PROFILE PARK POWER STATION

WASTE HEAT RECOVERY STATEMENT

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		Title: **Profile Park Power Station Waste Heat Recovery Statement**			

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1.0 GLOSSARY OF TERMS AND ABREVIATIONS

BGE	-	Bord Gáis Energy
GIL	-	Greener Ideas Limited
LFO	-	Light Fuel Oil
MV	-	Medium Voltage
MW	-	Mega Watt
SDCC	-	South Dublin County Council
SEDA	-	South Dublin Spatial Energy Demand Analysis

2.0 INTRODUCTION & DOCUMENT PURPOSE

The intent of this report is to address Planning Application Ref: SD21A/0167 Consent Decision Ref: 0918 date 30 August 2022 Condition 4 issued by South Dublin County Council:

Planning Permission Condition No.4: Waste Heat:

(a). Proposals for waste-heat recovery and ongoing delivery to a local heat-network shall be provided and implemented on site as relevant, in conjunction with the commencement and operation of the proposed development. Prior to the commencement of the development, a timeframe for implementation of waste heat proposals shall be submitted for the written agreement of South Dublin County Council, unless otherwise agreed in writing.

(b). Such proposals shall include all necessary infrastructure for waste heat recovery from the proposed development and delivery through a primary waste-heat water circuit to either, the boundaries of the site or to an Energy Centre (when constructed as part of the local heat network distribution) for connection to the heat network. Such proposals shall be submitted for the written agreement of South Dublin County Council, unless otherwise agreed in writing.

(c). Where waste heat recovery and utilisation proposals have been explored, and subject to the written agreement of South Dublin County Council, have been deemed to be technically or otherwise unfeasible, details of the future proofing of the building fabric, heat recovery and conversion systems and safeguarding of pipework/infrastructures routes up to the site boundaries to facilitate future waste heat connection to a local district heating network, shall be submitted for the written agreement of South Dublin County Council or as otherwise agreed in writing.

REASON: To promote the utilisation and sharing of waste heat and comply with Policy E5 of the South Dublin County Development Plan 2016-2022.

The SDCC Development Plan 2016-2022 Policy E5 states:

ENERGY (E) Policy 5 Waste Heat Recovery & Utilisation

It is the policy of the Council to promote the development of waste heat technologies and the utilisation and sharing of waste heat in new or extended industrial and commercial developments, where the processes associated with the primary operation on site generates waste heat.

E5 Objective 1:

To promote the development of waste heat technologies and the utilisation and sharing of waste heat, in new or extended industrial and commercial developments, where the processes associated with the primary operation on site generates waste heat.

E5 Objective 2:

To promote the development of local energy partnerships among businesses in the County.

E5 Objective 3:

To promote increased energy self sufficiency across business sectors.

3.0 PROFILE PARK POWER GENERATION SITE

The Bord Gais Energy (BGE) Profile Park Power Generation site is capable of generating up to 100 MW of exportable power to the Irish power grid. Its purpose is to serve as a peaking power station meaning that it will be brought online to meet peak demand where there is a shortfall in supply to the grid from renewable power generation plants (e.g. wind and solar) and base load power stations. The power station consists of five 20 MW reciprocating dual fuel engines which will operate primarily on mains gas but can also operate on Light Fuel Oil (LFO) if required as a back up fuel source. The engines are water cooled whereby cooling water is passed through their cooling jackets and then on to externally mounted radiators where the waste is dissipated to atmosphere. This report examines the extent to which this waste heat could be captured and exported for re-use.

There is, however, no district heating system in the vicinity of the power station to which the waste heat could be provided to at the present time.

The development of district heating schemes is increasingly recognised as an important facet of our future energy strategy and is a recommendation of the 2015 Codema report titled "South Dublin Spatial Energy Demand Analysis". The baseline data underpinning this analysis dates back to 2014 and needs to be updated to take account of the significant changes to the energy profile and mix in the South Dublin area. It is still useful however, in anticipating the growth in demand across the county in terms of energy needs. District Heat networks should aim to meet the following strategic objectives:

i. To reduce greenhouse gas emissions through the use of a wide range of low carbon and renewable heat sources.

ii. To improve the security of our energy supply by diversifying the energy sources from which heat is derived and thus reduce our dependence upon imported fossil fuels.

iii. To offer a supply of heat that represents good value for the consumer and that contributes to a reduction in fuel poverty.

A major challenge associated with the provision of heat networks supplied by recovery of waste heat from industrial sources is to deliver a high standard of service to the end consumer. That is, a service which requires a high-quality installation offering good reliability, long design life, low carbon intensity and low operating costs. The cost-effectiveness of the heat supply will also be dependent upon achieving low-cost financing over a prolonged timeframe with investors looking for long term performance and reliability.

The fundamental ways in which the high-level strategic aims are achieved are through the following broad objectives which need to be considered at each stage of the project:

i. Correct sizing of plant and heat network

ii. Appropriate use of new and emerging technologies

ii. Achievement of low heat network heat losses

iv. Achieving consistently low flow return temperatures

v. Use of variable flow control principles

vi. Optimising the use of low carbon heat sources to supply the district heating network

vii. Delivery of a safe, high quality, reliable scheme whereby the risks and environmental impacts are appropriately managed and controlled

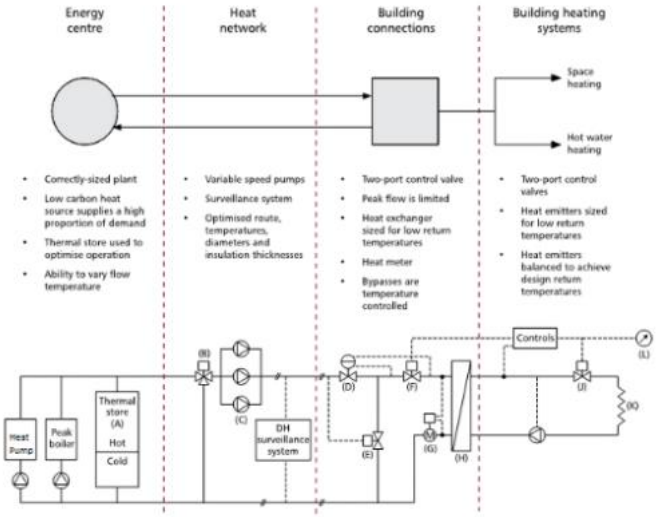

Figure 1: High level illustration of the typical features of an efficient heat network.

4.0 SOUTH DUBLIN COUNTY COUNCIL STRATEGY

The District Heating Scheme Strategy of South Dublin County Council can be articulated by referring to the following extract from the 2015 Codema report titled "South Dublin Spatial Energy Demand Analysis (SEDA)":

"To combat the effects of climate change, to reverse the dependency on imported fossil fuels and to reduce energy costs across all sectors, South Dublin County Council aims to respond in a way that prioritises and unlocks local low carbon and renewable energy opportunities, in partnership with all stakeholders, to 2022 and beyond."

One of the principal findings of the SEDA was to identify areas of South Dublin that would be a priority for district heating. The Codema report recommends that any areas identified within the SEDA as being highly suitable for district heating schemes in terms of high heat demand density, be prioritised by the Council when considering the implementation of low carbon district heating schemes in South Dublin County. By supporting the delivery of district heating schemes, the Council can implement a novel way of delivering energy in South Dublin County which would result in lower energy costs, reduced carbon emissions and a greater utilisation of local resources. Although there is the potential to utilise renewable sources of energy such as geothermal for the purpose of district heating it is recommended that sources of high waste heat be used where possible.

Many of the areas identified as having a high potential for District Heating utilisation are located within the same electoral division area and can therefore be grouped together with adjacent areas of high heat density, thus representing the areas most viable for district heating projects. There should be a high level of focus on utilising waste heat from industrial sources which are found in areas identified in the SEDA as areas with high levels of commercial activity and industrial processing. The opportunity to use these waste heat sources is not yet fully recognised and, as such, the local authority should encourage the utilisation of waste heat to supply nearby heat demands. Further analysis of the location and size of waste heat sources and the opportunity for the recovery and utilisation of such waste heat is recommended.

It is therefore clear that SDCC are interested in utilising District Heating Schemes and using the waste heat from heat sources such as power stations to supply such schemes. The aforementioned Codema report will inform future planning policies at SDCC. District heating has already been proposed and is currently being implemented in the Dublin Docklands area, utilising the waste heat from the incinerator currently in operation in Poolbeg. All new buildings in the docklands area will have provision for future connection to the district heating scheme. This scheme shall be capable of providing heat to up to 80,000 households.

There are many such schemes already under operation in the UK, with particular emphasis in the Greater London area being placed on decentralised heat and power generation networks. The technologies utilised in the UK schemes are sufficiently mature to allow for the rollout of similar schemes in Dublin provided that there is a political will to do so.

The low temperatures generated by the waste heat from the peaking power plants coupled with their intermittency of operation reduces the effectiveness of their waste heat supply.

The Codema report states that the metric generally used to establish the initial feasibility of district heating schemes is a heat density of greater than 150 TJ/km2. The analysis also identified the top ten areas in terms of heat demand in TJ/km2 and presented these in the table below.

ED Name	Area km²	TJ/km²
Tallaght-Springfield	0.005	1212
Tallaght-Springfield	0.010	743
Tallaght-Springfield	0.009	711
Templeogue Village	0.005	554
Tallaght-Springfield	0.003	442
Tallaght-Kingswood	0.034	432
Clondalkin Village	0.065	429
Templeogue Village	0.059	405
Clondalkin-Monastery	0.028	394
Tallaght-Oldbawn	0.039	358

Eight of the ten areas identified as the most viable in terms of heat demand are located in Tallaght with a further two in Clondakin. Therefore, in order to maximise the use of a district heating scheme, a line would need to be provided to Tallaght.

The site under consideration in this report is located within the Profile Park Business Park. At the current time there is no infrastructure provided for a district heating network in the local vicinity with the closest possible connection point to a potential future district heating scheme being in

Clondalkin, approximately 5 km (3 miles) away. The connection is therefore unfeasible as there is no district heating system in place to provide heat to. Between the Profile Park Business Park and the adjacent Grange Castle Business Park there exists a substantial reservoir of heat energy due the high density of existing and planned data centres in addition to the peaking power plant. As such there is huge potential to tap into this in the future and install a district heating network in a nearby area should a coordinated approach to waste heat distribution be established. Further technical studies would be required to establish routings, potential demand locations and a robust cost model.

5.0 PROFILE PARK POWER STATION PLANT - SYSTEM DESCRIPTION

The Profile Park Power Station will connect to the EirGrid operated Irish national grid and will export up to 100 MW of power. The power station shall consist of five MAN reciprocating engines, each rated at 20 MW output, which are capable of running on natural gas, a natural gas/hydrogen blend or LFO. The standard operating approach is for the plant to run on natural gas with LFO used as a back up fuel only. Each engine is water cooled via a cooling jacket which forms part of its cooling circuit. Waste heat is circulated around the cooling circuit to externally mounted radiator cooler units which dissipate the heat to atmosphere. It has been assessed that the potential total waste heat available from the plant when running at full load would be around 15-20 MW.

The Profile Park Power Station is intended to operate as a peaking plant. That is, the plant will not operate at all times in the manner of a base load plant but will only be brought online during periods of peak demand on the grid to make up the shortfall in power availability that cannot be met by renewable power generation plants (e.g. wind and solar) and base load power generation plants. This means that the plant will only operate on an infrequent, intermittent basis and as such, the heat output available for recovery would also be intermittent in nature and the plant would rarely output the maximum capacity it is sized for.

6.0 STRATEGY FOR WASTE HEAT RECOVERY

Although there is currently no district heating system infrastructure in place for the plant to be connected to, the plant design is such that it has been future proofed to allow the installation of the required heat recovery equipment and the ability to connect to a district heating scheme should such a scheme be installed in the future.

Reservation has been made underneath the radiator coolers for a plate-pack heat exchanger plantroom to be installed. In such an arrangement an appropriately sized bank of plate-pack heat exchangers would be installed through which the return line of each engine cooling water circuit would be passed, and the waste heat extracted for on-pass to distribution pipework on the user side to connect to an external district heating network. Upon exiting the heat exchanger plant, the cooling water would pass through the existing radiator cooler configuration to dissipate any remaining excess heat to atmosphere.

Prior to connection to any user side district heating system, the design would need to be checked by the engine manufacturer to ensure that it is suitable to comply with the conditions required for engine operation.

Design modifications required are as follows:

- Design, coordination and installation of plant side pipework to connect to the engine cooling circuit return lines.

- Design, coordination and installation of a plate-pack heat exchanger plantroom on site as well as the associated planning permissions and other regulatory consents.

- Selection and installation of all heat recovery equipment including, plate-pack heat exchangers, circulating pump sets, instrumentation and control equipment, piping etc.

- Design, coordination and installation of waste heat distribution pipework to take the waste heat from the heat exchanger plant to the extremity of the power station site for connection to the user district heating network.

- Design, coordination and installation of the connection to the external user side pipework.

- Control system modifications required to operate the heat exchanger plant.

7.0 CONCLUSION

The use of a waste heat recovery system at the Profile Park Power Station is currently not feasible as there is no district heating system or other end user for the waste heat recovery system to connect to. Furthermore, the intermittent nature of the operation of the power plant doesn't lend itself to waste heat recovery as the source of heat would be intermittent and unpredictable, due to the plant only being online to meet peaks in grid demand, and so the plant could not be relied on to provide heat to any external heat network.

Despite the current unfeasibility of waste heat recovery provision within the plant, provisions have been made in the plant design to allow it to be accommodated should it become a feasible option in the future. Reservation has been made for a plantroom for the installation of a plate-pack heat exchanger system to be installed and connected to the existing engine cooling water circuit. It must be noted that prior to connection to any user side district heating system, the design would need to be checked by the engine manufacturer to ensure that it is suitable to comply with the conditions required for engine operation.

While there are clear advantages to utilising waste heat from the Profile Park Power Station for a future district heating scheme the major barrier to this is financing. District heating schemes would need to be a key government strategy, with adequate financial supports in place, for such schemes to be successful. Only in these circumstances would a waste heat recovery scheme become a viable option for the power plant. Such an approach has already been adopted as part of planning policy in many European cities, including London, where policies, strategies and frameworks are already in place for such schemes. Density of development and heat demand are essential for such schemes to be financially viable.

The adoption of a waste heat recovery system at the Profile Park Power Station would present technical challenges but it is possible to implement such a system at the plant in future. Its implementation would be wholly dependent upon the availability of future district heating network

infrastructure in the locality external to the site with end users with sufficient demand requirements to absorb the waste heat generated. Should a local district heating scheme be brought into being in the future, further design and feasibility studies should be undertaken by a District Heating specialist consultant to determine if the variable and seasonal quantity of waste heat generated by the power station could be harnessed and utilised in a commercially viable manner.