Sustainability Report

2023

WDC Scottish Dolphin Centre

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1. Glossary of Terms

Net-Zero	The reduction of greenhouse gas emissions to zero, or as close to zero as possible, with any left-over emissions offset or re-absorbed from the atmosphere (United Nations, 2022).
Carbon Neutral	Carbon Neutrality is the prevention or offsetting of carbon dioxide in the atmosphere that results in a reduction to no net release; it can be viewed as the balance of offsetting an equal amount of carbon released through carbon sequestration. (European Parliament, 2013)
Emission Reporting	The process of measuring and reporting the levels of greenhouse gases emitted or produced by the reporting agency, the organisation or company, and the activities and processes associated with the organisation (WWF, 2022b).
Scope 1	'Direct emissions from owned or controlled sources' (GHG Protocol, 2004).
Scope 2	Indirect emissions caused by the organisation through purchased electricity (GHG Protocol, 2004)
Scope 3	All other indirect emissions which 'are a consequence of the activities of the company' (GHG Protocol, 2004)
CO2	Carbon Dioxide
N2O	Nitrous Oxide
CH4	Methane
CO2e	Carbon Dioxide Equivalent
Carbon Dioxide Equivalent	CO2e expresses the quantity of CO2 required to warm the atmosphere the same amount over a 100-year period, as whichever gas is being referred to (climatiq, n.d.).
GHG	Greenhouse gas
Greenhouse gases	Gases which trap heat in the Earth's atmosphere and subsequently, contribute to global warming. (EPA, 2022; WWF, 2022b)
Kg	Kilogram
g	Gram
t	Tonne
kWh	Kilo-watt hour

kWhth	Kilo-watt hour thermal
IPCC	Intergovernmental Panel on Climate Change
Offsetting	Offsetting is the removal of carbon dioxide (carbon offsetting), or other greenhouse gases from the atmosphere to 'counterbalance' for other emissions of that gas released (Chapter Zero, n.d.)
SMEs	Small and Medium Sized Enterprises
GWP	Global Warming Potential
Global Warming Potential	A relative index/unit of measurement used within the Kyoto Protocol which describes the climatic impact of the different GHG emissions (Shine, et al., 2005); how much warming will that gas produce within a period of time in comparison to CO2. This is the reason that emissions are measured in terms of CO2 equivalent (climatiq, n.d.).
HFC	Hydrofluorocarbon
HCFC	Hydrochlorofluorocarbons
HFO	Hydrofluoro-Olefins
Kyoto Protocol	The Kyoto Protocol is an international agreement as part of the United Nations, committing to reducing GHG emissions in the atmosphere. There are six GHG included in the Kyoto Protocol. These are: Carbon Dioxide (CO2), Nitrous Oxide (N2O), Sulphur Hexafluoride (SF6), Methane (CH4), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) Under the GHG Protocol, these six gases should be reported and accounted for. (ZWS, n.d.)
Montreal Protocol	An environmental agreement which controls the production and usage of various ODSs (UNEP, n.d.)
ODS	Ozone Depleting Substance
Emission (Conversion) Factor	Emission factors are used to calculate the emissions of equipment or an activity. An emission factor is a coefficient describing the rate of GHG release into the atmosphere from an activity or process (Climatiq, n.d.)
Fugitive Emission	Emissions from GHG compounds being released directly into the atmosphere, usually from equipment, such as fridges or ACs, or from certain processes (EPA, 2014; QL Gov, 2020)

2. Background

2.1. Scope and Boundaries

This is a voluntary report which covers solely the organisational boundaries for the WDC Scottish Dolphin Centre and their related emissions of which they have the capabilities to measure and record. The Scottish Dolphin Centre is part of the WDC (Whale and Dolphin Conservation) charity, but the emissions in this report are relating only to, and thus ownership and responsibility falls on, the WDC Scottish Dolphin Centre. The emissions in this document do not represent the whole WDC charity. For the purpose of transparency, the data is provided and organised into the Greenhouse Gas (GHG) Protocol's (2004) scopes, including scope 3 emissions. The reporting period covered is 26th October 2021 to 26th October 2022, however there are a few deviations when this was not possible. Everything in this report is accurate to best knowledge and ability. There are no intentionally incorrect estimates or calculations.

The information and data produced in this report will act as guidance to the organization to uncover where changes are necessary or possible and subsequently, will aid them in developing a plan or strategy to reduce future emissions and work toward carbon neutrality.

2.2. Data Compilation

The data used in this document was gathered through communications with the centre, by use of bills, meter readings, and information from staff.

2.3. Calculation Method

All calculations were made based on reputable information from the UK government, or relevant environmentally based organisations. All calculation tools used are referenced throughout the report. Emission factors were used for each calculation with the relevant emission factor used for each type of activity, process, or instrument. These factors were largely from the UK Government publication of emission (2021; 2022) as well as a few comparison or niche factors. It should be noted that these emission factors do not take into consideration differences between Scotland and the remainder of the United Kingdom, nor do they consider specific location differences within Scotland and the differences that may be present in regard to energy providers, or general emission sources.

2.4. Limitations

The baseline for 2021 – 2022 has various limitations. These limitations are mainly regarding inventory boundary. These include availability of data, quality of data, and quantity of data.

- The baseline did not include data regarding emissions from refrigerants/fugitive emissions as no refrigerants have yet needed to be topped up, thus the amount of fugitive emissions from this source cannot be gauged or measured. For this reason, fugitive emissions have not been included in the baseline calculation, but a breakdown of which refrigerants are used has been included for transparency.
- The baseline included estimates regarding electricity as the organisation had different billing periods for different on-site locations, thus, estimates for certain areas were made in order for each location to be within the same accounting period.
- The baseline did not include data regarding water usage, water wastage, and water treatment as data was not available.
- The baseline did not include data regarding wastage and waste management as data was not available.

- The baseline included estimates as small pieces of information were unavailable across all data.
- The baseline included estimates of vehicle size, weight, and make/model for each transportation or freighting calculation as precise data was unavailable. Vehicles were assumed to be ‘average’ unless more precise information available.
- The baseline includes supplier delivery emission estimate within Scope 3. Taking into consideration the possibility of double counting, the calculation was made based on the fuel/mileage of the transportation vehicle directly from the supplier venue to the organisation, not including any other deliveries they may make on the way, nor the return journey. The reason for this decision was to demonstrate that the organisation does indirectly produce emissions from supplier deliveries while acknowledging these emissions would be accounted for in the suppliers’ Scope 1. According to the GHG Protocol (2004), double counting is not a severe issue for voluntary reporting on the basis that the organisation discloses any and all relevant information relating to it.

3. Current Environmental Situation

The IPCC stated that to avoid climate catastrophe, global warming cannot exceed another 1.5 degrees Celsius (WWF, 2022a) in order to prevent irreversible impacts to the planet; this may include the extinction of species, drastic ice loss in the Arctic, the loss of valuable ecosystems, severe heat waves, extreme drought, and increased flood risk among others (WWF, no date).

The United Kingdom has set a goal to achieve net-zero by 2050 (WWF, 2022b). Achieving net zero means we no do not add any new quantity of emissions to the atmosphere and that any new emissions added are offset (United Nations, 2020a). According to NASA (2021), reduction in GHG emissions will improve air quality and aid in the prevention of severe health issues, including premature deaths. Emissions can be offset with trees, seaweed, peat, mangrove, among other natural absorbers of carbon (UN, 2020a).

4. Results

4.1. Total Baseline Emissions

The total emissions baseline figure is 38.29tCO_2e for the Scottish Dolphin Centre with the data available. The full breakdown can be seen in Figure 1 below.

Figure 1: Baseline Emission Breakdown

Activity	CO2e	CO2	CH4	N2O
Scope 1				
Biomass	9.60184616			
Scope 2				
Electricity 2021	1.404494792	1.39014094	0.005291743	0.00906211
Electricity 2022	4.72802342	4.67496824	0.019559514	0.033495667
Scope 3				
Commuting - petrol	10.2182638	10.1776679	0.01899444	0.02160152
Commuting - diesel	2.71934208	2.69482752	0.00008064	0.02443392
Business Travel P	0.27600616	0.27490962	0.00051306	0.00058348
Business Travel D.L.	0.0910494	0.0902286	0.0000027	0.0008181
Business Travel D.A.	0.4701132	0.4649148	0.00001	0.0051813
Suppliers - van	1.17201092	1.16274177	6.30554E-05	0.00920609
Suppliers - HGV	0.32249025	0.312574	0.00005175	0.0048645
Suppliers - R. HGV	7.295211	7.2001635	0.0010005	0.094047
TOTAL	**38.29885118**	**28.4431369**	**0.045567402**	**0.203293687**

4.2. CO_2e Emissions for Scope 1

4.2.1. Biomass

The Scottish Dolphin Centre uses a biomass boiler heating system. This boiler is fuelled using wood pellets sourced from Balcas Energy Wood Pellets in Invergordon, northern Scotland, an authorised Biomass Supplier List (BSL) supplier (UK Government; n.d.). Balcas Energy uses renewable energy sources on-site (Irish site) and claim to produce wood pellets with the 'lowest associated CO2' in the United Kingdom (Balcas Energy, n.d., a). The material for the pellets is sourced from forest pine and spruce trees which are managed sustainably (Balcas Energy, n.d. b) . The organisation offsets carbon emissions by operating 4:1 tree planting system where four trees are planted for each tree harvested and minimalizes waste by ensuring every part of the harvested trees are used within their various processes and are recycled.

Figure 2 below displays the emission calculations for the centre's biomass boiler for the reporting period. It is important to note that the dates for this data do not line up exactly with the reporting period (26.10.21 – 26.10.22) and are instead between the period 05.10.21 – 05.10.22, however, the difference should be small or negligible. It is also important to note that the data gathered is not in line with the calendar year thus there is an additional 5 day overlap for the 2021 data as seen below. Biomass powered by wood pellets is partially considered net zero/carbon neutral and is reported as such as comparable amounts of CO2 that are released into the atmosphere are offset/sequestered/absorbed by the trees planted to replace those used (Speare-Cole, 2021; UK Government, 2022). However, this does not account for the Methane (CH4) or Nitrous Oxide (N2O) that are released in the process and subsequently, these gases should be reported in Scope 1. Figure 2 shows the emission calculations for the CH4 and N2O relevant biomass, wood pellet that falls within Scope 1. The CO2 calculations fall under the section ‘out with scopes’ in this document.

Figure 2: Biomass Emission Calculation

Time	kWhth	Emission Factor	Tonnes CO2e
2021 (05.10.21 - 05.01.22)	277,727	0.01513	4.20200951
2022 (05.01.22 – 05.10.22)	512,805	0.01053	5.39983665
TOTAL	790,532		**9.60184616**

4.2.2. Refrigerants

This has not been included in the report as the data was unavailable. However, when data becomes available it will be added and included in Scope 1 reporting. Below is a breakdown of the data that was available for the organisation’s knowledge, but as previously stated, this was not included in the baseline figure..

Fugitive emissions are from escaped gas (refrigerant) from processes or equipment that directly release these GHGs into the atmosphere (EPA, 2014). Therefore, to calculate the relevant emissions, measuring when the refrigerants are topped up and multiplying that by the correct emission factor provides the related emissions. This is as any gas topped up suggests that gas has leaked and is therefore a ‘fugitive emission’. Refrigerant types are being looked at and replaced with more suitable options over time. Ozone Depleting (ODSs) Hydrochlorofluorocarbons (HCFCs) have been replaced by Hydrofluorocarbons (HFCs) , which are now being replaced by natural refrigerants such as Isobutane (non-halogenated) and HFC-HFO blends among others (EPA, 2014).

The only equipment and processes currently utilised by the centre that use refrigerants include 7 fridges and 3 freezers. Figure 5 below shows a table detailing which refrigerants each uses. Only refrigerants that belong to the Kyoto Protocol are reported in Scope 1, gases from other protocols should be reported out with scopes or separately (GHG Protocol, 2004, UK Government, 2021b; 2022). R134a and R600a are the two refrigerants currently utilised by equipment at the centre. To calculate emissions, refrigerant top up needs to be measured. → top up (kg) x conversion factor.

Figure 3: Refrigerant Information

Refrigerant	**Protocol**	**Make-up**
R134a	Kyoto	1,1,1,2-tetrafluoroethane (HFC)
R600a	Montreal	Isobutane

Figure 4: Refrigerant Conversion Factor

Refrigerant	**Emission Factor**
R134a	1430
R600a	3

Figure 5: Refrigerant Capacity Conversion

Equipment	**Refrigerant**	**Refrigerant Mass (capacity) (grams)**	**Conversion to Kg**
Fridge 1	R134a	215	0.215
Fridge 2	R600a	70	0.07
Fridge 3	R600a	40	0.04
Fridge 4	R134a	34	0.034
Fridge 5	R134a	40	0.04
Fridge 6	R600a	36	0.036
Fridge 7	R600a	36	0.036
Freezer 1	R600a	75	0.075
Freezer 2	R600a	62	0.062
Freezer 3	R134a	140	0.140

Since we don’t have top-up values; here are calculations for total capacity (which will be an overestimate of actual emissions). However, this may be useful for the organisation to see what the fugitive emissions could look like. (*Refrigerant mass in kg x conversion factor*.)

Figure 6: Refrigerant Capacity Calculation

Type	**Calculation**	**Emissions (kg)**	**Conversion to tonnes**
Fridge 1	0.215 x 1430	307.45	0.30745
Fridge 2	0.07 x 3	0.21	0.00021
Fridge 3	0.04 x 3	0.12	0.00012
Fridge 4	0.034 x 1430	48.62	0.04862
Fridge 5	0.04 x 1430	57.2	0.0572
Fridge 6	0.036 x 3	0.108	0.000108
Fridge 7	0.036 x 3	0.108	0.000108
Freezer 1	0.075 x 3	0.225	0.000225
Freezer 2	0.062 x 3	0.186	0.000186
Freezer 3	0.140 x 1430	200.0.22	0.2002
TOTAL		614.427kg	0.614427 0.614tCO2e

4.3. CO_2e Emissions for Scope 2

4.3.1. Electricity

Baseline Figure

The total baseline figure for the Scottish Dolphin Centre's Scope 2 emissions is 6.133t CO_2e.

Energy Estimates

a) Icehouse

See Appendix A for full breakdown of calculation.

Figure 7: Electricity - Icehouse Meter Readings

Period	kWh
21 Oct 2021 – 03 May 2022	591
21 Oct 2021 – 31 Dec 2021	218.1
21 Oct 2021 – 26 Oct 2021	15.2
26 Oct 2021 – 31 Dec 2021	202.9

Figure 8: Electricity - Icehouse Energy Estimates

2021 Period *(26th October 2021 – 31st December 2021)*	202.692 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	1232.154 kWh
Total *(26th October 2021 – 26th October 2022)*	1434.846 kWh

b) Shop and Exhibition

See Appendix B for full breakdown of calculation.

Figure 9: Electricity - Shop and Exhibition Meter Readings

Period	**kWh**
21 Oct 2021 – 21 July 2022	4392
21 Oct 2021 – 31 Dec 2021	1155.096
21 Oct 2021 – 26 Oct 2021	80.146
26 Oct 2021 – 31 Dec 2021	1074.95

Figure 10: Electricity - Shop and Exhibition Energy Estimates

2021 Period *(26th October 2021 – 31st December 2021)*	1074.95 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	4979.904 kWh
Total *(26th October 2021 – 26th October 2022)*	6054.854 kWh

c) Offices

See Appendix C for full breakdown of calculation.

Figure 11: Electricity - Offices Meter Readings

Period	**kWh**
26 July 2021 – 22 July 2022	6415
26 July 2021 – 31 Dec 2021	2835.359
01 January 2022 – 22 July 2022	3579.641

Figure 12: Electricity - Offices Energy Estimates

2021 Period *(26th July 2021 – 31st December 2021)*	2835.359 kWh
2022 Period *(1st January 2022 – 22th July 2022)*	3579.641 kWh
Total *(26th October 2021 – 26th October 2022)*	6415kWh

d) Meeting Room

See Appendix D for full breakdown of calculation.

Figure 13: Electricity - Meeting Room Meter Readings

Period	**kWh**
26 Oct 2021 – 01 Sept 2022	5
01 Sept 2022 – 26 Oct 2022	1
26 Oct 2021 – 31 Dec 2021	1.065
01 January 2022 – 01 Sept 2022	3.919

Figure 14: Electricity - Meeting Room Energy Estimates

2021 Period *(26th October 2021 – 31st December 2021)*	1.065 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	4.919 kWh
Total *(26th October 2021 – 26th October 2022)*	6 kWh

e) Café

See Appendix E for full breakdown of calculation.

Figure 15: Electricity - Café Meter Readings

Period	**kWh**
26 Oct 2021 – 25 April 2022	6942
26 April 2022 – 26 Oct 2022	10398
21 Oct 2021 – 25 Oct 2021	186.613
21 Oct 2021 – 31 Dec 2021	2687.226

Figure 16: Electricity - Café Energy Estimates

2021 Period *(26th October 2021 – 31st December 2021)*	2500.613 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	14,652.774 kWh
Total *(26th October 2021 – 26th October 2022)*	17,153.387 kWh

Emission Calculation and Data Tables

0.212kg of CO_2e per kWh of electricity

Figure 17: 2021 Electricity Conversion Factors

Activity	Country	Unit	Year	Total kg CO2e per unit	Kg CO2e of CO2 per unit	Kg CO2e of CH4 per unit	Kg of CO2e of N2O per unit
Electricity generated	UK	kWh	**2021**	0.21233	0.21016	0.0008	0.00137

0.193kg of CO_2e per kWh of electricity

Figure 18: 2022 Electricity Conversion Factors

Activity	Country	Unit	Year	Total kg CO2e per unit	Kg CO2e of CO2 per unit	Kg CO2e of CH4 per unit	Kg of CO2e of N2O per unit
Electricity generated	UK	kWh	**2022**	0.19338	0.19121	0.0008	0.00137

Figure 19: Electricity Meter Readings by Location

Location	**2021 (kWh)**	**2022 (kWh)**
Icehouse	202.692	1232.154
Shop and Exhibition	1074.95	4979.904
Offices	2835.359	3579.641
Meeting Room	1.065	4.919
Café	2,500.613	14,652.774
Total	**6,614.679**	**24,449.392**
2021 + 2022 Total	**31, 064.087**	

Figure 20: Electricity Emission Calculation

Year	**kWh**	**Emission Factor**	**Total (tonnes CO_2e)**
2021 (October 2021 – December 2021)	6,614.679	0.21233	1.40449479207
2022 (January 2022 – October 2022)	24,449.392	0.19338	4.72802342496
	Total		**6.13251821703 t**

Emissions = total energy consumption x emission factors

<u>Breakdown of Greenhouse Gases:</u>

Figure 21: Electricity GHG Breakdown - 2021

GHG - 2021	**Emission Factor**	**Emissions**	**Tonnes**
Total kg CO_2e of CH4 per unit	0.0008	5.2917432	0.0052917432
Total kg CO_2e of N2O per unit	0.00137	9.06211023	0.00906211023
Total kg CO_2e of CO2 per unit	0.21016	1,390.14093864	1.39014093864
Total kg of CO_2e per unit	**0.21233**	**1,404.49479207**	**1.40449479207**

Figure 22: Electricity GHG Breakdown - 2022

GHG - 2022	**Emission Factor**	**Emissions**	**Tonnes**
Total kg CO_2e of CH4 per unit	0.0008	19.5595136	0.0195595136
Total kg CO_2e of N2O per unit	0.00137	33.495667	0.033495667
Total kg CO_2e of CO2 per unit	0.19121	4,674.96824	4.67496824
Total kg of CO_2e per unit	**0.19338**	**4,728.02342**	**4.728.02342**

4.4. CO_2e Emissions for Scope 3

4.4.1. Commuting

In order to determine the emissions from staff commuting to the centre, data was gathered on the employees for fuel type of vehicle and total mileage to and from the centre. The relevant emission factor was multiplied by their total annual commute for the baseline reporting period to determine the emissions.

There was approximately 252 working days between October 26th, 2021, and October 26th, 2022, thus this was used to estimate the number of days employees travelled to the centre during the reporting period. This does not take into account any sick days, additional days off, or additional holidays taken by any members of staff. Part time staff work the equivalent of 0.8 days per every 1 day of full-time staff; thus, it was estimated that part time staff travelled to the centre approximately 202 days during the reporting period (80% of 252). This also does not consider additional holidays, days off, or sick days.

Figure 23 below depicts a table with the fuel type and annual commute data; Figures 24, 25, 26, and 27 depicts the emission calculation by emission factor x annual commute.

Figure 23: Commute data and fuel type

No.	Employee's Car	Full/Part time	1 way commute (miles)	Total day commute (miles)	Annual days worked (estimate)	Annual commute (miles)
1.	Diesel van	Full	16	32	252	8064
2.	Petrol car	Full	12	24	252	6048
3.	Petrol car	Full	13	26	252	6552
4.	Petrol car	Part	9	18	202	3636
5.	Petrol car	Part	14	28	202	5656
6.	Petrol car	Part	10	20	202	4040
7.	Petrol car	Part	7	14	202	2828
8.	Petrol car	Part	7	14	202	2828
9.	Petrol car	Part	7	14	202	2828
10.	Petrol car	Part	7	14	202	2828

Emission factor x total miles (annual commute) = annual emissions per vehicle (CO2e)

Figure 24: Full Time Employee Commute and Emission Data

No.	Emission Factor x	Annual Commute =	Emissions (kg) (annual)
1.	0.33722	8064	2719.34
2.	0.27436	6048	1659.33
3.	0.27436	6552	1797.61

Figure 25: Part Time Employee Commute and Emission Data

No.	Emission Factor	Annual Commute	Emissions (kg)
4.	0.27436	3636	997.57
5.	0.27436	5656	1551.78
6.	0.27436	4040	1108.41

Figure 26: Part Time Café Employee Commute and Emission Data

No.	Emission Factor	Annual Commute	Emissions (kg)
7.	0.27436	2828	775.89
8.	0.27436	2828	775.89
9.	0.27436	2828	775.89
10.	0.27436	2828	775.89

TOTAL	Annual Commute: 37,244 miles (petrol); 8064 miles (diesel) ➔ 10,218.26 (petrol/kg) + 2,719.34 (diesel/kg) = 12,937.6 = 10.22 (petrol/tonnes) + 2.72 (diesel/tonnes) = 12.938t CO_2e

Figure 27: Commute - GHG Breakdown

GHG – Petrol (average)	**Emission Factor**	**Annual Commute**	**Emissions (kg)**
Total kg CO_2e of CH_4 per unit	0.00051	37,244	18.99444
Total kg CO_2e of N_2O per unit	0.00058	37,244	21.60152
Total kg CO_2e of CO_2 per unit	0.27327	37,244	10,177.6679
Total kg of CO_2e per unit	**0.27436**	**37,244**	**10,218.2638**

GHG – Diesel (large)	**Emission Factor**	**Annual Commute**	**Emissions (kg)**
Total kg CO_2e of CH_4 per unit	0.00001	8064	0.08064
Total kg CO_2e of N_2O per unit	0.00303	8064	24.43392
Total kg CO_2e of CO_2 per unit	0.33418	8064	2,694.82752
Total kg of CO_2e per unit	**0.33722**	**8064**	**2,719.34208**

4.4.2. Business Travel

The emissions for business travel were calculated by determining the vehicle fuel type and annual commute per vehicle in order to multiply by the relevant emission factor. Figure 28 depict the emissions calculations for this category; figures 29, 30, and 31 depict the breakdown of emissions into the applicable greenhouse gases.

Figure 28: Business Travel Emission Calculation

Occasion	**Car**	**Emission Factor**	**Annual Commute (miles)**	**Emissions (kg) (annual)**	**Tonnes (CO_2e)**	**Total (Tonnes CO_2e)**
SDC Officer – volunteer support and events	Diesel van	0.33722	270	91.0494	0.0910494	0.091
Education Co-ordinator travel to schools and events	Diesel car	0.27492	1710	470.1132	0.4701132	0.470
Trading team travel to bank cash	Petrol car	0.27436	828	227.17008	0.22717008	0.276 (0.27600616)
SDC Manager travel to meetings	Petrol car	0.27436	178	48.83608	0.04883608	
TOTAL	/	/	/	837.16876	0.837	0.83716876

Figure 29: Business Travel - GHG Breakdown Petrol

Petrol (average)	Emission Factor	Annual Mileage	Emissions (kg)	Tonnes
Total kg CO_2e of CH_4 per unit	0.00051	1,006	0.51306	0.00051306
Total kg CO_2e of N_2O per unit	0.00058	1,006	0.58348	0.00058348
Total kg CO_2e of CO_2 per unit	0.27327	1,006	274.90962	0.27490962
Total kg of CO_2e per unit	**0.27436**	**1,006**	**276.00616**	**0.27600616**

Figure 30: Business Travel - GHG Breakdown Diesel (large)

Diesel (large)	Emission Factor	Annual Mileage	Emissions (kg)	Tonnes
Total kg CO_2e of CH_4 per unit	0.00001	270	0.0027	0.0000027
Total kg CO_2e of N_2O per unit	0.00303	270	0.8181	0.0008181
Total kg CO_2e of CO_2 per unit	0.33418	270	90.2286	0.0902286
Total kg of CO_2e per unit	**0.33722**	**270**	**91.0494**	**0.0910494**

Figure 31: Business Travel - GHG Breakdown Diesel (average)

Diesel (average)	Emission Factor	Annual Mileage	Emissions (kg)	Tonnes
Total kg CO_2e of CH_4 per unit	0.00001	1710	0.0171	0.00001
Total kg CO_2e of N_2O per unit	0.00303	1710	5.1813	0.0051813
Total kg CO_2e of CO_2 per unit	0.27188	1710	464.9148	0.4649148
Total kg of CO_2e per unit	**0.27492**	**1710**	**470.1132**	**0.4701132**

Total	**837.16876**

4.4.3. Deliveries from Suppliers

Figure 32 depicts the emission information in table format at the end of this section; Figure 33 depicts the breakdown of greenhouse gases relevant to this section.

The calculations for each supplier are described and explained in their relevant sections.

In order to try and reduce the possibility for double counting, the emissions were only calculated for one-way of the supplier journey (i.e., the emissions for Speyfruit were calculated based on a 12-mile journey distance as opposed to 24 miles (‘there and back’)). This was done to reduce the double counting (the emissions being reported for the centres Scope 3 emissions as well as the suppliers Scope 1 emissions) while still acknowledging the centre contributes to these emissions indirectly.

a) Speyfruit

This supplier delivers fruit, vegetables, and dairy products to the centre using a small van twice per week for 10 months of the year. The distance from supplier to the centre is approximately 12 miles thus this mileage figure was used to calculate the emissions. As aforementioned, this does not take into consideration other stops or deliveries that may be made *en route* to the centre. There are approximately 43.4524 weeks within a 10-month period thus this figure was used for the calculations; this was multiplied by 2 as the deliveries are twice weekly. This can be seen as follows:

43.4524 x 2 = 86.9048 = approximately 87 deliveries annually.

12 miles away x 87 deliveries = 1044 miles (one way) (2088 miles there and back)

Emission factor for average van freighting goods unknown fuel type = 0.37174

1044 x 0.37174 = 388.09656 kgCO2e = 0.388tCO2e (one way)

(2088 x 0.37174 = 776.19312 = 0.776tCO2e both ways)

b) Rizzas

This supplier delivers bread to the centre once a week for 10 months of year from 23 miles away by small van. There are approximately 43.4524 weeks within a 10-month period thus this figure was used for the calculations. The calculations can be seen as follows:

43.4524 x 23 miles = 999.4052 miles (1, 998.8104 both ways)

999.4052 x 0.37174 = 371.518889 = 0.372t CO_2e one way

(1,998.8104 x 0.37174 = 743.037778= 0.743tCO_2e both ways)

c) Cairngorm Coffee Delivery

This supplier delivers coffee to the centre once every three weeks for 10 months of year from 40 miles away in a small van. There are approximately 43.4524 weeks within a 10-month period thus this figure was used for the calculations; this was divided by 3 as the deliveries are once every three weeks. This can be seen as follows:

43.4524/3 = 14.4841333333 deliveries per year

40 miles x 14.4841333333 deliveries = 579.365333333 miles (one way)
(1158.73066667 both ways)

579.365333333 x 0.37174 = 215.373269013 kg = 0.215t CO_2e (one way)

(1158.73066667 x 0.37174 = 430.746538027 kgCO_2e = 0.431t CO_2e both ways)

d) Bidfood

This supplier delivers consumables, food, and drinks to the centre twice a week for 10 months of year from 50 miles away by lorry. As the lorry delivers consumables, it is appropriate to assume it is refrigerated, however it is unknown how laden the vehicle may be thus the emission factor chosen for this was for an average laden refrigerated HGV.

There are approximately 43.4524 weeks within a 10-month period thus this figure was used for the calculations; this was multiplied by 2 as the deliveries are twice weekly. This can be seen as follows:

43.4524 x 2 = 86.9048 = approximately 87 deliveries

50 miles x 87 deliveries = 4350 miles (1 way) (8700 miles both ways)

Average laden refrigerated HGV emission factor = 1.67706

1.67706 x 4350 = 7,295.211 kg = 7.295t CO_2e (one way)

(1.67706 x 8700 = 14,590.422 kg = 14.590422t CO_2e both ways)

e) Stew and Drew's Ice Cream

This supplier delivers ice cream to the centre by small van approximately once a month; they make approximately 14 deliveries in a 12-month period. The calculations can be seen as follows:

20 miles x 14 deliveries = 280 miles (560 miles both ways)

0.37174 x 280 = 104.0872 = 0.104t CO_2e (one way)

(0.37174 x 560 = 208.1744 = 0.208t CO_2e both ways)

f) Office Stationery

This supplier delivers office stationery to the centre by small van and make approximately 5 deliveries annually from 50 miles away. The calculations can be seen as follows:

5 x 50 = 250 miles (one way) (500 both ways)
0.37174 x 250 = 92.935 = 0.093t CO_2e (one ways)
(0.37174 x 500 = 185.87 = 0.186t CO_2e both ways)

g) Wood Pellets for Biomass Boiler

This supplier (Balcas Energy) delivers wood pellets from approximately 75 miles away between 2 - 3 times per calendar year by HGV. As the HGV is not carrying consumables, it can be assumed it is not refrigerated. We do not know how laden the vehicle is, thus the emission factor will be based on an average-laden HGV. The calculation will be based on 3 deliveries as the centre had 3 deliveries from this supplier during the reporting period.

3 x 75 = 225 (one way; 450 both)
1.43329 x 225 = 322.49025 = 0.322t CO_2e (one way; *6.44t CO_2e both*)

Summary

Figure 32: Supplier Deliveries - Emission Figures

Supplier	**One Way** (Tonnes of CO2 equivalent)	**Both Ways** (Tonnes of CO2 equivalent)
Office Stationery	0.093	0.186
Stew and Drew’s Ice Cream	0.104	0.208
Rizza’s Bread	0.372	0.743
Bidfood	7.295	14.590
Cairngorm Coffee	0.215	0.431
Speyfruit	0.388	0.776
Balcas Energy	0.322	0.644
Total	**9.751**	**19.502**

Emission Figures

Figure 33: Supplier Deliveries - Emission Figures

Supplier	**One Way** (Tonnes of CO2e)	**Both Ways** (Tonnes of CO2e)
Office Stationery	0.093	0.186
Stew and Drew’s Ice Cream	0.104	0.208
Rizza’s Bread	0.372	0.743
Bidfood	7.295	14.590
Cairngorm Coffee	0.215	0.431
Speyfruit	0.388	0.776
Balcas Energy	0.322	0.644
Total	**9.751**	**19.502**

Figure 34: Supplier Deliveries - GHG Breakdowns

Average van for freighting with unknown fuel type	Emission Factor	Annual Mileage	Emissions (kg)	Tonnes
Total kg CO_2e of CH_4 per unit	0.00002	3, 152.77053	0.06305541	0.00006305
Total kg CO_2e of N_2O per unit	0.00292	3, 152.77053	9.20608996	0.00920608
Total kg CO_2e of CO_2 per unit	0.3688	3, 152.77053	1,162.74177	1.16274177
Total kg of CO_2e per unit	**0.37174**	**3, 152.77053**	**1,172.01092**	**1.17201092**

Avg. laden refrigerated HGV	Emission Factor	Annual Mileage	Emissions (kg)	Tonnes
Total kg CO_2e of CH_4 per unit	0.00023	4350	1.0005	0.0010005
Total kg CO_2e of N_2O per unit	0.02162	4350	94.047	0.094047
Total kg CO_2e of CO_2 per unit	1.65521	4350	7,200.1635	7.2001635
Total kg of CO_2e per unit	**1.67706**	**4350**	**7,295.211**	**7.295211**

Average laden HGV	Emission Factor	Annual Mileage	Emissions-kg	Tonnes
Total kg CO_2e of CH_4 per unit	0.00023	225	0.05175	0.00005175

Total kg CO2e of N2O per unit	0.02162	225	4.8645	0.0048645
Total kg CO2e of CO2 per unit	1.41144	225	312.574	0.312574
Total kg of CO2e per unit	1.43329	**225**	**322.49025**	**0.32249025**

4.4.4. Water

Emissions were not calculated for any usage or treatment under this category as data was not sufficiently available.

4.5. CO_2e Emissions out with Scopes

According to the greenhouse gas protocol (2004), there are varying emission sources that should be reported but are not included within the scopes.

4.5.1. Biomass

See section 4.2.1. for the relevant details and background information on biomass. Only CO2 is measured and reported out with the Scopes (EPA, 2016; GHG Protocol, 2004; UK Government, 2021b; 2022) and the remaining GHGs are found in the previous section. The emission factor has not changed between the periods of 2021 and 2022 thus it is applicable for the whole reporting year. It should be noted that this calculation was based on tonnes of pellets delivered, as there was an issue with the conversion factor for kWhth. As a result of this, the dates fall significantly out with the reporting period (one month late in 2021 and 3 months late in 2022/23). Thus, it can be assumed that the figure for this category would be lower.

Figure 35: Biomass Calculation – Outside of Scopes

Time	**Tonnes**	**Emission Factor**	**Tonnes CO2e**
(03.11.21 – 10.01.23)	17.1000	1,677.18	28.679778

5. Further Considerations Regarding the Organisation

The below section details a series of recommendations for the centre to improve reporting standards and/or reduce GHG emissions. It should be noted that the organisation may already have some of these recommendations in place, but data was not available or known, as well as that some of these recommendations may not be feasible options for the centre.

5.1. Recommendations

Reporting Standards

a) Water Tracking and Treatment

It is recommended that the centre tracks water data where available. One method of tracking includes regularly recording cubic meters of water and that data can subsequently be used to track emissions for water usage and wastage. Zero Waste Scotland provides valuable sources for businesses to help understand how their business uses water and ways to reduce this as well as save money[1]. If it is feasible for the organisation, another consideration is tracking emissions and fugitive emissions from wastewater treatment. These emissions would fall under Scope 3.

b) Refrigerant Tracking

It is recommended that the organisation tracks any refrigerant top-ups that may occur in the future to measure fugitive emissions over time from refrigerants in the organisation's fridges and freezers. Should the organisation acquire any other cooling systems such as air conditioners, these should also be tracked. These emissions would fall under Scope 1.

[1] https://www.zerowastescotland.org.uk/content/measure-and-monitor-your-business-water-use

c) Customer Travel Tracking

It is recommended the organisation tracks how customers travel to the centre. This could be done through an optional questionnaire to gather data samples; while the likelihood is that only a small number of customers may participate, it would still provide the centre with some insight into how customers are travelling to the centre. This could be included in the Scope 3 reporting. As the centre already tracks the number of customers that visit the centre on a day-to-day basis, the centre could calculate the percentage of customers that fill out the questionnaire and declare the sample size within the reporting. For example, if 100 customers visited the centre, and 20 people filled out the questionnaire, the centre could state 20% of the customers travel by the varying methods. The centre could use this data to make estimations for the remaining customers and declare this in the reporting or only include the data from the questionnaire and declare it is only a 20% (or whichever percentage) representation of the full data. Either method is acceptable on the basis that any limitations, errors, or uncertainties are coherently declared. Including this in the Scopes is optional, however it will aid the centre to gain a fuller understanding of their indirect emissions and provide more in-depth transparency.

d) Waste Management Tracking and Recycling

It is recommended the centre track wastage where possible; this refers to both material waste and food waste.

GHG Reduction and Climate Mitigation

a) Wastage

Food wastage alone contributes to an immense 8% of global GHG emissions (Zero Waste Scotland, 2019). Food waste does not only waste the food, but the energy and resources that are used to produce, manufacture, process, transport, package, as well as cook or prepare once arrived at its destination is wasted. Food waste will also produce methane and thus, increase the emissions from the entire process if the waste ends up in landfill rather than reused for fuel, fertiliser, or energy (Zero Waste Scotland, 2019).

Wastage is evidently a large issue that needs to be addressed, especially in Scotland, where 4/5ths of Scotland's footprint can be attributed to materials and products that are one-use or not recycled (Zero Waste Scotland, 2021).

There are various steps an SME can take to help reduce wastage:

1) Check and re-evaluate where the organisation sources ingredients and materials from.
2) Investigate the sustainability of your supply chain.
3) Efficient inventory handling helps to reduce to prevent consumables expiring before sale, double ordering, and unnecessary disposal (SustainaBase, 2021).
4) Collaborate with suppliers to reduce unnecessary packaging (FSB, 2021).
5) Reuse products where applicable and ditch one-use disposables.
6) Switch to digital where applicable.
7) Identify products that should be getting recycled instead of thrown away.
8) Conduct internal audits.

9) Investigate phasing in ‘green’ office equipment – disposability and lifecycle.
10) Investigate the possibility of joining a circular economy club for SMEs in local area.
11) Investigate the feasibility of composting and/or using compostable products such as Vegware[2].
12) Ensure the centre is adequately recycling waste products.
13) Consult UK Gov’s approved waste buyers list.[3]
14) Familiarise the organisation with Scotland’s Deposit Return Scheme which will begin in August 2023 (Zero Waste Scotland, 2023).
15) Take advantage of Zero Waste Scotland’s Circular Economy Business Support Service[4]. See also ‘Scottish businesses leading the way’[5]- Fsb’s small business sustainability hub[6] also provides more information for businesses.

b) Energy usage – lighting

If the organisation does not already, switching to low-carbon footprint lighting alternatives such as LED lights as opposed to HID, halogen, fluorescent, etc. LED lightbulbs are predicted to immensely cut CO2, the UK government predicts a cut of 1.26 million tonnes (UK Gov, 2021a). LED lightbulbs are more efficient, last longer, more durable, and use 80% less power than halogen bulbs; they are considered more sustainable throughout their entire lifecycle (Peterson, 2023; UK Gov, 2021a).

[2] https://www.vegware.com/uk-en/
[3] https://environment.data.gov.uk/public-register/view/search-waste-carriers-brokers
[4] https://www.zerowastescotland.org.uk/circular-economy/business-support-service
[5] https://www.zerowastescotland.org.uk/circular-economy/in-action
[6] https://www.fsb.org.uk/knowledge/fsb-infohub/small-business-sustainability-hub.html

c) Energy usage – reduction

There are options to reduce energy consumption, some of these include (ofgem, no date):

1) Reduce water temperature.
2) Turn down heat when rooms are not in use.
3) Turn appliances off as opposed to standby.
4) Use curtains/blinds at night to trap warm air from heating in buildings/rooms.
5) Draught proof rooms/buildings to prevent heat escaping.
6) Use a smart meter to accurately monitor energy usage.
7) Improve insulation and/or window glazing.
8) Investigate phasing in ‘green’ office equipment – energy saving.

d) Refrigerant Substitution

The organisation could consider substituting refrigerants used with substances that have lower GWPs (or consider this when the equipment using these refrigerants needs replacing). Some of the centre’s refrigeration equipment uses the HFC R134a, which in the future could be replaced by natural refrigerants such as R290 or R717, or HFC-HFO blends such as R449A. Some of the refrigerating equipment at the centre already uses R600A which is a natural refrigerant considered as a suitable substitute for R134a in domestic refrigeration (Climate Action, no date).

e) Renewable energy

Investigate the feasibility of increasing renewable energy usage at the centre. Funding and guides are widely available for SMEs in the UK[7].

[7] https://www.gov.uk/guidance/find-funding-to-help-your-business-become-greener
https://smallbusiness.co.uk/sme-guide-renewable-electricity-2539462/

a) Electric Vehicles

Consider the feasibility of using EVs for business travel, as well as encouraging staff to make the change if they are in a position to do so.

b) Carbon Offsetting

There are my ways a business can offset their emissions. Consider collaborating with, seeking help from, or taking part in initiatives from organisations such as Carbon Neutral Britain[8] who specialize in carbon offsetting as well as offer carbon neutral certifications and offsetting programs within the United Kingdom.

c) Food and drink substitutions

Animal agriculture is a significant source of greenhouse gas emissions, this can particularly be seen in the methane produced from livestock. These emissions can be reduced by consuming more plant-based options (UN, 2020b). According to Worldwatch Institute in 2019, emissions from the meat industry contribute to 51% of global emissions instead of the UN's estimated 18% (Hance, no date; Hickman, 2009).

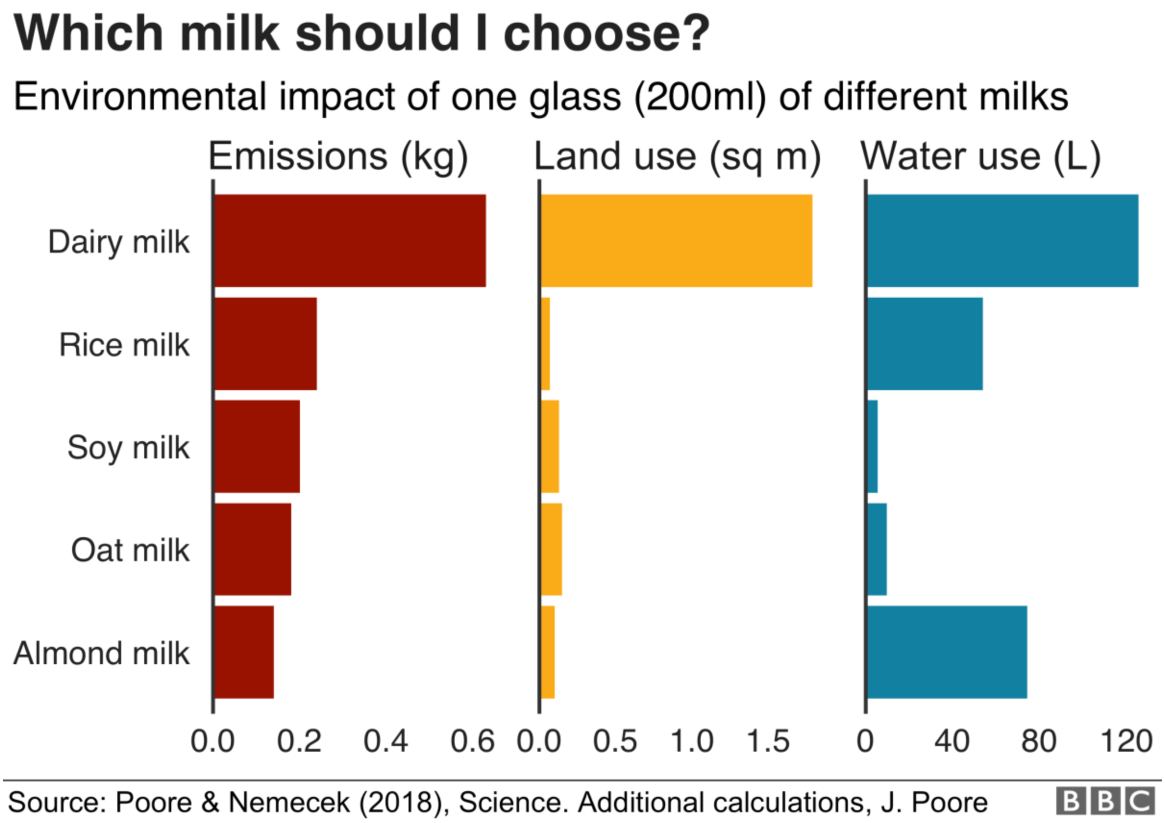
There are a wide range of sources that provide insightful information on the impacts of the meat and dairy industries, such as those linked in the footnotes below[9].

The centre should consider increasing the number of plant-based options on their menu as an optional substitute for meat and dairy products. The meat industry produces double the harmful emissions as plant-based food production (Milman, 2021). Furthermore, research shows that the production of plant-based milks produces significantly less GHG emissions

[8] https://carbonneutralbritain.org/pages/become-a-carbon-neutral-business
[9] https://www.cowspiracy.com/facts

than that of dairy as demonstrated in the figure below (Guibourg and Briggs, 2019). See Appendix F for more visuals.

Figure 36: "Which milk should I choose?" (Guibourg and Briggs, 2019)



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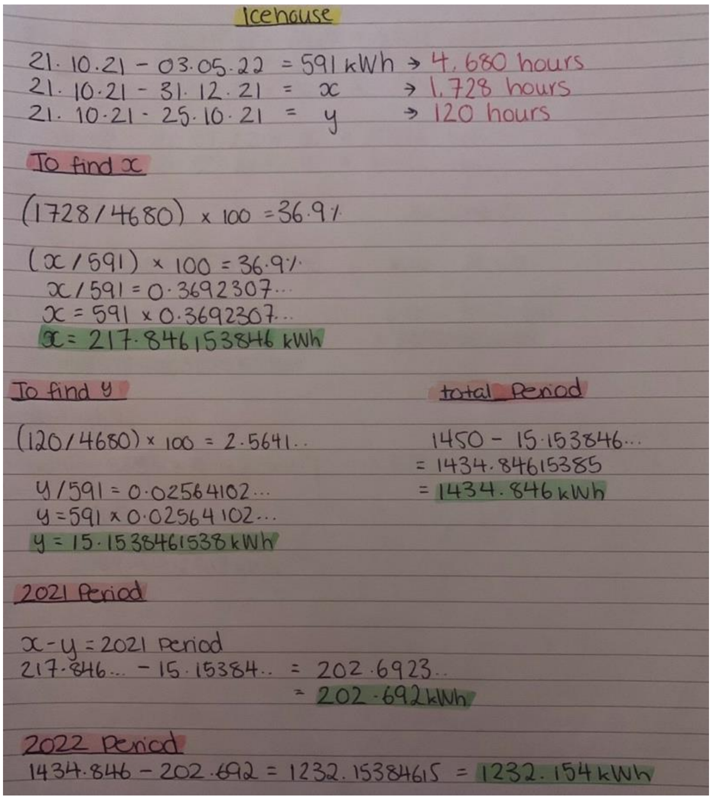
6. Appendices

6.1. Appendix A - Icehouse

7. Period	kWh
21 Oct 2021 – 03 May 2022	591
21 Oct 2021 – 31 Dec 2021	218.1
21 Oct 2021 – 26 Oct 2021	15.2
26 Oct 2021 – 31 Dec 2021	202.9

2021 Period *(26th October 2021 – 31st December 2021)*	202.692 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	1232.154 kWh
Total *(26th October 2021 – 26th October 2022)*	1434.846 kWh



Icehouse

21. 10.21 – 03.05.22 = 591 kWh → 4,680 hours
21. 10.21 – 31. 12. 21 = x → 1,728 hours
21. 10.21 – 25. 10. 21 = y → 120 hours

To find x

(1728 / 4680) x 100 = 36.9%

(x / 591) x 100 = 36.9%
x / 591 = 0.3692307...
x = 591 x 0.3692307...
x = 217.846153846 kWh

To find y

(120 / 4680) x 100 = 2.5641..

y / 591 = 0.02564102...
y = 591 x 0.02564102...
y = 15.1538461538 kWh

total Period

1450 – 15.153846...
= 1434.84615385
= 1434.846 kWh

2021 Period

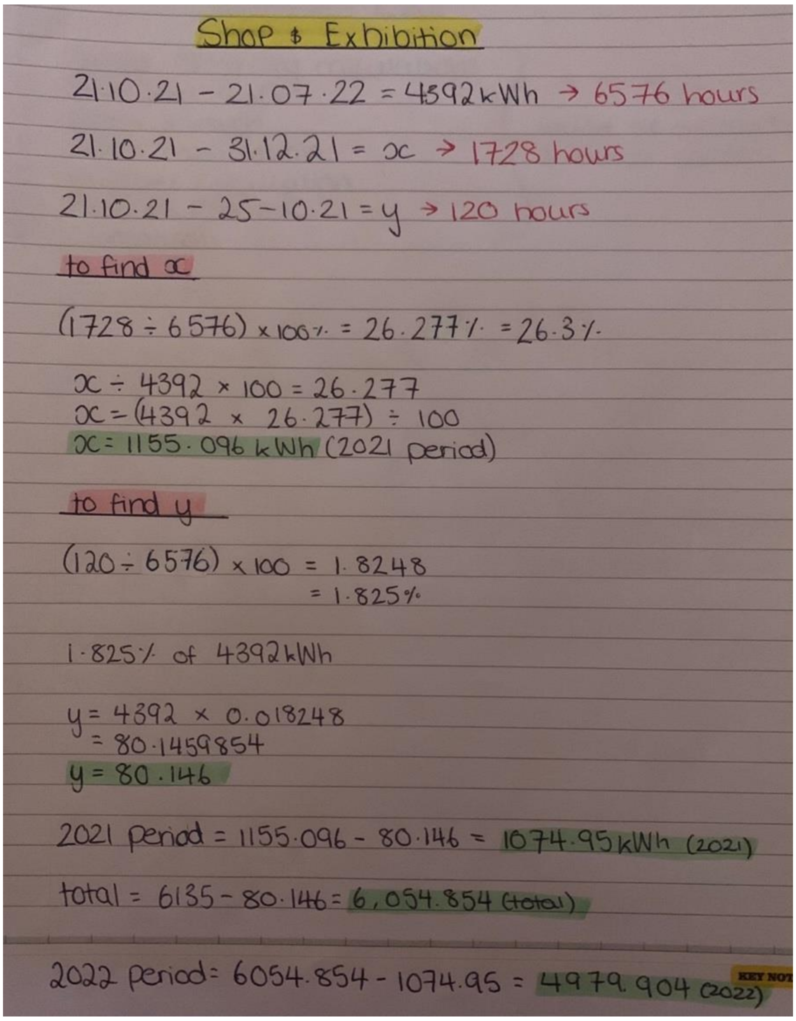
x – y = 2021 Period
217.846... – 15.15384.. = 202.6923..
= 202.692 kWh

2022 Period
1434.846 – 202.692 = 1232.1538461 = 1232.154 kWh

6.2. Appendix B - Shop and Exhibition

Period	kWh
21 Oct 2021 – 21 July 2022	4392
21 Oct 2021 – 31 Dec 2021	1155.096
21 Oct 2021 – 26 Oct 2021	80.146
26 Oct 2021 – 31 Dec 2021	1074.95

2021 Period *(26th October 2021 – 31st December 2021)*	1074.95 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	4979.904 kWh
Total *(26th October 2021 – 26th October 2022)*	6054.854 kWh



Shop & Exhibition

21.10.21 – 21.07.22 = 4392 kWh → 6576 hours

21.10.21 – 31.12.21 = x → 1728 hours

21.10.21 – 25-10.21 = y → 120 hours

to find x

(1728 ÷ 6576) x 100% = 26.277% = 26.3%

x ÷ 4392 × 100 = 26.277

x = (4392 × 26.277) ÷ 100

x = 1155.096 kWh (2021 period)

to find y

(120 ÷ 6576) x 100 = 1.8248

= 1.825%

1.825% of 4392 kWh

y = 4392 × 0.018248

= 80.1459854

y = 80.146

2021 period = 1155.096 – 80.146 = 1074.95 kWh (2021)

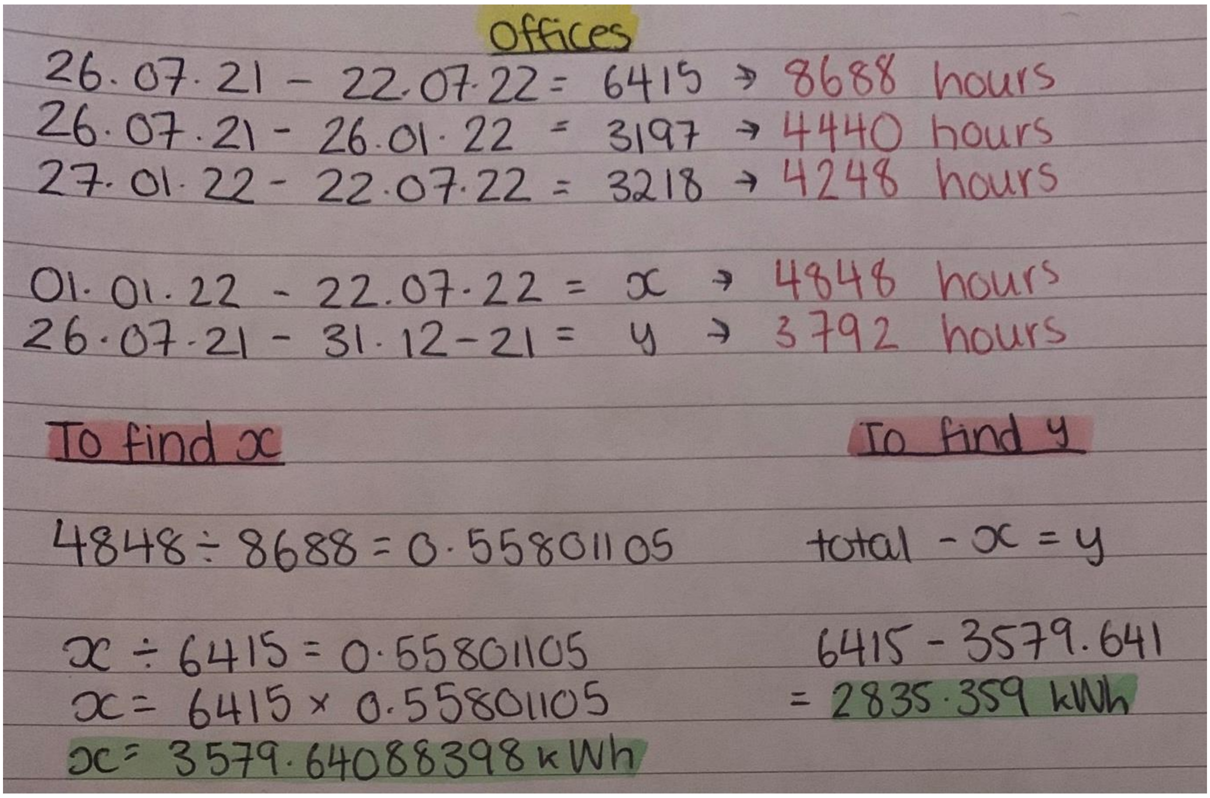
total = 6135 – 80.146 = 6,054.854 (total)

2022 period = 6054.854 – 1074.95 = 4979.904 (2022)

6.3. Appendix C – Offices

Period	kWh
26 July 2021 – 22 July 2022	6415
26 July 2021 – 31 Dec 2021	2835.359
01 January 2022 – 22 July 2022	3579.641

2021 Period *(26th July 2021 – 31st December 2021)*	2835.359 kWh
2022 Period *(1st January 2022 – 22nd July 2022)*	3579.641 kWh
Total *(26th October 2021 – 26th October 2022)*	6415 kWh



Offices

26.07.21 – 22.07.22 = 6415 → 8688 hours
26.07.21 – 26.01.22 = 3197 → 4440 hours
27.01.22 – 22.07.22 = 3218 → 4248 hours

01.01.22 – 22.07.22 = x → 4848 hours
26.07.21 – 31.12–21 = y → 3792 hours

To find x

$4848 \div 8688 = 0.55801105$

$x \div 6415 = 0.55801105$
$x = 6415 \times 0.55801105$
$x = 3579.64088398$ kWh

To find y

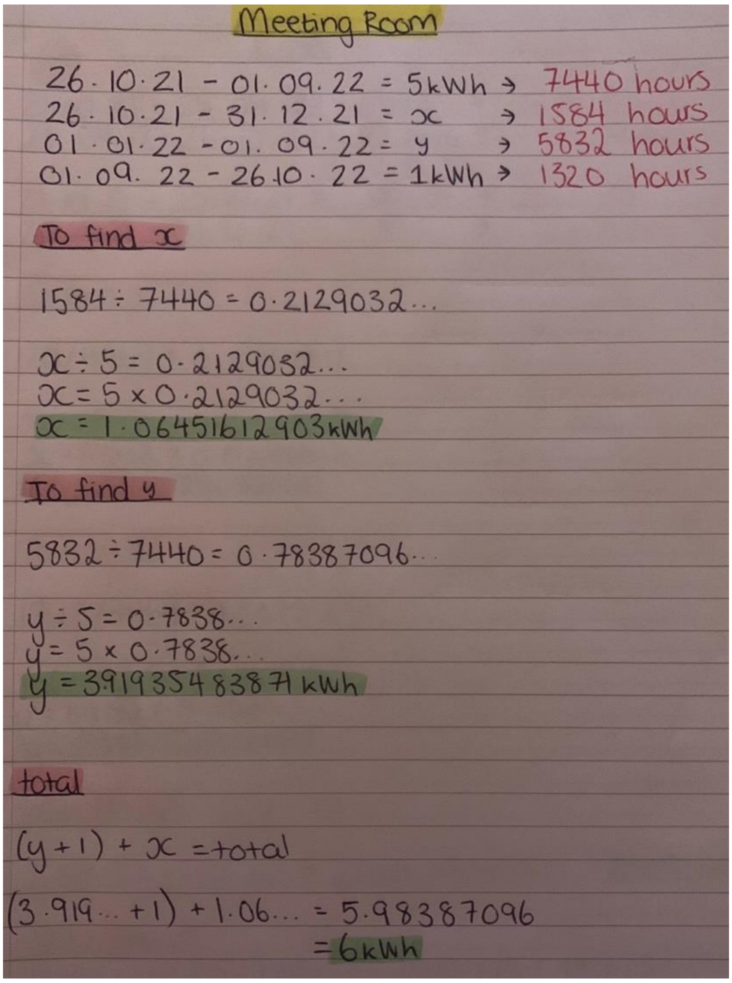
total $- x = y$

$6415 - 3579.641$
$= 2835.359$ kWh

6.4. Appendix D – Meeting Room

Period	kWh
26 Oct 2021 – 01 Sept 2022	5
01 Sept 2022 – 26 Oct 2022	1
26 Oct 2021 – 31 Dec 2021	1.065
01 January 2022 – 01 Sept 2022	3.919

2021 Period *(26th October 2021 – 31st December 2021)*	1.065 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	4.919 kWh
Total *(26th October 2021 – 26th October 2022)*	6 kWh



Meeting Room

26.10.21 - 01.09.22 = 5kWh → 7440 hours
26.10.21 - 31.12.21 = x → 1584 hours
01.01.22 - 01.09.22 = y → 5832 hours
01.09.22 - 26.10.22 = 1kWh → 1320 hours

To find x

1584 ÷ 7440 = 0.2129032...

x ÷ 5 = 0.2129032...
x = 5 × 0.2129032...
x = 1.06451612903kWh

To find y

5832 ÷ 7440 = 0.78387096...

y ÷ 5 = 0.7838...
y = 5 × 0.7838...
y = 3.919354838 71 kWh

total

$(y + 1) + x$ = total

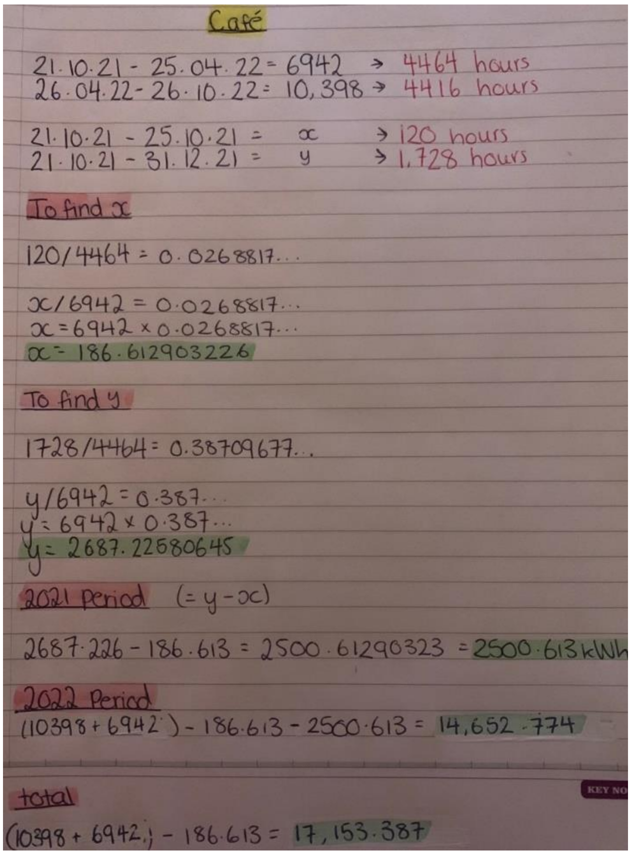
(3.919... + 1) + 1.06... = 5.98387096
= 6kWh

6.5. Appendix E - Cafe

Period	**kWh**
26 Oct 2021 – 25 April 2022	6942
26 April 2022 – 26 Oct 2022	10398
21 Oct 2021 – 25 Oct 2021	186.613
21 Oct 2021 – 31 Dec 2021	2687.226

Estimates:

2021 Period *(26th October 2021 – 31st December 2021)*	2500.613 kWh
2022 Period *(1st January 2022 – 26th October 2022)*	14,652.774 kWh
Total *(26th October 2021 – 26th October 2022)*	17,153.387 kWh



Café

21.10.21 - 25.04.22 = 6942 → 4464 hours
26.04.22 - 26.10.22 = 10,398 → 4416 hours

21.10.21 - 25.10.21 = x → 120 hours
21.10.21 - 31.12.21 = y → 1,728 hours

To find x

120/4464 = 0.0268817...

x/6942 = 0.0268817...
x = 6942 × 0.0268817...
x = 186.612903226

To find y

1728/4464 = 0.38709677...

y/6942 = 0.387...
y = 6942 × 0.387...
y = 2687.22580645

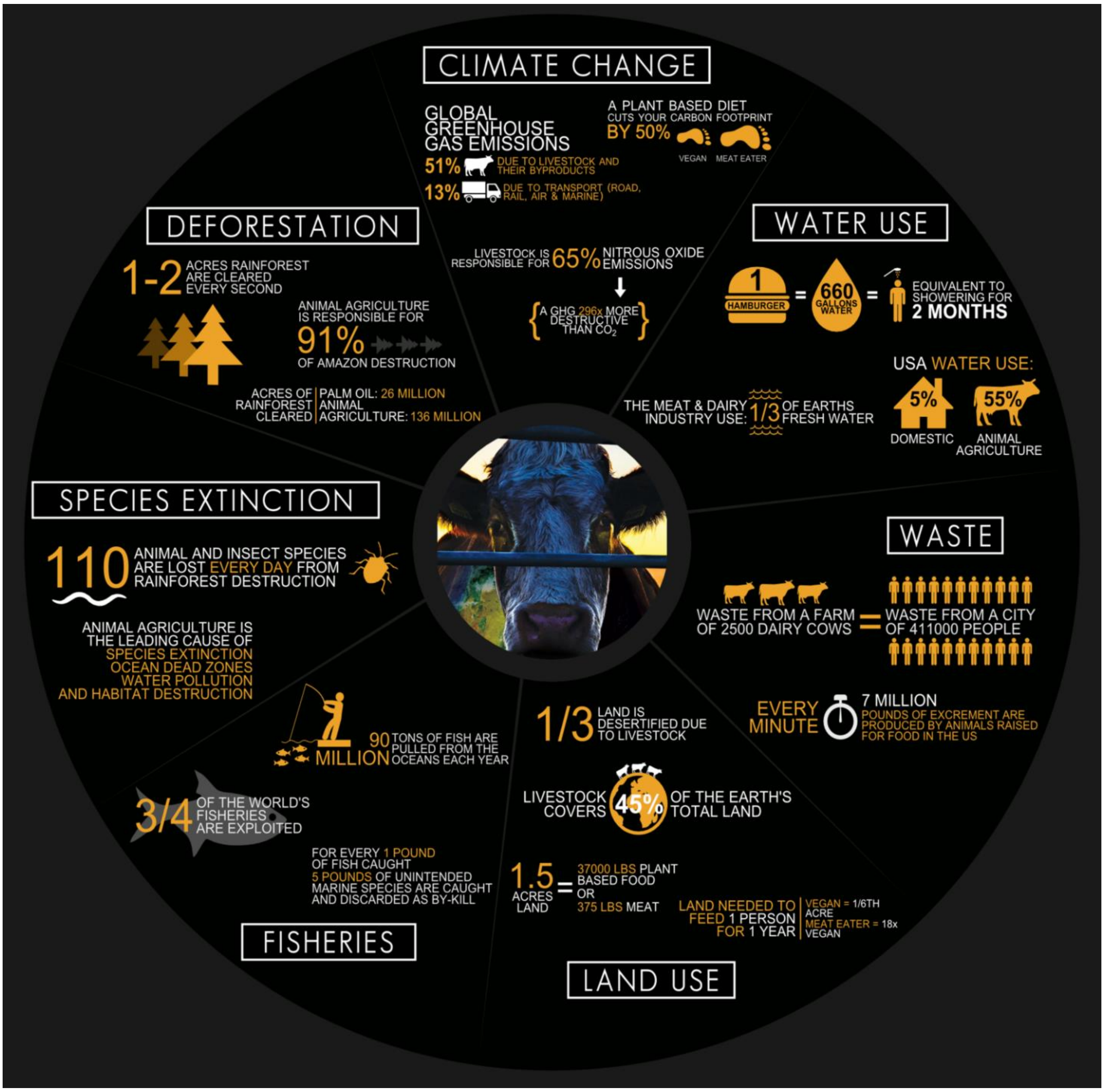
2021 Period (= y - x)

2687.226 - 186.613 = 2500.61290323 = 2500.613 kWh

2022 Period
(10398 + 6942) - 186.613 - 2500.613 = 14,652.774

total
(10398 + 6942) - 186.613 = 17,153.387

6.6. Appendix F – Infographic (Jones, no date)



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