Planning Statement

Appendix 6  
Design Stage R1 Calculation



Canford Energy from Waste

Combined Heat and Power Facility

June 2023

Glossary

|  |  |
| --- | --- |
| Term | Description |
| bara | Bar absolute |
| °C | Degrees Celsius |
| CV | Calorific value |
| CCRR | Carbon capture retrofit ready |
| CHP | Combined heat and power |
| DNC | Distribution network connection |
| EA | Environment Agency |
| EfW | Energy from waste |
| Ef | The annual energy input to the system from fuel contributing to the production of steam |
| Ei | The annual energy imported excluding Ew and Ef |
| Ep | The annual energy produced as heat or electricity |
| Ew | The annual energy contained in the treated waste |
| GJ | Gigajoule |
| kg | Kilogram |
| kPa | Kilopascal |
| l | Litre |
| MSW | Municipal solid waste |
| MWe | Megawatt electrical |
| MWh | Megawatt hour |
| MWth | Megawatt thermal |
| Nm3 | Normalised cubic metre |
| R1 | Calculation for establishing whether an MSW EfW is classified as a recovery activity |
| WFD | Waste Framework Directive |

Executive summary

Purpose of this report

This report has been produced to support the planning application for an Energy from Waste (EfW) Combined Heat and Power (CHP) Facility at Canford Resource Park. The report provides design stage calculations to determine whether the facility can qualify as a recovery operation in accordance with the methodology established by the Environment Agency. The calculations have been based on design data provided MVV.

Using this data the R1 energy efficiency has been calculated to be 0.83 which is greater than the minimum of 0.65 for it to be considered as a recovery operation.

Therefore, based on this design stage calculation the EfW CHP Facility will meet the definition of recovery.

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# Introduction

* + 1. The Applicant (MVV Environment Ltd) is proposing to operate an Energy from Waste (EfW) Combined Heat and Power (CHP) Facility at Canford Resource Park.
    2. EfW facilities can be classified as either ‘disposal’ or ‘recovery’ and the Waste Framework Directive (WFD) Article 3 provides the following definitions:[[1]](#footnote-1)
* 'recovery' means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy. Annex II sets out a non-exhaustive list of recovery operations;
* 'disposal' means any operation which is not recovery even where the operation has as a secondary consequence the reclamation of substances or energy. The WFD Annex I1 sets out a non-exhaustive list of disposal operations;
  + 1. The WFD and UK waste policy promotes moving waste up the waste hierarchy with recovery being higher than disposal.
    2. Determination of whether an EfW facility is classified as disposal or recovery is subject to the facility’s energy efficiency performance as defined in the WFD Annex II1. The R1 efficiency formula is not a conventional efficiency calculation but a calculation of the efficiency at which energy is utilised and is defined in the WFD by the following equation:

**R1 Energy Efficiency = (Ep – (Ef+Ei)**

**(0.97\* (Ew + Ef)**

Where:

Ep The annual energy produced as heat or electricity. It is calculated with energy in the form of electricity being multiplied by 2.6 and heat produced for commercial used multiplied by 1.1 (GJ/year).

Ef The annual energy input to the system from fuel contributing to the production of steam (GJ/year).

Ei  The annual energy imported excluding Ew and Ef (GJ/year).

Ew The annual energy contained in the treated waste calculated using the net calorific value of the waste (GJ/year).

0.97 The factor accounting for energy loss due to bottom ash and radiation (GJ/year).

* + 1. For EfW facilities processing municipal solid waste (MSW), to achieve R1 status their energy efficiency, calculated in accordance with the above formula must be equal to or above:
* 0.60 – for installations in operation and permitted in accordance with applicable legislation before 1st January 2009; or
* 0.65 – for installations permitted after 31st December 2008.
  + 1. The proposed EfW CHP facility is planned to be a ’recovery’ operation and therefore will need to have an R1 efficiency equal to or above 0.65.
    2. This report sets out a design stage calculation to support that the facility has been designed to meet recovery status.
    3. The structure of this document is as follows:

**Section 2** Provides an overview of the proposed facility, describes the methodology used to calculate the R1 efficiency and summarises the data input and sources.

**Section 3** Section 3 summarises the R1 Calculation and R1 status.

# R1 Calculation

## Overview of the Proposed Development and Energy Recovery

* + 1. The Proposed Development of a Carbon Capture Retrofit Ready (CCRR) EfW CHP Facility and associated infrastructure is located at:

Canford Resource Park

Arena Way, Magna Rd

Wimborne

Dorset

BH21 3BW

* + 1. The primary purpose of the EfW CHP Facility is to treat residual MSW from Bournemouth, Christchurch, Poole, and surrounding areas of Dorset that cannot be recycled, reused, or composted.
    2. The EfW CHP Facility is designed to treat up to 260,000 tonnes (t) of residual MSW per annum at the net thermal design point of 100.5 Megawatts thermal (MWth). It will have a design throughput of 33.2 tonnes per hour (tph) of waste with a net Calorific Value (CV) of 10.9 Megajoules per kilogram (MJ/kg)) and an availability of 89.4% (equal to approximately 7,830 full load operational hours per year).
    3. The Proposed Development consists of the following key elements:
* EfW CHP Facility
* CHP Connection; and
* Distribution Network Connection.
  + 1. The EfW CHP Facility has been designed to export hot water and electricity. Electrical energy generated will be exported via the Distribution Network Connection (DNC) to the distribution network. On average, 30.86MWe will be generated by the steam turbine, of which 2.38MWe will be consumed by the plant as the parasitic load, leaving 28.48MWe as the net electrical output for export to the distribution network.
    2. The Proposed Development includes a CHP Connection Corridor, in which underground pipework will connect the EfW CHP Facility to Magna Business Park located approximately 0.6km to the east of the EfW CHP Facility Site. Future expansion of the CHP network from Magna Business Park will be possible, to meet existing and new user requirements.
    3. To facilitate the supply of heat, the steam turbine will be designed so that low pressure steam can be used to produce hot water for supply to the district heating system. It is envisaged that approximately 5MWth of usable steam (heat) energy would potentially be available to produce hot water for export via the CHP Connection to users in the Magna Business Park. The amount of heat to be supplied will depend on the final occupancy of the Magna Business Park. If contracts are entered into with users of the hot water this would be transported via pipe to its destination and a return pipe would carry the cold water back to the facility for reheating.
    4. The heat would be supplied through insulated, pipes at a temperature of up to approximately 90°C. The hot water system would be continuously monitored and regularly tested to maximise efficiency and minimise the risk of an unplanned outage. It is possible that a much larger quantity of heat could be supplied to customers across a wider area. The connection point to such a wider district heating network would be in the vicinity of the Magna Business Park.
    5. To start-up the EfW CHP Facility it will be necessary to import electrical power from an external network. With the EfW CHP Facility in operation electrical power would be generated at 11kV, with the plant power requirement (parasitic load) being supplied via the internal power distribution system and transformers at the required auxiliary voltage level.

## Methodology

* + 1. The R1 recovery status process is overseen in England by the Environment Agency (EA). The EA has developed a spreadsheet tool which provides a standardised format for presenting the calculation. To apply for R1 status using the EA spreadsheet the EfW must:
* produce electricity using a standard Rankine cycle steam power plant;
* have or will have an environmental permit;
* be capable of incinerating mixed MSW including refuse derived fuel or solid recovered fuel incinerators if the fuels been made from mixed MSW;
* not be a co-incinerator.
  + 1. The proposed EfW CHP Facility produces electricity using a standard Rankine cycle. It is designed to incinerate residual MSW from the local area and is not a co-incinerator. In order to bring the EfW CHP Facility into operation an environmental permit must be granted by the EA. On this basis the R1 tool produced by the EA is suitable for use in establishing the R1 status of the Proposed Development.
    2. New facilities that are not yet in operation may apply for R1 status at the design stage. As the Proposed Development is not operational a design stage calculation only has been produced. This calculation has been designed to be suitable for supporting a design stage R1 application at the time the facility applies for its environmental permit.
    3. Once operational the design stage calculation will be revisited with operational data to demonstrate the operational performance and R1 status of the EfW CHP Facility.

## Data Inputs and Sources

* + 1. As detailed in **Section 2.2** above this R1 calculation is based on available design data. The EA recognise that full data inputs for all parameters included within the R1 spreadsheet may not be available at an early design stage. The level of detail provided to support this design stage calculation is similar to that included for other design stage calculation accepted and approved by the EA.
    2. Although there is the potential for the supply of heat, the R1 efficiency formula has been on the generation of electricity only to provide a conservative assessment. Should a heat supply be possible this would be expected to be beneficial and would improve the R1 efficiency rating.
    3. A climate change factor of 1 is assumed for the purpose of the R1 calculation.
    4. Data used to inform the R1 Calculation are summarised in **Table 2-1** below.

Table 2‑1: Summary of R1 Data Inputs

| Parameter | Value | Source/Comments |
| --- | --- | --- |
| Availability | 89.4% = 7,830 hours per annum | Confirmed by MVV |
| Gross electrical output (at turbine) | 30.86MWe | Provided by MVV, data input to R1 spreadsheet as MWh based on above availability |
| Electricity exported | 28.48MWe | Provided by MVV, data input to R1 spreadsheet as MWh based on above availability |
| Electricity imported | 176.3 MWh | Provided by MVV, includes imported electricity for start-up and shutdown when EfW is not generating electricity |
| Diesel oil usage | 806,000litres | Provided by MVV, includes fuel consumed during start-up/shutdown and to maintain the temperature above 850 °C. |
| Diesel oil density | 0.843kg/l | Density Source: Greenhouse gas reporting: conversion factors 2021[[2]](#footnote-2) Density for diesel (100% mineral diesel) used (843.17 kg/m3 = 0.843 kg/l) |
| Diesel oil CV | 42,860kJ/kg | Density Source: Greenhouse gas reporting: conversion factors 20212  Net CV reported at 42.86 GJ/tonne = 42,860 kJ/kg. |
| Annual primary combustion air supplied to furnace | 1,061,650,624m3 | Provided by MVV |
| Primary combustion air density | 0.942kg/Nm3 | Density for air at given temperature and assumed atmospheric pressure |
| Primary combustion air temperature | 99.97°C | Provided by MVV |
| Annual secondary combustion air supplied to furnace | 475,558,385m3 | Provided by MVV |
| Secondary combustion air density | 1.146kg/Nm3 | Density for air at given temperature and assumed atmospheric pressure |
| Secondary combustion air temperature | 33.72°C | Provided by MVV |
| Superheated steam at boiler outlet | 984,231 tonnes | Provided by MVV – annual tonnes |
| Superheated steam temperature | 380°C | Provided by MVV |
| Superheated steam pressure | 4,619kPa | Provided by MVV at 46.19 bara – multiply by 100 to convert bara to kPa |
| Boiler feedwater | 993,627 tonnes | Provided by MVV – annual tonnes |
| Boiler feedwater temperature | 131.3°C | Provided by MVV |
| Boiler feedwater pressure | 6,369kPa |  |
| Boiler efficiency | 90% | Provided by MVV, including uncertainty of 1.5% |

* + 1. Based on the above data inputs the R1 spreadsheet calculates the following values to inform the R1 calculation.

Ep = 2,261,692 GJ/year

Ef + Ei = 30,772 GJ/year

Ew + Ef = 2,769,002 GJ/year

# R1 Status

* + 1. The R1 efficiency has been calculated using the EA spreadsheet, with the data inputs that informed the assessment summarised in **Section 2.2** of this report.
    2. The R1 efficiency formula is defined in the WFD as follows:

**R1 Energy Efficiency = (Ep – (Ef+Ei)**

**(0.97\* (Ew + Ef)**

* + 1. The R1 efficiency is calculated as:

(2,261,692 – 30,772) = 0.83

0.97 x 2,769,002

* + 1. Based on the design data for the proposed plant, the R1 energy efficiency has been calculated to be 0.83 which is greater than the minimum of 0.65 for it to be considered as a recovery operation.
    2. Therefore, the EfW CHP Facility will meet the definition of recovery. The full calculation is provided in Appendix A.
    3. It is reasonable to assume that the supply of heat directly from the plant, which MVV is committed to achieving when possible, will increase the R1 efficiency. MVV’s plant at Devonport, of similar scale and design to this proposal, achieves an R1 efficiency of circa 0.9 as a result of exporting heat to Devonport Dockyard.

1. Excel Spreadsheet Calculation of Design Stage R1 Status

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PROFORMA FOR DETERMINING ENERGY EFFICIENCY USING R1** (V3.2 Aug 2022) | | | | | |  |  |  |
| **Site name, address and grid reference** | Canford EfW | **EPR Permit reference (if known)** | | Unknown | |  | | |
| **Operator name** | MVV | **Application fee (£)** | | N/A - Assessment  submitted to support planning at this stage | |
| **Details of who to contact if we**  **have any queries regarding this form** | N/A - Assessment submitted to support planning at this stage | **Assessment stage** | | Initial assessment using design data | |
|  | | | |  | |
| Indicative R1 factor (subject to  confirmation) | 0.83 | Quantity in  reporting year | Units | Uc | Properties  (Average over reporting year) | Units | Note which  parameters that have been estimated | Reference to  Supporting information |
| Climate change correction factor  (optional) | 1 |  |  |  |  |  |  |  |
| R1 after CCF adjustment | 0.83 |  |  |  |  |  |  |  |
| 1. Gross electricity meter (Electricity produced at turbine) | | 241633.8 | MWh |  |  |  |  | See main report |
| 2. Electricity exported - Net input/output meter | | 222998.4 | MWh |  |  |  |  | See main report |
| 3. Electricity imported - Net input/output meter | | 176.36 | MWh |  |  |  |  | See main report |
| 4. Other fuel inputs |  |  |  |  |  |  |  |  |
|  | 4.1 Light fuel oil |  | litres |  |  | kg/l |  |  |
|  |  |  |  |  | kJ/kg |
|  | 4.2 Natural gas |  | Nm3 |  |  | kJ/Nm3 |  |  |
|  |  |  |  |  |  |
|  | 4.3 LPG |  | Nm3 |  |  | kg/Nm3 |  |  |
|  |  |  |  |  | kJ/kg |
|  | 4.4 Other fuels similar to light fuel oil | 806000 | litres |  | 0.843 | kg/l |  | See main report |
|  |  |  |  | 42860 | kJ/kg |
| 5. Primary combustion air (as supplied to furnace) | | 1061455414 | m3 |  | 0.942 | kg/Nm3 |  | See main report |
|  |  |  | 99.97 | °C |
|  |  |  | 75.7197 | kJ/kg |
| 6. Secondary combustion air (as supplied to furnace) | | 475470942 | m3 |  | 1.146 | kg/Nm3 |  | See main report |
|  |  |  | 33.72 | °C |
|  |  |  | 8.8072 | kJ/kg |
| 7. Recycled flue gas (as supplied to furnace) | |  | m3 |  |  | kg/Nm3 |  |  |
|  |  |  |  | °C |
|  |  |  | 0 | kJ/kg |
| 8. Heat exported outside R1 boundary | |  |  |  |  |  |  |  |
|  | 8.1 steam exported |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | condensate returned |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 8.2 hot water exported |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | hot water returned |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  |  |  |  |  |  |  |  |  |
| 9. Internal steam use | |  |  |  |  |  |  |  |
|  | 9.1 for soot blowing (no backflow) |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 9.2 for steam driven devices |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | backflow as steam |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 9.3 for trace heating |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | backflow as condensate |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 9.4 for re-heating flue gas |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | backflow as condensate |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 9.5 for concentration processes |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | backflow as condensate |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 9.6 for building, equipment, tank heating |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | backflow as condensate |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
|  | 9.7 for deaeration and demineralisation |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg  °C  kPa kJ/kg  °C  kPa kJ/kg  °C  kPa kJ/kg  °C |
|  | backflow as condensate |  | tonnes |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | 9.8 other internal applications, in line with commission guidance, to be specified |  | tonnes |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | backflow as condensate |  | tonnes |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  | 9.9 other internal applications, in line with commission guidance, to be specified |  | tonnes |  |  |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | backflow as condensate |  | tonnes |  |  | °C |  |  |
|  |  |  |  |  | kPa |
|  |  |  |  |  | kJ/kg |
| 10. Use of condensing energy from steam in flue gas | |  | GJ |  |  |  |  |  |
| 11. Superheated steam at boiler outlet | | 984231 | tonnes |  | 380 | °C |  | See main report |
|  |  |  | 4619 | kPa |
|  |  |  | 3155 | kJ/kg |
| 12. Boiler feedwater | | 993627 | tonnes |  | 131.3 | °C |  | See main report |
|  |  |  | 6369 | kPa |
|  |  |  | 556.2 | kJ/kg |
| 13. Boiler Efficiency (Acceptance Test) | | 90% | ± | 1.5% |  |  |  | See main report |
| **Instructions for completing this spreadsheet** | | | | | | | | |
| **1.** | Ensure that you have completed the first three rows of the application form | | | | | | | |
| **2.** | This form should be accompanied by supporting information for the figures quoted. Where this information is in the permit application, reference to the relevant sections of the application can be made. | | | | | | | |
| A Sankey diagram (or equivalent) reflecting the boundaries of the installation used as well as any references to physical properties is the absolute minimum that should be provided for an application based on design information | | | | | | | |
| **3.** | We have colour coded the cells in this spreadsheet to assist you in completing this form, an explanation of the colour codes is provided below. The colour will disappear when data has been entered. | | | | | | | |
| Blue cells require data that is essential for the R1 calculation, where information on uncertainty of the data is available it would be useful (but not mandatory) for this to be included for these parameters. | | | | | | | |
| Beige Cells indicate that any data entered will be used in the R1 calculation. They have been used where there is a choice of inputs but not all plants will have data for all the input options.  Where you are entering data into beige cells you need to make sure that you enter data into all the beige cells associated with the input as they are all needed for carrying out the calculation. | | | | | | | |
|
| Yellow cells have been used to provide flexibility to include fuels or energy uses not identified elsewhere. Supporting information to explain why the standard fields were not appropriate or adequate will need to be provided where these cells are used. | | | | | | | |
| Data entered in uncoloured cells are not used when calculating the R1 energy efficiency factor but can be completed to provide a more complete data  set. | | | | | | | |
| Data in the purple cell for the CCF factor is optional. If used the way it was calculated must be explained in supporting information | | | | | | | |
| **4.** | Ensure the temperatures entered into cells F19 and F22 (and F25) are the actual temperatures of the heated air in oC. | | | | | | | |
| The spreadsheet uses these values to calculate the specific enthalpy associated with heating the air from ambient 25 oC in cells F20 and F23 (and F26). | | | | | | | |
| **5.** | Densities used in cells F18 and F21 (and F24) should be at the temperatures at which the flows quoted in C18 and C21 (and C24) are reported. | | | | | | | |
| The spreadsheet multiplies these pairs of entries to generate a mass of air. | | | | | | | |
| **6.** | Data can only be added to the spreadsheet on the first tab entitled “Input page”. The other tabs have been included to show how the calculation works and allow sense checking of the individual parameters, and cannot be edited | | | | | | | |
| **7.** | If you believe that any of the information that you have submitted in this application form is commercially confidential please identify the confidential information and the grounds on which you believe it to be confidential in your covering letter | | | | | | | |
| LIT 5753 |  |  |  |  |  |  |  |  |
| EAD/0812/xls/v3.2 |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| Ep (detailed) | 2261692 |
| Ef + Ei | 30772 |
| Ew + Ef | 2769002 |
| R1 | 0.83 |
| CCF | 1 |
| Adjusted R1 | 0.8305943 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Quantity | Uc | Average | Uc |  | Uc |  | Uncertainty |
| Gross electricity meter (Electricity produced at turbine) | in reporting year  241633.8 MWh |  | during operation over year |  |  |  |  |  |
| Electricity exported - Net input/output meter Heat exported outside R1 boundary  steam exported | 222998.4 MWh  0 GJ  0 tonnes |  | 0 K |  | 0 kPa |  | 0 kJ/kg |  |
| condensate returned  hot water exported  hot water returned | 0 tonnes  0 tonnes  0 tonnes |  | 0 K  #REF! K  0 K |  | 0 kPa  0 kPa  0 kPa |  | 0 kJ/kg  0 kJ/kg  0 kJ/kg |  |
| Internal steam use | 0 GJ |  |  |  |  |  |  |  |
| for soot blowing (no backflow) | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| for steam driven devices | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as steam | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| for trace heating | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| for re-heating flue gas | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| for concentration processes | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| for building, equipment, tank heating | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| for deaeration and demineralisation | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| other internal applications to be specified | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| other internal applications to be specified | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| backflow as condensate | 0 tonnes |  | K |  | kPa |  | 0 kJ/kg |  |
| Use of condensing energy from steam in flue gas | 0 GJ |  |  |  |  |  |  |  |
| Backflows of condensate | GJ |  |  |  |  |  |  |  |
| Condensate after cooling | tonnes |  | K |  | kPa |  | kJ/kg |  |
| Boiler feedwater | tonnes |  | K |  | kPa |  | kJ/kg |  |
| Ep | 2261692 |  |  |  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Quantity in reporting year | Uc |  | |
| Electricity imported - Net input/output meter | 176.36 MWh |  |
| Other fuel inputs  Light fuel oil | 29121.57 GJ  0 litres |  | 0 kg/l | 0 kJ/kg |
| Natural gas | 0 Nm3 |  | 0 kJ/Nm3 |  |
| LPG  Other fuels similar to light fuel oil | 0 Nm3  806000 litres |  | 0 kg/Nm3  0.843 kg/l | 0 kJ/kg  42860 kJ/kg |
| Ef + Ei | 30772.299 GJ |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Quantity | Uc | Average | | Uc |  | | Uc | |  | | Uc | |
| in |  | during | |  |  | |  | |  | |  | |
| reporting |  | operation | |  |  | |  | |  | |  | |
| year |  | over year | |  |  | |  | |  | |  | |
| Superheated steam at boiler outlet | 984231 tonnes |  | 380 K | |  | 4619 kPa | |  | | 3155 kJ/kg | |  | |
| Boiler feedwater | 993627 tonnes |  | 131.3 K | |  | 6369 kPa | |  | | 556.2 kJ/kg | |  | |
| Primary combustion air (heated) | 1.06E+09 Nm3 |  | 99.97 K | |  | 0.942 kg/Nm3 | |  | | 75.7197 kJ/kg | | #REF! | |
| Secondary combustion air (heated) | 4.75E+08 Nm3 |  | 33.72 K | |  | 1.146 kg/Nm3 | |  | | 8.8072 kJ/kg | | #REF! | |
| Recirculated flue gas | 0 Nm3 |  | 0 K |  | | | 0 kg/Nm3 | |  | | 0 kJ/kg | |  | |



A picture containing knot

Description automatically generated

1. Directive 2008/98/EC [↑](#footnote-ref-1)
2. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021 [↑](#footnote-ref-2)