Codema
Dublin's Energy Agency

Drogheda District Heating Feasibility Study

Thermal Source Network with Data Centre Waste Heat

IExternal summary document

comhairle chontae na mí
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Comhairle Contae Lú
Louth County Council

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Dublin's Energy Agency

Drogheda District Heating Feasibility Study: Scenario Two

Executive summary

This summary brochure focuses only on **a thermal source network (TSN) scenario**. A TSN works by sharing low-temperature heat between buildings and upgrading it locally using heat pumps, rather than distributing high temperature heat from a central plant.

This scenario **connects a data centre in central Drogheda directly to Our Lady of Lourdes Hospital** only. The TSN is designed to serve one large heat user only, which simplifies delivery but limits wider network expansion.

This scenario uses **waste heat from the data centre,** displacing energy produced using fossil fuel boilers or individual heat pumps at the hospital.

Switching to district heating would **reduce emissions equivalent to removing 1,030 diesel cars** from the road each year.

How the system works

Heat is transferred at low temperature and upgraded at the hospital using a heat pump owned and operated by the hospital.

Benefits of a TSN system

- The system is **compact and low risk** compared to larger district heating schemes
- It can be **delivered quickly and with low upfront cost**
- It offers **significant carbon savings** at the hospital but does not supply other buildings.

Introduction to district heating

District heating is an innovative and efficient way to supply heat to buildings from a centralised source. Instead of each building using its own boiler or heat pump, a network of insulated underground pipes distributes hot water or steam from a central plant to multiple buildings.

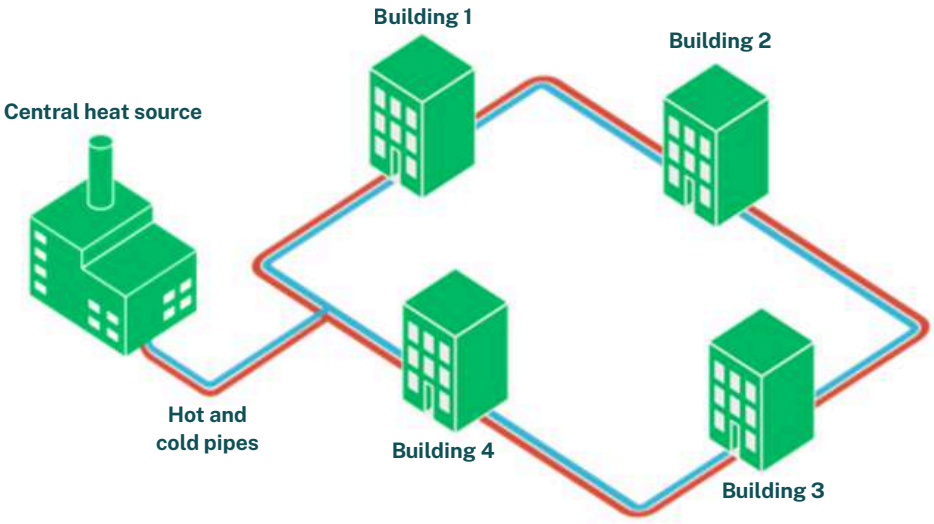


Figure 1: District heating diagram

Thermal Source Network (TSN)

District heating has developed over time through four main generations. Early systems used steam and very high temperatures, which led to high heat losses. Later generations moved to hot water networks with better insulation and lower operating temperatures, improving efficiency and safety. Fourth generation district heating operates at much lower temperatures and is designed to make better use of local, low-grade heat sources such as data centres, wastewater and ambient heat.

A **thermal source network (TSN)** is a variation of this approach. In some technical literature, thermal source networks are also referred to as fifth generation district heating. They move low-temperature water through simple, well-insulated pipes, with heat pumps located close to buildings to raise the temperature to what is needed for heating and hot water. This approach reduces heat losses, lowers infrastructure costs and makes it easier to reuse waste heat that would otherwise be lost.

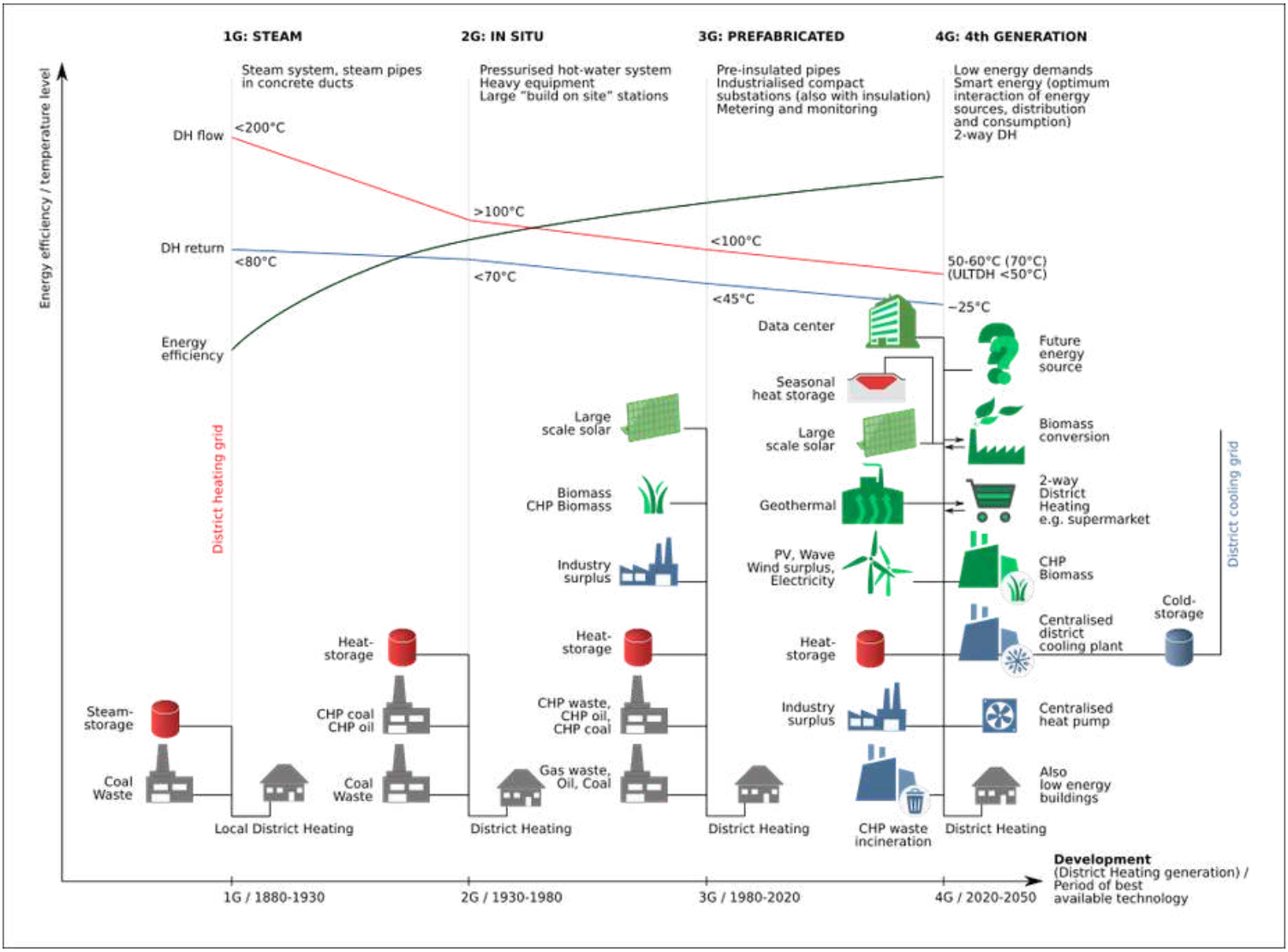


Figure 2: The evolution of district heating technologies from 1st to 4th generation. Source

Key advantages of district heating

Flexibility: District heating can use heat from many different sources. It can combine various renewable and low-carbon heat sources, including biomass, geothermal and waste heat from industrial processes or data centres.

Environment and climate: District heating is a vital tool in reducing greenhouse gas emissions and enhancing local air quality.

Legislation: District heating also aligns with local, national and EU-level climate goals; the European Union recognises district heating and cooling as critical components of its Energy Efficiency and Renewable Energy directives, while the Heat (Networks and Miscellaneous Provisions) Bill 2024 is in development to provide a legislative and regulatory plan for the district heating sector in Ireland.

Other benefits of district heating

What makes district heating feasible?

District heating is most effective in areas with **high building density**, where many heat users can be connected within a local network. In low-density or dispersed communities, the cost of laying extensive pipework relative to the heat demand makes the system less economically-viable. These areas are often better suited to individual, low-carbon solutions, such as heat pumps, which require less infrastructure and can be tailored to single-building needs.

High-density areas

District heating is effective in areas of high building density where mutliple users can connect to a local network.

Low-density areas

Low-density and dispersed communities are better suited to individual, low-carbon solutions such as heat pumps.

Rolling out district heating in Ireland

While district heating offers many environmental and efficiency advantages, it is a relatively new concept in Ireland and its use has been limited for a number of reasons. It requires **strategic, long-term planning and coordination** across local authorities, developers and utility providers. The initial infrastructure investments (such as underground insulated pipe networks and centralised energy hubs) are substantial but they lay the foundation for a clean, scalable heating solution.

Success also relies on connecting a sufficient number of users to achieve **optimal performance and cost-effectiveness**. In areas where heat demand is spread out or where shared heating systems weren't planned before, rollout may take longer. However, as policy, public awareness and technical experience grows, **district heating is well-positioned to become a central part of Ireland's low-carbon energy transition**.

Examples of district heating in Ireland

Although district heating is still in its early stages in Ireland, progress has been made. The **Tallaght District Heating Scheme**[1], developed by South Dublin County Council in close partnership with Codema, Dublin's Energy Agency, became operational in 2023 and is Ireland's first large-scale district heating network. It captures waste heat from an Amazon Web Services data centre and supplies South Dublin County Council buildings, a number of Technological University Dublin's Tallaght campus buildings and local, cost-rental apartments. The network is set to expand even further in future phases.

The **Dublin District Heating System**[2] is also being developed to use waste heat from the Dublin Waste-to-Energy Plant in Poolbeg to supply homes, businesses and public buildings in the surrounding area. Several other heat network developers and local authorities are actively developing schemes and feasibility studies for district heating networks, with the goal of rolling out sustainable heating solutions in their regions.

There are also district heating projects being spearheaded outside of Dublin. One example is the **Galway District Heating Project**[3], being developed by HeatGrid Ireland. Currently progressing through planning applications with Galway City Council, the project plans to deliver heat to a mix of public sector, commercial, industrial and residential buildings across the city. The network will primarily use renewable electricity to generate low-carbon heat, displacing fossil fuel use in individual buildings and supporting decarbonisation goals.

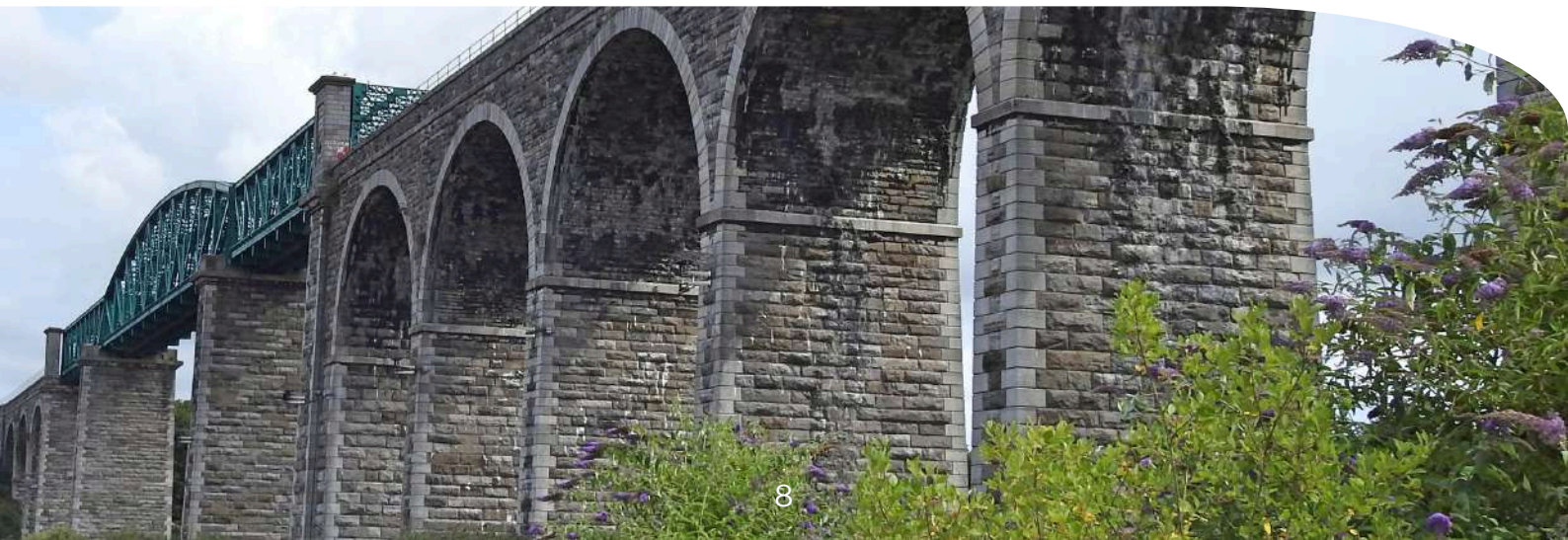
Image: Tallaght District Heating Scheme

The potential for district heating in Drogheda

Drogheda is well-suited to a thermal source network (TSN) because it brings together a large, continuous heat demand and a nearby source of recoverable waste heat within a compact urban area. Our Lady of Lourdes Hospital is the single largest and most concentrated heat user in the town, with year-round demand for space heating and hot water. This makes it an ideal candidate for using recovered heat as a stable base load.

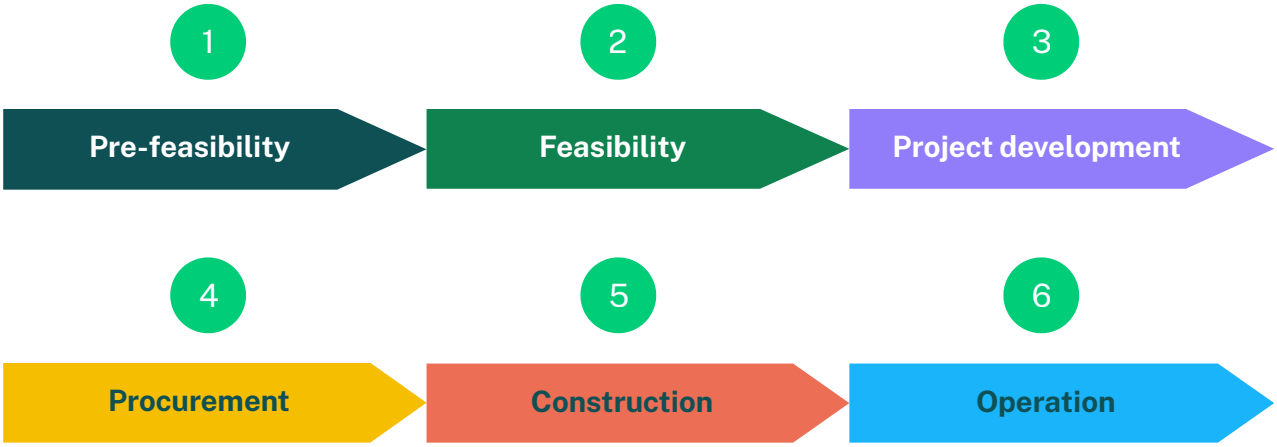
This scenario presents a strong, local opportunity because a data centre with waste heat recovery potential is located very close to the hospital. This proximity allows a short and efficient connection between heat supply and demand, enabling waste heat to be reused at scale where it can be most effective. The hospital has the technical capacity and organisational interest to own and operate a heat pump on site to upgrade the low-temperature heat to meet its needs. This makes a TSN a practical, low-risk and financially attractive solution for delivering significant carbon savings at a critical public building in Drogheda.

Drogheda is also well placed from a local policy perspective. Louth County Council identifies district heating as a relevant solution within its Climate Action Plan[4], including actions to raise awareness of district heating opportunities. While not explicitly named in the Louth County Development Plan[5], district heating directly supports objectives requiring the integration of climate change mitigation measures into future development. Both Meath and Louth County Councils have committed to a 51% reduction in energy-related greenhouse gas emissions and district heating aligns with their priorities on energy efficiency, emissions reduction and climate resilience. The Drogheda Joint Local Area Plan[6] also highlights the need to support a low-carbon transition and improve quality of life, both of which can be supported by the TSN scenario.



District heating development process

The development of a district heating system typically follows a structured process, beginning with a **conceptual exploration and pre-feasibility stage**, progressing through detailed **feasibility assessment** and ultimately leading to **design, financing, procurement and implementation**.



Current study

The current study for Drogheda represents the **feasibility stage** of this process and follows on from an initial pre-feasibility assessment carried out by Codema in June 2024. The pre-feasibility study involved high-level mapping and stakeholder identification.

The feasibility study aims to assess whether a district heating scheme is technically, financially and environmentally viable within the town. This includes:

- A **heat demand analysis** to identify suitable heat sources and map potential demand
- A **route analysis** to evaluate network routes
- A **financial assessment** to estimate capital and operational costs.

This study follows the SEAI's district heating feasibility study how-to guide as a standardised approach.[7]

While several scenarios and heat sources were explored, two scenarios were developed further for detailed analysis. The first relates to the use of waste heat from the nearby Waste to Energy Plant and the second relates to a Thermal Source Network (TSN) that would connect a data centre in central Drogheda directly to Our Lady of Lourdes Hospital only. A separate summary brochure has been developed for the Waste to Energy Plant scenario.

The study provides a solid evidence base to inform decision-makers, helping them determine whether to proceed to the next stages - namely detailed design, stakeholder engagement, business planning and ultimately, infrastructure development.

Heat demand analysis

This summary brochure **focuses only on a thermal source network (TSN) scenario**. A TSN works by sharing low temperature heat between buildings and upgrading it locally using heat pumps, rather than distributing high temperature heat from a central plant. In this instance, the TSN would involve supplying waste heat to **Our Lady of Lourdes Hospital** from the nearby data centre. For that reason, this heat demand analysis focuses only on Our Lady of Lourdes Hospital. This is because the scenario is designed as a direct connection between a data centre and a single, large heat user, rather than a town-wide district heating network. The aim of this option is to recover waste heat from the data centre and use it locally at the hospital, without extending the network to serve additional buildings.

Our Lady of Lourdes Hospital was selected because it is the largest and most consistent heat user in the area, with year-round demand for space heating and hot water. This makes it well-suited to using recovered waste heat as a stable base load. The heat demand data used in the analysis was taken directly from the hospital's energy meters and provided to Codema by the hospital's facilities management team. Using measured consumption data, rather than estimates or benchmarks, improves the accuracy of the assessment and supports a robust evaluation of the technical and financial feasibility of the thermal source network.

Thermal Source Network (TSN)

A TSN works by sharing low temperature heat between buildings and upgrading it locally using heat pumps, rather than distributing high temperature heat from a central plant.

Route analysis

For the TSN scenario, the route analysis focuses on a short, direct connection between the data centre and Our Lady of Lourdes Hospital. Both sites are located close to one another in central Drogheda, allowing the network to remain compact and straightforward. The proposed route follows existing public roads and service corridors where possible, which helps to minimise construction complexity and cost, although delivery will require coordination with the local authority, including securing a road opening licence. Because the system operates at low temperature, plastic pre-insulated pipes can be used. These are easier to install and require shallower excavation than conventional, high-temperature district heating pipes.

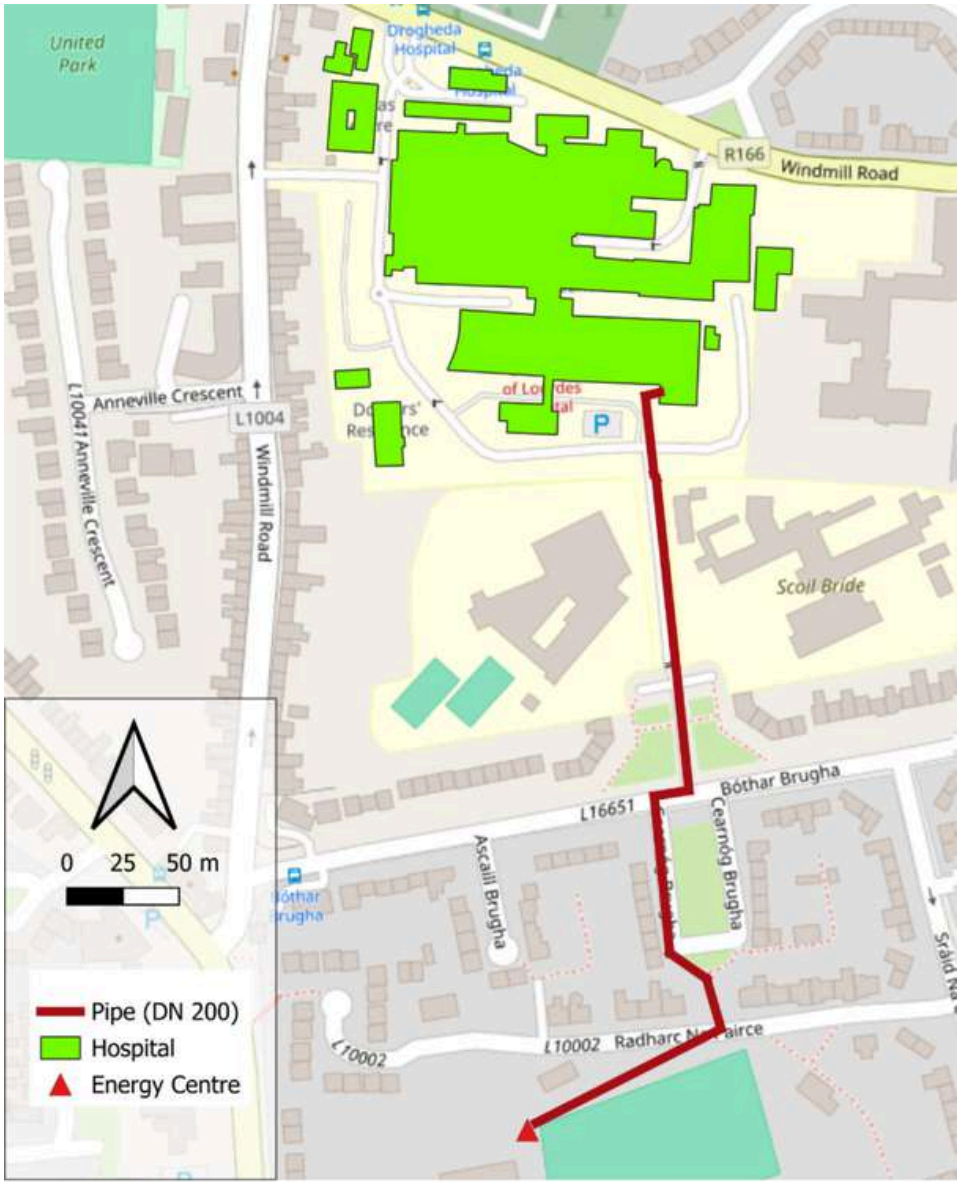


Figure 3: Route mapping

The limited route length significantly reduces construction risk, heat losses and disruption to the surrounding area. The route also avoids crossing the River Boyne and minimises works within areas of archaeological sensitivity, which are major constraints for larger networks in Drogheda. This straightforward routing is a key reason why the TSN scenario is considered low-risk and suitable for near-term delivery.

Heat source analysis

Codema assessed several potential heat sources that could supply a district heating network in Drogheda. These options were shortlisted based on technical suitability, availability, scale and alignment with long term decarbonisation goals. The assessment focused on heat sources that could provide reliable, low-carbon heat at a scale large enough to support a town-wide network, either from day one or as part of a phased rollout.

Heat sources assessed

Data centre waste heat

Using waste heat generated by cooling processes in data centres to provide heat

Wastewater heat recovery

Using heat generated by operations at wastewater treatment plants

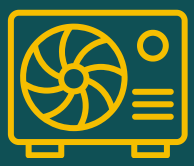
Industrial waste heat

Using heat generated by industrial activities that would otherwise be lost

Shallow geothermal

Using heat from up to 400m below the earth's surface

Air-source heat pump



Taking heat from the air outside and using electricity to raise the temperature

Biomass

Using animal or plant matter to create energy for heating

Preferred heat source

Among the options assessed, data centre waste heat was identified as a particularly suitable heat source for this scenario, due to its close proximity to Our Lady of Lourdes Hospital and the steady supply of low-temperature heat produced as a byproduct of normal cooling operations. This heat would otherwise be released to the atmosphere but can be captured and transferred over a short distance, then upgraded at the hospital using a heat pump. The short network length and low infrastructure complexity make this option technically robust and comparatively low risk when set against larger or more complex alternatives.

Financial analysis

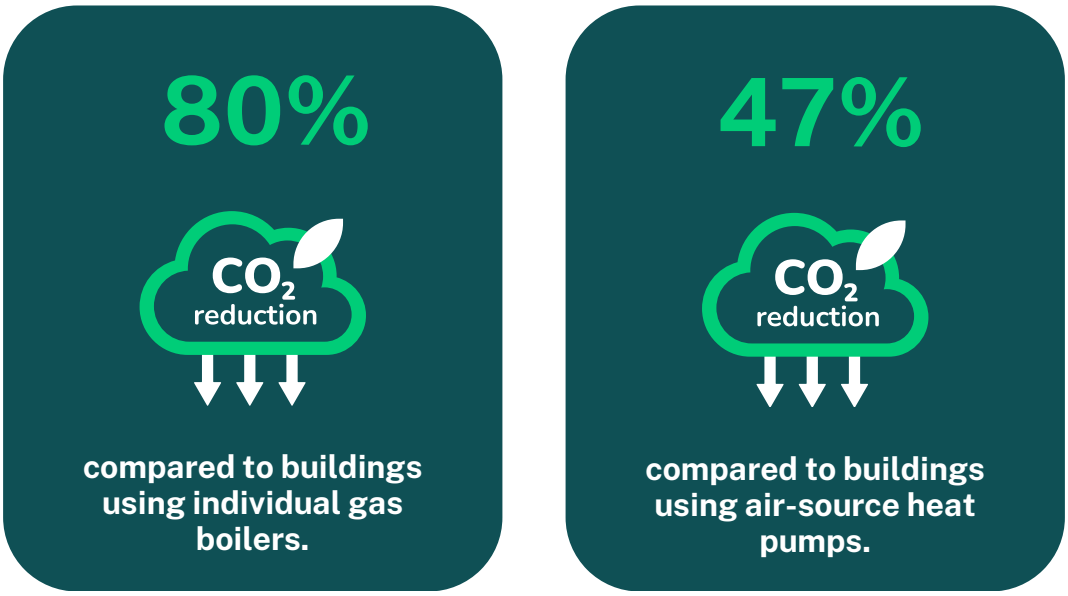
The project requires a total capital investment (CAPEX) of €868,000. This investment includes all infrastructure, construction and integration of customer connections.

- **Total CAPEX**: Approximately €868,000, (+/- 20%, including contingency costs)

The financial results show that the TSN scenario performs very strongly due to its low capital costs and simple design. A key reason for this performance is the assumption that Our Lady of Lourdes Hospital would own and operate the booster heat pump on-site, meaning the capital and operating costs of the heat pump would sit with the hospital rather than the network. This significantly reduces the cost and risk associated with the network itself, which is limited to pipework, pumps and heat exchangers. As a result, the overall scheme shows a short payback period and a very low cost of heat, indicating that this approach could deliver low-carbon heat to the hospital in a financially-efficient way.

Energy and emissions savings

By replacing traditional fossil fuel-based heating at the hospital with a thermal source network (TSN) that reuses waste heat from a nearby data centre, the scheme delivers substantial reductions in greenhouse gas emissions. Carbon emissions are reduced by approximately 80% compared to gas boilers and by 47% compared to air-source heat pumps. These reductions are achieved by capturing heat that is already being produced and would otherwise be lost, rather than generating heat through combustion.



A TSN works by sharing low temperature heat between buildings and upgrading it locally using heat pumps, rather than distributing high temperature heat from a central plant. This approach improves efficiency by reducing heat losses in the network and avoiding the need to burn fuel for heat production. In this case, the recovered waste heat is upgraded at the hospital to meet its heating needs. Overall, the scheme reduces energy consumption for the hospital by **9.7 GWh per year** and could reduce emissions by **up to 2,050 tonnes of CO_2 per year**.

This is the equivalent to **taking around 1,030 diesel cars off the road**. As the electricity grid continues to decarbonise, the emissions associated with operating the hospital's heat pump will reduce further, improving the carbon performance of the system over time. This makes the TSN a strong example of how local waste heat can be used to deliver lasting and measurable climate benefits at a major public building.

The proposed network would save 2,050 tonnes of CO_2, the equivalent of taking **1,030 diesel cars** off of the road.

Key considerations

Within this study, Codema identified several important factors that could influence the project's success:

Single customer focus

- The TSN is designed to serve one large heat user only, which simplifies delivery but limits wider network expansion.

Dependence on hospital commitment

- The viability of the scheme relies on the hospital’s willingness to own and operate the booster heat pump and to commit to long-term use of recovered heat.

Data centre operational stability and commitment

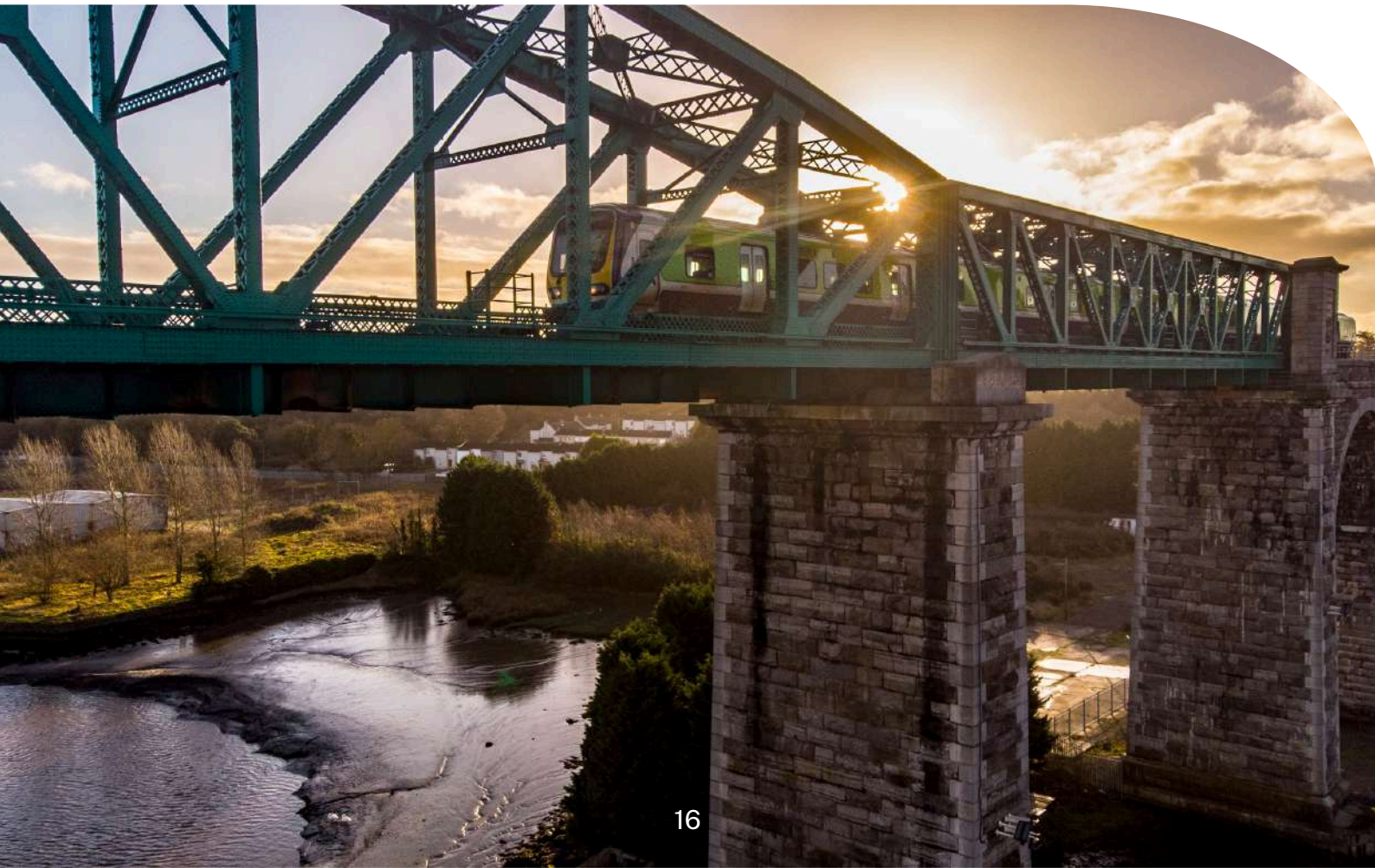
- A consistent supply of waste heat depends on the continued operation and cooling load of the data centre.

Clear roles and responsibilities

- Responsibilities for ownership, operation and maintenance of the network and heat pump must be clearly defined from the outset.

Why this option?

This option was selected because a TSN offers a targeted, low-risk and near-term opportunity to decarbonise heat at one of Drogheda's largest public sector energy users. The close proximity of the data centre and Our Lady of Lourdes Hospital allows waste heat to be reused efficiently through a short, low-temperature connection, keeping infrastructure proportionate to the scale of the opportunity. With the hospital willing and able to own and operate the booster heat pump, the network itself remains focused and straightforward, resulting in strong financial performance and significant carbon savings. This makes the TSN a practical way to deliver low-carbon heat where strong supply and demand conditions already exist, while supporting wider energy efficiency and climate objectives.



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