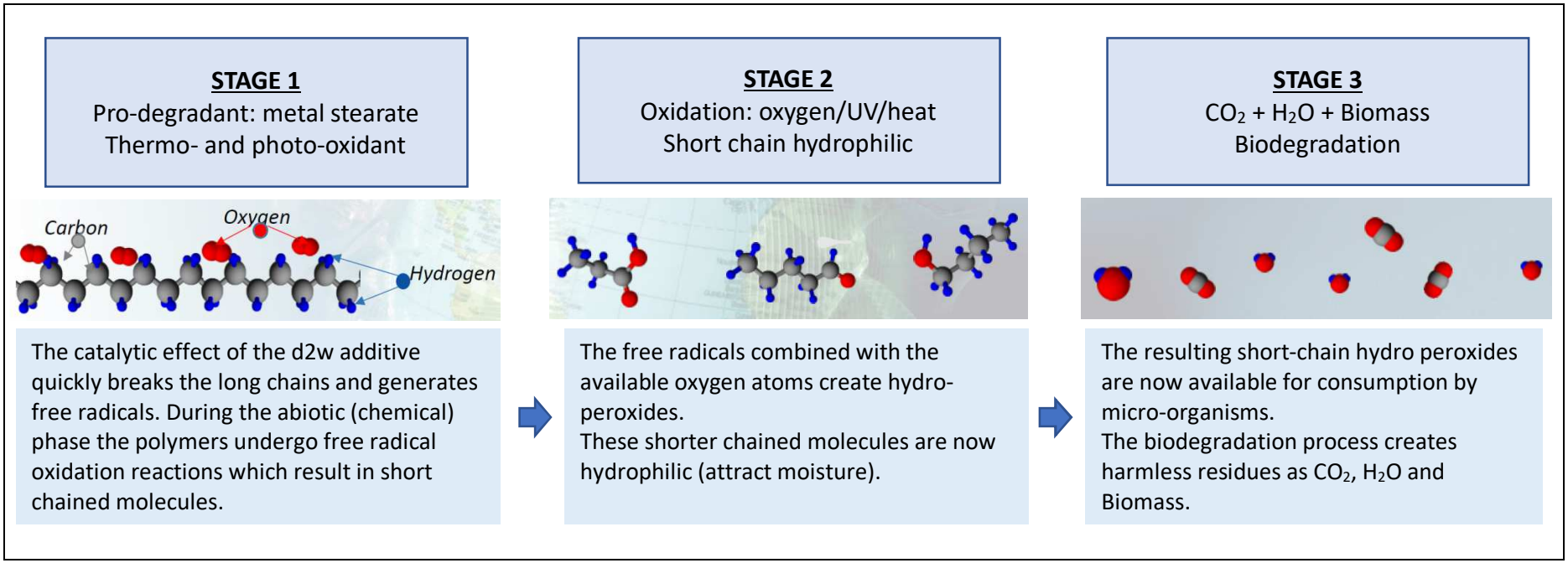
Van name	Van type/size	Official driving range
Renault Zoe Van (2020)	Car-derived van	245 miles WLTP
Renault Kangoo ZE 33	Small van	143 miles WLTP
Nissan e-NV200 40kWh	Small van	124 miles WLTP
Citroen Berlingo Electric (old)	Small van	106 miles NEDC
Peugeot Partner Electric (old)	Small van	106 miles NEDC
Maxus e Deliver 3 (2020)	Small van	Up to 150 miles WLTP (depending on van and battery size)
Citroen e-Berlingo (2021)	Small van	To be confirmed
Peugeot e-Partner (2021)	Small van	To be confirmed
Toyota Proace City electric (2021)	Small van	To be confirmed
Vauxhall Combo-e (2021)	Small van	To be confirmed
Mercedes eVito (2020)	Medium van	92 miles WLTP
VW eTransporter (2020)	Medium van	82 miles WLTP
Vauxhall Vivaro-e electric (2020)	Medium van	143-205 miles WLTP (depending on van and battery size)
Citroen Dispatch electric (2020)	Medium van	143-205 miles WLTP (depending on van and battery size)
Peugeot e-Expert (2020)	Medium van	143-205 miles WLTP (depending on van and battery size)
Toyota Proace electric (2020)	Medium van	143-205 miles WLTP - TBC (depending on van and battery size)
Sokon / DFSK EC35 (2020)	Medium van	138 miles
Morris Commercial JE (2020)	Medium van	200 miles (untested claim)
VW ID Buzz Cargo (2022)	Medium van	To be confirmed
Renault Master ZE	Large van	124 miles WLTP
LDV EV80	Large van	127 miles NEDC
Mercedes eSprinter (2020)	Large van	71-93 miles (depending on battery packs)
VW e-Crafter (2021)	Large van	68-71 miles WLTP
MAN eTGE (2021)	Large van	68-71 miles WLTP
Ford Transit electric (2021)	Large van	To be confirmed
Iveco Daily Electric	Large van	Varies with number of battery packs
Citroen e-Relay (2021)	Large van	99-140 miles
Peugeot e-Boxer (2021)	Large van	99-140 miles
Fiat Ducato Electric (2020)	Large van	136-223 miles
Maxus e Deliver 9 (2021)	Large van	To be confirmed

Source: Parkers Guide, accessed August 2020

Appendix 2: Oxo-biodegrading Process

The Dog Poop bags purchased by West Bletchley Council are made from high density polyethylene (HDPE) and contain up to 1% of an additive using the trade name d2w®, designed to render them "oxo-biodegradable". In essence this means that although the bags have a reasonably long (typically two years or more) shelf life when stored in dark, dry conditions. However, when the product is discarded in the environment, factors such as heat, UV radiation, mechanical stress generated by wind, rain, friction and tension between layers in a landfill destroy the stabilization package incorporated in the finished product and the plastic material is left with no protection to the degradation process.

The diagram below is reproduced with slight modifications from Symphony Environmental Ltd's technical briefing note on the process:



This is different from a simpler oxo-degradable process, which abiotically breaks up the chains into shorter molecules, but does not permit them to be used as food by micro-organisms, resulting in micro-plastics that can remain in the environment for many years and enter the human food chain. Under the EU Single Use Plastics Directive of 2019, oxo-degradable plastics are to be banned from 2021, as they lead consumers into a false belief that the products are safe to leave in the environment. However there is some doubt as to how completely oxo-biodegradable plastics degrade under normal conditions.

The WBC footprinting calculation for the bags did not explicitly recognise any additional CO_2 resulting from the biodegradation of the bags (or their content). A calculation based on molecular formulae suggests that the bags' CO_2 residues would be approximately 3.14tCO_2 for every tonne of bags.