Guernsey Electricity Limited

HOUSEHOLD APPLIANCE CARBON STUDY

2024UK261753_APPLIANCES STUDY
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PUBLIC

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EXECUTIVE SUMMARY

Guernsey Electricity Limited (GEL) is an integrated utility that generates, transmits and distributes electricity across the island of Guernsey. It also manages an interconnector with France through which a large proportion of electricity is imported.

WSP UK has previously verified the intensity of the electricity that GEL distributes. The aim of this previous study was to calculate greenhouse emissions released for every kWh of electricity consumed by GEL customers (gCO_2e/kWh), also taking into consideration emissions across the full lifecycle of electricity production. The MS Excel file containing the verified calculations for the GEL intensities is: *GEL Corporate GHG Emissions 2023_v1.11_18032024_FINAL.*

WSP UK was commissioned by GEL to conduct a study on the carbon impact of running household appliances using electricity supplied by GEL and the UK grid. Using the average annual energy consumption (kWh/year) from appliances, emissions were calculated for each of the appliances using the emission factors for total GEL mix, GEL importation mix and the UK grid factor sourced from the Department for Energy, Security and Net Zero (DESNZ).[1] The results demonstrate that using appliances with the GEL importation mix result in the lowest CO_2e emissions.

METHODOLOGY

The following appliances were selected as requested by GEL:

- Washing machine
- Dishwasher
- Tumble dryer
- Slow cooker
- Electric oven
- Electric Hob
- Kettle
- Microwave
- Direct hot water cylinder

The average annual energy consumption values (kWh/year) for each of these appliances was sourced, these values are presented in Table 2 of the Appendix. The average consumption value for washing machines, dishwashers, tumble dryers, kettles, microwaves, electric ovens and electric hobs were extracted from the *Electrical Products Data Tables (Table_A3) for Energy Consumption in the UK (ECUK)* (2023)[2]. For the slow cooker and dehumidifier, average annual consumption was calculated using figures from an appliance energy consumption blog[3]. This was sense checked against manufacturer data on power usage for various makes and models of slow cookers[4] and dehumidifiers[5] and was deemed representative. Where high and low values for power (watts) were

[1] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023
[2] https://ckan.publishing.service.gov.uk/dataset/energy_consumption_in_the_uk/resource/a01bfde3-c3e8-4910-a400-814f3b79de19
[3] https://www.nimblefins.co.uk/how-much-electricity-does-appliance-use#nogo
[4] Slow Cookers | ao.com
[5] Sites-curryspcworlduk-Site

provided, the worst-case scenario (i.e., the high value) was used, except in the case of dehumidifiers where the sense-checking exercise revealed an average towards the lower end of the range. For direct hot water cylinders, the average annual consumption was calculated using Neptune's Direct Unvented Cylinder and usage figures from the Energy Use Calculator.[6,7]

EMISSIONS FACTORS

An emissions factor is used to calculate the greenhouse gas (GHG) emissions produced from the electricity used by each appliance. The emission factor (therefore emissions) is different each source of electricity. The emissions factors for 'total GEL mix' (electricity from all GEL sources) and 'GEL importation mix' (electricity from GEL imports only) for 2023 have been given in Table 1. To note, these emissions factors include emissions form transmission and distribution (T&D) loses. GELs emission factors have been compared to the UK gird emission factor from DESNZ for 2023.[8] The DESNZ emissions factor includes T&D loses to align with the GEL factors.

Table 1 - Emission factors 2023

Emission factor	Emissions factor (gCO_2e/kWh)
Total GEL mix (Total Lifecycle Emissions Intensity of Distributed Electricity)	100.3
GEL importation mix (Carbon Intensity (Lifecycle electricity supplied) for imported sources only)	12.1
UK grid emission factor (includes transmission and distribution (T&D) loses and well-to-tank (WTT) to align with the GEL factors)	274.9

CALCULATIONS

The average annual energy consumption (kWh/year) used to calculate the emissions from each of these appliances was derived using the following equation.

GHG emissions ($kgCO_2e$) = Appliance annual kWh use X Emissions factor (gCO_2e) ÷ 1,000

[6] Neptune Direct Unvented Cylinders | Electric Heating Company (electric-heatingcompany.co.uk)
[7] https://energyusecalculator.com/electricity_waterheater.htm
[8] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023

ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply to this study:

- This study calculates only the emissions associated with the energy use/operation of the stated appliances, not the impacts of embodied carbon or end of life.
- In the absence of Guernsey-specific data on average annual energy consumption for household appliances, industry averages have been sourced and have been used for calculating operational emissions.
- At the request of GEL, direct hot water cylinders have used for this study. Direct hot water cylinders are designed to accommodate properties where external heat sources are not available. They operate using electricity which powers inbuilt immersion heaters. For this study a direct hot water cylinder that operates using electricity to power two inbuilt 3kW immersion heaters for 3 hours a day for 365 days a year has been chosen.

RESULTS

Using the stated average annual energy consumption (kWh/year), emissions were calculated for each of the appliances with respect to the emission factors for total GEL mix, GEL importation mix and UK grid factor. Figure 1 and Figure 2 present a comparison of operational emissions from the respective household appliances for these power sources.

Figure 1 - Comparison of average annual operational emissions from household appliances powered by total GEL mix, GEL importation mix and UK DESNZ emission factors

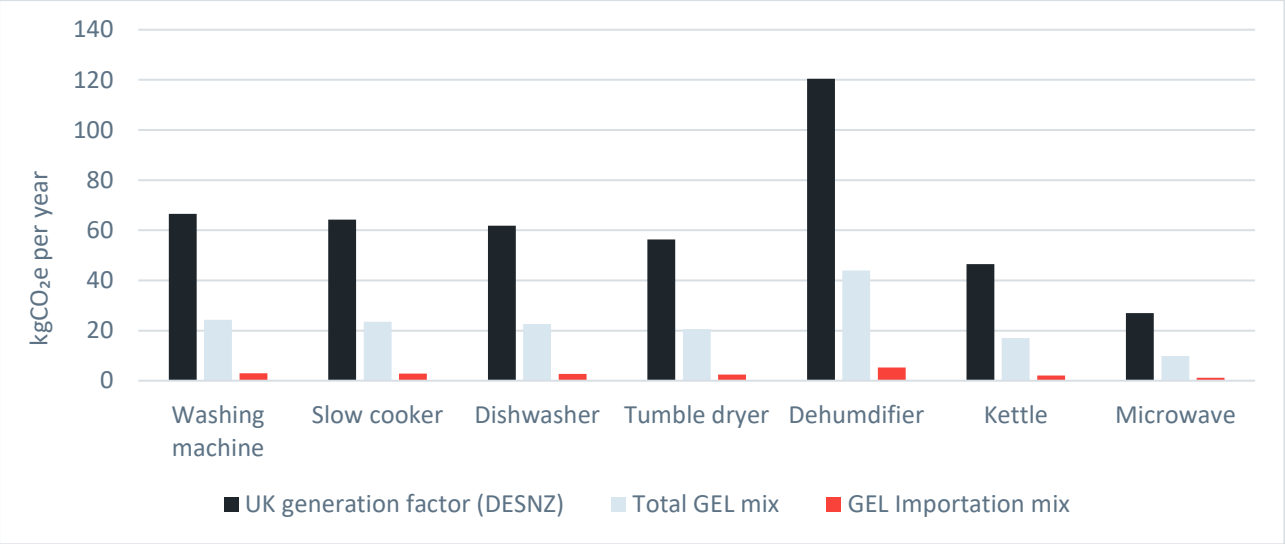
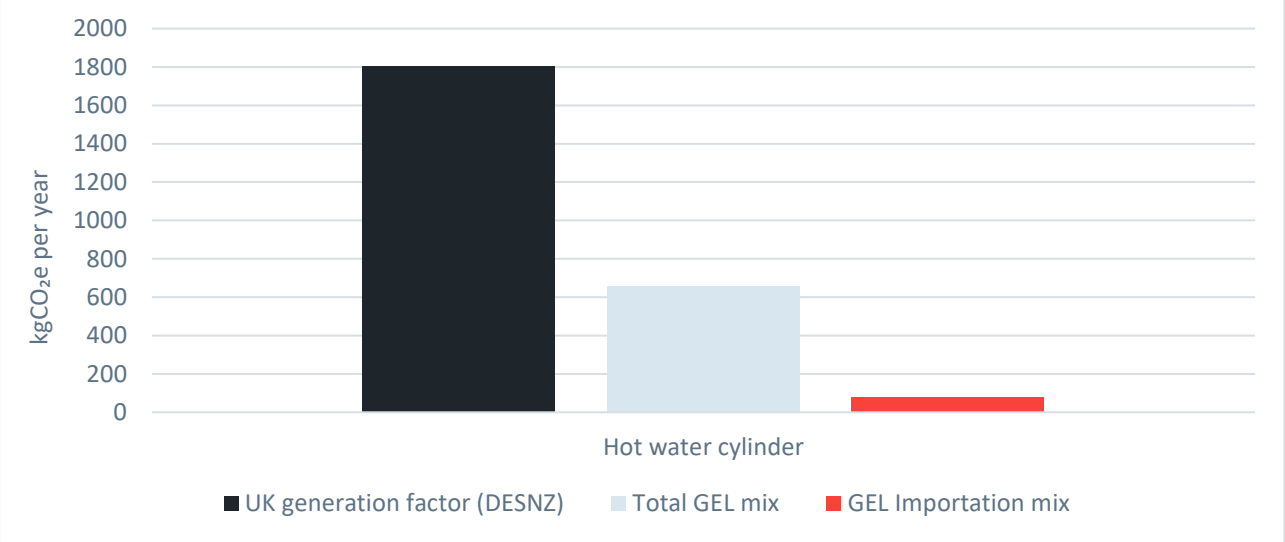


Figure 2 - Comparison of average annual operational emissions from direct hot water cylinders powered by total GEL mix, GEL importation mix and UK DESNZ emission factors



The results are based on average annual usage figures which is in part a function of the average usage of each appliance over a year period. Therefore, the purpose of this study is not to compare the appliances against each other but rather to compare the difference between the various electricity supplies (UK grid factor, GEL mix and GEL importation mix only). The results demonstrate that using appliances with the GEL importation mix result in the lowest CO_2e emissions.

APPENDIX – FULL RESULTS

Table 2 - Average annual energy consumption of household appliances in UK (2022)

Appliance type	Average annual consumption (kWh/year)	Source
Electric oven	96	ECUK 2023: Electrical products data tables
Electric hob	194	ECUK 2023: Electrical products data tables
Washing machine	242	ECUK 2023: Electrical products data tables
Slow cooker	234*	How Much Electricity Does My Appliance Use? From Fans to Slow Cookers | NimbleFins
Dishwasher	225	ECUK 2023: Electrical products data tables
Tumble dryer	205	ECUK 2023: Electrical products data tables
Dehumidifier	438**	How Much Electricity Does My Appliance Use? From Fans to Slow Cookers | NimbleFins
Kettle	169	ECUK 2023: Electrical products data tables
Microwave	98	ECUK 2023: Electrical products data tables
Direct hot water cylinder	6570***	Neptune Direct Unvented Cylinders Energy use calculator: hot water cylinders

*estimated using the assumption of 205 Watts of power for the appliance, in use 6 hours per day for 3 days a week for a year[2]

**estimated using the assumption of 300 Watts of power for the appliance, in use 4 hours per day for 365 days a year[2]

***estimated using the assumption of two immersion heater with 3000 Watts of power, in use 3 hours per day for 365 days a year[6, 7]

Table 3 - Operational emissions for household appliances using the GEL emissions factors

Appliance type	Total operational emissions ($kgCO_2e$/year)		
	Total GEL mix	GEL importation mix	UK generation emission factor (DESNZ 2023)
Electric oven	9.63	1.16	26.39
Electric hob	19.46	2.35	53.32
Washing machine	24.27	2.93	66.52
Slow cooker	23.47	2.83	64.32
Dishwasher	22.57	2.72	61.84
Tumble dryer	20.56	2.48	56.35
Dehumidifier	43.93	5.30	120.39
Kettle	16.95	2.04	46.45
Microwave	9.83	1.19	26.94
Direct hot water cylinder	658.97	79.50	1805.83

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