ENABLE DHC

INVESTMENT PLAN

For the District Heating system in Riga

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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[1] 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 Riga District Heating System (DHS) is operated by AS "RĪGAS SILTUMS", owned by the Riga City Council (49%), the Latvian State (48.995%), SIA "Enerģijas risinājumi. RIX" (2%), and AS "Latvenergo" (0.005%), which manages about 700 km of the 830 km city network and produces approximately 1,000 GWh of heat per year from 44 energy sources. This plan focuses on two currently isolated networks on the left bank of the Daugava River: Daugavgrīva, which covers 88% of its demand with biomass boilers, and Bolderāja (Gobas and Keramikas plants), which relies entirely on natural gas. Together, the two zones produce about 96 GWh of heat per year for approximately 410,000 m^2 of heated area, with a combined renewable share of only 41%.

The main challenge lies in the separation of the two networks: during the warmer months the Daugavgrīva biomass boilers have significant unused capacity, while the neighbouring Bolderāja area keeps relying on natural gas, also to cover its summer domestic hot water demand. The most viable RES/WH potential lies in the low-enthalpy residual heat of the treated effluent of the Daugavgrīva wastewater treatment plant (WWTP), whose stable flow (about 5,800 m^3/h on average) and temperature (10–20 °C) offer a thermal potential well above the combined demand of the two zones.

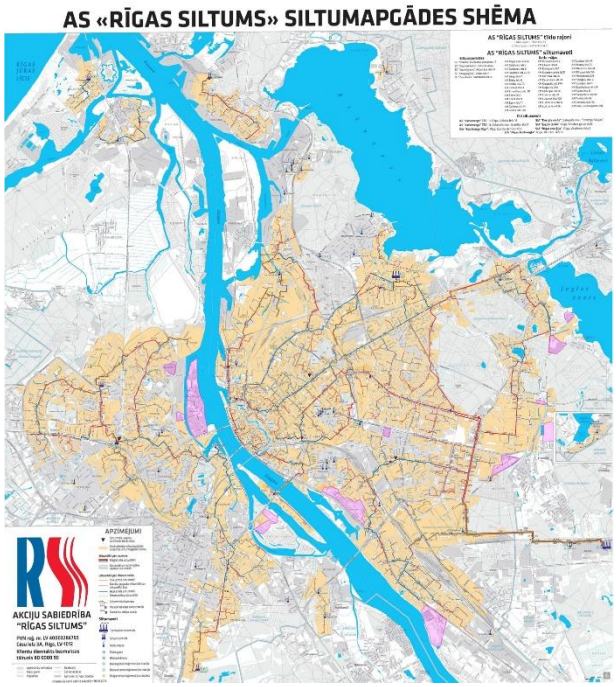


Figure 1 - Riga District Heating scheme (the Daugavgrīva and Bolderāja zones lie on the left bank of the Daugava River)

2. Solutions and Investment Scenarios Assessed

The technical feasibility assessment for decarbonizing the Daugavgrīva and Bolderāja networks focuses on waste heat recovery from the Daugavgrīva WWTP through a 6 MW large-scale heat pump (annual average COP of approximately 3.63) and on the physical interconnection of the two networks, to maximise the use of both the new source and the existing biomass assets. Three scenarios were explored through pipeline routing optimisation, thermo-hydraulic simulation and year-long dispatch modelling.
Scenario 1 (Heat Pump in Daugavgrīva) connects a 6 MW wastewater heat pump to the Daugavgrīva network only, through 2.43 km of new piping that includes the reconstruction of an existing, unused DN200 segment and a booster pump to keep pressure within the 10 bar limit. It raises the renewable share of the Daugavgrīva sub-network from 88% to 99%, but, as the local demand is already efficiently served by biomass, the heat pump cannot gather enough operating hours: with a CAPEX of 9.73 M€ it yields an IRR of 3.5% and a negative NPV (-1.20 M€).

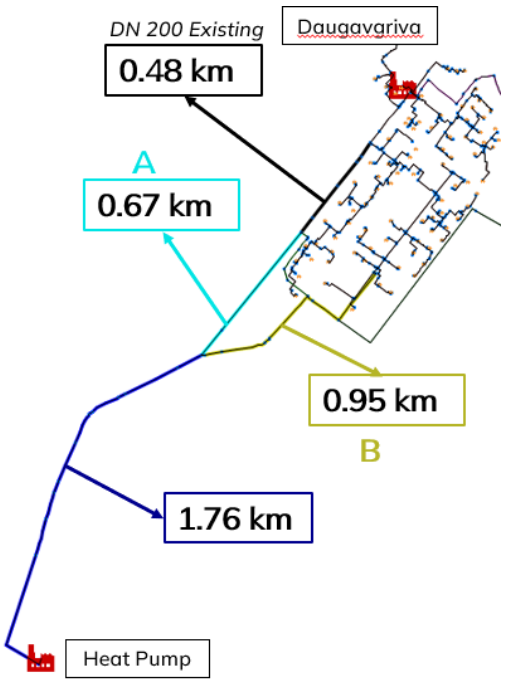


Figure 2 - Scenario 1 overview (routing alternatives between the WWTP and Daugavgrīva)

Scenario 2 (Interconnection) physically connects the Daugavgrīva and Bolderāja networks through approximately 2.5 km of new DN200 piping to the Gobas plant, supported by booster pumps, without adding generation capacity: the spare biomass capacity of Daugavgrīva serves part of the Bolderāja demand. With a CAPEX of 4.83 M€ it is the most profitable option (IRR 21.9%, payback of about 5.4 years) and raises the biomass share from 41% to 58%, but it does not meet the EED targets beyond 2035.

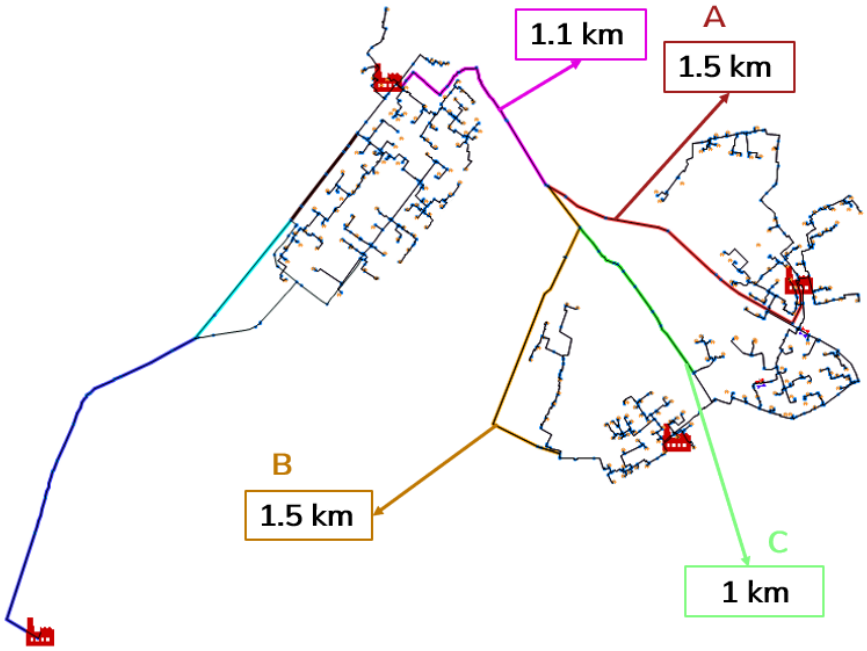


Figure 3 - Scenario 2 overview (routing alternatives between Daugavgrīva and Bolderāja)

Scenario 3 (Heat Pump and Interconnection) combines the 6 MW WWTP heat pump with the existing biomass boilers and the full interconnection of the two networks via Gobas. The heat pump operates for 82% of the annual hours, supplying about 32 GWh/year (33.5% of total demand), lifting the renewable share to 79% and cutting gas-fired production from 59% to 21%. An optimised DN200 network with three booster pumps (15.6 M€ CAPEX, IRR 24.1%) proved more convenient than an upsized DN250 network; a future-proof variant with DN400/DN450 backbones (25.67 M€) was then assessed, as requested by AS "RĪGAS SILTUMS", to accommodate future network expansion.

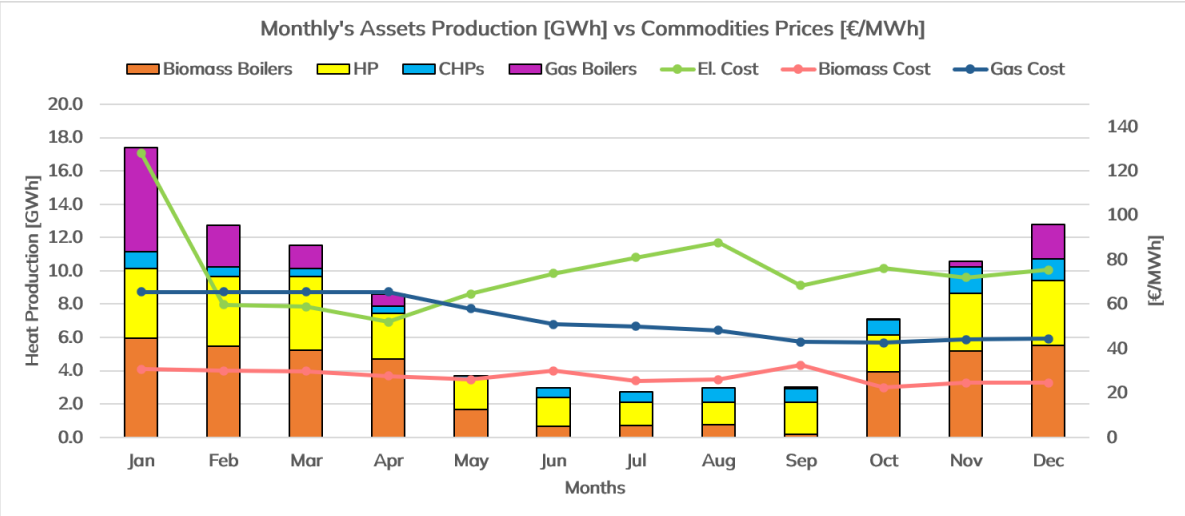


Figure 4 - Scenario 3 overview (monthly asset production vs commodity prices)

Scenario 3 is the only configuration that brings the system beyond the EU Energy Efficiency Directive (EED) Article 26 criteria for efficient district heating in the long term, exceeding the 50% renewable threshold required from 2035 and reaching a renewable share above 75%, in line with the 2045 decarbonisation target (the heat pump output counts as renewable, as it meets the minimum efficiency criterion of Annex VII to the RED).
Scenario 3 in its future-proof configuration (DN400/DN450 backbone) was selected as the reference decarbonization pathway, as it maximises the decarbonisation impact and the NPV while providing spare network capacity for future expansion of the DH system, provided that ALTUM (or equivalent) co-financing of 40% of eligible CAPEX is secured.

3. Investment and Implementation Outlook

3.1. Expected Impact

Scenario 3, selected for project implementation, yields the following KPIs (the optimised DN200 + booster pump design is reported for comparison):

Project KPI	Scenario 3 – future-proof design (DN400/DN450, selected)	Scenario 3 – optimised design (DN200 + booster pumps)
Total length of new pipelines	≈ 5 km	≈ 5 km
New Generation assets	6 MW wastewater heat pump + booster pumping stations	6 MW wastewater heat pump + booster pumping stations
Heat demand served	≈ 96 GWh/yr	≈ 96 GWh/yr
Renewable share	79%	79%
Total CAPEX	25.67 M€	15.6 M€
Net Present Value (NPV) at year 30	14.93 M€	20.78 M€
IRR with ALTUM co-financing (payback)/without co-financing	13.9% (9.3 years)/ 7.0% (22.1)	24.1% (4.9 years)/ 14.5% (8.8)

From a technical perspective, the plan interconnects the Daugavgrīva and Bolderāja networks through approximately 5 km of new backbone piping (2.43 km WWTP–Daugavgrīva and about 2.5 km Daugavgrīva–Bolderāja) and integrates a 6 MW wastewater heat pump at the WWTP. To keep the network pressure below the 10 bar limit, the thermo-hydraulic simulation showed the need for booster pumping stations at the heat pump outlet, at the Daugavgrīva mixing point and at the Gobas supply point (reusing existing infrastructure), a more cost-effective solution than upsizing the pipelines. Compared to the baseline, dispatching dynamics change significantly: the heat pump runs mainly overnight and during low electricity price hours, the biomass boilers increase their utilisation thanks to the interconnection, and gas boilers are confined to peak periods in the coldest months, while the existing CHP units keep following electricity price peaks.
Furthermore, from an economic perspective, the more efficient production mix increases the operative margin by about 2.06 M€/year. Assuming ALTUM co-financing of 40% of eligible CAPEX, the selected configuration reaches an IRR of 13.9%, a 30-year NPV of 14.93 M€ and a payback time of about 9.3 years

(7.0%, 3.81 M€ and 22.1 years without co-financing), above the 5.6% WACC. The sensitivity analysis on CAPEX and commodity prices (±20%) confirms the robustness of the investment, with payback times ranging from 5.6 to 16.6 years with co-financing and from 11.5 to over 30 years without co-financing.
Finally, from an environmental point of view, the heat pump mainly displaces gas-fired peaking production: gas-based heat falls from about 56,820 MWh/year (59.2%) to 20,570 MWh/year (21.4%), a 64% reduction, while the renewable share of the two zones rises from 41% to 79%. This corresponds to estimated savings of up to 50 GWh of primary energy and approximately 10,100 tons of CO2 per year, a benefit that can be further increased by sourcing the heat pump electricity from renewable generation through Power Purchase Agreements (PPAs).

3.2. Implementation Roadmap

The implementation of Scenario 3 future-proof design (DN400/DN450) is structured in five phases across approximately 2.5–3 years:

- **Phase 1 - Co-financing (~1–4 months):** identify co-financing options (ALTUM, the Ministry of Climate and Energy's Renewable Energy Support Programme, other financial institutions) and prepare the application for the available call.
- **Phase 2 - Procurement (~3–4 months):** launch design and construction procurement, potentially split into two or three lots covering the heat pump, the WWTP–Daugavgrīva network and the Daugavgrīva–Bolderāja interconnection.
- **Phase 3 - Design & Permitting (~6–9 months):** complete the detailed hydraulic design of the backbone and booster pump stations, finalise the heat pump technical specification and secure construction, environmental, land-use and electrical grid connection permits.
- **Phase 4 - Construction (~15–18 months):** install the new pre-insulated backbone (DN400 WWTP–Daugavgrīva and DN450 Daugavgrīva–Bolderāja), the electrical infrastructure upgrade at the WWTP, the heat pump and the booster pump stations.
- **Phase 5 - Commissioning & Ramp-Up (~6 months):** conduct hydraulic testing, tie-in operations and heat pump commissioning, with progressive ramp-up to full-load operation under SCADA monitoring to verify compliance with Energy Efficiency Directive (EED) targets.
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3.3. Key Risks and Enabling Conditions

The risk assessment, based on the PESTEL framework of the ENABLE DHC risk matrix, identifies four critical risk factors alongside specific mitigation measures required for successful implementation:

- **Market Risks:** competing renewable heat solutions in the same areas (e.g. a new biomass boiler house in Bolderāja or sand thermal storage charged with grid electricity) could displace the gas-fired heat targeted by the project, reducing its economic viability (highest risk score, 16). Mitigation includes coordinated planning of technology connectivity and the possible expansion of the heating zones served.
- **Governance & Regulatory Risks:** the shared ownership of AS “RĪGAS SILTUMS” and the separate municipal management of the WWTP may generate conflicts of interest among stakeholders (risk score 12), while the unavailability of ALTUM or other funding schemes is a further barrier (risk score

8). Mitigation relies on direct negotiation and joint coordination mechanisms among the parties and on pursuing additional co-financing sources.

- **Economic Risks:** higher electricity or fuel prices (risk score 12) and higher investment or maintenance costs may erode the operative margin. Mitigation includes long-term Power Purchase Agreements (PPAs) to limit exposure to electricity price volatility and standard cost monitoring, supported by a sensitivity analysis showing positive returns even in the worst-case combination when co-financing is secured.
- **Technical Risks:** heat pump performance and COP uncertainty (risk score 6), as well as the pressure levels induced by the interconnection, require attention. Mitigation includes booster pumping stations to keep pressure below 10 bar and, in the detailed design phase, the assessment of the impact of higher pressure on the service life of the existing networks and of the new pipelines on heat losses.

While not a risk per se, futureproofing the network for future expansion is a key enabling condition, addressed through the oversized backbone. During commissioning and operation, continuous operational and financial tracking is recommended to guarantee compliance with EU Energy Efficiency Directive decarbonization targets and alignment with the outlined economic performance.

3.4. Stakeholder Engagement & Endorsement

Stakeholder engagement for the investment plan is structured across all project phases to ensure alignment between municipal objectives, utility operations, and national regulatory requirements. Core coordination involves AS "RĪGAS SILTUMS" as the network operator, the Riga City Municipality as WWTP owner and majority shareholder, the Riga Energy Agency (REA), AS Sadales tīkls as the electricity distribution system operator, the State Environmental Service (VVD) and the Public Utilities Commission (SPRK).

Given the shared ownership of the utility and the separate management of the WWTP, a joint governance mechanism, such as a steering committee meeting at each project milestone, is recommended to resolve cross-institutional issues such as property rights and access agreements, and to keep all parties aligned on scope, cost and schedule. Furthermore, engagement includes advance communication with residents and businesses along the interconnection route regarding road works and traffic management, a dedicated point of contact for queries or complaints, and pre-commissioning notices to Bolderāja end-users about the higher renewable share and service tie-ins.

4. Conclusions and Key Lessons

The comprehensive technical, financial, environmental, and strategic assessment conducted for the Riga District Heating System (DHS) demonstrates that interconnecting the currently isolated Daugavgrīva and Bolderāja networks around a large-scale heat pump recovering residual heat from the Daugavgrīva wastewater treatment plant (WWTP) provides a highly effective and feasible pathway toward decarbonization. The interconnection is the key enabler: on its own, the heat pump would not gather enough operating hours in the biomass-supplied Daugavgrīva network, whereas serving the combined

demand of both areas it runs for more than 7,200 hours per year and unlocks the spare capacity of the existing biomass boilers.

The selected Scenario 3 3 future-proof design (DN400/DN450) enables the heat pump to cover about one third of the annual heat demand, raising the renewable share from 41% to 79% and cutting gas-fired production by 64%, fully aligning the system with the targets set by the EU Energy Efficiency Directive (EED) beyond 2035 and with the Riga SECAP.

Financial indicators remain positive across the sensitivity range when the 40% ALTUM co-financing is secured (IRR of 13.9% for the future-proof design): the oversizing of the backbone is a deliberate trade-off between short-term returns and long-term flexibility for future network expansion.

For other European municipalities and district heating operators facing similar challenges, the Riga experience serves as a clear, replicable model of how combining municipal waste heat recovery with the interconnection of neighbouring networks maximises the value of both new and existing renewable assets.

Since an investment plan cannot cover all aspects of implementing district heating projects, the following should be studied in depth before the detailed technical design is developed: changes in market conditions (new potential heat producers, future consumption, energy prices); the minimum summer load of both zones, using 3-year averages; the hydraulic regime based on the actual situation, including the permissible operating pressure and technical condition of existing DH networks and the operation of the interconnected network under different modes; cost items that can only be estimated in detail after detailed network design, such as replacement of existing equipment and new pumping stations, water treatment, and SCADA; and operational risks, including DH system safety during power outages, pump failures and automation faults.

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GET IN TOUCH WITH US!

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