Attachment 2

Draft Burnaby District Energy (DE) Policy
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1. BACKGROUND

The City of Burnaby (City) is committed to climate action and is currently developing a District Energy Utility (DEU) to serve space heating[1] and domestic hot water needs of buildings in Burnaby south of the Trans Canada Highway. Burnaby's DEU is a City-led project that will help meet Burnaby's GHG emissions reduction targets and will integrate with the City's green building strategy for reducing emissions in the building sector.

2. PURPOSE

The purpose of the proposed District Energy (DE) Policy is to outline building requirements for future DE system connections and readiness in Burnaby. Although it is anticipated that most of the heat from the Burnaby DEU will be supplied to new buildings, the DE Policy outlines both:

- future opportunities for existing buildings to connect to the Burnaby DEU, and
- future requirements for new buildings to connect to the Burnaby DEU.

Connection Guidelines located in **Attachment 2.1** have been created to support the DE Policy by providing high-level technical information to developers, building owners, engineers, and architects to tailor their designs to DEU requirements, to optimize the benefits of the Burnaby DEU. The City will work closely with developers of new buildings and their mechanical designers to ensure good compatibility and integration between buildings' mechanical systems and the Burnaby DEU. The information in the Connection Guidelines apply to all qualifying building types and uses listed in the DE Policy.

3. LEGISLATIVE AUTHORITY

The requirements outlined in the DE Policy are based on authority provided by the Province of British Columbia to the City of Burnaby by acts of provincial legislation, including those listed below.

3.1 Community Charter

Section 8(2) of the Community Charter, allows a municipality to provide any service that Council considers necessary or desirable, including providing district energy services and requiring buildings to connect to the district energy service.

A local service area bylaw is typically used to require connection to a district energy system that is already operating or is under construction. A bylaw would follow the DE Policy as one of the proposed supporting implementation tools for the DEU.

3.2 Section 219 Covenant

The DE Policy, as Council-adopted policy, establishes building requirements for certain types of existing buildings and new building construction. Requirements for new buildings will be

[1] The City is investigating cooling, but cooling is not currently part of the DEU service concept.

established as rezoning requirements and they will be secured through a Covenant under Section 219 of the Land Title Act (Section 219 Covenant).

3.3 BC Building Code

On February 8, 2023 the province introduced the latest BC building code (BCBC) changes. These new changes will come into effective on May 1, 2023 and will enable 20% better energy efficiency and provide an opt-in Zero Carbon Step Code (formerly known as the Carbon Pollution Standard)[2]. These changes in building energy efficiency and a new carbon pollution standard provide new tools for local governments, like the City of Burnaby, to develop zero emission pathways for new buildings.

These recent changes to the BCBC, and the introduction of the Burnaby DEU, will require update(s) to Burnaby's Green Building Policy. The objective is to ensure that Burnaby's Step Code adoption strategy for reducing emissions in the building sector aligns with these BCBC changes, that Burnaby's Green Building Policy continues to accelerate the adoption of building energy efficiency and carbon pollution standards, and that Burnaby's Step Code adoption strategy and Green Building Policy align and integrate with the DE Policy.

4. QUALIFYING BUILDINGS

This section outlines the Service Areas and characteristics of buildings that will be required to connect to and/or be compatible with the Burnaby DEU.

4.1 Service Areas

The DEU Service Area is divided into a number of areas as shown in **Figure 1***,* attached and **Table 1**, below and described in more detail below.

4.1.1 Service Area A – Core Area/Mandatory Connection

Service Area A is considered the core service area for the DEU and includes the two Burnaby town centres that are located in south Burnaby;

- A1 - Metrotown, Burnaby's downtown
  The limits of the Service Area A1 are shown in **Figure 2** attached and are the same as the limits of the Metrotown Downtown Plan less Central Park.
- A2 - Edmonds Town Centre
  The limits of the Service Area A2 are shown in **Figure 3** attached and are the same as the limits of the Edmonds Town Centre Plan.

These two town centres are expected to host about 47% of the city's new residential units[3] and about 22% of the city's employment growth[4] over the 20 years from 2021 to 2041.

[2] https://us15.campaign-archive.com/?u=6394fa7be6bf69bb22890b08e&id=ac626dfe4a
[3] https://www.burnaby.ca/our-city/about-burnaby/town-centres
[4] Table A and Table C, Appendix 1 of Burnaby OCP (page 133 of PDF)
https://www.burnaby.ca/sites/default/files/acquiadam/2021-05/OCP%201998%20%28full%20version%29.pdf

Table 1: *DE Policy Framework*

Service Areas	**A**	**B**	**C**	**D**
Type	Core	Expansion	Optional	No Service
System Status[5]	Feasibility	Concept	Concept	Not applicable
Location(s)	• Metrotown • Edmonds	• Willingdon from Trans Canada Highway to Metrotown • Kingsway from Metrotown to Edmonds	• South of Trans Canada Highway excluding service areas A and B	• North of the Trans Canada Highway
DE Connection: **Existing Buildings**	Optional (Opt In)[6]			No Service
DE Connection: **New Buildings**	Mandatory DE Connection	DE Ready	Optional (Opt In)	No Service
DE Connection: **Expected Service**	2026	TBD	TBD	No Service
DE Connection: **Timing**	When and where service is available.			Not applicable
Building Use Categories[7] [8]	• Multiple Family Residential (RM) – RM3, RM4, RM5 • Commercial (C) – C2, C3, C4, C8, C9 • Industrial and Business Centre (M and B) – M1-5, M8, B1, B2 • Public and Institutional (P) – P2, P3, P5, P6, P7, P11 • Comprehensive Development (CD) – CD			Not applicable
Building Size	≥ 100,000 sq. ft.[9]			Not applicable
Process	*Existing Buildings:* • DE Application Form • Review for Burnaby DEU system compatibility *New Buildings (part of the rezoning process):* • DE Application Form • Suitable Plan of Development (SPOD) • Rezoning requirements • Tentative Approval Letter • Conditions of DE readiness[10] • Covenant (commitment to connect to the DEU in future)			Not applicable

[5] Current stage of design and implementation for this portion of the project.
[6] Existing buildings will need to be practical to connect based on compatibility and cost to convert the building's heating system in order to connect to the Burnaby DEU.
[7] As defined by the Burnaby Zoning Bylaw: https://www.burnaby.ca/our-city/bylaws/zoning-bylaw
[8] Most of these zones have a FAR greater than one.
[9] Smaller buildings will be reviewed and connected on a case-by-case basis using an extension test.
[10] Including a Burnaby DEU system compatibility review prior to building permit.

The City is developing a new community plan for the Edmonds neighbourhood in southeast Burnaby that may include changes to its boundaries that may in turn require future changes to the boundary of Service Area A2.

Connection to the DEU within Service Area A is:

- optional (opt in) for existing buildings of certain types and sizes (see **Table 1**), and
- mandatory for new buildings of certain types and sizes (see **Table 1**).

Within Service Area A, the Burnaby DEU will make every effort to connect all feasible buildings within the service area, even if piping from the DEU is not yet in place. This could involve consideration of alternative strategies, such as containerized interim energy centres, that can be used to connect to remote buildings or groups of buildings until the piping from the DEU is in place[11].

4.1.2 Service Area B – Expansion Area/DE Ready

Service Area B covers areas where there is significant potential to expand the DEU. As the system further develops and expands, the City will consider adding additional connections in Service Area B in the future. Service Area B, includes:

- B1 - the Willingdon Avenue corridor south of the Trans-Canada Highway; and
- B2 - the Kingsway corridor between Metrotown and Edmonds.

The limits of Service Area B are shown in **Figure 4** and **Figure 5**.

The City is developing a new community plan for the Royal Oak neighbourhood in southwest Burnaby that may include changes to its boundaries that may in turn require future changes to the boundary of Service Area B2.
Connection to the DEU within Service Area B is **optional** (opt in) for **existing buildings**. This will leave the decision to each individual building and their situation. If the owners of an existing building are interested in connecting to the DEU the City will explore if and when it would be cost effective to extend connections to the building. All DEU connections to eligible existing buildings in Area B will be subject to approval by the General Manager Engineering.

Within Service Area B, **new buildings** of certain types and sizes (see **Table 1**) must be **DE Ready** for future connection to the DEU when it is available. These buildings may have to provide their own temporary boilers or other temporary heat sources if the DEU is not available in their area when they are being designed and constructed. Once the DEU service is available, connection to the DEU will be mandatory. The City is exploring putting a boiler buy-back program in place. If available at the time of connection, the City will offer to purchase the building's boiler.

4.1.3 Service Area C – Optional/Opt In

Service Area C covers all of Burnaby south of the Trans-Canada Highway, excluding Service Area A and Service Area B.

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[11] This strategy has been used extensively at other DEUs in the region like the City of Vancouver's NEU, River District, Richmond's LIEC, Burnaby Mountain, and UBC's NDES.

The limits of Service Area C are shown in **Figure 4** and **Figure 5**.

Connection to the DEU within Service Area C is **optional** (opt in) for both **existing buildings** and **new buildings.** If the owners of a building are interested in connecting to the DEU the City will explore if and when it would be cost effective to extend connections to the building or not.

- If the building meets the criteria shown in **Table 1** and is determined to be a good candidate for DE connection, the City will commit to taking the steps needed to assess DE service provision to the building. In some cases this would require the installation of a temporary boiler until the DE system is able to be connect to the building.
- If the building is determined to be unsuitable for DE connection, the building will be subject to Burnaby's Green Building Policy (e.g., low carbon building systems).

All DEU connections to eligible buildings in Area C will be subject to approval by the General Manager Engineering.

Some new buildings within Service Area C may also have to provide their own temporary boilers or other temporary heat source if the DEU is not available in their area when they are being designed and constructed. The City is exploring putting a boiler buy-back program in place. If available at the time of connection, the City will offer to purchase the building's boiler.

4.1.4 Service Area D – No Service

Service Area D is located north of the Trans Canada Highway (see **Figure 4**). There is no Burnaby DEU service anticipated in Service Area D.

The recent amendments to the BC Building Code (discussed in Section 3.3 of this policy) give local government new regulatory authority to require a low carbon energy system at a specific carbon performance standard.

New buildings in Service Area D will be subject to Burnaby's Green Building Policy, which is in the process of being updated to include reference to the Energy Step Code and new carbon pollution standard.

4.2 Building Use Categories

Buildings in Service Areas A, B and C that fall under certain building use categories (listed in **Table 1,** above) are expected to meet the connection requirement for their service area (listed in **Table 1**, above and in **Section 5**, below) if they are also larger than the minimum size requirement, unless it can be demonstrated that it is not cost-effective to do so. The General Manager Engineering will have the final decision on requests for exemption.

4.3 Building Size

Buildings in Service Areas A, B and C that are larger than the minimum size for their service area (listed in **Table 1**, above) are expected to meet the connection requirement for their service area (listed in **Table 1**, above and in **Section 5**, below) if they also fall under certain building use categories, unless it can be demonstrated that it is not cost-effective to do so. The General Manager Engineering will have the final decision on requests for exemption.

5. DEU COMPATIBILITY REQUIREMENTS

DEU connection and/or compatibility shall be a requirement of rezoning in the Service Areas A, B, and C.

This section provides additional background on the building requirements for district energy as part of the rezoning process.

5.1 Rezoning

5.1.1 Building Design

All new buildings that fall under the DEU service requirements listed within the DE Policy shall be required to provide:

- full hydronic space heating systems, designed to accept heat from the Burnaby DEU including, but not limited to:
    - hot water space heating (hydronic) piping[12]
    - hot water terminal units (e.g., make-up air units and air handling units' coils, in-floor heating, perimeter radiators, fan coils, VAV reheat coils, unit heaters, and more)
    - variable flow and variable temperature control.
- domestic hot water system designed to accept heat from the DEU
- full hydronic space cooling system with connection to cooling, where district cooling systems are available[13]
- space for the energy transfer station (ETS) room at or below grade
- mechanical system data sharing[14]
- electrical service for the energy transfer station room and equipment
- future connection to DEU, to be secured by means of a Section 219 Covenant and Statutory Right of Way

As previously stated in the purpose section of the DE Policy, the Connections Guidelines located in **Attachment 2.1** have been created to support the DE Policy by providing high-level technical information to developers, building owners, engineers, and architects to tailor their designs to DEU requirements, to optimize the benefits of the Burnaby DEU to both the building and the Burnaby DEU.

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[12] DE Ready buildings will be required to provide same size pipes (top to bottom within the building) where the interim heat production equipment is in a mechanical penthouse, but future ETS location would be in basement. In this case, risers/mains should be sufficiently sized to accommodate required flow from the ETS in the future, as well as the penthouse in the interim – this may drive risers to be single-sized top to bottom.
[13] Similar to space heating described above.
[14] Control points shared from building system to ETS control, and ETS operating data shared back to building BAS.

5.1.2 DEU Service Is Available

Where the DEU service is available, buildings will be immediately connected to the DEU by the Burnaby DEU. New buildings will be connected to the DEU by the Burnaby DEU prior to occupancy and as a condition of occupancy.

5.1.3 DEU Service Is Not Available

This section applies to qualified buildings within Service Areas A, B, and C.

The City will explore extending connections on a case-by-case basis for both existing and new buildings. This review may involve the Burnaby DEU undertaking a system expansion study to review and confirm whether the business case is there or not to expand the DE system to the building in question. For new buildings this review will be completed during the early stages of the rezoning process.

The City will work to establish a maximum Burnaby DEU connection timeframe for suitable buildings to avoid the long term use of temporary gas based boilers, since there will be limited ability to make mechanical system changes after occupancy. Once established, this connection timeframe can be refined within this policy and supporting District Energy Utility Bylaw at a later date as the system grows and evolves.

Where DEU service is not available, buildings will not be immediately connected to the DEU, but must still be compatible with the system. These "DE-Ready" buildings require their own hot water boilers to serve space heating and domestic hot water (DHW) requirements and will be "ready" for future connection to the Burnaby DEU when it is available.

5.2 Process and Procedures

5.2.1 Existing Buildings

Existing buildings interested in connecting to the DEU within Service Areas A, B, and C will need to complete a district energy application form. This form will be developed once the cooling feasibility for the Burnaby DEU been completed. By completing this form the applicant acknowledges the building is seeking to connect to the DEU and that the mechanical system within the building will be modified to accommodate connection to the DEU. The design of the building mechanical system will be subject to the approval of the Chief Building Inspector.

5.2.2 New Buildings

All applicants seeking rezoning to develop qualifying buildings will need to complete the following steps during the rezoning process to ensure that the mechanical systems of their building will be designed to accommodate both DEU compatibility and future connection to the DEU.

- Developer completes a district energy application form.

- Developer prepares a suitable plan of development in accordance with the DE Policy and Connection Guidelines.
- City lists DE readiness as a rezoning requirement in the rezoning Public Hearing report and Tentative Approval letter.
- Developer submits a letter of undertaking agreeing to DE readiness and future connection by means of Section 219 Covenant after Second Reading.
- City and Developer execute the covenant prior to Final Adoption of the Rezoning Bylaw.

District Energy System

Design Guidelines for Connection to District Energy

Draft Version 2 – 2023/02/22

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Definitions

BAS	Building Automation System
DE	District Energy
Delta T; ΔT	Temperature Difference
RE-Ready	New buildings that are designed and constructed to be compatible with DE, but do not initially receive DE service.
DCW	Domestic Cold Water
DES	District Energy System
DEU	District Energy Utility, the entity that designs, builds, owns, and operates the DES, i.e. the City of Burnaby or subsidiary
DHW	Domestic Hot Water
DHWR	Domestic Hot Water Recirculation
DPS	Distribution Piping System
ETS	Energy Transfer Station
HVAC	Heating, Ventilation & Air-Conditioning
MAU	Makeup Air Unit
NEC	Neighbourhood Energy Centre
OAT	Outdoor Air Temperature
Primary	Refers to systems, equipment, or water on the DES-side of the ETS's heat exchanger(s).
Secondary	Refers to systems, equipment, or water on the customer building-side of the ETS's heat exchanger(s).
WTEF	Waste to Energy Facility

1 Document Purpose

This document provides preliminary technical information to developers, building owners, engineers, and architects to tailor their designs to DE conditions, thereby optimizing the benefits of the District Energy System (DES) to all users of the system. The City of Burnaby or its subsidiary operator, collectively referred to as the District Energy Utility (the DEU), will work closely with developers of new buildings and their mechanical designers to ensure acceptable design integration between buildings and the DES. The information in this document applies to all building types and uses, including residential and commercial.

In accordance with the City of Burnaby's District Energy Policy, it is essential that the developer collaborate with the DEU on the HVAC and plumbing design of connected buildings, in accordance with this document, prior to issuance of the Building Permit.

2 The District Energy System

The DES in Burnaby is a community-based thermal network developed by the City of Burnaby. The system is designed, built, owned, and operated by the DEU. The customer rates are set using a transparent cost of service model.

The DEU provides its customers with thermal energy generated and distributed by the DES and transferred to the building heating system via heat exchangers located in each building. The DES provides all space heating and domestic hot water heating requirements. A detailed description of all DES components is provided in the following sections.

The DES will be supplied with low-carbon energy from the Metro Vancouver Waste to Energy Facility (WTEF) via Metro Vancouver's Regional District Energy System.

2.1 DES Description

The District Energy System (DES) is a system that distributes thermal energy in the form of hot water from one or more central Neighbourhood Energy Centre(s) (NECs) through a network of buried piping to individual customer buildings. The DES interfaces indirectly via heat exchangers with each building's space heating and domestic hot water systems. No other heat sources are required in buildings served by the DES.

The DES consist of three main components:

- Neighbourhood Energy Centre – the thermal energy generation
- Distribution Piping System, – the heat distribution network
- Energy Transfer Stations – the building interfaces

Each of these components has its specific function and design requirements as described below.

2.2 Neighbourhood Energy Centre

The Neighbourhood Energy Centre (NEC) is a key component of the DES where thermal energy (heat) is generated. Thermal energy can be produced using traditional energy sources such as natural gas boilers, or by utilizing alternative energy sources such as heat pumps or waste heat recovery. The NECs are planned to incorporate a connection to the Metro Vancouver Regional DES to make use of waste heat generated at the WTEF. The NECs will use this waste heat as the baseload energy source to supply the majority of the DES annual energy requirements. Peaking and back-up heat will be provided initially by natural gas boilers.

Production equipment and controls being implemented are state-of-the-art, based on the best of today's commercially proven technology. The DE infrastructure is designed to facilitate the future use of new renewable energy sources for thermal energy. The DEU will have the ability to switch fuel and energy sources over time as the system and regulations require.

Prior to final commissioning of any new building connected to the system, the DES will be capable of serving 100% of its thermal energy requirements from either temporary or permanent energy centre facilities.

The DES will have a higher level of reliability than is generally found in standalone heating systems in individual homes or commercial and multi-use residential buildings.

2.3 Thermal Distribution Piping System

Thermal energy is delivered to customers with a closed loop two-pipe (supply and return) hot water Distribution Piping System (DPS): the same water is heated in the NECs, distributed to the buildings, through the Energy Transfer Station (ETS), and returned back to the NECs to be reheated and redistributed. No water is drained or lost in the system, and no additional water is required during normal operation.

The DPS is composed of an all-welded, pre-insulated direct bury piping system in public streets and/or private corridors. The DPS is designed based on the size and location of customer buildings and NECs. Distribution network modelling is completed to optimize system performance and efficiency, and to ensure that all customers will always receive sufficient thermal energy.

Variable speed pumps located at the NEC control flow through the DPS to maintain sufficient pressure and flow at every ETS. The DE supply temperature is automatically adjusted based on the outdoor air temperature (OAT), but is never less than 65°C, such that it can always serve all domestic hot water (DHW) loads directly[1].

In hot water-based heating systems, low Secondary return temperatures from the customer buildings allow for large temperature differentials (delta T; ΔT) to be achieved in the DPS, resulting in low pumping requirements and high efficiency, smaller diameter pipes, minimized capital costs,

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[1] i.e., without requiring other heat sources to supplement or elevate the temperature to meet the building's requirements.

reduced thermal losses, and the optimal use of renewable and low-grade heat sources. District heating Primary return temperature is a function of the HVAC and DHW systems in customer buildings; hence, it is essential for the DEU to ensure that buildings connected to the system meet performance requirements, and it is imperative that building designers are conscious of and adhere to the DES temperature requirements, specifically the Secondary return temperatures.

2.4 Energy Transfer Stations

Each customer building houses an Energy Transfer Station (ETS) that is owned by the DEU. The key components of an ETS include:

- DE supply and return pipes from the building penetration (interface with the DPS);
- Heat exchangers for heat transfer between the DEU and the building's hydronic heating and DHW systems;
- Controls to regulate the Primary flow required to meet the building's energy demand and maintain DES return temperatures; and,
- Energy meters to monitor the demand and energy used by each customer for billing and system optimization purposes.

As shown in Figure 1 below, flow through the Primary side of the ETS is controlled to achieve the building's Secondary supply temperature set point.

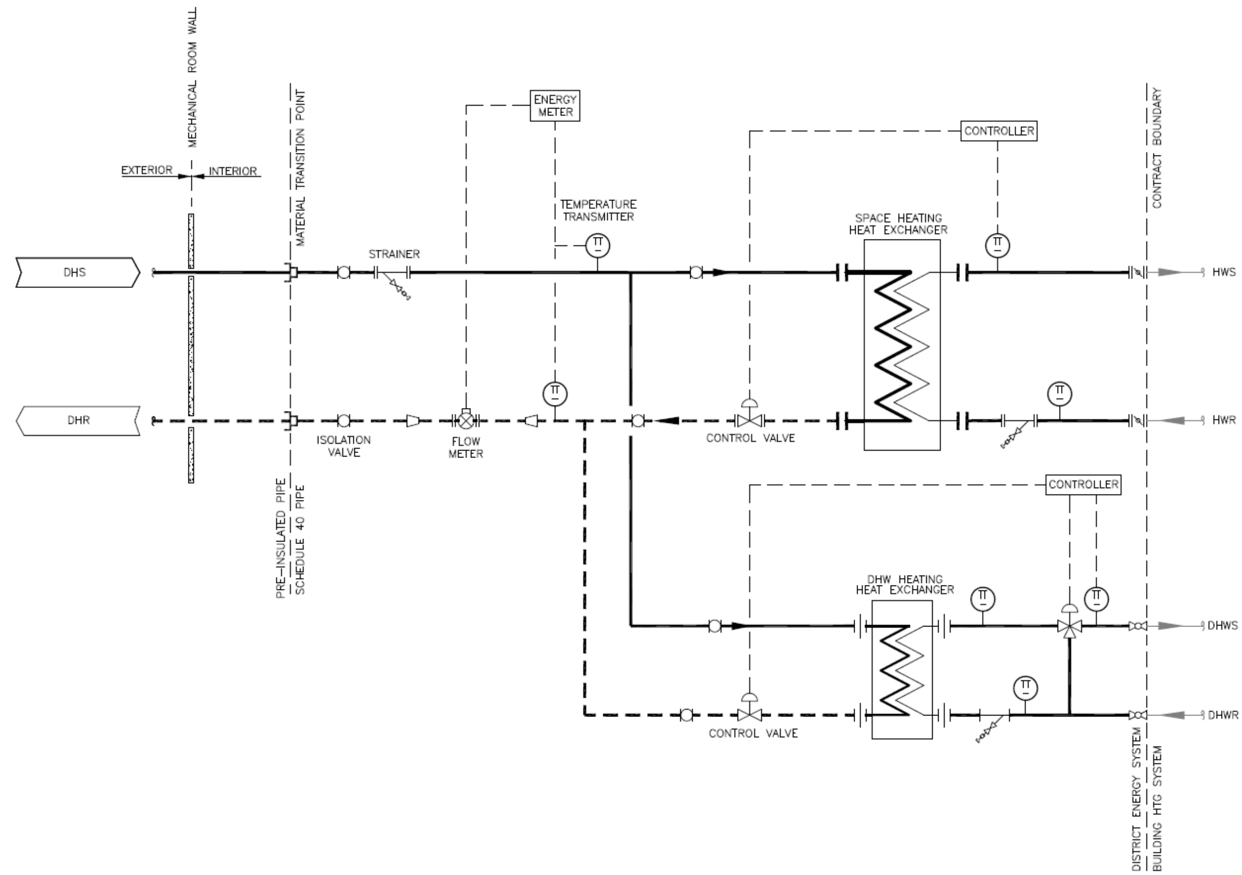

FIGURE 1: TYPICAL HEATING ETS FLOW SCHEMATIC

Heating ETSs generally have two heat exchangers: one for space heating, and a second to directly serve DHW. This is good industry practice for hot water DE in North America and around the world. There is a vast amount of experience and data regarding DE performance and reliability with this configuration. Heat exchangers are very reliable (with no moving parts); hence, it is not necessary to have redundant units in an ETS. Additional heat exchangers may be required where capacity or system configurations dictate.

Though very unlikely, the DEU will be able to repair or replace a faulty heat exchanger quickly and on short notice. It is important to note that a leaking or faulty heat exchanger can often continue to supply heat, and the repair/replacement can be scheduled for a convenient, low demand period.

2.5 DE-Ready Buildings

DE-Ready buildings may not be immediately connected to the DEU. In this case, they will not house an ETS, though are required to provide space for future installation of an ETS. Provisions must be made for future installation of an ETS and DPS service lines.

DE-Ready buildings provide their own thermal energy for space heating and DHW through direct ownership of the equipment. This equipment is the sole responsibility of the building. The DEU will provide guidance and support to ensure that DE-Ready buildings meet all DE compatibility requirements including location of future connection points for integration into the established DES.

No building equipment shall be installed in the space allocated for the future ETS, including natural gas boilers or other thermal energy generating equipment if it obstructs access to the installation of the future service connection or ETS. Building designers shall consider how district heating lines will connect in the future without disruption to the Secondary system's operation. Provision of tees and valves in the Secondary system for seamless integration of the future ETS is required. Future connection for these buildings may occur when DEU services are available at the site and/or at the time of Secondary equipment replacement.

3 Responsibilities of Customers and the DEU

The following section outlines the responsibilities of the developer and the DEU to ensure efficient and seamless integration of DE service, and to ensure full compatibility for DE-Ready buildings.

3.1 Developer's Responsibility

3.1.1 HVAC System

The building developer is responsible for designing and installing the building HVAC and plumbing systems. There are some differences and similarities with conventional, standalone systems, as explained below.

The following conventional building elements are not required for HVAC systems in DE customer buildings[2]:

- Boilers, furnaces, heat pumps, domestic hot water heaters, electric baseboards, or any other heat production equipment.
- Auxiliaries to heating systems such as stacks and breeching.
- Natural gas service for space heating and DHW purposes[3].

The building will require internal thermal distribution systems, including:

- Internal distribution pumps and piping (i.e., hydronic space heating distribution loops and DHW distribution piping)
- Heating elements such as fan-coil units, air handling units, and/or perimeter (baseboard) or in-floor radiant heating systems.
- Normal building controls and control systems.
- Make-up water, pressure regulation, thermal expansion compensation (e.g., expansion tanks), over-pressurization protection (e.g., relief valves), scald protection.
- Dielectric connections to the ETS's secondary DHW piping.

The following are some design conditions that are specific to DE:

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[2] DE-Ready buildings will require boilers or other thermal production equipment to serve space heating and DHW requirements.

[3] Natural gas service within buildings may exist, if allowed by other City of Burnaby requirements, for other uses, such as cooking.

- Customer buildings host service connection lines from the DPS. The DES branch lines enter the building, similar to other utilities, and transfer energy through the ETS.
- The building owner and the DEU agree on a suitable location for the ETS. The ETS invariably requires less space than comparable thermal production equipment (e.g., boilers) that it replaces. To reduce DES piping inside the building, the ETS shall be located on an exterior wall on the basement or ground floor, as close as possible to the DES branch pipeline entering the building.
- The DES operates most effectively and efficiently with the use of low temperatures in the building heating systems.

The DES will provide thermal energy for heating and domestic hot water only. Section 0 discusses specific requirements of the hydronic space heating and DHW systems for compatibility with hot water district energy.

The DEU reviews the HVAC and plumbing design of each building, but is not responsible for the design of the building system (which is executed by the developer). The DEU may make suggestions as necessary to ensure appropriate integration with the DES.

3.1.2 Installation and Operation Contract Boundary

The customer is responsible for all piping and other components necessary to connect the hydronic heating and DHW systems to the ETS at the stipulated demarcation point for the service boundary on the Secondary side of the heat exchangers. This demarcation point will be clearly marked on the DEU engineering drawings for the ETS, downstream of the main isolation valves on the Secondary side of the ETS, as shown in Figure 1.

3.1.3 Sub-Metering

Customers may install energy meters on individual units, suites or sub-systems within the heating and/or DHW systems in their building. These sub-meters are the sole responsibility of the customer, and will not affect the obligation of the customer to pay the DEU bill based on the DEU's thermal energy meter (part of the ETS) for the whole building. DEU billing to the customer will be based on the ETS meter only. Sub-meters are generally not utility grade and therefore less accurate. If a customer decides to use sub-meters, it is recommended that they be used for allocation of total building thermal energy only.

3.1.4 Preparation of Building for DE Service

All customers will provide suitable space for the installation of the ETS, including space for service lines and interconnecting piping, in a mechanical room in an agreed-upon location with sufficient access for the ETS. The ETS shall be located at an exterior wall facing the street with the DPS, as close as possible to the DPS branch pipeline entering the building, in the basement or ground level. If the building is located in an area with a flood plain restriction, the ETS shall be located in the lowest level allowed by the applicable bylaw.

The ETS room shall be ventilated per applicable Code and maintained at a temperature between 10°C and 35°C. The ETS room will require a double wide door and clear access from a delivery point to allow for installation of the ETS. Minimum access clearance of 2032mm high x 1800mm wide shall be maintained to the ETS room. A floor drain connected to the sanitary sewer system shall be provided in the ETS room within 1.0m of the proposed ETS location, but not underneath the ETS. A domestic water source and hose bibb shall be provided within the ETS room. A dedicated 15A 120V electrical service, with a lockable breaker, is required to power the ETS control panel.

Allowance should be made in the Building Automation System (BAS), if one exists, to provide heating pump on/off status to the ETS control panel. If a BAS is not planned for the building, the DES will directly monitor heating pump on/off status via a hardwire connection to current sensors or VFD contacts, provided by the building. As well, one 20mm electrical metallic tubing (EMT) conduit from the ETS room to a north facing exterior wall is required for the outdoor air temperature (OAT) sensor wiring. The ETS controls are standalone, and shall not have any connection to the customer building control system.

The footprint of an ETS depends on a number of factors, including customer load, number of heat exchangers, configuration of the hydronic heating and DHW systems, and specific restrictions within the customer building. Generally, a typical ETS requires between 4 and 10 m^2 of floor space, with a minimum ceiling height of 2.7 m. A minimum 1.0m of clearance is required in front of the control and electrical panel of the ETS and 300mm around all other sides when it is placed in its final location. The exact size and location of the ETS will be coordinated during the design process. Figure 2 below shows a typical ETS located near the DPS mains in the street.

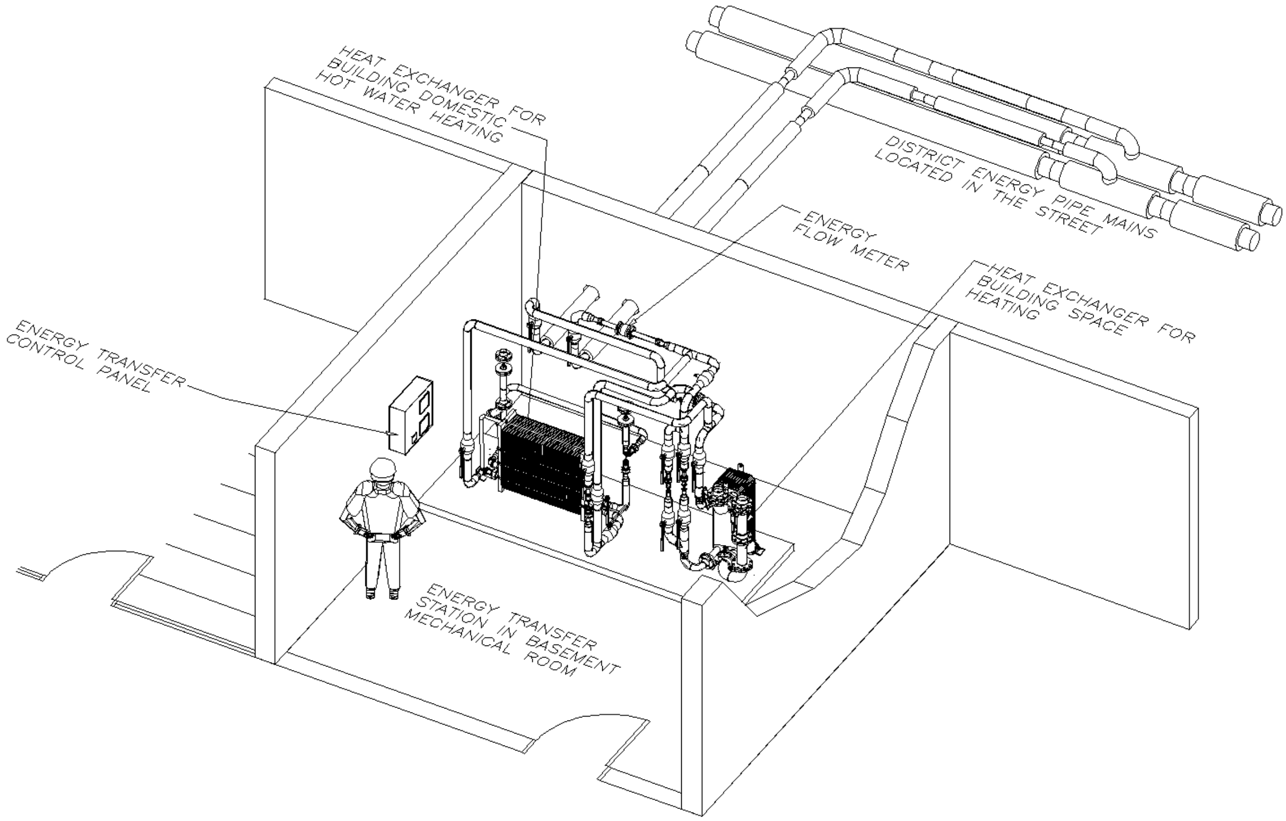

FIGURE 2: TYPICAL HEATING ETS INSTALLATION IN BUILDING BASEMENT

The building shall be responsible for concrete coring or pipe sleeves for all DE service lines' and communication conduits' penetrations through building and foundation walls, as well as sealing of penetrations after DEU installation, including building envelope waterproofing. The DEU will produce a penetration drawing during the detailed design stage. Penetrations may be core drilled (after foundation construction) or sleeved (during foundation construction). The DEU will install the DE service lines; however, as with other utilities, the customer is responsible for providing and maintaining the penetration. Final location and size of DPS core holes or sleeves to be confirmed with the DEU prior to installation. Timing of sealing and waterproofing after DE installation is to be coordinated with the DEU.

The DEU may also install one or more plastic (PVC or HDPE) conduits into the customer building to facilitate remote communication with the ETS. Communication allows for remote monitoring of the ETS, as well as remote reading of the energy meter. The customer is also responsible for providing and maintaining the penetration for communication conduit(s).

The DEU will require uninterrupted access to the ETS and service line within a customer's building for installation, regular maintenance and repairs, without confined space constraints. This is defined by a DES service agreement with the DEU and Statutory Rights of Way document.

3.1.5 Hydronic Heating Water Quality & Expansion

Building owners are responsible for filling and managing their own building hydronic space heating system. The DEU requires that water treatment for the building system meet the minimum criteria set forth below:

Chloride: < 30 ppm

Sodium Silicate Corrosion Inhibitor or Nitrite

Hardness: < 2 ppm

pH Level: 9.5-10

Iron < 1 ppm

The customer shall employ the services of a qualified water treatment contractor to provide the necessary chemicals, materials and supervision for a complete cleaning and flushing of all piping to the ETS demarcation point. ETS start-up and commissioning will occur only after acceptable water quality analysis results have been obtained. Certification from the water treatment contractor verifying that the water quality is adequate is required before the customer can flow water through the ETS. Cleaning and flushing test reports shall be provided to the DEU for review and acceptance prior to DEU connection and commissioning. No cleaning or flushing water shall be allowed through the ETS. The building is responsible for including necessary temporary bypasses to facilitate the cleaning and flushing process.

The cleaning and flushing process shall be completed by the building, but shall generally consist of a chemical clean, followed by a clean water flush to drain, then fill and treatment of the system service water. Flushing velocity shall be adequate to ensure removal of debris from the system; recommended values are:

- Pipe sizes NPS 6 and smaller: 1.5 meters per second (4.9 ft/s).
- Pipe sizes NPS 8 and larger: 0.9 meters per second (3.0 ft/s).

The building is responsible for continuously employing the services of a qualified water treatment specialist and maintaining acceptable water quality throughout the life of the building.

3.1.6 Commissioning

The ETS secondary isolation valves shall be opened to the building piping systems and commissioned only after the DEU is satisfied with the building's cleaning and flushing process and results. The customer is responsible for commissioning all equipment and systems on the building side of the demarcation point prior to requesting ETS commissioning by the DEU. During ETS commissioning, the building operator is responsible for the building's internal hot water hydronic and DHW systems.

3.1.7 Changes to the Building System

The Customer shall not materially change the design or substitute any pertinent equipment during installation without the DEU's approval. After commissioning, any changes to the building's hydronic or DHW system that may impact DES performance shall be reported to the DEU.

The ETS is owned and maintained by the DEU. Under no circumstances is the customer or any of its contractors permitted to adjust, modify or otherwise tamper with any ETS equipment. This includes adjusting or changing the position of any valves, gauges or instruments and altering the controls and control panel.

3.1.8 DE-Ready Buildings

DE-Ready building owners are responsible for design, installation, commissioning, operation, and maintenance of all systems within their building, including all boilers and chillers/cooling towers. The DEU has no responsibilities within DE-Ready buildings until DEU service branches and ETS are installed in the future.

3.2 DES Responsibility

3.2.1 DES Equipment within Customer Buildings

The DEU designs, installs, operates and maintains the ETS at the agreed-upon location, as well as the Primary (DE) distribution pipes to the ETS. Branch pre-insulated pipelines are generally direct buried from the mainline to the building penetration. From that point, DE piping runs inside the building to the ETS.

The DEU provides strainers on the Primary (DE) and Secondary (building) side at each heat exchanger in the ETS, which are cleaned as necessary. The DEU services the energy metering equipment and verifies accuracy at regular intervals per manufacturer recommendations.

The DEU provides temperature transmitters, pressure gauges, temperature gauges, thermowells, control valves, energy meters, and a control panel for the ETS. Temperature transmitters for the secondary side of the heat exchangers are also provided to facilitate monitoring and control of the building side heating and DHW systems. The ETS controls are standalone, and do not require any connection to the customer building control system. The ETS controls regulate Primary water flow rates to maintain Secondary supply water temperatures; the ETS does not control any other aspects of the buildings hydronic space heating and DHW systems.

The DEU provides pressure relief valves on the Secondary side of the ETS heat exchangers, within the bounds of the ETS. These relief valves are solely to protect the ETS heat exchangers, piping, and components from over-pressurization from thermal expansion if the ETS isolation valves are closed. Pressurization and over-pressure protection of the building's hydronic and domestic hot water systems remain the responsibility of the customer building. The building developer shall communicate the building systems' design and maximum operating pressures at the inlet of the ETS, in order for the DEU to coordinate relief valve selections.

3.2.2 District Energy Side Water

The DES provides the make-up water requirements for the Primary system side. All necessary water treatment and thermal expansion of water in the DES is accomplished at the NEC(s).

3.2.3 ETS Commissioning

The DEU will start and commission the ETS and all components up to the DE-service demarcation point. Commissioning includes verifying measurement points and testing the controls under various operating modes. The building operator is required to support this process as the building’s internal hydronic space heating and DHW systems must be ready to accept heat from the DES.

4 Requirements for Building HVAC and DHW Systems

This section summarizes technical requirements for hydronic heating and domestic hot water systems for new developments to be served by the DES, including DE-Ready buildings. The information provided in this document should be regarded as a general guideline only, and the developer's Engineer shall be responsible for the final building-specific design. The DEU will provide technical assistance to developers to improve integration of the customer building with the DES. Heating system schematics, layouts, equipment schedules and sequence of operation or control strategies are required to assist in the DES review process.

4.1 Design Strategies

The following table identifies the key elements or strategies that should be followed when designing the building hydronic systems.

Strategy:	**Rationale:**
Centralized hydronic system	• Water has four times the specific heating capacity of air. • Benefits from system load diversification. • Reduces utility interconnect costs. • Minimizes noise from mechanical systems.
Low[4] hot water supply temperatures	• Improves efficiency. • Allows use of lower grade energy sources.
Large temperature differentials	• Reduce piping capital cost. • Reduce pumping capital & operating costs.
Avoid conventional water-source heat pumps	• Fan-coil units and hybrid heat pumps reduce power consumption and noise when in heating mode, and have longer life than conventional heat pumps. • Improves energy efficiency and reduces cost for residents
Instantaneous or semi-instantaneous DHW systems	• Reduces cost and space required for storage tanks • Smaller storage volumes decrease risk of bacteria growth • Improves energy efficiency

[4] "Low" relative to traditional building HVAC design, which historically had >80°C on the building side of the ETS. The DEU is referred to as a "medium" temperature water system since it supplies water from 65°C up to 95°C and needs to be higher than the building side temperature.

Strategy:	Rationale:
Appropriate sizing of DHW pumps	• Reduce capital and operating costs • Improved DHW return temperatures improves energy efficiency • Reduced DHW volume decreases risk of bacteria growth
Variable flow with variable frequency drives	• Reduces pumping operating costs. • Improves system control.
Two-way control valves	• Necessary to achieve variable flow and a large temperature differential.
Seasonal reset of supply temperatures	• Improves energy efficiency. • Improves system control.
Return temperature limiting	• Improves energy efficiency. • Ensures large temperature differentials.
Direct Digital Control System	• Allows more accurate control and greater control flexibility. • Potential opportunities for energy savings.
Night setback settings & recovery times	• Minimize equipment sizes by allowing reasonable recovery times. • Maximize recovery times from unoccupied to occupied mode.

4.2 Pumping and Control Strategy

The building hydronic heating system shall be designed to minimize Secondary hot water return temperatures across all operating conditions.

The building heating system shall be designed for variable hydronic flow (with variable speed pumps to minimize pumping energy), using 2-way modulating (or on/off) control valves at terminal units (radiators, fan coil units, etc.). Alternatively, 3-way mixing valves at sub-systems and terminal units may be used.

Bypass valves (e.g., 3-way bypass valves at terminal units) are not permitted. One allowable exception to the bypass valve restriction is the use of a controlled bypass flow path to ensure minimum pump speeds can be maintained without deadheading the pumps; in this case, the bypass valves must be programmed to remain closed at all times that circulating pumps are operating above minimum speed settings. Bypass valves shall be sized to minimize the rate of bypassed flow, only providing that as sufficient to maintain minimum pump speeds.

Pumps shall be selected for the diversified demand (with a reasonable margin) in order to avoid oversizing and consequential impacts to the ETS heat exchanger sizing. The allowable pressure drop between ETS tie-in points from the Secondary side return piping tie-in to the secondary side supply piping tie-in, including the pressure drop through the secondary side of the ETS heat exchanger, needs to be carefully considered so as to not affect pumping and flows to secondary side end devices. Table 1 shall be followed when sizing the hydronic system and DHW pumps:

TABLE 1: ETS MAXIMUM ALLOWABLE SECONDARY SIDE PRESSURE DROP

System	ETS total pressure drop[5]	HX pressure drop
Space Heating	Maximum 70 kPa	Maximum 50 kPa
Space Cooling	Maximum 70 kPa	Maximum 50 kPa
Domestic Hot Water	Maximum 70 kPa	Maximum 50 kPa

See Figure 3 below for typical hydronic heating system configurations.

[5] Certain configurations may require higher overall secondary side pressure drop, e.g., if three-way mixing valves are included. Such configurations will be discussed with the building developers if required.

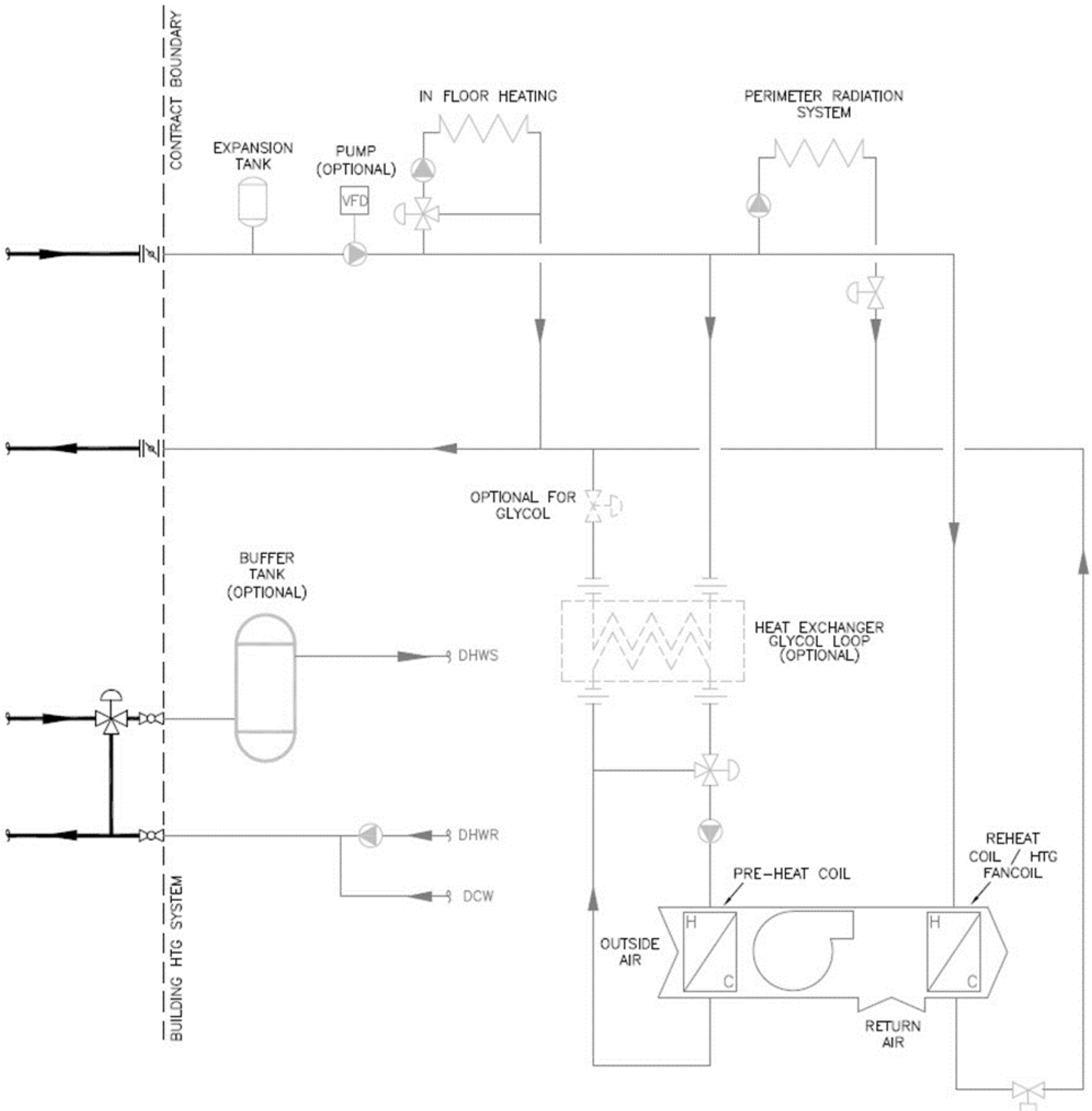

FIGURE 3: EXAMPLES OF TYPICAL SECONDARY (BUILDING) HEATING SYSTEMS

4.3 Hydronic Heating and DHW System Requirements

4.3.1 Hydronic Space Heating

Optimization of the hydronic heating system return temperature is critical to the successful operation of the DEU. The ETS controls the supply water temperature to the hydronic circuit (i.e., the temperature of the water leaving the space heating piping of the ETS) based on an outside air temperature reset schedule. This is the maximum temperature available to the building hydronic space heating circuit. A sample hydronic space heating circuit supply and return temperature reset curve is shown in Figure 4 below.

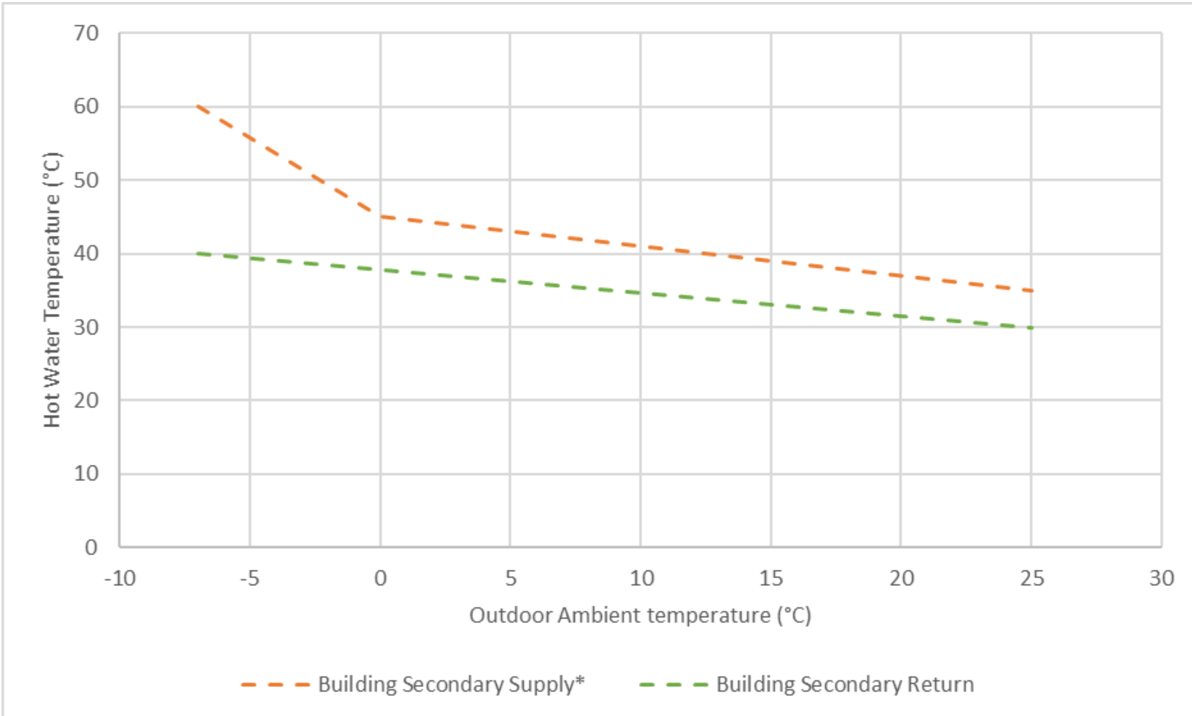

FIGURE 4: TYPICAL SECONDARY SPACE HEATING TEMPERATURE RESET CURVE
*SPACE HEATING ONLY. DHW SUPPLIED SEPARATELY FROM ETS, HEATED TO MAX. 60°C

The hydronic space heating system shall be designed to provide **all** space heating and ventilation air heating requirements for the whole building, supplied from a central ETS. Gas-fired or electric-resistance heating or ventilation equipment (roof top units, air handling units, electric coils, electric baseboards, etc.) are not permitted, unless approved by the DEU when hydronic heating is not deemed feasible or is prohibited by a building code.

Heating water generated by the ETS is distributed via a 2-pipe system to the various heating elements (terminal units) throughout the building. The building Secondary heating system **must** be designed for temperatures and pressures no greater than those specified in Table 2 below.

TABLE 2: MAXIMUM HYDRONIC SPACE HEATING SYSTEM TEMPERATURES

	Peak Winter	*Summer*
Supply Temperature, **Max.**	60°C	35°C
Return Temperature, **Max.**	40°C	30°C
Design Pressure[6]	≤1600 kPa	≤1600 kPa

Specific types of heating systems (i.e., terminal units) can operate at lower temperatures. The terminal units must be selected based on temperatures as low as can be reasonably expected. Table 3 below outlines **maximum** hot water supply (HWS) and hot water return (HWR) temperatures for which terminal units should be designed and selected.

TABLE 3: MAXIMUM HYDRONIC SPACE HEATING SYSTEM TEMPERATURES (BUILDING SIDE)

Type of Terminal Unit	Maximum HWS	Maximum HWR
Radiant in-floor heating	50°C	38°C
Perimeter radiation system	60°C	40°C
Fan-coil units, reheat coils, and unit heaters	50°C	40°C
Make-up air units (MAU) and air handling units (AHU)	60°C	40°C

The specified temperatures shall be regarded as maximum requirements; lower temperatures are desirable. The building return temperatures should be minimized to allow the DES to take advantage of alternate energy technologies.

4.3.2 Domestic Hot Water

The Domestic Hot Water (DHW) system shall be designed to provide all DHW requirements for the building, supplied from a dedicated DHW heat exchanger from the ETS. It is understood that DHW systems require supply temperatures as high as 60°C; the DES is able to supply this temperature to all buildings at all times, as illustrated in Table 4.

[6] So as not to exceed standard design pressure. If building specifics (e.g., building height) imposes a higher pressure requirement at the ETS, the building designer shall communicate this to the DEU.

TABLE 4: DOMESTIC HOT WATER SYSTEM TEMPERATURES (BUILDING SIDE)

	Winter	*Summer*
Supply Temperature (with storage), **Max.**	60°C	60°C
Supply Temperature (no storage), **Max.**	55°C	55°C

The building is responsible for ensuring their system design meets all maximum and minimum temperature and anti-scaling requirements per the latest editions of the local Plumbing Code and ASHRAE Standard 188 and Guideline 12, depending on the DHW configuration chosen.

DHW systems may be designed in various configurations, each with their own benefits and draw backs. The allowable configurations are:

- Instantaneous
- Semi-Instantaneous
- Charging

Instantaneous and semi-instantaneous systems are encouraged to reduce DHW storage size and cost if peak demands are not excessive.

Instantaneous

A fully Instantaneous DHW system has no storage tanks; domestic water is heated on demand. This results in the smallest footprint and lower maintenance and capital costs. Additionally, the ETS experiences the lowest return temperature, benefiting the DEU. However, as the heating is on demand, the ETS heat exchanger must be sized for the peak DHW draw flow, resulting in the largest capacity heat exchanger of the three options. Instantaneous DHW systems are configured with DHW recirculation lines connected in parallel to the DCW supply line, to the inlet of the ETS heat exchanger. Refer to Figure 5 for a typical Instantaneous schematic.

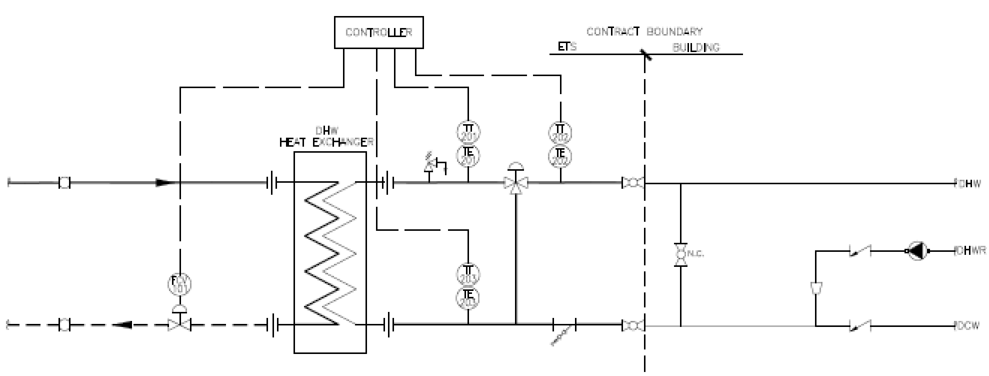

FIGURE 5: TYPICAL INSTANTANEOUS DHW CONFIGURATION

Semi-Instantaneous

A Semi-Instantaneous DHW system has a small amount of storage capacity, where storage tanks act as “buffer tanks” only; there is no recirculation from the DHW storage tanks directly back to the ETS heat exchanger. The buffer volume allows for a drain down of DHW during atypical or critical demand periods, while potentially reducing the heat exchanger capacity. Semi-Instantaneous DHW systems are configured with DHW recirculation lines connected in parallel to the DCW supply line, to the inlet of the ETS heat exchanger, and the buffer tank(s) connected off the supply from the heat exchanger. Refer to Figure 6 for a typical Semi-Instantaneous schematic.

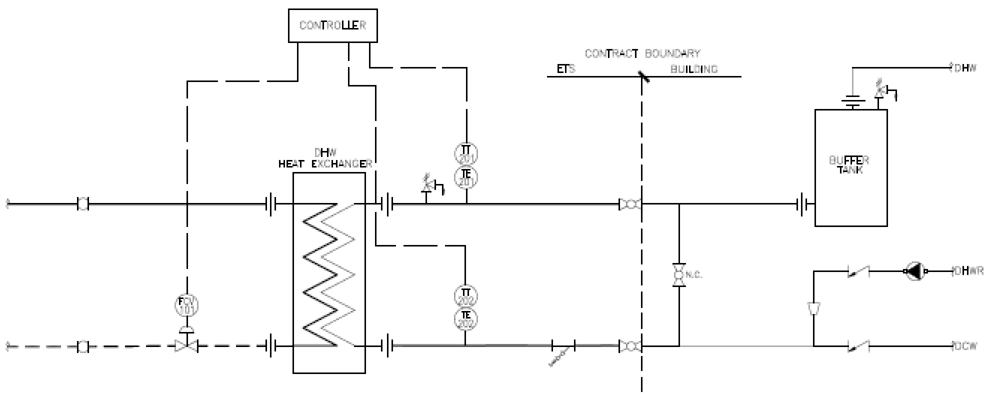

FIGURE 6: TYPICAL SEMI-INSTANTANEOUS DHW CONFIGURATION

Charging

A Charging DHW system can have a significantly reduced heat exchanger capacity compared to Instantaneous or Semi-Instantaneous, but requires the addition of charging pumps and ample storage volume to suit the DHW demands. Due to the presence of larger storage volumes and increased residence times, the risk of Legionella growth is higher than for the other configurations, and must be prevented appropriately. Additionally, Charging configurations require careful consideration of piping connections, charging flow rates, and DHW recirculation flow rates in order to return acceptable temperatures to the ETS. Charging configurations must meet the following requirements:

- Charging circulation connection on the storage tank(s) returning to the ETS shall be as low as possible on the tank(s).
- DCW make-up connection must connect to the charging piping returning to the ETS.
- DHW supply piping from the ETS shall connect to the storage tank(s) as high as possible.
- DHW supply to the building shall connect to the storage tank(s) as high as possible.
- DHW recirculation piping from the building shall connect either to the mid- or upper-section of the storage tank(s) or to the charging circulation piping returning to the ETS.
    - If connected to the charging circulation piping returning to the ETS, the charging pump capacity must be larger than the recirculation pumps from the building, or proper charging of the tank(s) will not be possible when both pumps are running simultaneously.

- Charging pump flow rates shall be less than the peak DHW draw flow rate, and shall be sized to provide reasonable recovery time of the storage tank(s) to suit the application. Unreasonably high flow and recovery rates impacts the ETS heat exchanger capacity. The ASHRAE HVAC Applications Handbook[7] provides guidance on recovery vs input rate for different applications.

Tanks and pumps must be selected and installed to meet the above requirements. While these items are checked during the DEU compatibility review of the building system, it is common for tanks to be supplied with incorrect connections during the construction phase of a project; therefore, the DEU shall be provided with the proposed tank shop drawing and piping isometrics/spool drawings submittals for comment prior to purchase and delivery.

Refer to Figure 7 for a typical Charging system schematic.

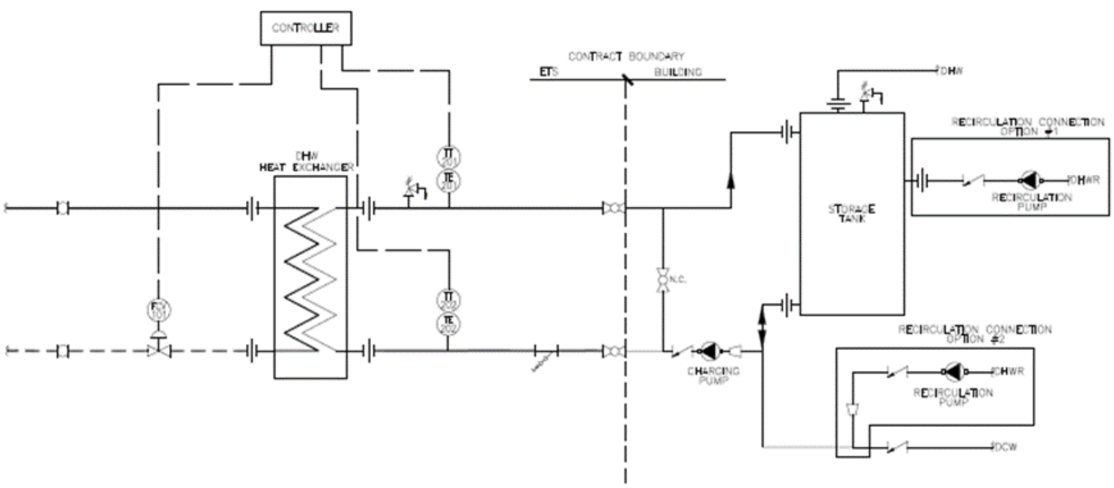

FIGURE 7: TYPICAL CHARGING DHW CONFIGURATION

DE-Ready Buildings

DE-Ready buildings may employ alternate DHW configurations. However, provisions shall be made for conversion to District Energy, including but not limited to full-size tees and isolation valves in the ETS room for future connection to the ETS, to facilitate one of the above configurations.

4.4 Supplemental Energy Sources in Customer Buildings

At the discretion of the DEU, some heating energy can be served by supplemental energy sources within the building. Solar heating systems are typically acceptable, as are other waste heat sources. Use of a supplemental energy source does not change the hydronic heating return water temperature requirements outlined in Section 4.3.1.

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[7] 2019 version, Chapter 51.

Gas-fired or electric-resistance heating or ventilation equipment (boilers, roof top units, air handling units, electric coils, electric baseboards, etc.), air or water source heat pumps to provide heating are not acceptable. All thermal energy for space heating and DHW shall be supplied by the DEU. Exceptions can be made for remote spaces within the building not practical to be serviced by the hydronic system, and/or electrical rooms, and are reviewed and approved by the DEU on a case-by-case basis.

The following exemptions to the supplemental heat sources restrictions are permitted:

- Electric baseboard heaters for freeze protection only, at stairwells, egress vestibules, electrical rooms, and isolated mechanical rooms only.
- Electrical heat tracing of piping in areas subject to freezing.
- Exterior heating (e.g., gas-fired radiators or fireplaces) where hydronic heating is impractical.

Any alternative and/or supplemental energy sources must be reviewed approved by the DEU, and shall be implemented by the Customer are the sole responsibility of the Customer.

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