WOW WAGENINGEN

1.0 Overall project description

21. april 2026

NORTH JUTLAND
Jyllandsgade 1
9520 Skørping

CENTRAL JUTLAND
Jægergårdsgade 97, 1
8000 Aarhus C

ZEALAND
Nørregade 13, 1.
1165 Copenhagen K

+45 9682 0400
CVR no.: 7403 8212
www.planenergi.dk
planenergi@planenergi.dk

Report title:	WOW Wageningen
Subject:	1.0 Overall project description
Short Description:	Project description for WOW Wageningen.
Release date:	21. april 2026
Project No.:	25-045
Prepared by:	THN
Quality assured by:	NV
Approved by:	THN
Document No. and Title:	1 Overall project description

Prepared for:

Coöperatie WOW

Warmtebedrijf Oost-Wageningen B.V.
Attn. Mw Ada van Oorschot
's-Heerenbergseweg 6
7038CC Zeddam
The Netherlands
VAT-no.: 862763812B01

Table of Contents

1 General information

This document provides an overall description of the Wageningen district heating project and outlines how the construction works are structured into contracts, including their respective scopes, demarcations, and responsibilities.

The project concerns the design, supply, installation, and commissioning of a district heating production facility in Wageningen, the Netherlands. The plant is designed to supply approximately 461 residential and commercial consumers, with a combined peak heat demand of 2.6 MW.

This document defines the key project requirements, boundary conditions, and procurement framework for the heating plant. It serves as a guiding document for tenderers, providing the necessary context to develop a complete and optimised technical solution within the defined constraints.

The contracting authority for the project is WOW Wageningen, who will assume full ownership and operation of the district heating plant upon completion and handover.

Detailed technical specifications, performance requirements, and contractual conditions are provided in the Special Requirement Specifications and associated tender documents. Parts of this material will be made available in Phase 2 of the tender procedure.

1.1 Executive Summary

WOW Wageningen is tendering the design, supply, installation, and commissioning of a district heating production plant to serve approximately 461 residential and commercial consumers in Wageningen, the Netherlands. The project represents a significant step towards sustainable energy infrastructure, combining advanced heat pump technology with backup natural gas systems to ensure reliable and efficient heat supply.

A key characteristic of the project is the integration of the heating plant within an existing building structure (22.5 × 8.5 metres, maximum height 4.4 metres). External modifications to the building are not permitted due to strict regulatory constraints. In addition, the site is located near protected natural areas and residential properties, resulting in stringent requirements on environmental performance, particularly with regard to noise and nitrogen emissions.

These boundary conditions require a compact, well-integrated, and acoustically optimised design. Tenderers are therefore encouraged to optimise system configuration, capacity, and layout within the defined spatial and regulatory constraints.

The scope of the tender includes the complete delivery of the heating plant, including but not limited to:

- A minimum 800 kW air-to-water heat pump system. Higher capacity solutions are permitted and encouraged where feasible within noise, space, and permit limitations.
- An approximately 2.6 MW low-NO_x natural gas boiler.

- A buffer tank with a minimum volume of 26 m^3. Larger volumes may be proposed where spatial constraints allow.
- Cooling yard equipment within a designated area of approximately 106 m^2.
- All associated mechanical, electrical, and control systems.

All proposed solutions shall be designed to minimise noise emissions, CO_2 emissions, and nitrogen oxide (NO_x) emissions, and must comply with all applicable permit conditions, Dutch regulations, and the acoustic requirements defined in this tender.

The successful contractor will be responsible for delivering a fully integrated and operational system that meets all technical, environmental, and regulatory requirements, with particular emphasis on acoustic performance, system efficiency, and long-term adaptability.

1.2 Project Timeline and Milestones

The project is expected to follow the timeline outlined below. The Contractor shall plan and execute the works in accordance with these milestones, while ensuring coordination with the Client and relevant authorities.

Contract Award (Q3 2026)
Contract execution, mobilisation, and initial coordination between the Contractor, Client, and relevant regulatory authorities.

Permits & Approvals (2026–2027)
Preparation and submission of all required documentation for building permits, environmental approvals, and utility connections. This phase runs in parallel with the detailed design.

Detailed Design (2027)
Development of complete design documentation, including final equipment selection and technical specifications. All designs shall be completed and approved prior to the start of major procurement activities.

Construction & Installation (2028–2029)
Site preparation, delivery of equipment, and execution of all mechanical, electrical, and control installations, including full system integration. This phase represents the most resource-intensive part of the project.

A phased commissioning approach may be applied. In such case, the heat pump system may be commissioned prior to the gas boiler, depending on installation progress and regulatory conditions. The Contractor shall ensure that both phased and full commissioning scenarios are fully functional, compliant, and properly integrated.

Commissioning & Handover (Late 2029 / Early 2030)
System testing, performance verification, operator training, and delivery of all required documentation, culminating in formal handover to the Client.

Service & Maintenance Period (2030–2035, with optional extension to 2040)
Following handover, the Contractor shall provide a service and maintenance agreement covering a period of five (5) years. The scope includes scheduled inspections, preventive maintenance, component servicing, warranty-related corrective actions, and system performance monitoring as defined in the contract.

Daily operation of the system remains the responsibility of the Client.

The Client retains the option to extend the service and maintenance agreement for an additional period of up to five (5) years under the same contractual framework.

1.3 Project Context and Strategic Importance

This project forms part of the broader national and European transition towards sustainable and efficient district heating systems. The Wageningen heating plant is intended to serve as a model for local energy infrastructure, demonstrating how collective heating solutions can be realised within a constrained urban environment.

The project is initiated by Coöperatie Warmtenet Oost-Wageningen (WOW U.A.), a resident-driven cooperative founded with the ambition to realise a local and sustainable heating solution for the Benedenbuurt. In close collaboration with the Municipality of Wageningen, this initiative has been further developed into Warmtebedrijf Oost-Wageningen B.V., which will act as the owner and operator of the heating system. In parallel to the realisation of the heating plant, the cooperative is actively contributing to knowledge sharing and capacity building within both national and international energy transition initiatives.

A key strength of the project is that a 2 MVA electrical connection has already been secured through agreements with the local DSO (Liander). This represents a significant advantage compared to many similar projects in the Netherlands, where grid capacity limitations often delay or restrict development. The available connection enables immediate deployment of a substantial heat pump system and creates strong potential for further electrification of the system over time.

The project is therefore not only focused on delivering a reliable heating solution, but also on establishing a flexible and future-oriented energy system. The design shall enable smart utilisation of the available electrical capacity, both under current operating conditions and in future scenarios, including participation in flexibility mechanisms, optimisation against dynamic electricity pricing, and integration of additional electrical assets.

In parallel, the availability of natural gas infrastructure ensures operational reliability during peak demand and transitional phases. The combination of secured electrical capacity, hybrid system design, and future expansion potential positions the project as both a robust initial solution and a scalable platform for long-term development within the broader context of the city of Wageningen.

1.4 Sustainability and Efficiency Objectives

Energy Efficiency Targets

The heating plant shall be designed to achieve high energy efficiency across all operating conditions. The heat pump system, as the primary heat source, shall achieve Seasonal Coefficient of Performance (SCOP) values in line with current best practice for air-to-water heat pumps in district heating applications.

System-level efficiency shall be optimised through:

- intelligent control strategies that minimise auxiliary electricity consumption
- variable-speed pumping adapted to real-time demand
- effective utilisation of thermal storage to enable operation during favourable conditions
- minimisation of distribution and standing losses through proper insulation and system design

In addition to operational efficiency, the system shall be designed for long-term flexibility and adaptability. Given the availability of significant electrical capacity, the Contractor shall propose a system architecture that enables smart and future-oriented use of this connection. This includes the potential integration of:

- Electric boilers
- Additional heat pump capacity
- in the future: possibility to participation in electricity market and flexibility services (e.g. congestion management, demand response, or ancillary services)

The control and SCADA system shall support this by providing a transparent and flexible platform with full insight into system performance. This includes access to live and historical data from key components such as heat exchangers, storage systems, and production units. The system shall enable data-driven optimisation, including load shifting, temperature optimisation, and future system expansion without major redesign.

Evaluation Framework (VP01)

To support transparent and comparable evaluation of tender proposals, the Contractor shall complete the "*VP01 spreadsheet" in Phase 2*. This includes all relevant technical specifications, investment costs, and annual service and maintenance costs of the heat pump.

The VP01 tool will calculate overall project value and performance indicators, forming part of the formal evaluation. Contractors are encouraged to optimise their proposed solution within this framework.

Carbon & Nitrogen Emissions Reduction

The system design shall prioritise heat pump operation over gas boiler use in order to minimise carbon emissions. Compared to conventional gas-fired district heating systems, this configuration reduces CO_2 emissions and lowers nitrogen oxide (NO_x) emissions.

1.5 Organization

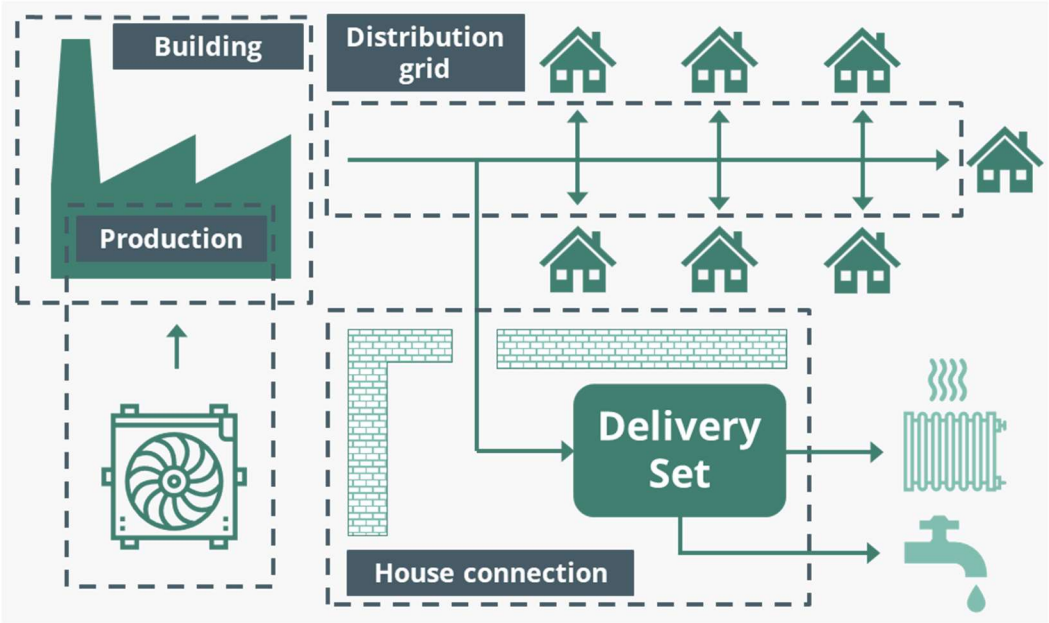
Warmtebedrijf Oost-Wageningen B.V is the developer and contracting entity for the Wageningen District Heating Project.

Warmtebedrijf Oost-Wageningen B.V is responsible for fulfilling all contractual obligations towards the contractors under the respective agreements.

Client	Technical Advisor
Warmtebedrijf Oost-Wageningen B.V. 's-Heerenbergseweg 6 7038CC Zeddam The Netherlands KVK-no.: 83193960 Contact Person Ada van Oorschot	**PlanEnergi** Jyllandsgade 1 9520 Skørping Denmark CVR-no.: 7403 8212 Project Manager Niels van der Veer E-mail: nv@planenergi.dk Tel.: (DK) +45 91 10 58 34 | (NL) +31 6 25 35 99 57

1.6 Lots

The district heating system is divided into several contractual lots, which together form the complete system from heat production to end-user delivery. An overview of the system and the division into lots is illustrated in the figure below.



This tender concerns the delivery of the heating central (Lot A). Other parts of the system are executed under separate contracts, as described in Section 1.6.1.

Lot A: Heating Central (included in this tender)
The Contractor shall deliver the complete heating central, including design, supply, installation, and commissioning of all systems within the heating central building.

The scope includes, but is not limited to:

- Approximately 800 kW air-to-water heat pump installation
- Approximately 2.6 MW natural gas boiler
- Internal hydraulic systems, including pumps, piping, and buffer integration
- Water treatment system
- Complete SCADA and control system
- All associated mechanical and electrical installations within the heating central

The Contractor for Lot A is responsible for full integration of all systems within the heating central and for ensuring proper interfacing with external systems as defined in the project demarcations.

1.6.1 Parallel Works (Not included in this tender)

The following works are executed under separate contracts and are not part of the scope of Lot A. These works are essential to the overall system and require coordination at defined interface points.

Lot D: Heat Grid Distribution Network
Construction of the pre-insulated primary distribution network throughout the neighbourhood, including installation, pressure testing, and commissioning.

This lot is under the responsibility of WOW Wageningen B.V. and is executed as part of a combined civil works contract together with local sewer replacement.

The combined sewage replacement and district heating works are already contracted, and work is planned to start no later than September 2028.

Lot H: Heating Central Building
Renovation and preparation of the existing building that will house the heating central, including all required structural and architectural works.

Lots E, F, G: Consumer Connections and Heat Interface Units
Realisation of individual consumer connections and installation of in-home heat interface units, including metering and heat delivery to approximately 460 consumers.

2 Project Demarcations

This heating plant project interfaces with several external systems and third-party contracts that require clear responsibility allocation and structured coordination to ensure successful integration into the wider district heating system. The primary interfaces include the district heating distribution network, electrical supply infrastructure, natural gas service, water supply and drainage systems, and communication networks required for SCADA and remote monitoring.

2.1 Overall Coordination Responsibility

The **Contractor for the Heating Plant (Lot A)** has the **overall coordination responsibility** and shall lead and manage all **physical and functional interface points** throughout the design, construction, testing, commissioning, and handover phases. Lot A ensures compatible system designs, correct technical interfaces, aligned installation schedules, and full functional integration of all equipment and control systems inside the new heating central building. Lot A is responsible for integrating all subsystem data as distribution network temperature and pressure inputs, into the central SCADA/SRO platform.

Lot A shall coordinate all interfaces with third parties responsible for:

- District heating distribution connections
- Electrical grid supply and metering
- Natural gas connection to the gas boiler
- Potable water, process water, and drainage systems
- Building renovations/construction lot H

Lot A shall ensure:

- Fully compatible designs at all interface boundaries
- Aligned installation and commissioning schedules across all parties
- Full functional integration of the heat pump, gas boiler, auxiliary systems, and controls inside the heating plant building

Lot A shall act as the Interface Lead and is responsible for identifying, coordinating, documenting, and resolving all interface-related issues.

Appendix 2.1 contains the detailed project demarcation

3 Scope of Works

Contractor Responsibilities

This tender encompasses all works necessary to deliver a fully operational district heating plant, from detailed design through commissioning and performance verification. The contractor's scope includes but is not limited to the following elements:

- Complete detailed design of all mechanical, electrical, and control systems within the constraints of the existing building structure.
- Procurement and delivery of all equipment, materials, and components specified in the design.
- Installation of heat pump system including refrigerant pipework, electrical connections, and control integration.
- Construction and commissioning of the complete cooling yard including evaporator units, fans, structural supports, and acoustic treatments, foundation and drainage.
- Installation of gas boiler system including fuel supply connections, flue systems, and safety interlocks.
- Installation of buffer tank including supports, insulation, pipework connections, and instrumentation.
- Installation of all hydraulic systems including primary circuits, distribution pumps, expansion systems, and pressure relief devices.
- Installation of complete electrical systems including main switchgear, distribution panels, motor circuits, control power supplies, and emergency generation.
- Installation and programming of integrated SCADA control system with operator interfaces and remote access capabilities.
- Installation of water treatment systems including filtration, chemical dosing, and monitoring equipment.
- System commissioning including performance testing, control verification, and operator training.
- Preparation of all required documentation for regulatory approval and ongoing operations.

4 Key Technical Parameters

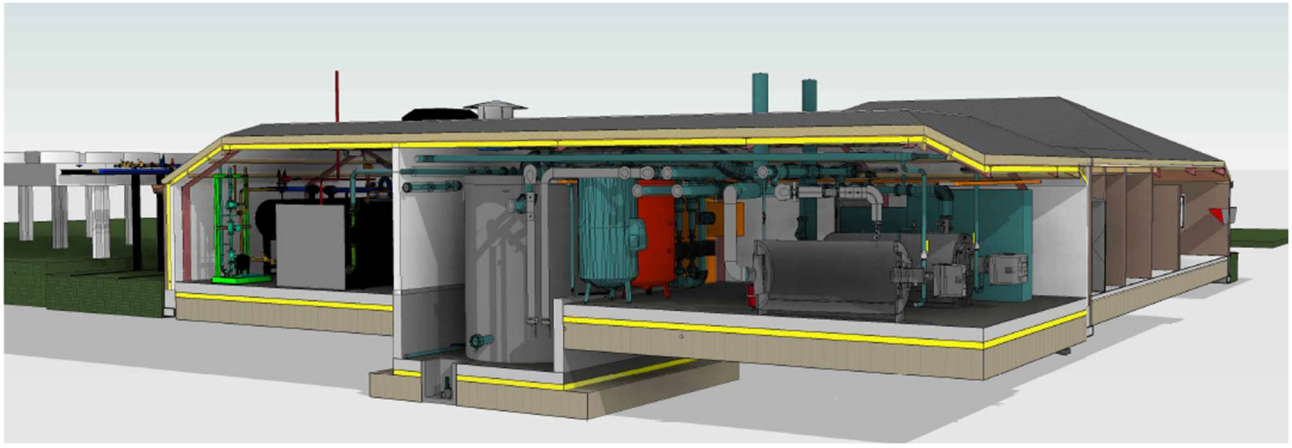
Peak Load Capacity	Heat Pump System	Backup Capacity	Buffer Storage
- Approximately 2.6 MW total demand - Distributed across 461 consumers	- Minimum 800 kW thermal output - Air-to-water technology with dedicated cooling yard	- Natural gas boiler with low-NOx technology - Peak and reserve load coverage	- Minimum 26 m^3 - Larger tank possible if building constraints allow for it

The technical requirements defined in this section are intended to ensure reliable heat supply under all operating conditions, with particular emphasis on peak winter demand.

The proposed system shall be based on a combination of heat pump technology for base load operation and a gas boiler for peak load and backup. This hybrid configuration provides operational flexibility while maximising energy efficiency and minimising carbon emissions.

4.1 Building and Site Specifications

The heating plant must be integrated into an existing building structure with the following dimensions: 22.5 meters in length, 8.5 meters in width, 3.4 meters above ground level, and 1.4 meters below ground level, resulting in a maximum building height of 4.4 meters. The building features a sloping roof configuration that must be preserved in compliance with local building regulations.



Previous technical design by Dutch engineering firm, for inspirational purposes

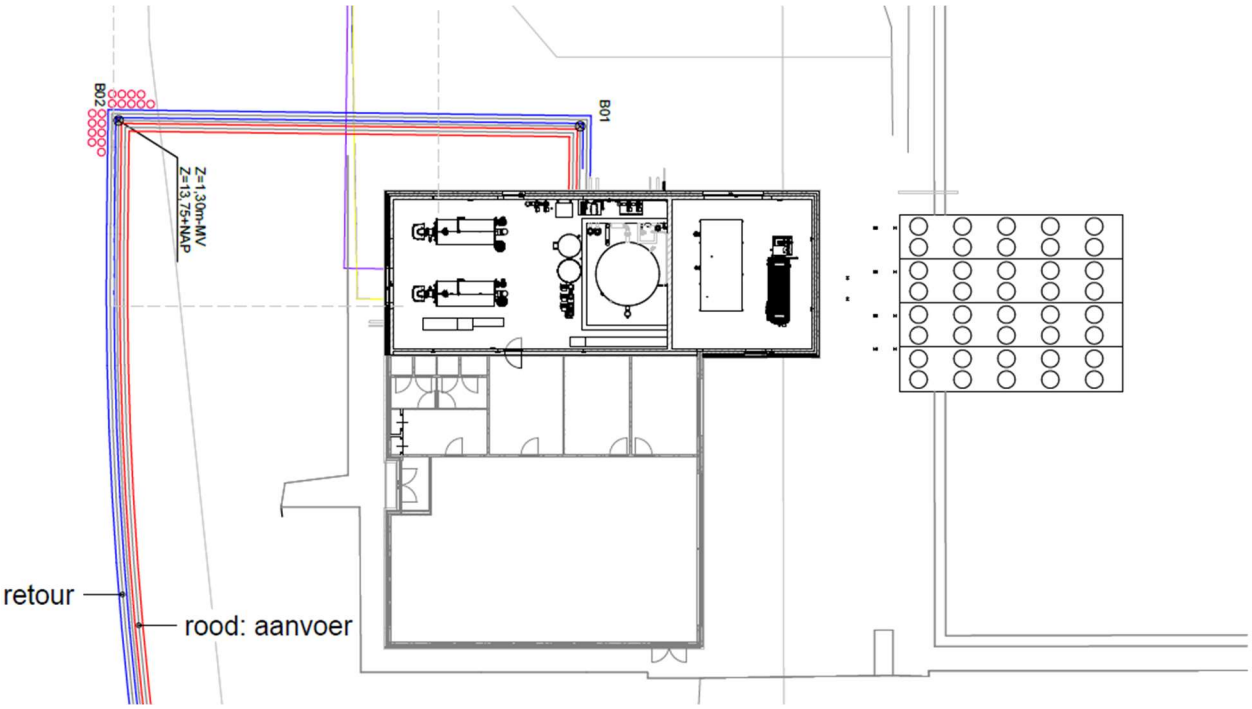
The roof will be replaced as one of the first construction steps, enabling installation of large components via crane access. As part of this replacement, the Contractor under Lot A shall also assess and propose future-proof access solutions (such as removable roof sections, equipment hatches, or double-door configurations) to facilitate the eventual replacement or upgrading of major components over the building's lifetime.

The structural integrity of the building will be evaluated to verify that it can support the new heating plant equipment and roof structure. Special attention shall be given to the foundation conditions associated with the 1.4-metre below-ground level. In addition, the design must incorporate appropriate noise and vibration mitigation measures to ensure compliance with environmental regulations and minimise disturbance to the surrounding area. The Contractor under Lot A shall supply all necessary technical inputs to these building modifications.

The interface between the existing building and the new heating plant will be carefully engineered to ensure seamless functional and aesthetic integration. Access points for maintenance and repair must be strategically placed, considering the building dimensions and layout, and ensuring safe and practical access to all key plant components.

Given the limited available space, the Contractor shall develop an optimised equipment layout that:

- Respects all spatial constraints and vertical clearances
- Enables safe and practical installation and maintenance
- Ensures proper airflow, ventilation, and thermal management



Previous layout design by Dutch engineering firm, for inspirational purposes

All major equipment, including the heat pump units, gas boiler, buffer tank, control systems, and ventilation systems, shall be fully accommodated within the existing building envelope. External extensions or modifications to the building are not permitted.

Particular attention shall be given to the design and placement of ventilation systems, including the emergency ventilation fan, with respect to noise emissions, airflow performance, space constraints, and maintenance accessibility. The Contractor shall ensure that the overall ventilation concept is properly balanced and integrated into the building design.

4.2 Heat Pump System Requirements

The heat pump system shall provide a minimum thermal output of 800 kW under design conditions. The system must utilise air-to-water heat pump technology, extracting thermal energy from ambient air via the dedicated cooling yard and delivering heat to the district heating circuit at the specified supply temperature.

The heat pump installation can incorporate multiple compressor stages or units to provide operational flexibility, allowing for capacity modulation in response to varying heat demand. Part-load efficiency shall be optimised through intelligent control strategies and equipment sequencing.

All refrigerant systems must comply with EU F-gas regulations and Dutch workplace safety requirements. The contractor shall specify refrigerant type, charge quantities, leak detection systems, and containment measures in accordance with current environmental standards. Only Natural refrigerants will be accepted.

4.3 Cooling Yard Specifications

The outdoor cooling yard, which functions as the heat source for the air-to-water heat pump system, must be designed to accommodate all heat rejection equipment within a maximum footprint of 106 m^2 (approximately 10 meters by 10 meters). This area must contain the evaporator units, fans, structural support systems, and all associated controls, while ensuring sufficient airflow and safe, unobstructed service access.

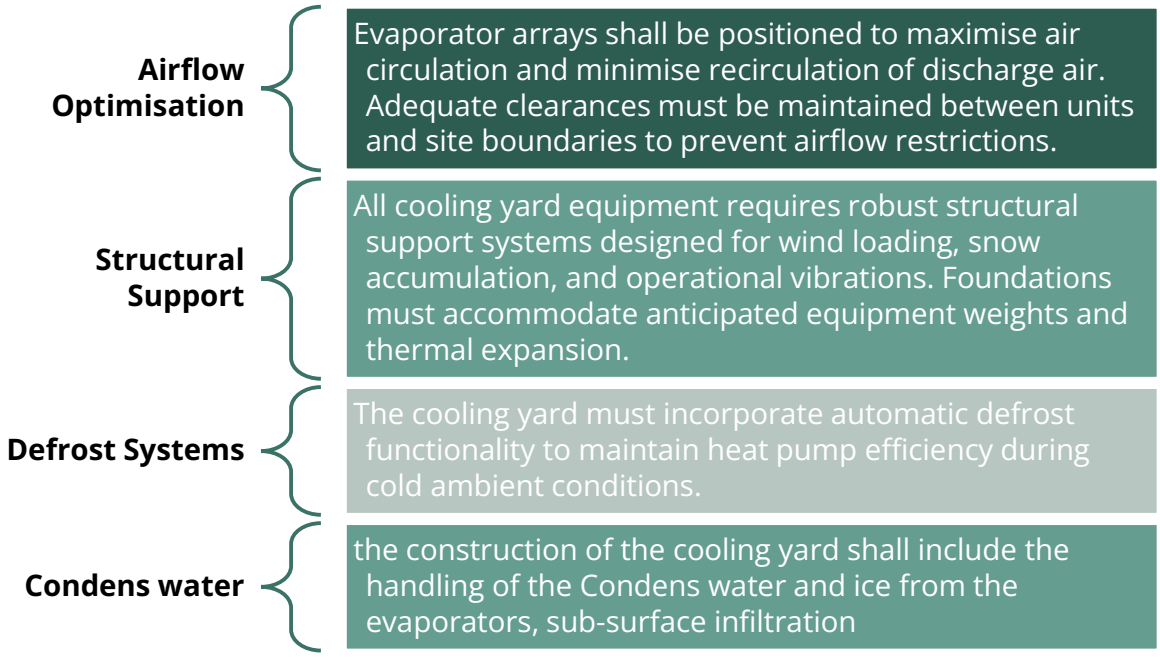
The cooling yard design shall integrate seamlessly with the existing site layout and comply with strict acoustic requirements. Equipment placement, airflow pathways, and enclosure design must collectively support efficient heat pump performance and minimise noise emissions to the surrounding environment.

In addition, specific attention should be given to the placement, vibration control, acoustic shielding, and service accessibility of the coolant expansion valve, as this component is critical for stable refrigerant operation and may contribute to noise generation if not properly integrated into the cooling yard layout.

In addition, the cooling yard is expected to be designed with sub-surface infiltration beneath the cooling yard area, allowing rainwater and condensate management to be fully integrated into the structural layout of the installation.

To ensure reliable winter performance, the cooling yard must be engineered to provide optimized defrost capability, enabling the system to maintain stable operation even during prolonged periods of low ambient temperatures. Defrosting shall be performed in sections, ensuring that part of the evaporator capacity remains available at all times, thereby preventing operational interruptions and ensuring stable heat pump output during defrosting cycles.

.



4.4 Gas Boiler Specifications

A natural gas-fired boiler shall provide backup heating capacity during heat pump maintenance periods, extreme cold weather events when heat pump capacity is insufficient, and system peak demand periods. The boiler must be equipped with low-NOx burner technology to minimise nitrogen oxide emissions in compliance with Dutch air quality standards with a maximum of 40 mg/nm3.

The gas boiler system shall be capable of rapid response to load demands, with automatic controls enabling seamless integration with the heat pump system. When both systems operate simultaneously, the control system must optimise load distribution to maximise overall efficiency while maintaining supply temperature and system pressure within specified parameters.

Safety and Control Systems

The gas boiler installation must incorporate comprehensive safety interlocks, including flame supervision systems, pressure relief devices, combustion air proving switches, and emergency shutdown controls. All safety systems shall comply with EN standards for commercial gas-fired appliances.

4.5 Buffer Tank Requirements

A buffer tank with a minimum useful volume of 26 m^3 must be installed within the building structure. The buffer tank serves multiple critical functions: decoupling heat generation from distribution demand, enabling heat pump cycling optimisation, providing thermal inertia during system transients, and allowing for load shifting opportunities.

If building spatial constraints permit, a larger buffer tank capacity is acceptable and may provide operational advantages through extended thermal storage duration and improved system efficiency. The contractor shall evaluate maximum achievable tank capacity within the building envelope, considering

equipment access requirements, clearances for insulation, and compliance with pressure vessel regulations.

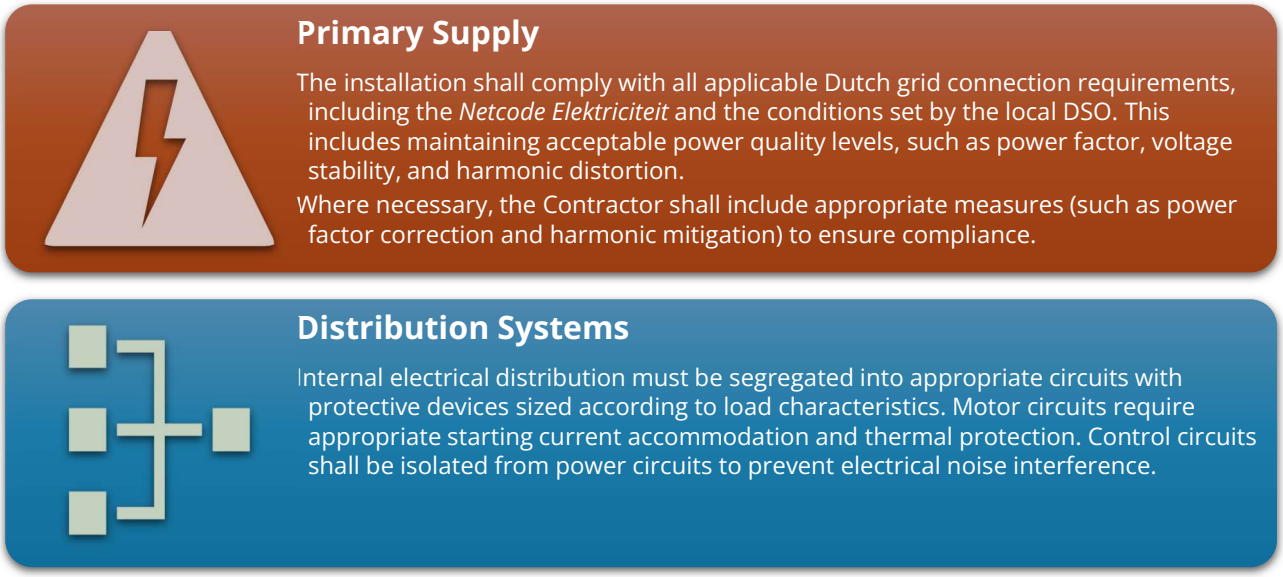
Installation Considerations

The buffer tank must be positioned to accommodate refrigerant pipework connections, district heating circuit connections, temperature sensors, and associated valves and instrumentation. Adequate space must be maintained around the tank for inspection, maintenance, and potential future replacement activities.

4.6 Electrical Infrastructure

Electrical supply arrangements have been established with the local electricity distribution company, securing approximately 1.5 MW of contracted electrical capacity (AC5 connection) for the heating plant.

As outlined in Section 1.3, this capacity exceeds the immediate demand of the initial system configuration. It ensures that sufficient electrical capacity is available for operation of the heat pump and all auxiliary systems under all operating conditions.



In addition, the available electrical capacity represents a key strategic asset for the project. The system design shall therefore enable efficient utilisation of this capacity, both under current operating conditions and in future scenarios. This includes facilitating:

- Potential expansion of heat pump capacity
- Integration of electric boilers or other electrical assets
- Participation in flexibility mechanisms or grid services, where relevant

The Contractor shall ensure that the electrical design, distribution system, and control architecture support this flexibility without requiring major future modifications.

4.7 Control and Monitoring Systems

A comprehensive supervisory control and data acquisition (SCADA) system shall provide centralised monitoring and control of all heating plant equipment and distribution network parameters. The SCADA system must integrate heat pump controls, gas boiler sequencing, buffer tank management, distribution pumping, and alarm management into a unified operator interface.

The control system architecture shall enable autonomous operation of major equipment subsystems while also providing high-level optimisation and coordination. Heat pump operation must respond to supply-temperature requirements, electrical load-management signals, and system demand patterns. Gas boiler operation must activate automatically when heat pump capacity is insufficient or during maintenance periods.

In addition to core SCADA functionality, the system shall be designed to interface with advanced optimisation and digital-twin platforms such as Gradyent, Tighten (Danfoss), Priva, Idrica, or equivalent solutions. These platforms typically enhance operational insight by enabling hydraulic modelling, predictive optimisation, and dynamic network analysis. The Contractor shall therefore ensure that the SCADA architecture supports secure data exchange, open communication protocols, and compatibility with third-party analytics platforms, allowing the client to adopt such tools either immediately or at a later stage.

To ensure transparency and support continuous operational improvement, the SCADA system must provide insight into its internal logic, including clear visibility of control sequences, operating modes, parameter dependencies, and calculation pathways. Furthermore, the system shall include full change tracking, enabling operators to review historical adjustments, analyse their impacts, and make data-driven decisions regarding network optimisation, temperature reduction strategies, utilisation of electric boilers, or future system expansion.

Remote access functionality shall allow off-site monitoring and control, enabling operators to respond to alarms, adjust set points, and review performance data without requiring physical presence at the facility. All control communications must be secured against unauthorised access through appropriate cybersecurity measures.

4.8 Hydraulic System Design

4.8.1 Primary Circuit Configuration

The hydraulic design must integrate heat pump output, gas boiler output, and buffer tank connections into a coherent primary circuit that enables flexible operation of all heat sources. Pipework sizing shall be based on design flow rates that accommodate maximum heat output from all sources operating simultaneously.

Primary circuit pumps must provide sufficient head to overcome heat exchanger pressure drops, pipe friction losses, and valve pressure drops whilst maintaining design flow rates. Variable speed pump control shall optimise energy consumption by modulating pump speed in response to system differential pressure.

4.8.2 Secondary Distribution

The secondary circuit supplies heat to the district heating network, with distribution pumps sized to maintain adequate pressure at the most remote consumers. Differential pressure control ensures consistent supply whilst minimising pumping energy. Pressure relief and expansion systems protect against over-pressurisation during thermal expansion events.

4.9 Water Treatment and Quality

District heating system water chemistry must be maintained within specified parameters to prevent

The water quality of the district heating system shall be maintained within defined parameters to prevent corrosion, scaling, and biological growth in both primary and secondary circuits.

The Contractor shall provide a complete water treatment system for conditioning of make-up water and maintaining appropriate chemical conditions throughout the system. The installation shall include, as a minimum:

- Filtration systems for removal of suspended solids
- Chemical dosing systems for corrosion inhibition and pH control
- Degassing and air removal, where required
- Instrumentation for monitoring of water quality parameters

Automatic dosing and control shall be implemented to ensure stable and consistent water chemistry without the need for manual intervention.

Continuous monitoring shall be provided for key parameters, including conductivity, pH, oxygen concentration, inhibitor levels, turbidity, and temperature. The monitoring system shall be fully integrated with the SCADA/SRO platform, enabling real-time visualisation, alarm handling, and long-term performance tracking.

All equipment and system design shall comply with applicable Dutch standards and regulations for water treatment in district heating systems.

Initial Fill and Commissioning	Ongoing Monitoring	Make-up Water Management
During commissioning, the system must be thoroughly flushed to remove installation debris, then filled with treated water meeting specified quality standards. Initial chemical treatment shall establish protective films on metal surfaces.	Regular water sampling and analysis shall verify continued compliance with water quality standards. Monitoring parameters include pH, dissolved oxygen, iron content, and inhibitor concentration. Corrective actions must be taken if parameters drift outside acceptable ranges.	System make-up water requirements should be minimal in a properly designed and maintained installation. However, provision must be made for automatic make-up to compensate for minor losses. Make-up water must receive appropriate treatment before introduction to the system.

4.10 Detailed Engineering & Design

The Contractor shall perform full detailed engineering for all technical systems within the Wageningen heating plant. The scope includes all mechanical, electrical, automation, and SCADA/SRO systems within the heating plant, as well as all internal structural and installation-related works required to support the equipment.

The detailed engineering shall include, as a minimum, the following elements:

Mechanical, Electrical and Control Design

- Complete design of a minimum 800 kW air-to-water heat pump system, including evaporator yard interfaces, hydraulic circuits, defrost strategy, heat exchangers, pumps, expansion systems, safety devices, and internal process piping.
- Design of the approximately 2.6 MW gas boiler system, including combustion air supply, flue/chimney routing, condensate handling, gas connection, safety interlocks, and hydraulic integration.
- Design of all internal hydraulic systems, including primary and secondary circuits, buffer tank integration, distribution manifolds, valves, filters, sensors, and instrumentation.
- Design of the complete electrical distribution system within the heating plant, including switchboards, motor control centres (MCCs), drives, protection systems, structured cable routing, grounding, and integration of external power supplies.

Water Treatment Systems

The Contractor shall design, supply, and commission all required water treatment systems for the heating plant.

This includes, as a minimum:

- treatment of the district heating primary circuit, including filtration, chemical dosing, and air and gas removal
- monitoring and control of water quality parameters

All systems shall comply with applicable national and local regulations for water quality and discharge.

SCADA/SRO and Automation Engineering

The Contractor shall design and deliver a complete and fully integrated SCADA/SRO system, including:

- PLC/BMS logic for coordinated control of the heat pump, gas boiler, pumping systems, safety interlocks, and auxiliary systems
- Control strategies covering:
    - winter and summer operation
    - part-load and peak-load operation
    - heat pump defrost sequences (including sectional defrosting to ensure continuous operation)
    - automatic boiler backup and fallback modes
- Digital communication architecture, including data logging, alarm management, and trend analysis
- Cybersecurity-compliant system architecture in accordance with EN IEC 62443 (or equivalent)
- SCADA/HMI visualisation, including operator interfaces and dashboards

Integration & Interface Engineering

The Contractor shall ensure full functional integration between all subsystems, including:

- heat pump system, including evaporator yard and defrost control
- gas boiler and backup heat supply
- hydraulic systems and internal distribution
- electrical systems and control infrastructure
- SCADA/SRO and communication networks

Regulatory Compliance

The design, supply, installation, and commissioning of the facility shall comply with all applicable EU directives, harmonised standards, Dutch legislation, and local permit requirements, including, where applicable, but not limited to the following:

EU Directives and Harmonised Standards

- Pressure Equipment Directive (PED) 2014/68/EU – safety of pressure vessels, boilers, and pressurised components
- Machinery Directive 2006/42/EC – mechanical safety and risk assessment of machinery
- Ecodesign / ErP Regulations – minimum energy efficiency and environmental performance
- Low Voltage Directive (LVD) 2014/35/EU – electrical safety for low-voltage equipment
- EMC Directive 2014/30/EU – electromagnetic compatibility of electrical systems
- EN/IEC 60204-1 – electrical equipment of machines
- EN/IEC 61439 – design and safety of low-voltage switchgear assemblies
- EN ISO 13849 – safety-related control systems (performance levels)
- EN 62061 – functional safety of electrical control systems
- EN IEC 62443 – cybersecurity for industrial automation and control systems (SCADA)
- EN 12828 – design and safety of water-based heating systems
- EN 13445 (where applicable) – design and fabrication of unfired pressure vessels

Cybersecurity and Digital Resilience

- NIS2 Directive (EU) 2022/2555 – cybersecurity, resilience, and incident reporting for essential and important entities

(Applicable due to the use of network-connected SCADA and control systems forming part of critical energy infrastructure.)

Dutch Legislation and National Standards

- Bouwbesluit / BBL – building and installation requirements
- Omgevingswet – integrated environmental and permitting framework
- Bal / Bkl – environmental rules, emissions, and noise limits
- NEN 1010 – electrical installation requirements
- NEN 3140 – safe operation and maintenance of electrical installations
- Relevant NEN-EN standards – HVAC systems, water quality, sampling, and treatment

General Compliance Obligations

The Contractor shall be responsible for identifying, obtaining, and complying with all applicable statutory requirements, including but not limited to:

- environmental and building permits
- gas safety regulations
- noise emission limits
- grid connection and utility requirements
- water authority and discharge requirements

Compliance shall cover both design and execution, as well as documentation, testing, and commissioning.

4.11 Procurement & Delivery

The Contractor shall procure, deliver, and supply all equipment, materials, and components required for the complete construction and integration of the Wageningen heating plant. The procurement scope includes, but is not limited to:

Heat Production and Process Equipment

- **One (1) heat pump system** providing at least 800 kW thermal capacity.
  The system may be offered either as a **monoblock unit** or as a **split/ modular configuration**, provided that all required components — including evaporator sections, fans/coils, defrost functionality, structural supports, vibration isolation, and hydraulic interfaces — are fully integrated into the overall design and meet the performance and acoustic requirements specified in this tender.
- **One (1) gas-fired boiler system** (approx. 2,6 MW), including burner, flue system, condensate drain, gas valve train, safety devices, and automation interfaces.
  Optional multifuel capability (e.g., propane or biogas) may be proposed as an alternative solution.

Plate heat exchangers (if applicable), circulation pumps, expansion systems, degassing equipment, safety valves, strainers, and all internal piping and valves required for full system functionality.

Electrical Power Distribution

The Contractor shall provide all equipment and materials necessary for the complete electrical distribution system of the heating plant, including (but not limited to) the following:

- Main switchboard, sub-distribution boards, and all required protection equipment.
- Motor Control Centre (MCC) sections including:
    - Motor starters (DOL, soft starters)
    - Variable Frequency Drives (VFDs) for pumps and heat-pump fans
    - Protective relays, circuit breakers, disconnect switches
    - Auxiliary power supplies and transformers
- All internal power, grounding, and control cabling, including cable trays, conduits, and cable identification systems.
- UPS units for SCADA/SRO systems and all safety-critical controls.
- The complete electrical interface and connection to the main transformer, including incoming supply cables, terminations, protective devices, metering interfaces, and all coordination required with the network operator. The Contractor shall ensure full compatibility with the available transformer capacity, fault-level requirements, and the grid protection philosophy.

SCADA/SRO and Automation Systems

- PLC hardware, remote I/O panels, industrial communication switches, gateways, and SCADA server hardware.
- HMI/operator workstation including visualisation screens, alarm pages, control interfaces, and reporting tools.
- All cables, communication modules, and interfaces required for monitoring, control, alarm handling, and data logging.

Water Treatment Systems

- Water treatment components, including filters, chemical dosing systems, conductivity sensors, and sample points.

Auxiliary Supplies and Installation Materials

All necessary fittings, supports, mechanical connections, electrical accessories, fasteners, insulation, sealants, and general installation materials.

All procured equipment shall comply with EU legislation, harmonised standards, Dutch regulations, and the technical specifications of this tender.

4.12 Mechanical & Electrical Installation

The Contractor shall install all mechanical, electrical, control, and SCADA/SRO systems within the heating plant in full accordance with the approved design documentation and Dutch standards. The scope includes:

Mechanical Installation

- Complete installation of the minimum 800 kW heat pump, including hydraulic integration, evaporator yard connections, condensate drainage, and defrost design.
- Installation of the approx. 2,6 MW gas boiler, including combustion air provisions, flue system, safety shut-off valves, condensate neutralisation, and gas connection to the Liander distribution point.
- Installation of all primary and secondary piping, pumps, valves, strainers, expansion vessels, degassing units, safety relief systems, and thermal insulation.
- Installation of all necessary pipe supports, vibration dampers, and penetrations (fire-rated as required).

Electrical Installation

- Installation of main switchboards, MCC panels, distribution boards, and power circuits.
- Installation of all VFDs, motor starters, protective devices, and auxiliary supplies.
- Routing and installation of all power and control cables, including earthing and equipotential bonding.
- Labeling, documentation, and testing of all electrical installations.

SCADA/SRO Installation

The Contractor shall install and integrate a complete and fully operational control system for the heating plant. This includes all hardware, software, communication infrastructure, and automation components required for full system monitoring, control, and optimisation.

The Contractor shall install and integrate:

- All PLCs, I/O modules, network switches, communication hardware, SCADA/SRO servers, and all required software licences.
- All sensors, transmitters, actuators, safety devices, and signal cabling associated with the heat pump, gas boiler, circulation pumps, valves, and internal utility systems.
- The entire internal and external communication infrastructure required for SCADA connectivity, including firewalls, routers, VPN solutions, gateways, protocol converters, and cybersecurity layers.

The Client will only provide a functional internet connection at a defined demarcation point. All remaining equipment, interfaces, and configurations required to securely connect the SCADA/SRO system to the internet connection shall be fully supplied, installed, and commissioned by the Contractor.

All systems shall be installed such that full visibility, traceability, and operational control of the entire heating plant is available from the SCADA/SRO platform at handover. The Contractor is responsible for ensuring that the complete control system is fully integrated, tested, documented, and operational.

4.13 Commissioning & Handover

Commissioning, Performance Verification and Post-Completion Obligations

The Contractor shall perform full commissioning of all systems within the heating central. Commissioning activities shall include, as a minimum:

- **Functional testing** of the heat pump installation, gas boiler system, hydraulic circuits, pumping groups, electrical distribution panels, and all relevant safety and interlock systems.
- **SCADA/SRO verification**, including validation of control strategies, optimization algorithms, weather-forecast integration, alarm management, data acquisition, and inter-system communication.
- **End-to-end system testing** under varying thermal and hydraulic load conditions to demonstrate stable, reliable, and coordinated system performance across all subsystems.
- **Operator training** and handover of all required documentation, including as-built drawings, test records, commissioning protocols, system descriptions, and complete O&M manuals.

Performance verification shall be conducted in accordance with the warranty, performance guarantees, and acceptance procedures defined in the tender documentation.

Verification Based on Test Matrix VP01 (Efficiency and Operating Scenarios)

As part of commissioning, the Contractor shall conduct system testing in accordance with the test matrix defined in Excel sheet VP01.

- Prior to contract award, as part of the tender submission, the Contractor shall complete VP01 with the expected system efficiency (COP, seasonal performance values, boiler efficiency curves, pumping efficiency, etc.) for all required operating scenarios listed in the sheet.
- During commissioning, the Contractor shall verify measured system efficiency values against the values submitted in the tender.
- Tests shall cover multiple operating scenarios, including but not limited to:
    - Part-load operation
    - Peak-load operation
    - Minimum-load and fallback modes
- Any deviation from the tendered performance shall be documented, justified, and corrected by the Contractor at no additional cost to the Contracting Authority, unless otherwise stated in the contract.

The verified results shall be included in the final commissioning dossier.

Post-Completion Requirements: 1-, 2- and 5-Year Inspections

To ensure long-term reliability, safety, and contractual performance, the Contractor shall conduct mandatory post-completion inspections at **1 year**, **2 years**, and **5 years** after Final Acceptance.

1-Year Inspection (12-Month Review)

- Verification of system performance against the guaranteed performance values submitted in VP01 and confirmed during commissioning.
- Review of operational data, SCADA logs, alarms and optimization behaviour.

- Inspection of mechanical, electrical and automation components for early-life defects.
- Implementation of corrective actions for all identified defects.

2-Year Inspection (Interim Warranty Review)

- Follow-up assessment of corrective actions identified at the 1-year review.
- Assessment of wear-related or performance-critical components.
- Review of system efficiency trends from VP01-related data and SCADA history.
- Verification of control network stability, cybersecurity integrity and communication robustness.

5-Year Inspection (Extended Warranty / Structural Review)

- Full inspection of all principal technical components, including compressors, heat exchangers, boiler assemblies, pumps, valves, MCC sections and SCADA hardware.
- Review of structural components, insulation, cable infrastructure, and mounting systems.
- Long-term performance evaluation comparing VP01 values with actual historic performance.
- Implementation of all necessary corrective measures to ensure continued system functionality and compliance with lifetime expectations.

Reporting and Acceptance

For all commissioning activities and for each of the 1-, 2- and 5-year inspections, the Contractor shall:

- Submit a Post-Completion Inspection and Performance Report summarizing findings, measurements, deviations, and recommended corrective actions.
- Provide updated VP01 performance comparisons where applicable.
- Propose corrective actions with clear timelines, subject to approval by the Contracting Authority.

Implement all approved corrective actions at no additional cost when covered by the defects liability obligations.

4.14 Expected Operating Conditions (network)

Temperature Set Points

The district heating system is designed with a nominal operating point of 70°C supply and 40°C return temperature under standard conditions.

In practice, the system will operate within the following temperature ranges:

- **Supply temperature:** 65–75°C
- **Return temperature:** 35–50°C

The supply temperature shall follow a weather-dependent control curve (“stooklijn”), resulting in lower supply temperatures under mild conditions and higher temperatures during colder periods. The return temperature will vary depending on consumer behaviour and system conditions.

During the initial phase of network operation, elevated return temperatures of up to 50°C are expected, due to system start-up conditions and limited optimisation of consumer installations. Over time, return temperatures are expected to decrease as the system is balanced and optimised.

These temperature levels have been selected to ensure reliable heat delivery while maintaining overall system efficiency. The resulting temperature differential supports efficient heat transfer and contributes to minimising pumping energy across the network.

The heat pump system shall be capable of delivering the required supply temperatures under standard operating conditions. During peak demand periods or extreme cold conditions, the gas boiler shall supplement the heat pump to maintain system performance and supply temperature.

4.15 Future Expansion Provisions

Scalability and Future System Development

The heating plant shall be designed with a view to long-term flexibility and adaptability, allowing for potential future developments without requiring fundamental redesign of the core installation. The intent is to ensure that the system can accommodate changes in operational needs, regulatory frameworks, or network development over time.

The initial installation shall be limited to the approved scope and designated areas. Where feasible, the design shall take into account that additional building space or system functionality may become available in later phases, subject to separate approvals.

The Contractor shall therefore adopt design principles that, where reasonably practicable, allow for:

- Future adjustment or optimisation of heat production capacity
- Potential integration of additional thermal storage
- More effective utilisation of the existing electrical connection
- Logical hydraulic, electrical, and control system layouts that do not unnecessarily constrain future modifications

Any considerations related to future options shall be non-binding, indicative in nature, and shall not presume approval of expansions, additional equipment, or changes to the building or permits.

The Contractor is encouraged to describe, at a high level, how the proposed solution supports flexibility over time, without committing the Contracting Authority to specific future investments or regulatory decisions.

The control and SCADA system shall be designed so that future extensions can be accommodated through configuration and expansion, rather than replacement of the core system.

Connection Points and Interfaces

Future equipment connection points must be clearly identified in the system documentation, with capped or valved connections provided for all major circuits. Electrical switchgear shall include spare circuit breaker positions or provisions for panel expansion. The control system architecture must support the integration of additional modules — including future heat pump units, gas boiler capacity, or an electric boiler — without requiring replacement of the core control platform.

5 Final approval and Hand over Documentation Requirements

The Contractor shall prepare and deliver complete technical documentation covering all elements of the Wageningen heating plant, including the design, installation, testing, commissioning, and operational configuration of the air-to-water heat pump, the gas boiler system, and all associated hydraulic, electrical, and SCADA/SRO systems.

All documentation must meet the level of detail required for submission to Dutch regulatory authorities, including those responsible for environmental permits, gas safety, water quality compliance, and building/technical installation approvals.

The documentation shall be structured to support the long-term operation and maintenance of the Wageningen heating installation. It must enable operational personnel to clearly understand:

- System functionality and design intent
- Control logic and SCADA/SRO behaviour
- Safety and interlock requirements
- Normal, part-load, peak-load, and fallback operating modes
- Defrost operation and seasonal performance behaviour

The Contractor shall provide sufficient technical detail to support future modifications, optimisation, or system upgrades carried out by third parties.

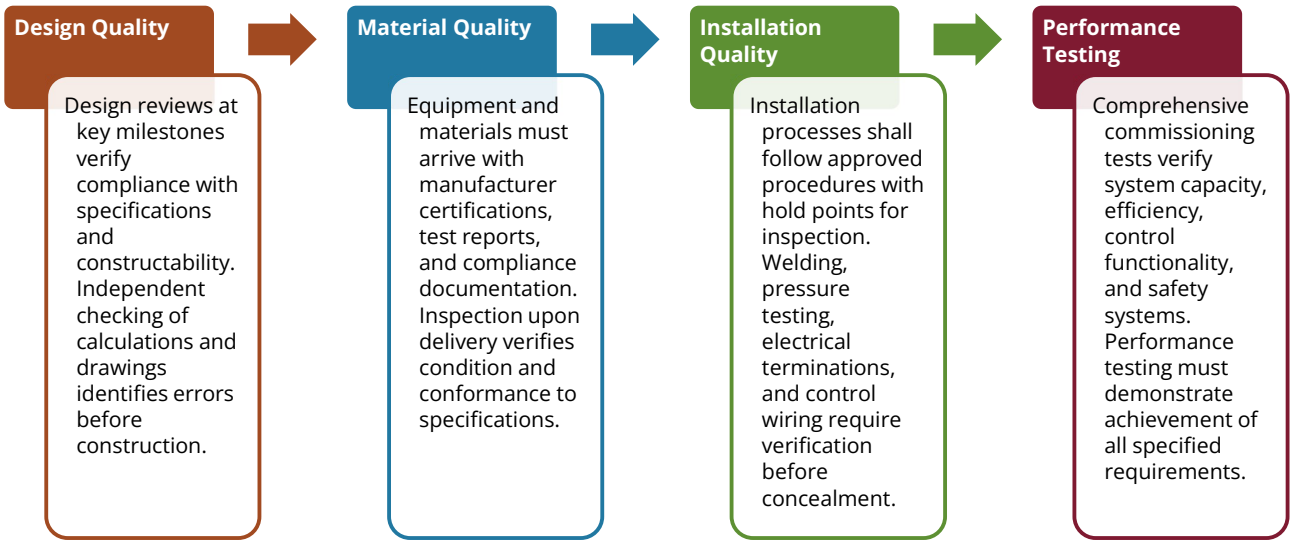
The documentation package shall include, as a minimum:

- As-built drawings (mechanical, electrical, SCADA)
- Hydraulic and electrical schematics
- P&IDs
- Equipment datasheets and manufacturer documentation
- Control philosophy and functional descriptions
- SCADA/SRO configuration files, point lists, alarm lists, and network diagrams
- Commissioning reports and validated test protocols
- O&M manuals for all installed equipment
- Inspection certificates and compliance documentation in accordance with Dutch legislation

All documents shall be delivered in digital and editable formats and must meet the quality and completeness requirements defined by the Client for the Wageningen project.

5.1 Quality Assurance and Testing

A comprehensive quality assurance programme must be implemented throughout all project phases to ensure delivered systems meet specified performance criteria and regulatory requirements. The contractor shall establish quality control procedures covering design reviews, material inspections, installation verification, and performance testing.



5.2 Training and Knowledge Transfer

Operations Training Programme

Upon completion of commissioning, the Contractor shall deliver a comprehensive training programme for the Client's operational personnel. The training shall cover all systems and subsystems installed in the Wageningen heating plant, including the air-to-water heat pump, the gas boiler, the hydraulic and electrical systems, and the complete SCADA/SRO control platform.

The purpose of the training is to ensure that all operators are fully capable of managing the heating plant during normal, part-load, peak-load, and abnormal operating conditions. The programme shall include instruction on:

- Day-to-day operation of the heat pump and boiler
- Seasonal operation, including heat pump defrost sequences and boiler backup modes
- Navigation and use of the SCADA/SRO interface
- Alarm handling, fault identification, and basic troubleshooting
- Routine inspections, daily/weekly operational checks, and scheduled maintenance tasks
- Safety systems, shutdown proc
- edures, and emergency response actions
- Interpretation of temperature, flow, and pressure values for stable and efficient operation

The Contractor shall also train operators to understand the control logic governing:

- Heat pump performance and defrost management
- Boiler sequencing, modulation, and fallback behaviour
- Interaction between the heating plant and the district heating network

The training shall be delivered through a combination of classroom-based instruction and hands-on practical demonstrations within the completed Wageningen facility.

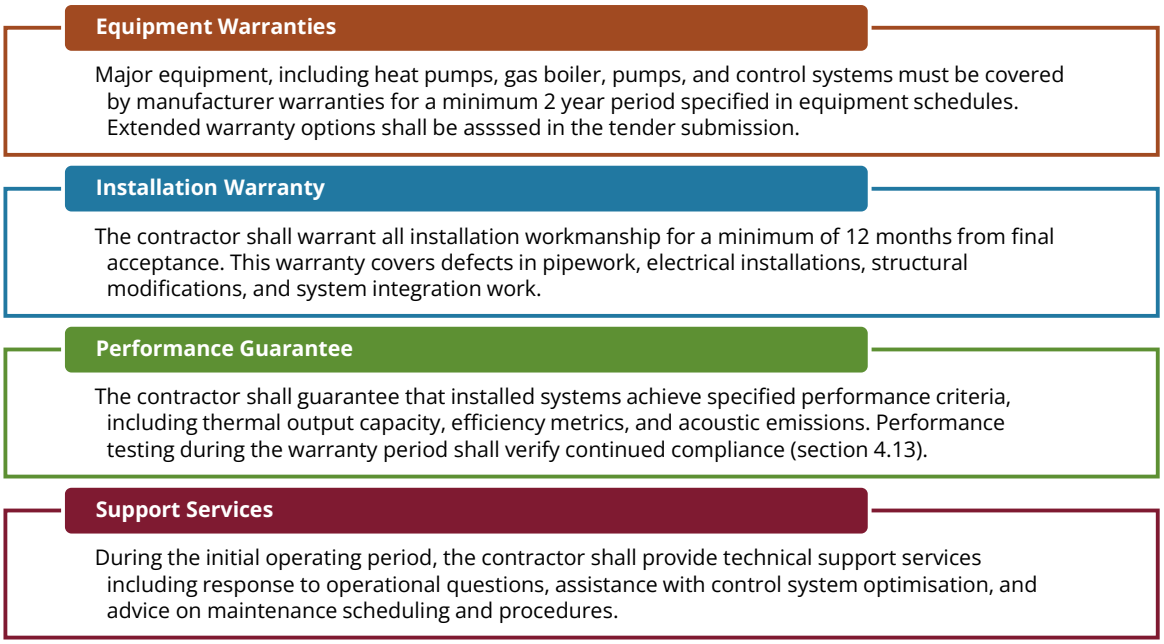
All training materials shall be provided in English and/or Dutch, and shall include:

- Operating procedures
- Troubleshooting guides
- Alarm response instructions
- Maintenance checklists
- Detailed system descriptions and SCADA/SRO user guidance

The Contractor shall plan the training schedule to include multiple sessions, ensuring that all operational personnel are able to participate prior to handover and commencement of live operation.

5.3 Warranty and Support

The contractor shall provide comprehensive warranty coverage for all equipment, materials, and installation workmanship. Warranty terms must align with industry standards for district heating installations and provide the client with appropriate protection against defects and premature failures.



6 Maintenance Access Provisions and Service Contract Requirements

6.1 Maintenance Access Provisions

The heating plant shall be designed to provide adequate access for all routine maintenance, inspection, and long-term equipment replacement activities. All major components shall be installed with sufficient clearances to allow service personnel to safely perform required tasks, including removal and replacement of parts that may require servicing during the operational lifetime of the plant.

Specific access requirements include, but are not limited to:

- Clearances around the heat pump unit for refrigerant service, defrost components, and fan/coil access
- Boiler access for burner inspection, cleaning, flue maintenance, and safety device servicing
- Pump access for seal and coupling replacement
- Valve access for actuator maintenance and manual operation
- Electrical cabinet access in accordance with applicable Dutch electrical safety codes
- Control panel and SCADA access for diagnostics, programming, and component replacement

6.2 Mandatory Service and Maintenance Contract (5 + 5 Years)

As part of the tender, the Contractor shall include a complete service and maintenance contract covering all systems installed in the Wageningen heating plant. This contract shall:

- Cover a minimum period of 5 years from the date of Final Acceptance
- Include an option for the Client to extend the contract for an additional 5 years under the same terms or renegotiated terms as specified
- Cover all preventive maintenance, scheduled servicing, inspections, safety checks, and replacement of wear parts recommended by the manufacturer
- Include call-out support for corrective maintenance within agreed response times
- Exclude daily operational tasks, which remain the responsibility of the Client's operations staff

The Contractor shall propose a clear scope of services, maintenance intervals, expected spare parts, and service visit schedules as part of their tender submission.

Explicit Exclusion of Daily Operation

The service and maintenance agreement shall explicitly exclude all daily operational activities, including but not limited to:

- Day-to-day operation of the plant
- Routine monitoring and manual operation
- Start-up and shut-down for normal operation
- Optimisation of daily dispatch or production schedules
- On-site operational staffing

Daily operation of the heating plant shall at all times remain the sole responsibility of the Client / cooperative, and shall not form part of the Contractor's scope, whether during the service period or otherwise.

The Contractor shall, as part of the tender submission, clearly define:

- the scope of maintenance services included
- maintenance intervals and service visit frequency
- expected spare parts and consumables
- response times and escalation procedures for corrective maintenance

No responsibilities related to continuous or routine operation shall be assumed by the Contractor unless explicitly instructed in writing under a separate agreement.

6.3 Maintenance Requirements Documentation

The Contractor shall provide comprehensive maintenance documentation, including:

- Routine inspection schedules
- Preventive maintenance procedures
- Recommended spare parts lists with part numbers and supplier information
- Safety precautions for all maintenance activities
- Troubleshooting guidance and replacement procedures for key components

This documentation shall enable the Client to understand maintenance obligations and ensure that the provided service contract can be evaluated, implemented, and audited effectively.

At the end of the five-year period, the Contractor shall provide a Final Maintenance Summary Report documenting the condition of all systems, major service actions performed, and recommendations for long-term maintenance.

6.4 End of Five-Year Obligation

At the expiry of the five-year service period:

- All maintenance responsibilities transfer to the Client, unless otherwise agreed.
- The Contractor shall participate in a handover review meeting and deliver the final maintenance summary.
- The installations shall be left in fully operational condition, with all service work up to date.

7 Environmental and Regulatory Framework

7.1 Site Constraints and Construction Conduct Requirements

The The site is located in an area subject to exceptionally strict building regulations due to its proximity to sensitive zones and nearby residential areas. The existing building structure may not be modified externally under any circumstances. Any proposed changes to the building envelope would trigger a multi-year regulatory review process that would fundamentally compromise project viability and timeline.

In addition, the Contractor shall plan and execute all construction activities with due consideration for traffic impact, access routes, and safety for surrounding road users. Deliveries, crane operations, and transport movements must be organised to minimise disruption to the neighbourhood and avoid congestion in adjacent streets.

The Contractor must also take full account of neighbouring residents and shall implement all reasonable measures to limit construction-related disturbance. Noise-generating activities outside normal working hours must be avoided wherever possible, and any unavoidable out-of-hours work shall require prior approval from the Client and must comply with all applicable municipal regulations.

Furthermore, the **Contractor is responsible for communicating directly with the relevant neighboring residents** regarding any construction activities that may temporarily affect their daily routines — including, but not limited to, noise, restricted access, temporary traffic changes, or use of heavy machinery. Such communication shall be timely, clear, and coordinated with the Client, ensuring that residents are informed well in advance of any disruptive works.

All required permits and approvals associated with the construction and operation of the new heating central will be obtained by the Client. This includes, but is not limited to, building permits, environmental permits, occupancy certificates, water-discharge approvals, and any additional permissions related to construction within forest zones or near protected waterways. The Contractor shall review and familiarise itself with all permit conditions and is fully responsible for ensuring that all work is carried out in strict compliance with these conditions. The Client will provide all relevant permit documentation and coordinate with local authorities as necessary.

7.2 Environmental Considerations

The Contractor shall ensure that all construction and operational activities associated with the Wageningen heating plant comply with all applicable Dutch environmental regulations and local permit conditions. This includes, but is not limited to:

- **Noise emissions** from the outdoor cooling yard, heat pump equipment, fans, and auxiliary systems, in accordance with local environmental noise limits and municipal regulations.
- **Construction-related impacts**, including dust, vibration, traffic movements, waste handling, and site safety measures required under the Omgevingswet and related Dutch environmental legislation.
- **Refrigerant management** for the air-to-water heat pump installation, including certified handling, leak detection obligations, and documentation as required under EU F-gas regulations and Dutch enforcement rules.

- **Combustion emissions** from the gas boiler system, including compliance with applicable NOx, CO, and flue-gas discharge limits defined in the Bal/Bkl and local emission requirements.
- **Water discharge and drainage**, including condensate handling from the heat pump and gas boiler in accordance with the requirements of the local water authority.

The Contractor must implement all necessary mitigation and monitoring measures to prevent adverse environmental impacts during both construction and commissioning. The Contractor shall maintain complete documentation demonstrating ongoing compliance with all environmental obligations and permit conditions and shall make such documentation available to the Client upon request.

7.3 Acoustic Requirements

Given the heating plant's proximity to both residential areas and the Wageningse Eng, an area characterised by its landscape quality, including the core value of *"rust" (tranquillity)*, careful consideration of acoustic performance is essential.

The current permitting framework and spatial justification for the project are based on previously conducted acoustic simulations. These simulations were carried out on earlier design configurations and form the basis for the environmental assessment and permit conditions currently in place.

Noise contours of 40, 45, 50, 55 and 60 dB Lden, heat generation installation, applicable for the day, evening, and night periods, calculated at a height of 1 meter. 6 (source: SAB)

It is important to note that these studies are indicative of achievable acoustic performance rather than prescriptive design limits. The final acoustic performance of the installation shall therefore be demonstrated through the Contractor's detailed design.

The Contractor shall design, optimise, and document the installation such that:

- The acoustic impact of the installation is minimised under all operating conditions, including part load, full load, and transient conditions (e.g. defrost cycles).
- The installation complies with all applicable permit requirements and regulatory conditions.
- The resulting sound emissions are consistent with preserving the landscape quality of the Wageningse Eng, with particular emphasis on maintaining the experience of “rust” in the surrounding area.

The Contractor is explicitly encouraged to:

- Further reduce sound emissions beyond the levels assumed in the current permitting basis where technically and economically feasible.
- Consider the full system design, including equipment selection, layout, control strategy, and operational philosophy, as part of the acoustic optimisation.
- Address both tonal and broadband noise, as well as potential low-frequency effects and intermittency (e.g. fan cycling or defrost events).

The acoustic design shall take into account:

- Continuous operation during nighttime conditions;
- The cumulative effect of all sound sources, including heat pumps, cooling yard equipment, pumps, and auxiliary systems;
- Interaction with the existing ambient noise environment.

Existing acoustic studies, including noise contour assessments, are made available as reference material for the Contractor during subsequent tendering steps. These may be used to understand the current permitting basis and to support the development of an optimised design.

Compliance with the permit shall be demonstrated by the Contractor through updated acoustic calculations based on the final design, and, where required, through on-site measurements during commissioning.

Heatpump/Cooling Yard noise management
Fan systems, refrigerant flow, and structural vibrations must be attenuated through acoustic enclosures, vibration isolation, and sound-absorbing materials. The contractor shall specify all noise reduction measures in the detailed design submission.

Gas Boiler and Flue Systems
Combustion air intake and flue gas discharge systems must be designed with appropriate silencers. Flue gas velocity shall be controlled to minimise flow noise. Boiler room mechanical systems require vibration isolation and acoustic treatment.

7.4 Health, Safety and Environmental Management

Safety Requirements

All construction and installation activities must comply with Dutch health and safety legislation, including the Working Conditions Act (Arbeidsomstandighedenwet) and associated regulations. The contractor shall prepare and implement a comprehensive health and safety plan addressing all identified hazards associated with design, construction, and commissioning activities.

Specific safety considerations for this project include: working at heights during equipment installation and structural modifications; confined space entry for tank and vessel installations; hot work activities including welding, cutting, and brazing; electrical safety during installation and testing of high-voltage systems; refrigerant handling requiring qualified personnel and appropriate safety equipment; lifting operations for heavy equipment requiring certified lifting equipment and trained operators; and noise exposure during equipment testing and commissioning.

Environmental Protection

Construction activities must implement appropriate environmental protection measures to prevent pollution of soil, groundwater, or surface water. Fuel storage, chemical handling, and waste management must follow approved procedures. Any spills or releases must be reported immediately and remediated appropriately.