Appendix 3.2

Heat Network Feasibility Study

FICHTNER
Consulting Engineers Limited

Heat Network Feasibility Study

Indaver

Review of the potential for a Heat Network in 6 areas of Co. Cork

ENGINEERING + CONSULTING

Document approval

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Management Summary

Indaver Ireland Limited (Indaver) is considering the development of a waste to energy facility in County Cork that could process 240,000 tonnes per annum of waste. The plant would generate up to 21 MW_e of electricity (in fully condensing mode) and could export heat if a viable heat network opportunity exists. Similar projects of this scale that Fichtner have worked on typically export around 12 MW_{th} but the figure in Cork will be dependent on the final plant design. This heat could either be exported as hot water or steam, but it is typical for a heat network to use one (but not both) of these mediums.

Coakley O'Neill, prepared the Planning Report for the project. Within *Planning Report: Industrial Lands within Metropolitan Cork,* the development potential for a strategic large-scale waste to energy recovery centre was reviewed. Six areas were assessed – five 'Strategic Employment Locations' set out in the Cork County Development Plan, 2022 along with the landfill site at Bottlehill:

1. Bottlehill;
2. Carrigtwohill;
3. Kilbarry;
4. Little Island;
5. Ringaskiddy; and
6. Whitegate.

Indaver has engaged Fichtner Consulting Engineers Limited (Fichtner) to undertake a high-level assessment of these 6 areas to consider which may be suitable for a heat network. There is no Irish guidance on how to assess the feasibility of a heat network adjacent to a waste to energy plant. In the absence of this, Fichtner has undertaken its assessment in line with the UK Environment Agency's document "CHP Ready Guidance for Combustion and Energy from Waste Power Plants". Fichtner also undertook a series of visits in February 2019 to each of the 6 areas to verify potential heat consumers in each and assess potential pipe routing options.

Fichtner reviewed the SEAI District Heating Candidate Areas Map and SEAI Spatial Analysis of Heating Demand in Ireland to Identify Candidate Areas for District Heating. The analysis identified a number of areas in County Cork as candidate areas, but these did not include any of the areas being assessed within this study. Therefore, Fichtner conclude that developing a conventional hot water heat network from a facility such as that proposed, to serve retail, commercial and residential consumers is not considered feasible at this time.

As a separate study, Fichtner reviewed details of all EPA licensed facilities in Co. Cork, which are likely to require higher grade heat (steam). Sites that were over 10 km from each area or had no steam load were screened out. The Annual Environmental Reports (AERs) for the remaining sites were reviewed and an estimate of the site heat load was calculated from this information.

Little Island has 5 facilities with a total estimated heat load of 129 GWh/annum and Ringaskiddy has 7 facilities that use an estimated 239 GWh/annum of heat, comprising mostly of large-scale pharmaceutical plants. Both areas could support a steam based industrial heat network, although compatibility with the heat available from the Indaver plant would need to be confirmed. Irish Distillers Ltd. is a single large heat load (189 GWh/annum) located approximately 9 km to the east of Carrigtwohill, however a connection is not considered viable due to the economic case and complexities of above ground pipe routing over this distance. A further 5 facilities exist in Carrigtwohill, all of which are located at least 2 km from the centre, with relatively modest demand totalling 76 GWh/annum. In Bottlehill, there is only one potential heat load which is from the intensive agriculture sector and has a potential heat load of 0.7 GWh/annum.

Whitegate has a single large heat load of approximately 417 GWh/annum. Fichtner understands that the site owner previously looked at obtaining steam from a neighbouring power station but did not progress this project due to reliance concerns and a competitive existing cost base. It is therefore considered highly unlikely that steam from a waste to energy plant would be suitable.

This report concludes that implementation of a heat network could be feasible in Little Island or Ringaskiddy, but that with a larger number of customers in Ringaskiddy and with a larger average heat load, Ringaskiddy would be the most suitable of the 6 areas considered. Site visits in February 2019 identified Ringaskiddy as the most favourable due to the concentration of large heat loads, pipe routing feasibility and potential for development expansion in the locality. Little Island also accommodates pharmaceutical plants (and to a lesser degree office and retail space) which may offer connection prospects, although these are smaller in scale.

At no stage did the authors engage with site owners. As a result, heat demands will need to be verified in later studies, as well as the willingness of site owners to enter into commercial agreements for heat supply.

Contents

1 Introduction

1.1 Background

Indaver is considering the development of a waste to energy facility in County Cork for the treatment of up to 240,000 tonnes per annum of residual household, commercial, industrial, non-hazardous and suitable hazardous waste. The plant will be capable of generating 21 MW_e of electricity, of which approximately 18.5 MW_e will be exported to the grid. Indaver is considering the feasibility of exporting a proportion of heat to offsite consumers via a heat network, which would require the plant to be capable of combined heat and power (CHP) operation.

The Cork County Development Plan published in 2022 states that waste to energy recovery facilities will be considered in 'Industrial Areas' designated as 'Strategic Employment Locations'. The plan lists the following four areas in the County as 'Strategic Employment Locations':

1. Carrigtwohill;
2. Little Island;
3. Ringaskiddy; and
4. Whitegate.

Indaver has engaged Fichtner to undertake a high-level assessment of heat loads for these four areas as well as two further areas in line with Coakley O'Neill *Planning Report: Industrial Lands within Metropolitan Cork* in Appendix 3.1 of the EIS*.* The six areas which have been assessed are:

1. Bottlehill;
2. Carrigtwohill;
3. Kilbarry (Cork City Council area);
4. Little Island;
5. Ringaskiddy; and
6. Whitegate.

Figure 1: Map of Ireland showing Cork

Source: www.landdirect.ie

Figure 2: Map of 6 areas of Cork being assessed

Source: Planning Report: Industrial Lands within Metropolitan Cork*, Coakley O'Neill, 2025*

1.2 Objective

Fichtner was engaged to review the potential for establishing a heat network in 6 areas of Cork. The principal objectives of this study are as follows.

1. Detail technical considerations for heat export and distribution from the Indaver waste to energy facility.
2. Review the heat demand within 10 km of the centre of each of the 6 areas, using the heat map published by SEAI.
3. Identify potential anchor loads from publicly available information.
4. Review which site locations could be connected to a heat network drawing on industry experience of the heat grade likely to be required.

This assessment has used publicly available information to compare the 6 areas. At no stage did the authors engage with site owners. As a result, heat demands will need to be verified in later studies, as well as the willingness of site owners to enter into commercial agreements for heat supply.

2 Description of the technology and heat network

2.1 The facility

Indaver is considering a plant with a design capacity of 240,000 tonnes per annum, through a single combustion line, of residual household, commercial, industrial, non-hazardous and suitable hazardous waste. The fuel will have an estimated net calorific value (NCV) of 10 MJ/kg. The design point of the plant is approximately 29 tonnes per hour, based on an annual operational availability of 8,000 hours per annum. The process is illustrated in Figure 3.

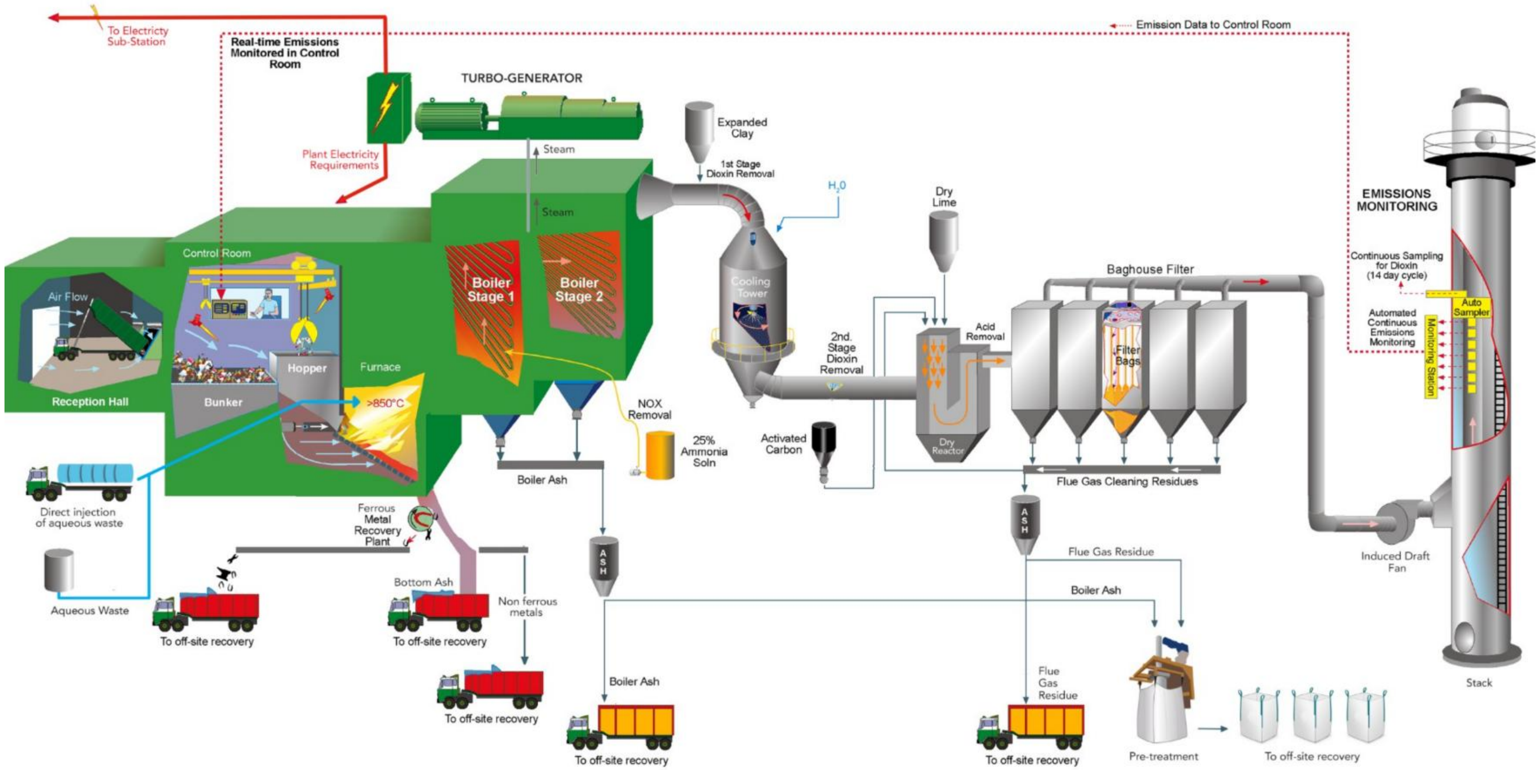
Waste will be combusted on a moving grate to ensure continuous mixing of the fuel and hence promote good combustion. The heat released by combustion will be recovered in a water tube boiler, which is integral to the furnace and will produce (in combination with superheaters) high pressure superheated steam. The steam from the boiler will feed a steam turbine-generator used to generate electricity. Exhaust steam will then be cooled using an air-cooled condenser, with condensate being retained for reheating, to minimise make-up water volumes.

In fully condensing mode, the steam turbine will generate up to 21 MW_e. The house load is projected to consume approximately 2.5 MW_e, leaving the balance of 18.5 MW_e available for export to the grid.

Based on Fichtner's experience of similar facilities, it should be possible to export approximately 12 MW_{th} of heat. This figure will be subject to the method of heat recovery selected and the design of the turbine and primary water/steam cycle. This figure could therefore vary considerably from 12 MW_{th} when the detailed design is completed.

Subject to technical and economic feasibility, a heat supply system may be installed to export heat to offsite consumers, as discussed in the following sections.

Figure 3: Indicative process schematic



Source: Indaver

2.2 Heat available

Assuming detailed design of the Indaver plant is progressed based on exporting up to 12 MW_{th} of heat (subject to the method of heat recovery selected), a maximum of 96 GWh/annum would be available for export. Due to seasonal and diurnal variations in heat demand which are universally present in heat networks, it is not possible to utilise the maximum heat export capacity consistently. The heat supply system must be capable of supplying peak heat loads, or alternatively peak lopping plant or accumulators (thermal stores) could be incorporated within the network, as discussed in the following section.

2.3 Back-up heat source

During periods of routine maintenance or unplanned outages of the Indaver plant, the heat consumers will still require heat. There is therefore a need, somewhere within the heat distribution system, to provide a back-up source of heat to meet the needs of the heat consumers.

At the scale of the heat network under consideration, the standby plant will likely comprise oil- or gas- fired hot water heaters or steam boilers, with separate dedicated chimney stack(s). Back-up boilers are typically designed to ensure that the peak heat export capacity can be met but also provide sufficient turndown to supply smaller summer loads with reasonable efficiency.

In the case that a majority of heat consumers were retrofit connections to industrial consumers, it is possible that existing heating infrastructure could be retained as back-up. The back-up strategy would need to be developed as part of the detailed design phase. Subject to detailed heat demand modelling, once heat consumer requirements are known with more certainty, opportunities for installing thermal stores may also be considered to lessen reliance on the back-up plant/peak lopping boilers by storing excess heat generated during off-peak periods for use during times of peak heat demand.

2.4 Heat recovery

Heat is typically supplied from waste to energy plants in the form of steam and/or hot water, depending on the grade of heat required by end consumers. The most commonly considered options for recovering heat from waste to energy facilities are discussed below.

2.4.1 Heat recovery from the air-cooled condenser

Wet steam emerges from the steam turbine typically at around 40°C. Steam is condensed in a large air-cooled system which rejects the heat in the steam into an air flow, which is rejected to atmosphere. An air-cooled condenser generates a similar temperature condensate to mechanical draught or hybrid cooling towers but cooling this condensate further by extracting heat for use in a heat network requires additional steam to be extracted from the turbine to heat the feedwater prior to being returned to the boiler. The additional steam extraction reduces the power generation from the facility.

2.4.2 Heat extraction from the steam turbine

Steam extracted from the steam turbine can be used to generate hot water or steam for a heat network. Conventional hot water networks typically operate with a flow temperature of 90 to 120°C and return water temperature of 50 to 80°C. If heat is exported as steam, temperatures and pressures will be subject to end user requirements and the turbine extractions will be designed accordingly.

Steam is preferably extracted from the turbine at low pressure to maximise the power generated from the steam. Extraction steam is passed through condensing heat exchangers, with condensate recovered back into the feedwater system. Hot water is pumped to heat consumers for consumption before being returned to the condensing heat exchangers where it is reheated.

In this case, the steam is normally extracted from the two lowest pressure bleeds on the turbine, depending on the heating requirements of the heat consumers.

This source of heat offers the most flexible design for a heat network. The steam bleeds can be sized to provide additional steam above the plant's parasitic steam loads. However, the size of the heat load needs to be clearly defined to allow the steam bleeds and associated pipework to be adequately sized. Increasing the capacity of the bleeds once the turbine has been installed can be difficult.

2.4.3 Heat extraction from the flue gas

The temperature of flue gas exiting the flue gas treatment plant is typically around 140°C and contains water in vapour form. This can be cooled further using a flue gas condenser to recover the latent heat from the moisture. This heat can be used to produce hot water in the range 90 to 120°C and this method of heat extraction does not significantly impact the power generation from the plant.

Condensing the flue gas can also be achieved in a wet scrubber, but this has several disadvantages over the option described above. The scrubber temperature is typically no more than 80°C, which restricts the hot water temperature available for consumers. Additionally, condensing water vapour from the flue gas reduces the flue gas volume and hence increases the concentration of non-condensable pollutants within it. The lower volume of cooler gas containing higher concentration of some pollutants could require a higher stack height to effect adequate dispersion. The additional cooling of the flue gas results in the production of a visible plume from the chimney and although this is only water vapour it can be misinterpreted as pollution. The water condensed from the flue gas needs to be treated and then discharged as an effluent.

2.4.4 Summary

The solution most commonly selected to extract heat to a heat network is extraction of low or medium pressure steam from the turbine. This is typically chosen for the following reasons.

1. Extraction of steam from the turbine offers the most flexibility for varying heat quality and capacity to supply variable demands or new future demands, which is particularly relevant where there is uncertainty over heat loads.
2. Extraction of steam from the turbine, heat transfer to a distribution circuit and delivery of heat to consumers can be facilitated by well proven and highly efficient technology.
3. The use of a flue gas condenser often generates a visible plume which would be present for significant periods of the year. This is often not desirable as it significantly adds to the visual impact of the plant.

2.5 Heat export medium

The choice to export heat as hot water or steam is substantially driven by the requirements of consumers in the locality of the plant. The main considerations for each option are discussed in the following sections.

2.5.1 Heat export via hot water

In the case of a conventional heat network served by hot water, heat is typically distributed using buried pipework. Pre-insulated steel pipes are used to supply pressurised hot water and to return cooler water. Less expensive polymer pipes can be incorporated where the temperature and pressure are within design limitations. Where pipes are small, two pipes may be integrated within a single insulated sleeve. For larger heat demands, large bore pipes are installed as a single insulated run. Pipe technology is well proven and can provide a heat distribution system with a design life of 30 years or more. Additional pipe work can be added retrospectively, and it is reasonably straightforward to add branches to serve new developments.

Modern pre-insulated pipes enable hot water to be transferred large distances without significant heat losses. Where the topography creates challenges, for example to provide heat to buildings on a hill significantly higher than the plant, heat exchangers and additional pumping systems can be installed to create pressure breaks, enabling the network to be extended.

Heat delivery arriving at a consumer's premises usually terminates using a secondary heat exchanger. The heat exchanger is typically arranged to supply heat to a tertiary heating circuit upstream of the customers' existing boiler plant. The water in the tertiary circuit is boosted to the temperature required to satisfy the heating needs of the building.

Water is pumped continuously around the heat network. Pumps are operated with 100% standby capacity to maintain heat supply in the event of a pump fault. Pumps are likely to utilise variable speed drives to minimise energy usage.

2.5.2 Heat export via steam

Steam is considerably less dense than water, so the space requirements and capital cost of the pipework is typically higher than a comparative hot water system. In addition, expansion loops may be required, which increase the total pipe length. Heat losses from steam pipework, resulting from higher working fluid temperatures, can be offset though improved insulation.

Depending on the processes undertaken at the consumer sites, it may or may not be possible to recover and return condensate to the source. Any condensate lost, for example due to direct use within an industrial process, would need to be made up to ensure that water supply to the Indaver boiler is not compromised. This configuration could necessitate an increased water usage and larger water treatment plant but can be managed with appropriate heat pricing structure.

Where condensate is returned from consumers monitoring of condensate conductivity is advisable to ensure that water quality remains within acceptable limits stipulated by the boiler and turbine suppliers. This risk could be mitigated by incorporating a hydraulic break in the system, in this case by means of steam generators, so that heat supply to consumers is provided via a secondary circuit.

To protect against condensate formation in the steam supply pipeline, pipe gradients, steam traps and associated valving need to be incorporated into the design. These additional components require ongoing maintenance and as a result steam pipelines are typically routed above ground. Health and safety, planning and asset protection considerations of running steam mains above ground would need to be considered. However, this approach has already been adopted on industrial sites within Co. Cork, for example at the Thermo Fisher and Pfizer Ireland Pharmaceuticals sites, amongst others. Indaver has also commissioned a large-scale industrial steam network, ECLUSE, at the Port of Antwerp which commenced operations in March 2019. The network provides steam from three waste to energy plants to six chemical companies at the port, reducing CO2 emissions by an estimated 100,000 tonnes per year. The majority of the steam and condensate piping is routed above ground.

2.6 Heat station

Within the Indaver site, space will be required for the heat export infrastructure. Subject to the heat export medium selected, the heat station could house heat exchangers, circulation pumps, metering, pressurisation and water treatment systems and ancillary equipment. The quantity of equipment required to export steam from the site would be reduced, however the steam supply pipework would be larger, relative to a comparative hot water system.

In consultation with Indaver, sufficient space will be allowed for in close proximity to relevant steam and condensate interface points in the boiler hall area of the plant.

In the case of a buried pipe system, it would be prudent to install any onsite pipe sections alongside other buried services, and prior to surfacing and road laying. Otherwise, a pipe bridge may be required for hot water (or steam) supply and hot water (or condensate) return.

3 Heat load assessment for a hot water-based network

3.1 Sustainable Energy Authority of Ireland Heat Demand Map

There is no Irish guidance on how to assess the feasibility of a heat network adjacent to a waste to energy plant. In the absence of this, Fichtner have based this assessment on the Environment Agency's document "CHP Ready Guidance for Combustion and Energy from Waste Power Plants", which was published in February 2013. Section 4 of this document explains that a review of potential heat loads in the area should be conducted and advises that an indicative search radius of 10 km should be used for plants less than 300 MW and 15 km for plants greater than 300 MW.

In 2021, the Sustainable Energy Authority of Ireland (SEAI) commissioned Element Energy and Ricardo Energy and Environment to work with the SEAI on the National Heat Study. As part of this study the heating and cooling demand of each sector has been analysed spatially to produce a national map of heat demand linked to Ireland's small geographical areas, with all values representative of a one-year period. The most recent map is available online at https://www.seai.ie/data-and-insights/heat-demand-map .

This SEAI heat map is colour coded by linear heat density but also includes the following data:

1. Heating and cooling demands for domestic and non-domestic (public sector, commercial, and industrial) buildings;
2. public sector significant energy users; and
3. potential sources of waste heat.

Previously, a heat demand calculator tool was included in the heat map and had been used in previous versions of this study to analyse the heat demand within a 10 km search radius, as suggested in the Environment Agency's guide for plants under 300 MW of each of the 6 areas. As this tool is no longer available, the SEAI District Heating Candidate Areas Map was used, more details can be found in Section 3.2.

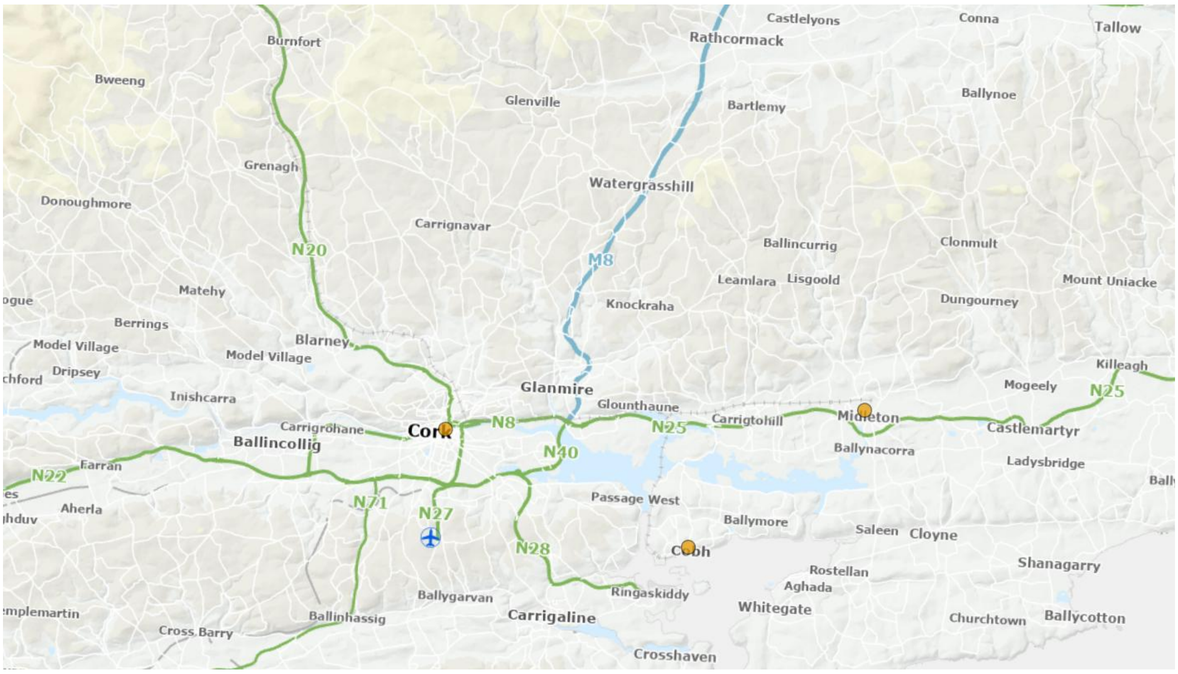
3.2 District Heating Candidate Areas Map

The SEAI published *Spatial Analysis of Heating Demand in Ireland to Identify Candidate Areas for District Heating* in February 2024. This report presents an initial modelled analysis of heating demand in Ireland to identify potential areas for district heating, based primarily on heat demand density. It uses the best available spatial data but does not consider local, technical, or stakeholder factors. Further detailed assessments are needed to determine the cost-competitiveness of district heating in these areas. The assessment identified a number of areas in County Cork as candidate areas (Figure 4) but these did not include any of the areas being assessed within this study.

Notably, there is a lack of alignment between the zoning requirements necessary for a facility such as that proposed (Industrial Areas designated as Strategic Employment Locations[1]) and the locations of the identified high heat demand areas. These areas are primarily suited for hot water distribution networks and are typically associated with offices, public buildings, and high-density residential developments.

[1] Cork County Development Plan 2022 – Volume 1 – Main Policy Material

Figure 4: SEAI District Heating Candidate Areas - Cork



Source: https://www.seai.ie/data-and-insights/district-heating-map

3.3 Discussion

Based on the SEAI's Spatial Analysis of Heating Demand from 2024 and earlier assessments completed for the previous iteration of this report, Fichtner does not consider it feasible for Indaver, as a private company, to develop a hot water-based district heating scheme in any of the areas reviewed in Co. Cork. The combination of high upfront infrastructure investment and the significant distances from the SEAI candidate areas to suitably zoned planning areas for the type of facility that is proposed would make project finance unattractive without public support or guarantees. If local area plans were developed mandating new buildings to be enabled for district heating, it may be worth considering these areas in the medium term. Alternatively, if a scheme were to be developed by another entity, perhaps a public body offering relatively certain heat demand over the medium to long term, Indaver could potentially provide heat to such a scheme.

4 Heat load assessment for a heat network to serve industrial users

A desktop assessment of industrial heat demand in the 6 areas was conducted by assessing publicly available information on all EPA licensed sites in Co. Cork with the status 'Licensed' or 'Applied'.

To choose the centre point of the search radius, the point provided in Google Maps for Carrigtwohill, Kilbarry, Little Island and Whitegate was used. For Ringaskiddy, the site owned by Indaver was used. The Bottlehill landfill site was used as the centre point for the radius around Bottlehill.

Table 1: Co-ordinate used for centre of search areas

Area	Co-ordinates
Bottlehill	52.0615, -8.5307
Carrigtwohill	51.9100, -8.2589
Kilbarry	51.9284, -8.4741
Little Island	51.9027, -8.3512
Ringaskiddy	51.8303, -8.3065
Whitegate	51.8272, -8.2320

Source: Fichtner

4.1 Short listing sites

A search of the EPA's website on 07/07/2025 showed that the EPA has issued licences to 99 companies in Co. Cork. This list was screened as follows.

- Power stations have a significant heat demand but are typically designed to provide for that demand with startup boilers and then self-generation of the required heat and therefore were removed from the list.
- Waste collection/recycling sites do not have a significant heat demand and were removed from the list.
- Any sites not within 10 km of one of the 6 areas being assessed were removed from the list.
- Licences with 'Applied' status were reviewed and all 4 were updates to existing licences – none of which detailed any changes to the thermal loads.

After this screening, 25 sites remained on the list. Of these, the sites are located as follows:

1. Bottlehill – 1;
2. Carrigtwohill – 6;
3. Kilbarry – 4;
4. Little Island – 6;
5. Ringaskiddy – 7; and
6. Whitegate - 1.

These facilities are listed in the table below.

Table 2: EPA licensed facilities within 10 km of the 6 assessed areas

Name	Location	Area
Messrs Jack and David Ronan	Carraig, Glenville, Cork.	Bottlehill

Name	Location	Area
Marinochem Limited	Marino Point, Cobh, Cork.	Carrigtwohill
Mr James OBrien	Ballintubbrid East, Carrigtwohill, Cork.	Carrigtwohill
Irish Distillers Limited	Midleton Distilleries, Midleton, Cork.	Carrigtwohill
Merck Millipore Limited	Tullagreen, Carrigtwohill, Cork.	Carrigtwohill
Kepak Cork	Condonstown, Watergrasshill, Cork.	Carrigtwohill
Fournier Laboratories Ireland Limited T/A AbbVie	IDA Industrial Estate, Anngrove, Carrigtwohill, Cork.	Carrigtwohill
Dulux Paints Ireland Limited	Shandon Works, Commons Road, P.O. Box 45, Cork, Cork.	Kilbarry
Galco (Cork) Limited	Tramore Road, Cork.	Kilbarry
Irish Pioneer Works (Fabricators) Limited	Kinsale Road, Cork.	Kilbarry
Heineken Ireland Limited	Lady's Well Brewery, Cork, Cork.	Kilbarry
Janssen Pharmaceutical Sciences UC	Wallingstown, Little Island, Cork.	Little Island
Cara Partners	Little Island Industrial Estate, Cork.	Little Island
BASF Ireland Designated Activity Company	Inchera and Wallingstown, Little Island, Cork.	Little Island
Wexport Limited	Wallingstown, Little Island, Cork.	Little Island
Upjohn Manufacturing Ireland Unlimited Company	Wallingstown, Little Island, Cork, Cork.	Little Island
Architectural & Metal Systems Limited	Wallingstown, Little Island, Cork.	Little Island
Thermo Fisher Scientific Cork Limited	Currabinny, Carrigaline, Cork.	Ringaskiddy
Sterling Pharma Ringaskiddy Ltd.,	Ringaskiddy, Cork.	Ringaskiddy
Hovione Limited	Loughbeg, Ringaskiddy, Cork.	Ringaskiddy
Pfizer Ireland Pharmaceuticals Unlimited Company	PO Box 140, Ballintaggart, Ringaskiddy, Cork.	Ringaskiddy
Recordati Ireland Limited	Raheens East, Ringaskiddy, Cork.	Ringaskiddy
JANSSEN SCIENCES IRELAND UC	Barnahely, Ringaskiddy, Cork.	Ringaskiddy
BioMarin International Ltd	Ballintaggart, Shanbally, Ringaskidddy, Cork.	Ringaskiddy
Irving Oil Whitegate Refinery Limited	Whitegate, Midleton, Cork.	Whitegate

Source: EPA website and Google Earth Pro

4.2 Estimating the heat load for each site

Licensed facilities are required to submit an Annual Environmental Return (AER) for each calendar year. The AER covers 8 different sections, one of which is titled 'Energy & Water' and a PDF of this section is attached in Appendix A. The sheet records energy use listed as electricity and fossil fuels (which are broken down into heavy fuel oil, light fuel oil, natural gas, coal/solid fuel and peat).

AERs are submitted throughout the following years and 2024 AERs are accessible on the EPA's website. Fichtner has reviewed the published AERs of all sites listed in Table 2 but no 2024 AERs were published for the following sites and therefore the assessment was based on the most recent available AER:

- Janssen Pharmaceutical Sciences UC (2023 AER)
- Cara Partners (2023 AER)
- Wexport Limited (2022 AER)
- Thermo Fisher Scientific Cork Limited (2023 AER)
- Janssen Sciences Ireland UC (2023 AER)

Most of the remaining sites use primarily natural gas, and while some will use natural gas for industrial processes, for this assessment Fichtner has used it for a proxy for the heat demand of the site. Where natural gas consumption was reported in m^3, this was converted to MWh of energy input by using a conversion of 11 kWh/m^3. The MWh of energy input for each site was then converted to MWh of heat, using an assumption that each site uses an 85% efficient boiler, in line with industry norms.

Based on the nature of activities undertaken at these sites, it is reasonable to assume that most of the heat demand will be for high grade heat (steam). Discussion with potential heat consumers will be required to verify heat loads (in terms of volume of heat and grade of heat required) and to determine whether site owner/operators are willing to enter into a commercial agreement for the provision of heat.

The sections below show the annual heat load for all remaining sites. The approximate distance to the relevant area (based on Google Earth Pro) is also shown.

4.3 Bottlehill

Table 3: Heat Loads within 10km of Bottlehill

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Bottlehill (km)	Potential to connect
Messrs Jack and David Ronan	0.7	9	Unlikely

Source: EPA website and Google Earth Pro

In Bottlehill, there is only one potential heat load which is from the intensive agriculture sector and has a potential heat load of 0.7 GWh/annum. Fichtner can conclude that there is not likely to be sufficient heat demand in the Bottlehill area to support an industrial heat network of the scale which Indaver is planning.

4.4 Carrigtwohill

Table 4: Heat Loads within 10km of Carrigtwohill

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Carrigtwohill (km)	Potential to connect
Marinochem Limited	3	8	Unlikely
Mr James O'Brien	0.6	2	Unlikely
Irish Distillers Limited	188	9	Possible
Merck Millipore Limited	60	2	Possible
Kepak Cork	3	9	Unlikely

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Carrigtwohill (km)	Potential to connect
Fournier Laboratories Ireland Limited T/A AbbVie	12	3	Possible

Source: EPA website and Google Earth Pro

In Carrigtwohill there are six potential heat loads. The largest of these, Irish Distillers Limited has a potential heat load of 188 GWh/annum and is located approximately 9 km from the centre of Carrigtwohill. If the plant had a steady load for the entire year (which is unlikely) this would require an average heat input of 22 MW. With an exceptionally well insulated pipe that lost only 1% of energy/km, a waste to energy plant in Carrigtwohill would need to supply 24 MW of heat. This is more than the Indaver plant is planned for. As the Middleton site is so far from a potential plant in Carrigtwohill and heat losses are likely to be prohibitively large, connecting to this consumer is not considered to be viable.

4.5 Kilbarry

Table 5: Heat Loads within 10km of Kilbarry

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Kilbarry (km)	Potential to connect
Dulux Paints Ireland Limited	1	2	Possible
Galco (Cork) Limited	4	9	Highly unlikely
Irish Pioneer Works (Fabricators) Limited	4	8	Highly unlikely
Heineken Ireland Limited	15	4	Possible

Source: EPA website and Google Earth Pro

In Kilbarry, there are four potential heat loads of which only two have good potential to connect and have a combined potential heat load of 16 GWh/annum. Fichtner can conclude that there is not likely to be sufficient heat demand in the Kilbarry area to support an industrial heat network of the scale which Indaver is planning.

4.6 Little Island

Table 6: Heat Loads within 10 km of Little Island

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Little Island (km)	Potential to connect
Janssen Pharmaceutical Sciences UC	40	2	Possible
Cara Partners	28	3	Possible
BASF Ireland Designated Activity Company	10	3	Possible
Wexport Limited	35	2	Possible

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Little Island (km)	Potential to connect
Upjohn Manufacturing Ireland Unlimited Company	16	2	Possible
Architectural & Metal Systems Limited	18	3	Possible

Source: EPA website and Google Earth Pro

Little Island has six plants with potential connection prospects, with a total estimated heat load of 147 GWh within approximately 3 km of the centre of Little Island. This corresponds to an average instantaneous heat supply requirement of approximately 18 MW, assuming the facilities operate for 8,000 hours per annum, which is within the range of the Indaver plant. All these sites are to the west of Little Island and if a suitable site were available, it would be worth investigating Little Island as a potential site for an industrial heat network.

The average load per licensed facility of those with potential connection prospects in Little Island is 24.5 GWh/annum.

4.7 Ringaskiddy

Table 7: Heat Loads within 10 km of Ringaskiddy

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Ringaskiddy (km)	Potential to connect
Thermo Fisher Scientific Cork Limited	35	5	Possible
Sterling Pharma Ringaskiddy Ltd.,	46	3	Possible
Hovione Limited	22	2	Possible
Pfizer Ireland Pharmaceuticals Unlimited Company	68	3	Possible
Recordati Ireland Limited	4	3	Possible
Janssen Sciences Ireland UC	52	3	Possible
BioMarin International Ltd	12	3	Possible

Source: EPA website and Google Earth Pro

Ringaskiddy has seven potential sites that use an estimated 239 GWh of heat per year. The furthest of these is approximately 5 km by road from the Indaver site, but only approximately 2 km 'as the crow flies'. It would be relatively easy to find a shorter route for a steam distribution pipe. This would give 239 GWh within 5 km of the site. This translates to an average instantaneous heat requirement of approximately 30 MW, assuming the facilities operate for 8,000 hours per annum, which is greater than the planned capacity of the Indaver plant, but it is likely that not all of the plants identified would take up this option in the future.

4.8 Whitegate

Table 8: Heat Loads within 10km of Whitegate

Site name	Potential heat load (GWh/annum)	Distance for pipes from Centre of Whitegate (km)	Potential to connect
Irving Oil Whitegate Refinery Limited	417	1	Unlikely

Source: EPA website and Google Earth Pro

There is a 2024 AER available for Irving Oil Whitegate Refinery Limited, however Indaver has supplied a report by Tungsten Consulting Limited (attached as Appendix B) which describes how Tungsten Consulting Limited consider it unlikely that Irving Oil Whitegate Refinery Limited would be a suitable site for connection to a heat network. This is primarily due to the preference of oil refineries to maintain self-reliance for energy supply services, in addition to the very cost-effective baseline offered by the existing steam generation plant on site.

4.9 Discussion

Each of the areas of Carrigtwohill, Little Island, Ringaskiddy and Whitegate have sizeable industrial heat loads which have the potential to connect to. The table below summarises the heat loads based on the distance to the centre of the area.

Table 9: Industrial heat loads in GWh/annum

Area	Up to 5km	6 to 10km	Total
Carrigtwohill	73	194	267
Little Island	147	-	147
Ringaskiddy	239	-	239
Whitegate	417	-	417

Source: EPA website and Google maps

Section 2.2 of this report describes how the Indaver plant may have up to 96 GWh/annum of heat available for export (subject to detailed design). This is insufficient to supply the entire heat demand of the large heat loads identified in Carrigtwohill, Ringaskiddy and Whitegate. This assessment considers sites which are licensed by the EPA. The feasibility of connecting these will require heat demands to be verified in later studies, as well as ascertaining the willingness of site owners to enter into commercial agreements for heat supply.

From the information assessed for this study, Fichtner considers Ringaskiddy the most suitable area for a heat network that focuses on industrial users based on the number, proximity and heat demand of potential industrial heat network users in the area.

Appendices

A Energy & Water section of AER template

3) Energy & Water

Energy

Explanation
Fossil fuels such as coal, gas and oil are non-renewable resources. As a result, our EPA licence requires that we measure our energy use and set targets to improve the energy efficiency of our activities and reduce our overall use, where possible. Where we have the means and technology on-site to generate energy, this is also captured in this report.

The information below summarises the energy used this year compared to the previous year and includes renewable and non-renewable energy types.

Table 3 Energy Used

Energy Used	**Quantity (GJ)**	**% Increase/ decrease on previous year**
Electricity		
Heavy Fuel Oil		
Light Fuel Oil		
Natural Gas		
Coal / Solid Fuel		
Peat		
Renewable Biomass		
Renewable Energy Generated On-site		
Total Energy Used		

Comment

100 word limit

12

The information below summarises the energy we generated on our site this year with specific focus on renewable energy generation.

Table 4 Energy Generated

Energy Generated	**Quantity (GJ)**	**% Increase/ decrease on previous year**
Renewable Energy		
Total Energy Generated		

Comment

100 word limit

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B Tungsten Consulting Limited report

Business Confidential - Preliminary Review of Potential Commercial Concerns on Locating at the Whitegate Refinery

1. Introduction

This preliminary report looks at some of the factors which might be relevant in considering if a waste to energy plant producing, electricity, steam and hot water could be located adjacent to the Whitegate Refinery.

2. Background and Security of Operation

Whitegate Refinery will celebrate 60 years in operation in 2019. It was widely recognised that the future operation of the refinery was in question until September 2016, when the business was acquired by the current owners Irving Oil.

Whitegate is Ireland's only crude oil processing refinery and is small and simple in configuration by international standards. The refinery provides about 35% of the transport fuels used in the country.

The refinery operates 24 hours a day, seven days a week and 365 days a year. The processing units shutdown for a turnaround every 5 years and even during that time products continue to be distributed from the site by sea or truck.

3. Land availability

It is my understanding that Whitegate Refinery has development plans to utilise any spare land within its boundary for its own use in the future.

An energy project of this nature would need to minimise pipe runs and so it would be desirable for any land for this project to be adjacent to the refinery boundary and as close to the processing units as possible. It is my understanding that the land is zoned industrial, which has given rise to high expectations of its value to the local landowners.

4. Electricity, Steam. and Hot Water

Whitegate refinery has no process requirement for hot water.

Electricity and steam are critical for continuous operation of the refinery. The plant is connected to the national grid for electricity supply with redundancy in supply points. Steam is even more critical as it is needed for safety reasons, including at a time of power loss for safe unit shutdown. The refinery has a number of steam generating boilers. The refinery also typically uses a CHP, which can provide about 50% of the electricity demand and about 40% of the steam demand. This steam generation is very cost effective as it is from a waste heat boiler.

The refinery's electrical demand is typically 10 MW. The boiler house produces approximately 20 tonnes per hour of steam plus or minus 10% at between 9 to 10 bar and at temperatures usually in the range of 280 to 285 degree C. These loads would be relatively stable given the 24/7/365 nature of the process operation.

Business Confidential - Tungsten Consulting Report for Indaver 1st March 2019

There is no condensate recovery because of the slight risk of contamination with oil and this stream is processed in the refinery's waste water treatment plant.

In 2010, BGE commissioned the 440MW CCGT Whitegate Independent Power Plant, WIPP, on land leased to them by the refinery and close to the existing boiler house and processing units. It was envisaged at that time that this plant would be base loaded with an expected on stream time of typically 8000 hours per year. Although agreements were put in place between Whitegate Refinery and BGE for the provision of steam to the refinery, this has never been activated. Even at 8000 hours per year this leaves a sizeable gap in reliable steam supply. In my opinion, the factors which influenced this were the significant cost of installing the steam supply piping and the lack of incentive for the refinery as it still needed to keep all of its existing steam generating capability for when WIPP was unavailable. Another factor became the change in National electricity supply with the significant move to wind generation, which meant that WIPP is typically not a base load plant.

This would also be my experience of other refineries around the world, that the plants focus on self- reliance for these critical services of power and steam. External third party service providers are only part of the solution and are installed at a time that incentivized both parties.

5. Summary

Given Whitegate Refinery's previous experience with WIPP, I would think it would be difficult to justify sufficient synergies to locate a new waste to energy plant in the area for either party.

Dave Austin,
CEO Tungsten Consulting Limited

C Site visits – February 2019

In order to investigate the potential heat consumers within the 6 areas of County Cork, Fichtner visited each of the areas on 25 and 26 February 2019. The visits comprised a visual inspection of each of the key heat consumers across all sectors, but did not include communication with any site owners or access onto the premises. Local infrastructure and topology were reviewed as part of the visits to better understand potential pipe routing options and constraints. A summary of each area is provided in the following sections.

C.1 Bottlehill

Bottlehill is a substantially rural area, located approximately 18 km north of Cork city centre, where the predominant land uses are agriculture and forestry, interspersed with residential dwellings. The centre of the area was taken as the disused landfill facility, located equidistantly between the settlements of Blarney and Mallow. Based on a visual assessment of the area, there does not appear to be any heat demands which would warrant a connection to a heat network.

The Cork to Mallow line of the Cork Suburban Rail network runs substantially south-north approximately 4 km to the west of Bottlehill and would need to be considered in the event of development of a heat network in the wider area, which is considered unlikely.

C.2 Carrigtwohill

Carrigtwohill is located approximately 8 km to the east of Cork city centre. The majority of development in the area is situated between the N25 national road and the Cork to Midleton rail line. Land use includes a range of business, light industry, distribution and warehousing, offices, retail and commercial premises located at the Carrigtwohill Industrial Estate and Cobh Cross Industrial Estate.

Of relevance in establishing a heat network are the pharmaceutical plants Stryker, GE Healthcare, AbbVie, Gilead Sciences and Merck Millipore. While smaller than industrial units located at Ringaskiddy and Little Island, these developments could potentially act as anchor heat loads for the area. IDA Ireland owns lands to the west of the industrial estates, which is zoned for future industrial development but is currently vacant.

The Cork to Midleton line of the Cork Suburban Rail network runs east-west via a single-track section with a 1.7 km passing loop at Carrigtwohill. Engineering a crossing would require detailed structural assessments and the consent of the bridge and rail network owner. Service interruptions would have to be kept to an absolute minimum. As a result, connecting heat consumers located to the north of the line (the Gilead Sciences and Stryker Anngrove sites) would present a major challenge. Similarly, pipe routing to consumers located south of the N25 national road (Merck Millipore) would need to be carefully managed.

C.3 Kilbarry

Kilbarry is located approximately 4 km to the north of Cork city centre. The area to the south comprises well developed urban land uses, including a mix of residential, retail and light industrial development. This differs from the land to the north which is largely agricultural.

The majority of retail and light industrial development exists between the N20 and the Cork to Mallow rail line, at North Point Business Park and Blackpool Retail Park. Many of the business are located within warehouse units which typically use radiant heaters (direct gas fired or infra-red electric) and are therefore not suitable for connection to heat network. Three residential tower blocks also exist (with commercial floorspace on the ground floor) at the junction of the N20 and Popham's Road which may be capable of accepting heat if a centralised boiler plant exists. As detailed in the preceding section, engineering a rail crossing to any of these potential heat consumers (from the potential plant site to the north) would present a major challenge.

Beyond this area to the northeast is the Kilbarry Business Park, occupied by light manufacturing firms including Yves Rocher, Trulife, and Flextronics. The demand of these consumers is likely to be very modest.

Although additional heat demand exists towards the centre of Cork City, much of this demand comprises existing domestic buildings which, as discussed previously, are unsuitable for inclusion in a heat network as a result of the prohibitive costs of replacing existing heating infrastructure and connecting multiple smaller heat consumers to a network. In addition, the River Lee runs substantially eastwards through Cork city centre and would be technically challenging and expensive to route across. Non-traditional techniques such as horizontal directional drilling could potentially be used to install pipelines below ground, although this approach requires substantial capital outlay. To justify such a crossing, the economic returns associated with establishing the connection would need to be substantial, which does not appear to be the case in this location.

C.4 Little Island

Little Island is located approximately 9 km to the east of Cork city centre at the northern extent of Cork Harbour. It has developed rapidly as an employment location since the 1990s. Land use at Little Island comprises a diverse mix of business, technology, industry, offices, distribution and warehousing, and a handful of residential areas.

Chemical and pharmaceutical plants including Pfizer, BASF, Johnson & Johnson, FMC and Cara Partners exist towards the western side of the island. While these sites potentially offer anchor heat loads for a network, they are smaller in size than similar types of facilities in Ringaskiddy and connection to a greater number is therefore likely to be required. Based on a visual assessment, pipe routing in the area would be unconstrained in accessing the major heat consumers but could be complicated by a large quantity of buried services in the area.

A large quantity of retail, logistic and light industry units exist across a number of business parks to the north and at the centre of the island. As discussed previously, many of these types of developments will not be suitable for connection to a heat network. The Harbour Point Business Park located to the south-east of the island is of a similar nature. However, in the event that a heat network was established in the area, engagement with landowners would be worthwhile to ascertain whether upgrading of heating systems to be served by a heat network could be considered.

C.5 Ringaskiddy

Ringaskiddy is located circa 14 km southeast of Cork city centre on the western side of Cork Harbour. Significant industrial and port related development has been implemented since the 1970s and this was evident when visiting the area. The main pharmaceutical plants, specialising in pharmaceutical, bio-pharmaceutical and medical device manufacturing, include Hovione, Pfizer, De Puy, Novartis, Johnson & Johnson Biologics and GlaxoSmithKline. These facilities represent an extensive volume of heat demand, and while heat consumer requirements would need to be confirmed (in particular whether the Indaver plant could supply heat at the required conditions), this appears to be an attractive location for establishing a heat network.

In addition to the large industrial facilities, other premises worth consideration include the National Maritime College of Ireland and the MaREI (Marine and Renewable Energy Ireland) Centre located on the north-eastern extent of the peninsula. Beyond these exists a crossing to Haulbowline Island, on which is located the Irish Defence Forces Naval Service Base and a crematorium on Rocky Island. Heat provision to these sites may be restricted due to the narrow crossing bridge, although this would need to be explored further.

Intensification and expansion at the Port of Cork is currently in the planning process, including significant additional lands available for development, which may result in additional heat demand in the short to medium term.

The large expanse of mudflats and estuary habitat constrains possible pipe routing options to the east of Ringaskiddy. However, large heat consumers are concentrated within 2.5 km of the site owned by Indaver and feasible routing options exist via established transport routes. A detailed engineering assessment including surveying of the route and potentially trial holes would be required to determine the extent of existing buried services and optimum pipe routes.

C.6 Whitegate

The Whitegate area is located on the eastern side of Cork Harbour some 18 km southeast of Cork city centre. The region comprises four relatively small settlements surrounded by agricultural land, with a handful of notable industrial zones.

The largest heat consumer by a considerable margin is the Irving Oil Whitegate Refinery but this is not considered to represent a viable connection opportunity for the reasons discussed in section 4.8. Three power stations are also located in the area but since these are net heat generators, they are not relevant for the purpose of understanding heat demand in the area. It is worth noting that if a heat network was developed to the east of Cork Harbour, then the feasibility of utilising these assets to supply heat to the network should be considered. However, given the relatively large distance from population and industry centres, and the pipe routing constraints owing to the large expanse of estuary habitat in the locality, the location of these power stations is unfavourable.

C.7 Conclusion

Based on the concentration of large heat loads within a relatively short distance of the proposed plant, pipe routing feasibility and potential for development expansion in the locality, we consider Ringaskiddy as the most favourable area for establishing a heat network. Engagement with potential consumers would be required to verify requirements (in terms of heat medium and conditions, and load profiles) prior to the implementation of a heat network. Little Island also accommodates several pharmaceutical plants (and to a lesser degree office and retail space) which may offer connection prospects, although these are smaller in scale. Smaller still are the pharmaceutical and manufacturing plants located in Carrigtwohill.

Kilbarry comprises a wider mix of development types, many of which are unlikely to require heating or utilise heating systems which are not suitable for connection to a heat network. At Carrigtwohill and Kilbarry, local infrastructure presents a major barrier to connecting potential consumers, therefore reducing the amount of accessible heat demand.

There are poor synergies in terms of the development of a heat network in the areas of Bottlehill and Whitegate.

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