ENABLE DHC

INVESTMENT PLAN

For the District Heating system in Tallaght

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Dissemination level		
SEN	Sensitive, limited under the conditions of the Grant Agreement	☐
PU	Public, fully open	☒

Nature of the deliverable		
R	Report, document	☒
DEM	Demonstrator, pilot, prototype, plan designs	☐
DEC	Websites, patents filing, press & media actions	☐
DATA	Datasets, microdata, etc.	☐
DMP	Data management plan	☐
ETHICS	Deliverables related to ethic issues	☐
SECURITY	Deliverables related to security issues	☐
OTHER	Software, technical diagram, algorithms, models, etc.	☐

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This template is prepared to support consortia participating in the LIFE Clean Energy Transition subprogramme in developing investment plans for existing or new district heating and/or cooling systems. The goal is to facilitate the preparation of plans that meet the "efficient district heating and cooling" criteria outlined in the Energy Efficiency Directive article 26, which is further explained in Commission Recommendation (EU) 2024/2395 [1].

[1] Commission Recommendation (EU) 2024/2395 of 2 September 2024 setting out guidelines for the interpretation of Article 26 of Directive (EU) 2023/1791 of the European Parliament and of the Council as regards the heating and cooling supply, available at https://eur-lex.europa.eu/eli/reco/2024/2395/oj/eng

1. Case Study Context and Transformation Objective

The Tallaght District Heating Scheme (TDHS), operated by Heatworks CLG since 2023, consists of a 3 MW heat pump module and a 3 MW auxiliary electric boiler, fuelled with 100% renewable electricity. The pipeline network currently extends 3.8 km and serves 55,000 m² of public and residential buildings through six customer substations, including the Technological University Dublin (TUD), County Hall (SDCC) and 133 affordable apartments.

Almost 90% of the heat produced (4.3 GWh out of 4.9 GWh in 2024) comes from waste heat recovered through the heat pump from the adjacent Amazon Web Services (AWS) data centre, while an electric boiler covers the remainder of the demand. Combining this waste-heat recovery with the renewable electricity used by the boiler, the system already achieves an estimated 68% renewable/waste-heat (RES/WH) share without any further investment, comfortably meeting the Energy Efficiency Directive (EED) efficient district heating criteria applicable up to 2039 (≥50% RES/WH).

The main transformation challenge of this system is increasing the system's efficiency and scaling it: only 2-3 MW of the roughly 10 MW of waste heat available at the data centre is currently recovered, at an average system COP of 2.1 in 2024 (heat pump and electric boiler combined) against a nominal design value of 3.2 for the heat pump, because the current demand profile is not yet large enough to keep it running at its optimal load. The transformation objective is to bring the heat pump closer to its optimal operating point and to expand the customer base, so as to grow the volume of decarbonised heat delivered while maintaining EED compliance and moving towards the 75% RES/WH threshold that applies from 2040, over a ten-year planning horizon.

In Ireland, heating is still largely fossil-fuel based and district heating remains a marginal but fast-growing segment, supported by a strengthening policy and national funding landscape. TDHS's objective is to establish itself as a cost-competitive alternative to low-carbon individual heating systems.

Figure 1 illustrates the potential of the installed heat pump compared to the 2024 heat demand. The demand swings from a winter range of 10-35 MWh/day to a summer baseload of 1-6 MWh/day, while the heat pump's maximum capacity stands at around 72 MWh/day and its technical minimum at approximately 10 MWh/day. As a result, demand always stays below the heat pump's capacity, and in summer it stays below its technical minimum, when the electric boiler is used to cover the load. Closing this gap between available capacity and actual demand is a crucial aspect behind the investment pathways in this plan.

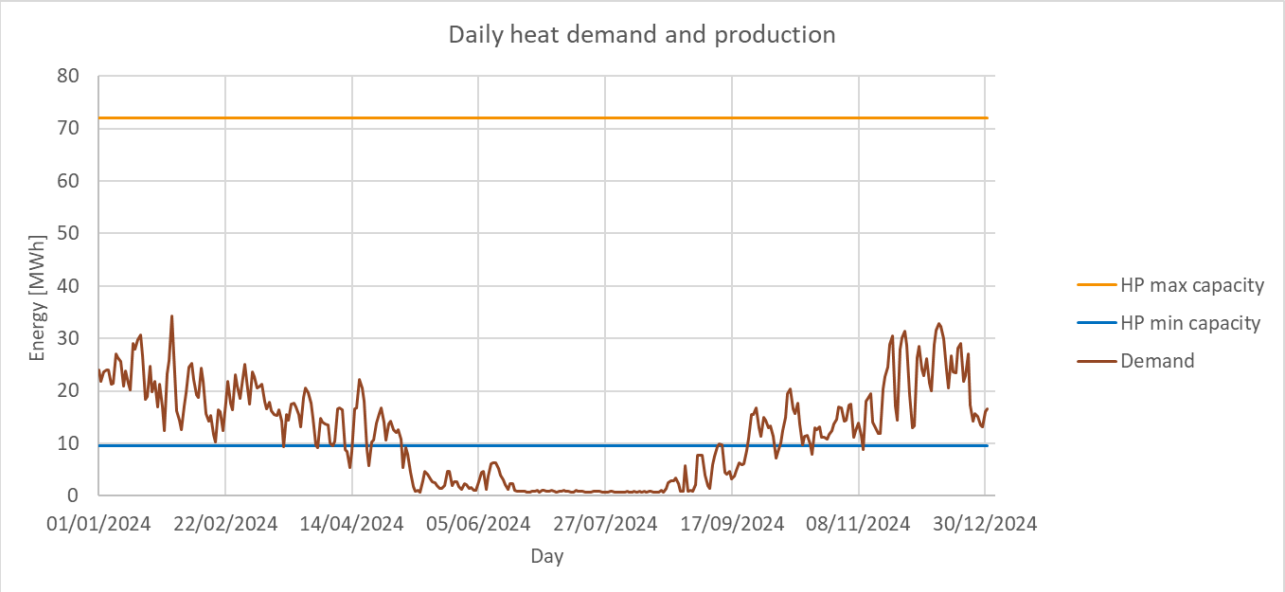


Figure 1 - Daily heat demand versus heat pump production capacity and technical minimum (2024)

2. Solutions and Investment Scenarios Assessed

Three investment scenarios were assessed for the TDHS, all building on the existing waste-heat heat pump and sharing the same core technology (thermal energy storage, TES, chosen for all scenarios equal to two 200 m³ tanks):

- ***Scenario 1 (storage only)***: installation of thermal energy storage (TES) to decouple heat production from demand, allowing the heat pump to run at a higher load throughout the year and raising HP coverage from 88% to over 99% (system COP from 2.1 to 3.0). CAPEX is 1.25 M€; the RES/WH share stays at 68%; simple payback is 9.6 years. This improves efficiency and reduces cost, but generates no additional revenue and leaves most of the available waste heat unused.
- ***Scenario 2 (storage + single anchor load)***: TES combined with a network extension to one large anchor load (such as Tallaght University Hospital), lifting HP coverage to 98% and the RES/WH share to 69%. CAPEX is 2.1 M€; simple payback is just 2.4 years, and the scenario avoids approximately 3,260 tonnes of CO2 per year. This scenario builds on the efficiency gain of the sole storage, resulting in a solid business case.

- ***Scenario 3 (storage + wider network expansion + additional heat pump)***: TES combined with an additional 3 MW heat pump module, and several new customers, reaching a system COP of 3.15 and a 69% RES/WH share. CAPEX is 7.6 M€; simple payback is 6.3 years, avoiding more than 4,500 tonnes of CO2 per year. This scenario delivers the highest efficiency, the largest volume of decarbonised heat and the lowest cost of heat for customers (54.7 €/MWh, against 57-58 €/MWh in Scenarios 1 and 2), at the price of a higher capital requirement and more complex civil works.

In every scenario, EED compliance is comfortably maintained over the ten-year horizon; the three options differ mainly in scale, revenue, and capital exposure.
Within Scenario 3, four technical variations were simulated, driven by the available heat pump module size (0, 3 or 6 MW of additional capacity) and by which of five candidate customers are connected: Tallaght University Hospital, the TUD Synergy Centre, the Steelworks residential site, the LDA site and The Square Tallaght. Connection costs and revenues were estimated for each candidate individually: the Hospital and the Steelworks site stand out as the most beneficial (payback of 0.5 and 0.8 years respectively), while The Square Tallaght is around seven times less profitable than the Hospital connection, owing to its longer connection distance and lower demand density.

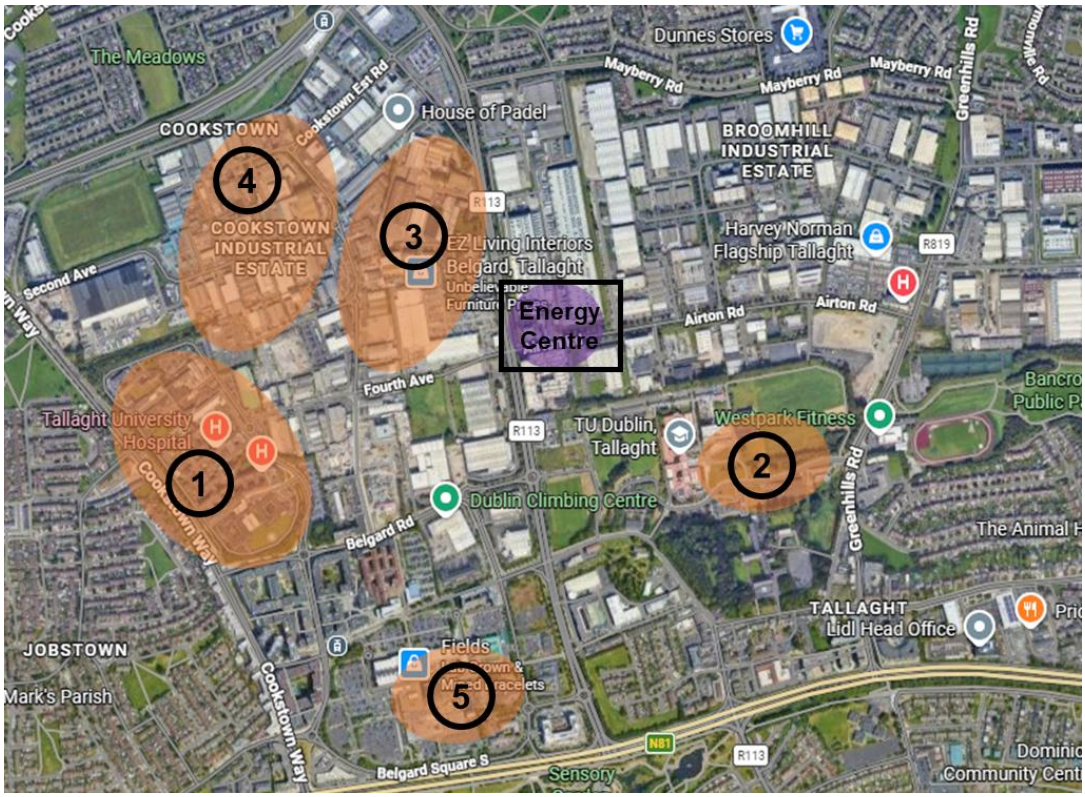


Figure 2 - Candidate new customers assessed for the network expansion under Scenario 3

Scenario 3 is selected as the preferred pathway, because it reduces the marginal cost of heat the most, keeping TDHS competitive with individual low-carbon alternatives such as residential air-source heat pumps, while contributing to the highest decarbonisation contribution.
Variation 4 of scenario 3, with a new 3 MW heat pump module paired with a medium-size TES (two 200 m³ tanks) and connection of the four highest-benefit customers (Hospital, TUD Synergy Centre, Steelworks site, and LDA site) is the best alternative. This pathway secures a high NPV, with the highest return on investment among the Scenario 3 variations (16.0% ROI, 6.3-year payback, both without subsidies), and raises the heat pump's overall COP to 3.15.

3. Investment and Implementation Outlook

3.1. Expected Impact

Scenario 3 (Variation 4), the preferred pathway identified in D3.1, yields the following KPIs, measured against the 2024 as-is baseline:

Project KPI	*Scenario 3*
New generation assets	+3 MW heat pump module + thermal storage (2 × 200 m³)
New customers connected	4 (Tallaght University Hospital, TUD Synergy Centre, Steelworks site, LDA site)
Heat delivered	23.5 GWh/year (up from 4.9 GWh/year in 2024)
RES/WH share	69%
Total CAPEX (without subsidies)	7.6 M€
Equity contribution (with 50% public grant funding)	3.8 M€
CO2 emissions avoided	> 4,540 t/year
Simple payback (without subsidies)	6.3 years
Simple payback (with subsidies)	3.1 years
ROI and IRR (with subsidies)	≈ 32%
NPV at 25 years (with subsidies)	≈ 15.1 M€

From a technical perspective, the additional heat pump module and thermal storage allow the system to cover almost the entire heat load with the heat pump, cutting reliance on the less efficient electric boiler and bringing the heat pump closer to its optimal operating point. From an economic perspective, a blended financing structure, with 50% equity from the DH operator and 50% non-repayable public grants, brings the investment's IRR to around 32% and its discounted payback to approximately 3.4 years. From an environmental perspective, the expansion avoids

more than 4,540 tonnes of CO2 per year and raises the system's RES/WH share from an already-high 68% baseline to 69%, while multiplying the volume of decarbonised heat delivered nearly five-fold.

3.2. Implementation Roadmap

The rollout of the selected configuration is split into three phases over approximately 2.5 years, sequenced so that permitting is cleared before infrastructural works begin:

- ***Phase 1 - Preparation (1 year, 1 M€):*** securing heat delivery contracts with clients, obtaining permits from SDCC, processing road-opening licences, finalising engineering design and selecting contractors.
- ***Phase 2 - Infrastructure (1 year, 6 M€):*** civil works (excavation, trenching and pipeline installation for the network expansion), installation of the thermal storage tanks and their connection to the energy centre, control-system upgrades, and delivery and integration of the new heat pump module.
- ***Phase 3 - Connection (6 months, 0.6 M€):*** individual customer substation construction, pipework connection, telemetry integration, closed-loop pressure testing, commissioning, and full thermal load handover.

Financing draws on a mixed capital structure: 50% equity from the DH operator (3.8 M€) and 50% from public grants (3.8 M€), combining the Dedicated DHC capital grant fund (from the Infrastructure, Climate and Nature Fund, 40% of CAPEX) and the Climate Action Fund (10% of CAPEX). As grant funding carries no repayment obligation, the project is not expected to require project debt.

3.3. Key Risks and Enabling Conditions

The risk assessment for TDHS identifies moderate technical and financial risks and low-to-moderate regulatory risk:

- ***Technical and social risks:*** extending and connecting new assets or consumers to the network carries moderate execution risk. Mitigation includes further efficiency improvements to keep the system competitive with low-carbon alternatives, together with awareness campaigns and regular communication with local communities.
- ***Financial risks:*** the main threat is the availability and certainty of funding schemes, alongside exposure to electricity and fuel price volatility. Mitigation includes diversifying funding sources, maintaining bilateral contact with funding agencies, securing long-term fixed-price supply contracts, and relying on self-produced renewable electricity to decouple operating costs from market prices.

- ***Regulatory risks:*** low-to-moderate risk relates to possible instability in EED or RED targets and subsidy eligibility, and to maintaining competitiveness against individual gas-fired heating. Mitigation includes maintaining an active policy dialogue and frequent contact with policymakers to adapt quickly to regulatory change.

3.4. Stakeholder Engagement & Endorsement

The analysis was supported by keeping close contact with the local Working Group, comprising Codema, Heatworks, IrDEA and Optit. A series of technical sessions helped to resolve assumptions and validate storage-integration configurations, building on bilateral discussions led by Codema, the energy centre manager, to confirm consumer interest and alignment with high-density loads in south Dublin.

The selection of the preferred configuration was steered by existing regulatory milestones: planning permission has already been granted for the two 200 m³ storage tanks, and while the energy centre has formal approval for a heat pump expansion of up to 6 MW, stakeholder consultations favoured phasing the investment with an initial 3 MW module to match the pace of network growth. These configurations were presented at the yearly IrDEA congresses in Dublin, where the full Working Group, including South Dublin County Council, took part.

4. Conclusions and Key Lessons

Thanks to its waste-heat heat pump, TDHS already operates at an estimated 68% renewable/waste-heat share without any further investment, comfortably meeting current EED efficient district heating criteria. The investment plan shows that the most capital-efficient pathway to build on this position is not to add more standalone generation, but to grow the customer base while sizing the capacity accordingly.

Scenario 3, with a 3 MW heat pump addition, medium-size thermal storage, and connection of four high-density anchor loads delivers the best return (16.0% ROI, 6.3-year payback without subsidies) among the variations assessed, nearly five times the heat delivered by the current baseline while maintaining the system's RES/WH share at 69%.

The pathway selected is influenced primarily by the economics of individual customer connections (dense, nearby anchor loads are markedly more profitable than distant ones), by existing permitting milestones for the thermal storage, and by the availability of public grant funding, which brings the investment to an IRR of around 32% with no project debt required.

A general lesson for other DHC systems with access to a free waste-heat source is that once a high renewable/waste-heat share is already secured, the main lever for further decarbonisation and value creation shifts from the generation technology to network and customer growth: the connection economics of individual prospective customers, more than the choice of production asset, become the main factor differentiating investment scenarios.

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