CiNER Glass Ltd

CiNER Rassau

Energy Statement

DRAGON-ARUP-ENVZ-XX-RP-T-000009

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 273927-00

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ARUP

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1 Introduction

Ove Arup and Partners Limited ('Arup') has been appointed by CiNER Glass Ltd ('the Applicant') to prepare an Energy Statement in support of an application pursuant of full planning permission for the Dragon Glass Bottle Manufacturing Facility ('the proposed development').

The proposed development is described as follows:

'Construction and operation of a purpose-built glass bottle manufacturing facility, and associated development'.

The planning application has been submitted to Blaenau Gwent County Borough Council ('BGCBC') on 22 September 2021.

1.1 Energy Statement

Policy DM 4 (Low and Zero Carbon Energy) of the BGCBC Local Development Plan ('LDP') outlines that:

'The Council will encourage major development proposals to incorporate schemes which generate energy from renewable and low/zero carbon technologies. These technologies include onshore wind; landfill gas, energy crops; energy from waste; anaerobic digestion; sewerage gas; hydropower; biomass; combined heat and power; and solar.

Energy Statements should be prepared for all major development proposals, and should set out how development proposals can make a contribution towards providing increased levels of energy generation from renewable and low/zero carbon sources.

1.2 The Proposed Development

The application seeks full planning permission for the construction of a purpose-built glass manufacturing facility at the Rassau Industrial Estate (RIE) adjacent to the A465 Head of the Valleys Road, approximately 3.5km north of Ebbw Vale.

The application site comprises two vacant plots allocate for employment uses in the BGCBC LDP and an undeveloped plot to the eastern boundary of the RIE, south of the Carno Reservoir.

The proposed development, would comprise the construction and operation of:

- 2no. furnaces with associated filers and 2no. 75, tall chimney stacks;
- 2no. cullet buildings and stores for the storage and processing of rejected and recycles glass cullet;
- 1no. batch and 2no. silo buildings for the storage and mixing of raw materials;
- 2no. production lines for hot and cold processing, inspection and packing of bottles, including workshops and storage areas within the process building;
- Office space and welfare facilities including canteen, infirmaries and changing facilities;

- An automated warehousing facility for the storage and distribution of glass bottles;
- Utilities building which includes plant space, workshops and waste materials store;
- Liquified Petroleum Gas ('LPG') store and Regulating and Metering Station ('RMS') building;
- Back up fuel storage facilities, main entrance security lodges and associated weighbridge;
- External hardstanding for the storage of materials, parking and loading; and,
- Landscaping to the eastern side of the proposed facility.

Figures 1 and 2 below illustrate the proposed built form and the proposed site layout of the CiNER facility.

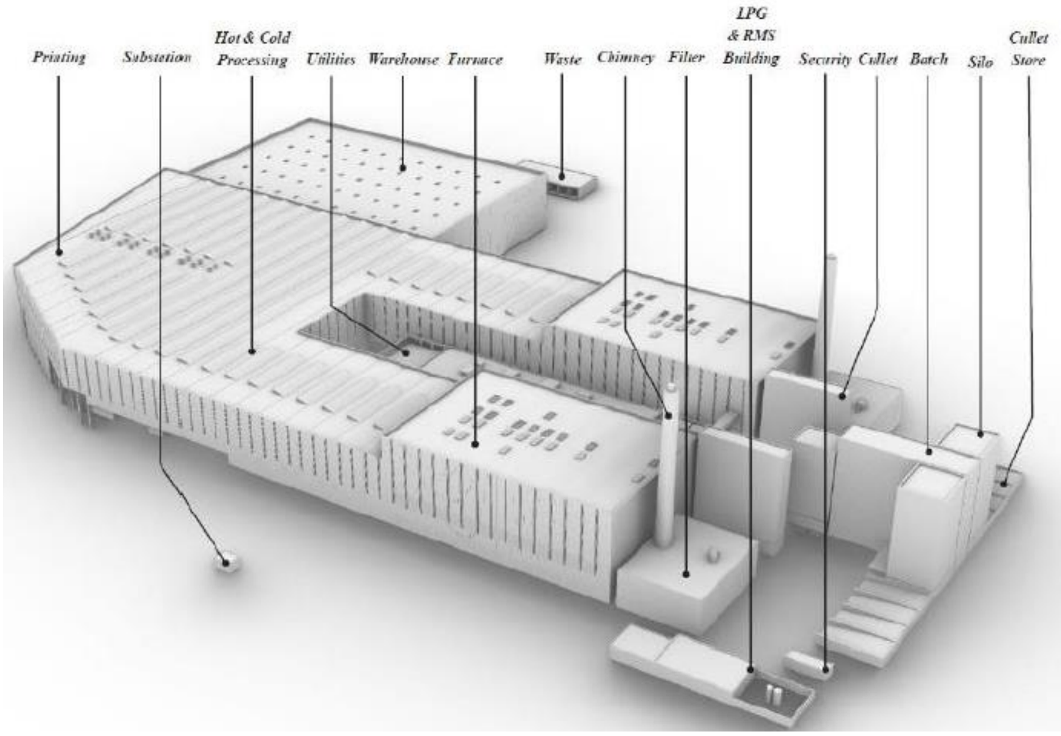


Figure 1 Proposed built form of the Dragon Glass Manufacturing Facility.

Figure 2 Proposed site layout of the Dragon Glass Manufacturing Facility.

1.3 The Application Site

The application site extends to an area of approximately 21.5ha and is located 400m south of the Brecon Beacons National Park (BBNP). The RIE was constructed in the 1970's and is predominantly characterised by B1, B2 and B8 uses, with the application site constituting the final two plots to be developed. Notable surrounding land uses include the National Grid 400kV Rassau substation EnviroWales Limited which comprise warehousing units, transformers and overhead electricity infrastructure.

The RIE demonstrates a sloping topography, ranging from 390m above ordinance datum (AOD) at the southern extent of the site to 427.5m AOD at the northern boundary. Due to the topology and underlying geology of the site, the ability to harness renewable energy from sources such as hydropower, wind turbines and geothermal methods has been discounted.

The proposed development of a large manufacturing facility which utilises furnaces for glass manufacturing demonstrates the potential for solar power generation and heat reclaim from furnaces.

1.4 Purpose of the Energy Statement

This Energy Statement outlines the renewable and low/zero carbon sources considered by the Applicant in the design of the proposed development. A summary of the working principles of solar power generation and heat recovery systems are outlined in Sections 2 and 3 of this Statement which consider the advantages and disadvantages of their installation. In addition to the justification for renewable and low/zero carbon energy production measures being assessed, this Energy Statement further outlines the wider alternative methods used to reduce energy demand which have been adopted as part of the design.

2 Solar Power

2.1 Systems Overview

The Applicant has undertaken studies into various solar panel options for the proposed development during RIBA Stage 2. Studies explored three photovoltaic (‘PV’) technologies including; Solar Panels, Kalzip Solar Systems; and, Plate Glass Solar Panels/Solar Glazing. Each of the options explored assessed the same principle of a PV module which includes the converting of sunlight into electricity to be used for on-site operations.

Table 1 below provides a summary of each of the solar panel options outlined above.

Table 1: Solar Panel installation summary table.

Technology	Solar Panels	Kalzip Solar Panels	Plate Glass Solar Panels/Solar Glazing
Description	Flat panels comprised of PV modules	Curved or shaped panels comprised of PV modules	Glazing panels with integrated PV modules
Cost	High cost but financially justifiable over lifetime. Estimate ~ £75,000	Greater than solar panels due to customisation required for shaping.	Very high cost, however, dependent on number of windows proposed.
Payback	6-12 years	15-20 years	12+ years
Degradation	~1% per year	~1% per year	~1% per year
Lifetime	20-25 years	20-25 years	20-25 years
Maintenance	Regular sample washing required	Self-cleaning	Regular window washing
Grants/Gov Support	No grants/gov funding available	No grants/gov funding available	No grants/gov funding available
Example Image			

The assessment undertaken determined that roof top solar panels were the most suitable option due to the architectural design and industrial purpose of the proposed development. An area of approximately 500m² on the southern side of the warehouse rooftop, constitutes the optimum location for the installation of solar panels.

However, whilst it would provide a reduction in annual energy consumption associated with the operational running of the facility, grants and government funding are no longer available for solar panel installations. As such, the initial capital cost does not make this a viable business option. Therefore the installation of solar panels to the proposed roof space has not been progressed as part of the design.

3 Furnace Heat Reclaim

The proposed development would necessitate the installation of two glass furnaces which would use a combination of natural gas and electric smelting, required to control the supply of molten glass to the production lines. Furnaces would use a lot of residual heat from the burners to feed back into the system to reduce energy wastage. Although residual heat would be utilised, a significant quantity of combustion bi-product (heat) would be exhausted into the atmosphere via the two 75m chimney stacks. Heat reclaim systems would harness an amount of the heat energy which would be lost to the atmosphere to heat internal areas of the proposed development.

Due to the process-based nature of the furnaces, any reclaimed heat from the flue gasses is considered ‘free’ and would constitute ‘low carbon’ technologies, as set out in Policy DM 4 of the LDP. The Applicant considers heat reclaim systems to constitute a ‘low carbon’ option by virtue that heat reclaim would be harnessed through necessary operational activities.

Two heat reclaim systems are considered as part of this Energy Statement, with the positive and negative aspects of each system outlined below.

3.1 Organic Rankine Cycle Systems

Systems Overview

An Organic Rankine Cycle (ORC) system utilises an intermediate thermal oil system to extract heat from the flue gases. This high temperature thermal oil subsequently used to superheat a silicon-based fluid which is passed through a turbine which generates electricity for use in the building. This hot fluid is subsequently circulated through a series of recuperators and condensers, which transfers any remaining heat to a water system for use in the building. Cooled silicon-based fluid is circulated back to the initial thermal oil heat exchanger to repeat the process, resulting in continued electricity and hot water generation.

The electricity generated through the ORC could be used to offset the utility electricity consumption of the proposed development. Due to the proposed high electricity use within the proposed development, there would be no opportunity to export this electricity to the grid, as advocated under LDP Policy DM 4.

The hot water generated in the final stages of the system would be of a very low grade, however, with the use of a water source heat pump, this could be harnessed to contribute towards heating of the facility. Excess heat from this process (due to the building heating load being lower than the total output of the ORC system) could be directed to a District Heating connection. In addition, any unused heat from this would need to be rejected to atmosphere via additional cooling towers or adiabatic coolers.

Should the building heating load exceed the heat available from the hot water system, a series of backup boilers or air source heat pumps would be required to cover any shortfall.

Figure 3 below illustrates a simplified schematic diagram of the ORC system.

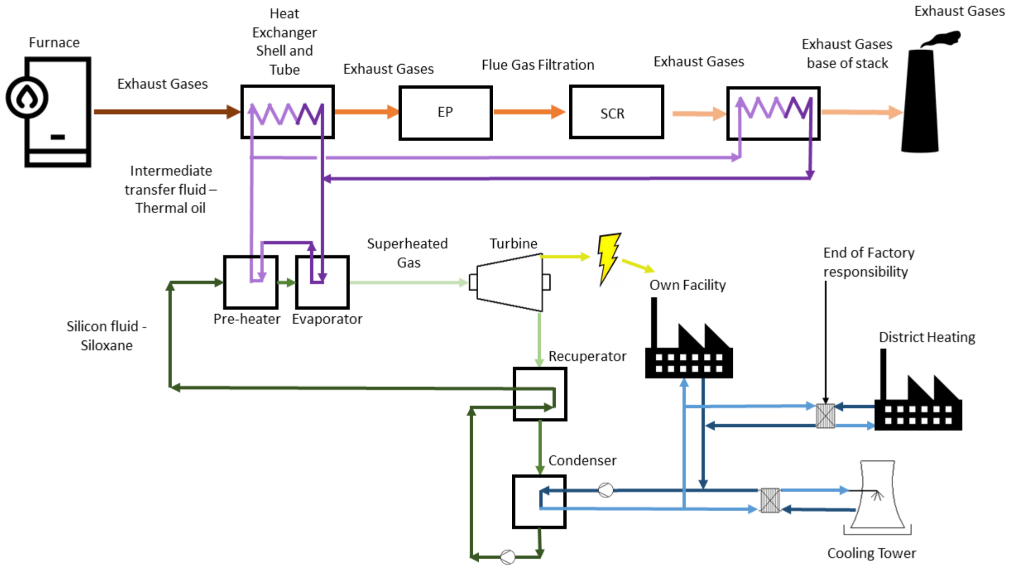


Figure 3 ORC system overview schematic.

System Evaluation

The specific performance of the ORC system is highly dependent on the detailed design of the furnace, filters, flues and heat exchangers which is undertaken by a furnace specialist and is not available at the time of the submitted application. However, a qualitative assessment of the advantages and disadvantages of ORC systems is outlined in Table 2 below.

Table 2: Qualitative ORC Assessment

Advantages	Disadvantages
On-site electricity generation to further reduce factory's annual grid electricity consumption.	High initial upfront costs for the complex equipment, pipework, pumping and controls.
Possibility to connect to district heating system to provide benefit to local community.	District heating connections are currently unavailable within the local area.
Overall annual furnace heat recovered is high.	As the heat extract from the furnace is constant (the requirement for electricity generation is constant) the water has a year-round load, meaning that if the building and district heating loads are not sufficient, additional cooling equipment must be operated to keep the ORC system operational.
	Water for the use in the building or district heating systems is very low grade heat, so there may be a requirement for additional water source heat pumps and/or additional boilers and air source heat pumps to elevate this water temperature to a more useful temperature.

3.2 Heat Recovery Systems

System Overview

A Heat Recovery (HR) system uses an intermediate working fluid (options include thermal oil and steam) to extract heat from the flue gases. This high temperature working fluid is passed through a heat exchanger to transfer its heat into a water system for use in the building. The hot water generated would be of a good grade, in comparison to the ORC system outlined in Section 3.1. Therefore, hot water generated through the HR system could be directly used for building heating and district heating, if required.

The thermal energy from the furnace exhaust would be expected to be sufficient to cover all the building's heating needs. As such, it is not anticipated that there would be a requirement for additional boilers or air source heat pumps to meet any unanticipated shortfalls. The amount of heat extracted from the flue can be adjusted to suit the combined demand of these HR systems, and therefore no additional heat rejection equipment would be required, reducing emissions into the atmosphere.

Figure 4 below illustrates a simplified schematic diagram of the ORC system.

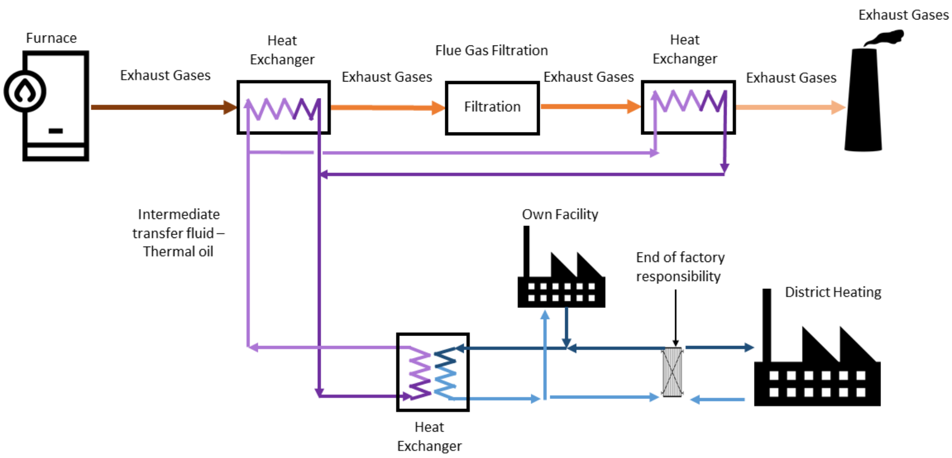


Figure 4 HR system overview schematic.

System Evaluation

The specific performance of HR systems is highly dependent on the detailed design of the furnace, filters, flues and heat exchangers which is undertaken by a furnace specialist and was not available at the time of the application submission. However, a qualitative assessment of the advantages and disadvantages is provided below in Table 3.

Table 3: Qualitative HR Assessment

Advantages	Disadvantages
Quantity of heat recovery available is expected to be sufficient to meet the peak heating demand of the system, therefore no addtional boilers or heat pumps are required.	No electricy production.
Possibility to connect to district heating system to provide benefit to local community.	Overall annual furnace heat recovered is low.
Ability to vary the amount of heat recovered from the flues means that additional heat rejection equipment is not required.	
Low initial upfront costs for the complex equipment, pipework, pumping and controls.	
Facility can take advantage of a decarbonising electricity grid to reduce carbon footprint over time.	

3.3 Furnace Heat Reclaim Conclusions

In comparing both the ORC and HR systems, the ORC system demonstrates the greatest potential for energy reclaim from the furnaces in the proposed facility which evidences potential year-round heat load. If the installation (and operation) of the cooling towers or adiabatic coolers could be mitigated by a high building load, then the ORC system would become more viable. However, the heating load of the proposed development would be very low in the summer, and there would be a constant high electrical load. As such, the ORC system would be required to run additional cooling equipment (which in turn consume additional energy), minimising the effectiveness of its installation.

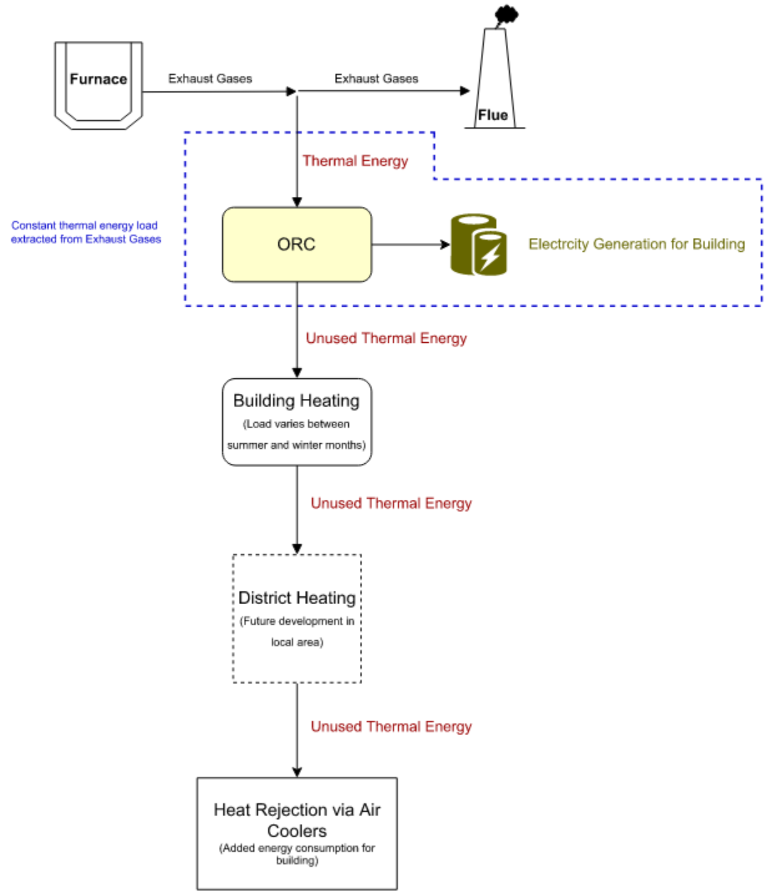
The HR system would provide an option to vary the heat extracted from the flue, and any surplus heat would be rejected automatically by the flues without needing to run any additional cooling equipment.

We note that, whilst there is no district heating system currently available, there is intention in the future to progress such a scheme. The heat recovery system will be configured to allow future connection to this system once it becomes available, and details of this interface will be outlined during the following design stages.

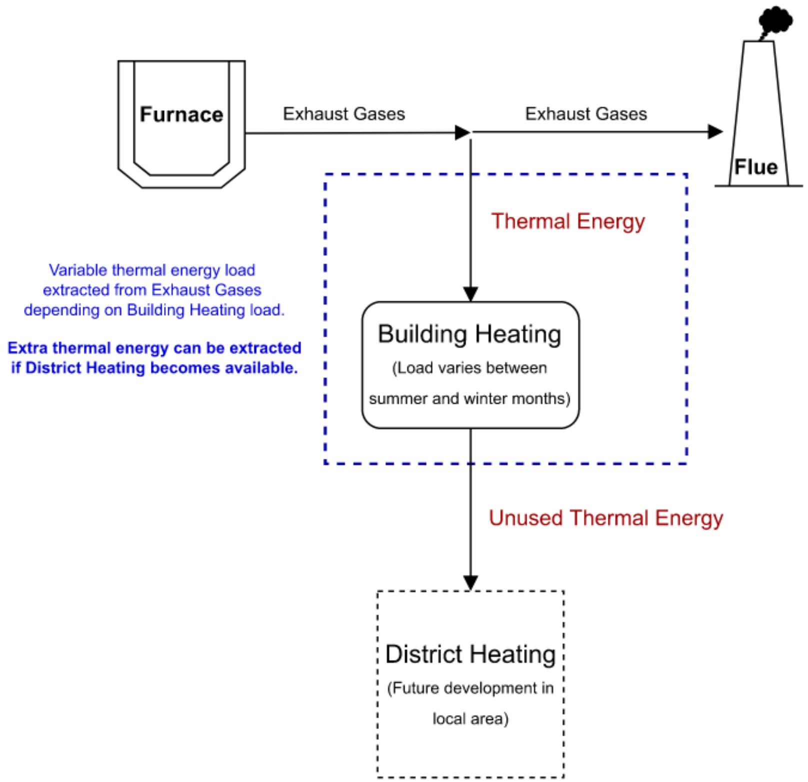
Table 4 below illustrates the energy flow of the two systems, and justifies the rationale why the HR system constitutes the ‘preferred system’ in comparison to the ORC system for the proposed development, and therefore HR would be progressed into the next design stage.

Table 4: Heat reclaim energy flow diagram.

ORC System



HR System



4 Alternative Sustainable Design Principles

The proposed development would incorporate the inclusion of other sustainable design principles to reduce energy and water consumption for operational and domestic uses within the facility. The proposed development would incorporate a number of 'best practice and beyond' technologies in the servicing strategy.

These measures include:

- **Rainwater Harvesting** – Rainwater harvesting installations will collect and reuse rainwater to reduce the consumption and usage of freshwater on site;
- **Rooflights** – Rooflights would be installed within the roof and orientated in a north west direction, reducing the amount of artificial lighting required within the factory areas and would reduce light pollution into the BBNP to the north;
- **Air Compressor Heat Recovery** – Heat recovery would reuse heat from the compressed air equipment to pre-heat domestic water supplies within the facility, reducing the need for gas and electric heating;
- **Adiabatic Coolers** – Coolers would be used for cooling purposes and would save significant amounts of energy during the winter months;
- **Energy Efficient Lighting** – As standard all lighting installations would be LED to reduce electricity usage; and,
- **Energy Efficient Pumps and Fans** – All pumps and fans would be installed with inverter drives, resulting in the ability to adjust speeds to accord with changing demands.

5 Conclusion

This Energy Statement has set out the renewable and low/zero carbon technologies considered during the design of the proposed development by the Applicant in accordance with Policy DM 4 of the LDP.

The Applicant has considered that the installation of 500m² of roof mounted solar panels is not feasible and therefore has not been pursued. However, heat recovery systems constitute the preferred option for renewable and low/zero carbon technologies and have been progressed to the next stage of the design. Furthermore, the proposed development would utilise additional sustainable design principles to reduce electricity and water consumption through embedded design measures, as outlined in Section 4 of this Statement.

Based on the information submitted in this Energy Statement, it is considered that the Applicant has appropriately considered the installation of renewable and low/zero carbon technologies and that the proposed development is in accordance with Policy DM 4 of the adopted LDP.