Guernsey Electricity Limited

CARBON INTENSITY METHODOLOGY

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GUERNSEY ELECTRICITY LIFE-CYCLE CARBON INTENSITY

WSP UK were commissioned by Guernsey Electricity Ltd. (GEL), to conduct a study into the carbon intensity of the electricity that GEL distributes. The aim of this study was to calculate the amount of greenhouse emissions released for every kWh of electricity consumed by GEL customers (gCO_2e/kWh), taking into consideration emissions across the full life cycle of the electricity production.

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, the emissions from this electricity are quantified using a market-based approach. GEL also undertakes operations that use electricity including works power, office activities and the charging of electric vehicles.

WSP included in its study the life cycle emissions relating both GEL's direct electricity generation and the electricity that it imports. WSP calculated the carbon intensity of GEL's electricity sold during the 2019/20 reporting cycle and forecasted this intensity out to 2050.

METHODOLOGY

For the purposes of this study, the following emissions sources were assessed:

- The embodied carbon in the electricity generation equipment;
- Electricity transmission and distribution losses;
- Carbon emissions relating to the upstream activities of fuel production i.e. well-to-tank emissions (extraction, refining and transportation of the raw fuel);
- Direct carbon emissions from the combustion of fuels for generating electricity; and
- Carbon emissions relating to the on-site activities at GEL's generating facility.

A number of data sources were used for the study, including primary data from GEL's own electricity generation, data provided by the generating companies supplying electricity to GEL's interconnector and secondary data obtained through a literature review.

The assessment methodology included the following key stages:

1. The carbon emissions from GEL's electricity production facility were calculated for the reporting period of April 2019 – March 2020. This included the combustion of fuels for electricity generation and all plant activities involving the combustion of fuel. These calculations were carried out by GEL in line with Department for Environment, Food and

Rural Affair's (DEFRA) Environmental Reporting Guidelines,[1] (the 'Guidelines') which were updated in March 2019.

2. The life cycle carbon intensity of the renewable electricity imported through its interconnector by GEL, was provided by the electricity generating company through guarantee of origin (GoO) certificates for the reporting period. The life cycle carbon intensity of the other renewable electricity sources (solar, onshore wind and offshore wind) were identified through a literature review.[2,3]
3. The well-to-tank emissions for all fuel used by GEL at its production facility, were calculated using DEFRA's 2019 conversion factors.[4]
4. The sum of the emissions values from steps 1-3 provided the total life cycle emissions value ($CO2_e$) of the electricity that GEL provided to its customers in 2019/20.
5. WSP then calculated the carbon *intensity* of the electricity that GEL supplied its customers during 2019/20, using the following formula:

$$\text{Life cycle intensity of electricity received by GEL customers } (gCO_2e/kWh) = \frac{\text{Total life cycle emissions } (gCO_2e)}{\text{Total electricity consumed by GEL customers (kWh)}}$$

6. The life cycle intensity of GEL's electricity was then forecasted to 2050, using GEL's predicted electricity generation capacity and Guernsey's electricity demand.

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf
[2] https://www.imperial.ac.uk/media/imperial-college/grantham-institute/public/publications/briefing-papers/Solar-power-for-CO2-mitigation---Grantham-BP-11.pdf
[3] https://www.theccc.org.uk/wp-content/uploads/2013/04/Reducing-carbon-footprint-report.pdf
[4] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019

COMPARISON OF LIFETIME INTENSITY OF HEAT SOURCES

The carbon intensity of different heat sources has been compared in the table below. This includes the use of GEL's electricity to power an air source heat pump, compared to the emissions intensity of using LPG and heating oil for heating purposes.

Source	Lifetime carbon intensity gCO_2e/kWh
GEL Forecasted 2020/21 Electricity Mix[1]	62
Air Source Heat Pump (using GEL electricity)[2,3]	33
LPG Fuel used for heating[4]	241
Heating Oil used for heating[5]	316

Table footnotes:

1. This is the forecasted life cycle carbon intensity of the electricity which GEL customers will receive in 2020/2021. The forecast includes the anticipated electricity demand between April 2020 and March 2021 and the electricity mix modelled by GEL.
2. The lifetime carbon intensity assumes the use of GEL electricity in an air source heat pump with a coefficient of performance (COP) of 2.
3. 5% of the intensity is due to refrigerant losses; embodied carbon of the equipment; and downstream transport and distribution.[5]
4. This includes carbon emissions from the combustion of fuel for heating and upstream emissions for the supply of LPG (well-to-tank emissions). This information has been sourced from 'DEFRA Greenhouse gas reporting: conversion factors 2020'. The intensity does not include embodied carbon of the equipment used or emissions from the downstream distribution of fuel, which are both deemed to be minimal.
5. This includes carbon emissions from the combustion of heating oil for heating and upstream emissions for the supply of heating (well-to-tank emissions). This information has been sourced from DEFRA Greenhouse gas reporting: conversion factors 2020. The intensity does not include embodied carbon of the equipment used or emissions from the downstream distribution of fuel, which are both deemed to be minimal.

[5] https://www.escholar.manchester.ac.uk/api/datastream?publicationPid=uk-ac-man-scw:178995&datastreamId=POST-PEER-REVIEW-PUBLISHERS.PDF

ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply to WSP's study:

1. The emissions intensity of GEL's electricity is forecasted to reduce significantly between 2019/20 and 2020/21, due to an expected significant decrease in the use of oil for electricity generation and an increase in the proportion of renewable energy as part of GEL's electricity mix.
2. The forecasted emissions intensity of GEL's electricity in 2020/21 includes an assumption of the proportion of electricity generated by each energy source (oil and renewable imports).
3. From 2019/20 to 2020/21, GEL's imported nuclear energy will be replaced by a mix of renewables. For the forecast calculations, a mix of 50% offshore wind and 50% onshore wind has been assumed to replace nuclear energy.
4. The exact life cycle emissions of the renewable electricity imported by GEL in 2020/21 will not be known until GoO certificates have been received in 2021.
5. The life cycle intensity study relies on emissions intensity values obtained through literature research.

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