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Guernsey Electricity Limited

HOUSEHOLD APPLIANCE CARBON STUDY

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TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70110192

OUR REF. NO. 70110192_APPLIANCES STUDY

DATE: SEPTEMBER 2023

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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: *WSP GHG Review Spreadsheet_RP of 2022_v1.0_14042023.xlsx.*

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 average UK grid. 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 the grid factor sourced from the Department for Business, Energy and Industrial Strategy (BEIS).[1] The results demonstrate that using appliances with the GEL importation mix result in the lowest CO_2e emissions.

METHODOLOGY

LITERATURE REVIEW

To identify the household appliances that would be suitable to meet the objectives of the study, a preliminary literature review was conducted on the following appliances (each selected for further assessment):

- Washing machine
- Dishwasher
- Tumble dryer
- Slow cooker
- Electric oven
- Electric Hob
- Kettle
- Microwave

Here, the criterion for selection was that the appliance should not be time-sensitive, i.e., it should be feasible for any household to operate the appliance at any time during the day.

Thereafter, a secondary literature review was conducted to source the average annual energy consumption values (kWh/year) for each of these appliances, the 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*

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[1] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022

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Data Tables (Table_A3) for Energy Consumption in the UK (ECUK) (2022)[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 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.

EMISSIONS FACTORS

An emissions factor is used to calculate the GHG emissions released from the use of electricity for every kWh of energy used and hence, would be different for different sources of electricity. The emissions factors for 'total GEL mix' (electricity from all GEL sources) and 'GEL importation mix' (electricity from GEL imports only) for 2022 have been given in Table 1. To note, these emissions factors correspond to the full lifecycle of electricity produced and include Well-to-Tank (WTT) emissions[6]. For reference, the stated emissions have been compared to the UK generation emission factor from BEIS[7] for 2022. The BEIS emissions factor includes generation and WTT to align with the GEL factors.

Table 1 - GEL emissions factors 2022

Emission factor	Emissions factor (gCO_2e/kWh)
Total GEL mix	87.34
GEL importation mix	9.27
UK generation emission factor (BEIS 2022)	211.07

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

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[2] Department for Business, Energy and Industrial Strategy. (2022). Energy Consumption in the UK 2022: Electrical products data tables. Available at: Energy consumption in the UK 2022 - GOV.UK (www.gov.uk) (Table A3) [Accessed 14 July 2023]

[3] How Much Electricity Does My Appliance Use? From Fans to Slow Cookers. Available at: https://www.nimblefins.co.uk/how-much-electricity-does-appliance-use#nogo [Accessed 14 July 2023]

[4] Example makes and models of slow cookers: Slow Cookers | ao.com [Accessed 14 July 2023]

[5] Example makes and models of dehumidifier: Sites-curryspcworlduk-Site [Accessed 14 July 2023]

[6] Emissions released from the production, processing, distribution and delivery of fuel or energy.

[7] Department of Business, Energy and Industrial Strategy. (2022). Greenhouse gas reporting: conversion factors (2022). Available at: Greenhouse gas reporting: conversion factors 2022 - GOV.UK (www.gov.uk)

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, UK average annual energy consumption data from the Electrical Products Data Tables for Energy Consumption in the UK (ECUK) (2022)[1] has been used for calculating operational emissions.

- For dehumidifiers and slow cookers, the average annual energy consumption is not provided in ECUK, hence alternate sources[2-5] have been referred to.

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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 BEIS. Figure 1 presents a comparison of operational emissions from the respective household appliances for these three cases.

Figure 1 - Comparison of average annual operational emissions from household appliances for total GEL mix, GEL importation mix and UK BEIS emission factors
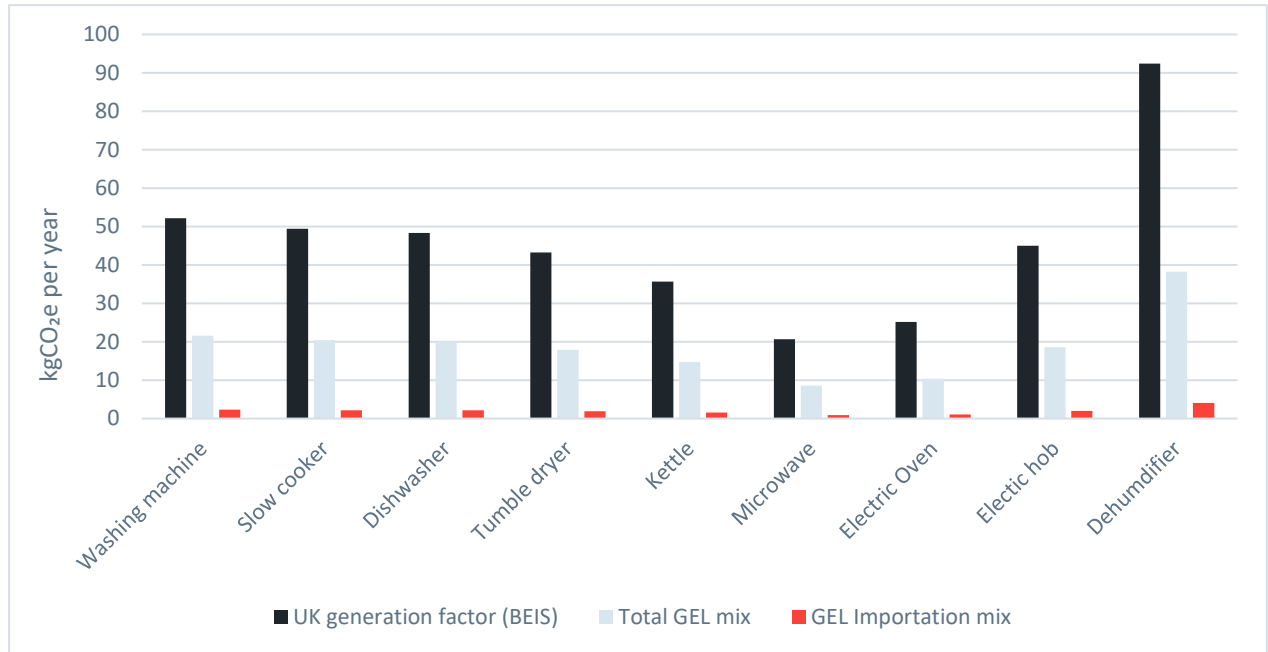
The results are based on average annual usage figures which is in part a function of the average usage of each appliance over a year period. Therefore, the purpose of this study is not to compare the appliances against each other but rather to compare the difference between the various electricity supplies (UK, 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)
Electric oven	119
Electric hob	213
Washing machine	247
Slow cooker	234*
Dishwasher	229
Tumble dryer	205
Dehumidifier	438**
Kettle	169
Microwave	98

*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].

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

Appliance type	Total operational emissions (kgCO$_2$e/year)		
	Total GEL mix	GEL importation mix	UK generation emission factor (BEIS 2022)
Electric oven	10.39	1.10	25.12
Electric hob	18.60	1.97	44.96
Washing machine	21.57	2.29	52.13
Slow cooker	20.44	2.17	49.39
Dishwasher	20.00	2.12	48.34

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Tumble dryer	17.90	1.90	43.27
Dehumidifier	38.25	4.06	92.45
Kettle	14.76	1.57	35.67
Microwave	8.56	0.91	20.68

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