District Energy Briefing Packet

Project Lead
Office of Sustainability and Environment

District Energy Interdepartmental Team

- Mayor's Office
- Seattle City Council Central Staff
- Office of Sustainability and Environment
- Seattle City Light
- Seattle Public Utilities
- Department of Planning and Development
- Central Budget Office
- Seattle Department of Transportation
- Office of Economic Development

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Introduction

On October 10, 2011, the Seattle City Council passed Resolution 31329 requesting the Office of Sustainability and Environment (OSE) conduct an analysis of the First Hill District Energy Partnership, which was originally proposed in the District Energy Pre-Feasibility Study completed by Compass Resource Management (Compass).

OSE has worked with the Mayor's Office, the District Energy Interdepartmental Team (IDT), and Compass to develop a response to Resolution 31329. In addition, OSE worked with additional external stakeholders (Virginia Mason, Swedish, Harborview, Seattle Housing Authority, and Seattle Steam) to develop the proposed Request for Qualifications (RFQ) also being reviewed as part of this packet.

The questions, scenario analysis, and precedent studies requested in the Resolution are all essential elements of the vetting process that any proposal of this magnitude should receive over the course of a full feasibility analysis. Because the feasibility analysis will not be completed until a partner has been engaged, many of the questions posed as part of Resolution 31329 cannot be fully answered at this time. OSE has noted when this is the case, and has provided a timeline of the different phases of the proposed process.

In advance of addressing Resolution 31329, it is important to emphasize that the City is still in a "pre-feasibility" phase of the First Hill District Energy Partnership. While the Compass report recommended one strategy that would involve a Joint Cooperative Agreement, there a number of strategies, including different ownership and governance scenarios, that the City could pursue in the development of a First Hill District Energy Partnership that would upgrade and expand district energy on First Hill. Whether a First Hill District Energy Partnership makes sense (regardless of structure) is contingent on identifying a viable business case, one that works for the City and all key stakeholders on First Hill, including the Hospitals, Seattle Housing Authority, and Seattle Steam.

The City's role at this point is as a convener of all parties and an advocate for the public interest in upgrading and expanding district energy on First Hill. The role of the City in the implementation of district energy on First Hill remains an open question, and would depend on what business case (if any) is viable. While the City's role will be further defined during the feasibility study stage, OSE has provided a summary of the different possible ownership outcomes in this briefing packet to help the Council understand the range of possibilities.

First Hill District Energy Opportunity

First Hill has one of the highest current energy densities in the City. More than 40% of Seattle Steam's existing load is located on First Hill, including three large hospitals - Harborview, Swedish and Virginia Mason (Hospitals). Given the size of their energy loads, decisions by these large institutions could have significant follow-on effects for the rest of the 200 existing customers on Seattle Steam and for the GHG goals of the City.

First Hill was also identified in Seattle's District Energy Pre-Feasibility Study as one of the most promising areas for expansion of district energy in the City. Significant new development is anticipated on First Hill. By 2030, housing supply is expected to grow by nearly 165% and employment by nearly 15%.

A large new redevelopment planned by the Seattle Housing Authority (SHA) at Yesler Terrace represents a particularly important opportunity for expanding and modernizing district energy on First Hill. Yesler Terrace could add 2 – 5 million square feet of new floor area to First Hill by 2030, the equivalent of as much as half of the existing floor area of the hospitals on First Hill. SHA has expressed interest in district energy as one tool for achieving high levels of environmental performance at Yesler Terrace, but has not expressed interest in developing, owning or operating the energy system itself.

The high energy density, existing district energy assets, large existing loads, and new proposed development on First Hill pose a unique opportunity. However, due to the core differences in business plans for the actors involved, OSE has recognized the need for the City to act as a facilitator to explore a collective vision for First Hill that meets stakeholder and community objectives. OSE proposes an RFQ solicitation process that invites a district energy utility partner to work with all key stakeholders (City, Hospitals, Seattle Housing Authority and Seattle Steam) to explore a collective district energy vision for First Hill.

Through the RFQ process, the City wants to explore opportunities to develop and deliver a collective, long-term vision for a flexible, reliable, cost-effective and environmentally responsible district energy system on First Hill, leveraging existing loads, existing infrastructure, and expected new development.

The preferred solution identified after feasibility analysis by the selected partner could be a combined solution for all of First Hill or a subset of stand-alone solutions. Any option to move forward would require a series of definitive agreements among participants, and those involving the City (for example, a franchise agreement) would require Mayor and Council action. Based on a successful model implemented elsewhere, Compass has also proposed a Strategic Partnership Agreement as a possible alternative to a traditional franchise agreement. A partnership agreement could include the normal provisions in a franchise agreement as well as other expectations, considerations and governance structures to achieve outcomes that support the public interest in district energy (e.g., GHG reductions, long-term energy security, and local economic development) without direct City involvement in ownership or operation. Such agreements can also include provisions to allow for more active City involvement in the future if desirable. The possible types of City involvement, together with their pros and cons, will be considered in parallel with the examination of technical solutions for First Hill during the feasibility study stage.

Resolution 31329 – Response

Question A: In addition to the "strategic district energy partnership" approach recommended by Compass Resource Management Ltd., in its August 2011 report (Compass), what other approaches warrant analysis or have already been analyzed? This should include identification of alternatives including:

(1) Taking no further action;

(2) Creating a smaller, stand-alone district energy system for Yesler Terrace which could possibly be expanded in the future; and

(3) Creating a municipal heating district.

Each of these approaches is discussed within the context o the questions laid out under Item B.

Question B: For each alternative, respond to questions 1 through 5, below:

Alternative (1): Taking No Further Action

(1) Conduct or cite policy, financial, legal, and other analysis to the extent necessary to compare the alternatives, evaluating pros and cons and tradeoffs.

No policy, financial, or legal analysis necessary.

(2) Identify entities or groups that have interests in the area or the issues and how they might be affected by the choice of alternative.

The path forward differs for the Hospitals, Seattle Steam, and the Seattle Housing authority if the City decides to take no further action.

SHA & Yesler Terrace:
As part of the legislative process, Yesler Terrace is committed to connecting to a district energy system should a signed franchise be in place at the time of each project's building permit. The franchise agreement in turn is contingent on finding a suitable franchisee and confirming the viability of a stand-alone district energy system for Yesler Terrace through an investment-grade analysis. Should the City decide not to pursue the First Hill pilot project as proposed, SHA may issue a similar RFQ with the scope reduced to focus on a Yesler Terrace stand-alone system could be pursued. A stand-alone system may be viable; however, it will not necessarily leverage any synergies between Yesler Terrace and the Hospitals or other loads on First Hill.

Hospitals & Seattle Steam

For the Hospitals and Seattle Steam, taking no further action could have more significant consequences. While Virginia Mason has recently signed a 20-year service agreement with Seattle Steam, Harborview's service agreement expires in 2013 and the hospital has expressed a desire to move to a stand-alone, gas fired steam plant. Should a load of this size be removed from the Seattle Steam system, it is likely that the heating provider would need to raise costs for other customers, leading to further attrition from the system, which in turn would lead to further price increases. It is likely that a majority of buildings leaving Seattle Steam would pursue a natural gas-based strategy, a negative impact to the carbon footprint of building energy use in the city.

(3) Identify and address challenges or barriers to implementing the alternative.

As this alternative does not require a proactive City role, there are no challenges/barriers to implementation. Potential negative impacts are highlighted above.

(4) Identify the changes in City law or practice that might be needed, including revising or waiving City requirements as recommended by Compass, the pros and cons of making such changes (costs, legal, policy, etc.), and the likely schedule for considering them.

As this alternative does not require a proactive City role, there are no changes in City law/practice that would be required.

(5) Identify the changes in state law (if any) that might be needed, and the positions and interests of other groups in the state, and assess the likelihood of the City being successful in securing the changes.

No changes in state law are required in this alternative.

Alternative (2): Creating a smaller, stand-alone district energy system for Yesler Terrace which could possibly be expanded in the future

Seattle Housing Authority conducted a Sustainable District study, which considered various district energy options including a Geothermal/Solar solution for a stand-alone system. An investment-grade analysis is still required to confirm the technology selection and business case for district energy. It should be noted that the proposed RFQ would have, as its minimum requirement, consideration of a stand-alone district energy system for Yesler Terrace. Without a proactive City role, SHA would likely issue a similar RFQ to the one proposed but with a more limited scope, one that would likely not fully explore a system that leverages the surrounding loads.

(1) Conduct or cite policy, financial, legal, and other analysis to the extent necessary to compare the alternatives, evaluating pros and cons and tradeoffs.

The policy, financial, and legal implications of a stand-alone option for Yesler Terrace would remain focused around the legislative package the Council will consider in the coming months for Yesler Terrace, including a rezoning proposal and a planned action ordinance.

(2) Identify entities or groups that have interests in the area or the issues and how they might be affected by the choice of alternative.

Seattle Housing Authority, the future Master Developer, future property developers at Yesler Terrace, and future residents would be affected by this course of action. This option, as well as the one currently proposed by OSE, would require that developers design buildings to accommodate hydronic systems (in which thermal heat is transported through water pipes) and to connect with a district energy system should a signed franchise be in place at the time of the building permit. Hydronic systems represent an estimated 3%-5% premium on construction prices. Given the SHA commitment to green building and infrastructure at Yesler Terrace, however, this premium is not as severe given that a non-district energy option is still anticipated to use heating technology with a greater efficiency than the status quo or baseline.

SHA residents would be affected by whatever rate structure is established with the district energy provider. It is OSE's assumption, which will need to be born out with further analysis, that a Yesler Terrace stand-alone system would less likely to achieve the cost saving opportunities that larger systems provide as they capture new customers.

(3) Identify and address challenges or barriers to implementing the alternative.

Seattle Housing Authority has expressed they have no interest in financing, building, owning, or operating their own district energy system.

(4) Identify the changes in City law or practice that might be needed, including revising or waiving City requirements as recommended by Compass, the pros and cons of making such changes (costs, legal, policy, etc.), and the likely schedule for considering them.

The current draft of the Yesler Terrace redevelopment legislative package has language creating the necessary framework for a future district energy provider to have a "guaranteed load" in the Yesler Terrace area, while providing SHA and future property owners an "out clause" if a provider is not identified. This exercise has proven helpful in thinking through how future district energy opportunities could be facilitated through land use actions in other areas of high building concentration.

(5) Identify the changes in state law (if any) that might be needed, and the positions and interests of other groups in the state, and assess the likelihood of the City being successful in securing the changes.

No changes in state law would be required for the proposed strategy identified in the Yesler Terrace Sustainable District Study. Any other strategies identified through further feasibility analysis would need to be reviewed at the time regarding any identified changes to state law.

Alternative (3): Creating a municipal heating district:

This scenario addresses the type of ownership structure that the City can pursue on First Hill rather than a specific technical solution. For instance, this ownership structure could apply to a First Hill joint district energy solution or a Yesler Terrace stand-alone solution. To date, the City has expressed no desire to own or operate district energy in Seattle. The Hospitals on First Hill expressed interest in more involvement by the City in district energy governance, but did not express a strong desire for City ownership or operation. The RFQ process does not preclude City ownership. Through the due diligence process, viable technical solutions will be identified for First Hill. The specific partnership model best suited to the preferred technical solution will be identified at that time, and could include City participation in ownership and financing. This has occurred in other partnerships (e.g., St. Paul, MN).

(1) Conduct or cite policy, financial, legal, and other analysis to the extent necessary to compare the alternatives, evaluating pros and cons and tradeoffs.

Chapter 35.97 RCW authorizes a municipality (including counties, cities, towns, port districts and water-sewer districts) "to establish heating systems and supply heating services" through a municipal heating utility enacted by an ordinance or resolution, without any public hearing or vote. Once established, there are a variety of ownership structures possible, from full municipal ownership to a public-private partnership to a full contracting out model.

While RCW 35.97.080 authorizes cities to establish municipal heating districts, it also provides that "potential customers shall not be compelled to subscribe or connect to the heating system."

There are a number of tools available for the City to finance a municipal heating system, including but not limited to federal grants, bonds, LID revenues, and tax increment financing linked to Transfer of Development Rights.

(2) Identify entities or groups that have interests in the area or the issues and how they might be affected by the choice of alternative.

The stakeholders affected by this course of action would be the Hospitals, Seattle Housing Authority, future developers of buildings within Yesler Terrace, future residents, and Seattle Steam. The City would also become a major stakeholder in the process and various departments could be affected to different degrees. Should

the City decide to pursue a municipal heating district, it could turn to Seattle City Light to incorporate the district into its utility service, or establish a separate utility.

(3) Identify and address challenges or barriers to implementing the alternative.

The financial implications to the City would be substantial. Development of district energy systems is capital intensive and often takes 5-15 years before positive cash flow is achieved.

(4) Identify the changes in City law or practice that might be needed, including revising or waiving City requirements as recommended by Compass, the pros and cons of making such changes (costs, legal, policy, etc.), and the likely schedule for considering them.

The City would run both an electrical and heating utility. As such, it would likely need to develop new policy to ensure that provision of electrical and thermal energy do not conflict with each other.

(5) Identify the changes in state law (if any) that might be needed, and the positions and interests of other groups in the state, and assess the likelihood of the City being successful in securing the changes.

At this time, no changes in state law have been identified.

Question C: For the partnership approach recommended by Compass on First Hill, respond to questions 1 through 9, below:

As part of the District Energy Pre-Feasibility Study, Compass recommended the City facilitate a strategic public-private partnership for district energy on First Hill. This project would provide a model for City vision and leadership in upgrading and expanding district energy, without requiring direct City ownership or operation of district energy. A partnership on First Hill would capitalize on the neighborhood's high existing thermal energy density (which includes three large hospitals), existing district energy infrastructure, and large potential for increased density, including the Seattle Housing Authority's proposed redevelopment of Yesler Terrace.

There are a number of different ownership models that could be used to create a First Hill District Energy Partnership, from full private ownership to a City-owned municipal heating system. Based on preliminary feedback from the City and the timeline of opportunities on First Hill, Compass recommended the City pursue a joint cooperative agreement. However, several different models will be evaluated in the context of a full feasibility analysis. OSE is working closely with Law and other departments to ensure that the City's interests and risk are represented in the context of specific proposals.

(1) What is the City's authority to select and contract with a retail district energy provider?

The City has the authority to select and contract with a retail district energy provider. The City has all the usual powers of a corporation, to be exercised for public purposes. This includes the power to contract for the operation of heating facilities. Under a scenario of municipal ownership, the specific authority to enter into contracts is within RCW 35.97.030 and RCW 35.97.040. .

(2) What regulatory authority over scope, operations, guarantee of load, rates, performance etc., does the City have?

Related to guarantee of load, the City has a somewhat unique opportunity with the proposed rezone and master development package at Yesler Terrace to include provisions for developments to be served by a district energy system if available. Beyond the borders of Yesler Terrace, the City cannot mandate that buildings hook up to a district energy system. The City does have the authority to offer incentives to hook-up to district energy through non-mandatory means (SMC Chapter 23.58A, 23.49.012, and 23.49.013 of the Seattle Land Use Code include examples of incentives). .

Related to authority over scope, operations, rates, and performance, there are different legal parameters for each of the number of options the City could pursue to define the partnership. RCW 35.97 outlines City authority to establish, acquire, install, maintain, operate, and regulate its own heating system.

The City may also engage in a public private partnership because if its authrioty to contract for the operation of heating facilities. The partnership may be for the

construction of facilities and/or the operation of facilities. Examples of public private partnerships or other cooperative arrangements include: contracting out services; privately built, government-owned facilities; government-owned, privately operated facilities; and privately owned, privately operated facilities.

In the absence of municipal ownership or a public private partnership, under a pure contractual arrangement, the City could enter into a voluntary contract that allowed some sort of City oversight if mutually agreeable by both parties.

(3) What might the legal structure of such an entity look like? What are the risks to the City of involvement in such a legal construct?

At a minimum it is expected the City will need to issue a franchise for any new entity. Beyond that, there are many different forms of agreements and legal structures that could be implemented to support and enhance the viability of a collective district energy system that addresses customer and City objectives. These structures would be evaluated as part of the due diligence and negotiation phase with the successful proponent in the RFQ process. No decisions have been made on the legal structure, which will depend in part on the partner selected and the specific vision developed for district energy.

Specific legal analysis regarding the City's risks on each of these (and other) options would happen during the full feasibility study in 2012, and the City will not move forward with any solution until authorized in ordinance by the Mayor and Council.

(4) Does RCW 35.97 provide a feasible basis for such a system? What authority does it give the City in this context? What risks are involved of using that authority?

RCW 35.97 could be used in multiple different scenarios, as mentioned above. The City has made no decisions with respect to the use of RCW 35.97 and will consider its applicability and advantages or disadvantages during the due diligence and negotiation stage with the selected partner.

(5) If a new district energy system were to include a guaranteed load to a new provider, what consumer protections would exist and how would they be enforced?

The City is not able to guarantee exclusivity of load through a retail franchise agreement on First Hill. In the particular case of Yesler Terrace, OSE is working with DPD to use the current legislative process around the Yesler Terrace rezone to guarantee load for a retail district energy provider. As part of this process, DPD and OSE are working closely with SHA to protect future developers in the case that a district energy provider has not been found at the time of building permit application. Other consumer protections would be developed as part of any contractual arrangement between either a district energy provider and the City or the provider and Yesler Terrace. For example, conditions within an agreement to meet broader City goals for an "open books" approach to the utility and a form of quasi-regulation (e.g., benchmarking returns to other regulated utilities and/or indexing rates to other alternatives) is desired. Mechanisms to establish such a standard exist through

contracting terms, municipal ownership options, and public private partnership options. The appropriate mechanism for meeting City goals will be identified within the context of the feasibility analysis results.

(6) *What might the City's role(s) in a new structure be? These could include regulatory, financial (capital, operating, debt, guarantees), contractual, etc.*

The City is acting as a convener to explore a new structure for the delivery of DE on First Hill. The City's legal and financial role in this new structure will depend in part upon the successful proponent, and the final form and extent of any collective DE solution proposed for First Hill. At a minimum, it is likely the City will need to provide a franchise for the new entity, at least for incremental infrastructure on First Hill (e.g., Yesler Terrace). Whether other regulatory or financial involvement is required to achieve desired outcomes would be determined through a full feasibility process.

(7) *What is the likely financial implication for invested parties over 10, 20, 30 years? How might capital costs reasonably be financed and recovered?*

The proposed partnership currently anticipates private partner equity and ownership participation in the near-term (although a long-term concession model could be explored) and so the City, hospitals, and SHA will not have costs to recover from infrastructure investment or operations.

For customers, district energy systems tend to offer competitive rates in the near-term, and lower than baseline rates in the longer term as sunk costs are recovered. The specific rate structure and customer protections will be developed as part of identifying a viable business case.

(8) *Describe the process and criteria for establishing a rate structure for retail customers. What is the likely range of possible rates? How would rates be expected to compare to those for existing systems, and to those for other alternatives? How might future expansion be financed and paid for?*

This will be determined as part of the feasibility and negotiation stages, but the City has identified cost competitiveness as a primary performance objective the successful party must achieve. Rate structures for district energy vary. They may include a combination of fixed and variable payments. For very large customers, they may include term commitments to minimize the risk of large amounts of stranded capital and to take advantage of longer amortization rates for capital (thereby lowering rates). In some systems, rates are negotiated through individual contracts. In other systems, a tariff approach is used where similar rates are applied across a class of customers. In addition, rate setting may be subject to additional review or oversight depending upon the form of agreements or governance. All of these things will be explored further during the feasibility stage.

(9) *If key parts of a new system were to rest on contractual relationships among parties (e.g., City, new retail provider, Seattle Steam, customers), what might happen when*

the various contracts end? What if a particular party were to choose not to renew a contract? What if a particular party failed to perform?

These are important considerations and would normally be included in contract language. Most contracts (and there would be a range of definitive agreements that may be required to implement the strategic partnership on First Hill including retail service agreements, wholesale service agreements, and a franchise agreement) would include provisions for exit, renewal and non-performance. As an example, in the Joint Cooperation Agreements discussed in the Compass report, many communities have included provisions to formally renew the agreement or assume the assets (at net book value) if the agreement is not renewed. The due diligence process may identify other models for district energy, such as a stand-alone system for Yesler Terrace, that could move forward even if a plan involving all the key partners does not move forward.

Question D: Some of Compass's analysis of potential carbon reduction shows "aggressive" scenarios that represent "an upper bookend for potential savings." The Council would like to see policy analysis that shows other, perhaps more likely, scenarios.

There are many potential outcomes from the proposed RFQ in terms the extent and form of district energy.

Table 2 below outlines the five potential scenarios that demonstrate the range of possible outcomes for First Hill by 2030. They make no judgment on the relative pros and cons of different scenarios (e.g., costs and other impacts).

The scenarios focus on GHG emissions associated with heating only. They do not include GHG emissions associated with transportation or other energy uses. Further, the focus of the scenarios is on loads that are or could potentially be connected to a district energy system.

Table 1 below outlines the 2030 district energy load assumptions that form the basis of our evaluation of the five scenarios.

Table 1: Potential Loads

Load	Annual Heat Demand	Comments
Existing Hospital Facilities	126,600 MWh	Does not include any growth in facilities (up to 1 million sf or 18% currently anticipated across hospitals by 2030). This is offset in part by the fact that we assume no further efficiency improvements at existing facilities. An 18% increase in total hospital floor area coupled with a 10 – 15% increase in the efficiency of existing facilities (assuming new floor area has lower energy intensity) would result in no change in total hospital load by 2030.
Yesler Terrace	35,000 MWh	Assumes 4 million sf of new mixed used development at an average end use heating intensity of ~8.5 kwh/sf/year. This represents about a 35% lower average energy intensity then existing SHA housing stock on First Hill, which is lower intensity than many other commercial uses.
Other Existing Steam Loads	15,000 MWh	Estimate based on total First Hill heating demand from AEI, estimated penetration of steam among non-hospital customers, and information from other individual Seattle Steam customers (e.g., SHA's Jefferson Terrace development uses about 2,800 MWh of steam alone).
Other Existing Gas- or Oil-fired Hot Water Loads	20,000 MWh	These are existing hot water loads that could potential be retrofit to district energy. For the purposes of this analysis, we assume a gas-fired GHG intensity. Oil would have a higher GHG intensity but represents a very small portion of existing loads.
Other New Development	50,000 MWh	Because this represents new construction, it could be served by a variety of heating technologies and is included in the DE scenario analysis.
Total – Included in Scenario	246,600 MWh	These are existing loads currently connected to Seattle Steam, existing loads served by oil-fired or gas-fired hot water systems, and forecast new loads. These are included in the scenarios because they are the loads that could be affected by district energy scenarios.
Other Heating Loads (Excluded)	35,000 MWh	These reflect estimated existing contribution from electric resistance, electric heat pumps, and gas-fired furnaces. These loads are likely to remain electric or gas under all district energy scenarios because of conversion costs.
Total Heating Loads on First Hill	282,000 MWh	As projected by AEI in pre-feasibility study.

Five scenarios are presented reflecting different supply assumptions for the above load categories. These scenarios are summarized in Table 2. Note that for hospitals, which will require steam for the bulk of their loads for the foreseeable future, the only significant technically and economically viable options would be a natural gas- or biomass-fired steam plant.

Table 2: Scenario Definitions[1]

	Hospitals	Yesler Terrace	Other Existing Steam	Other Existing Hot Water Loads	Other New Loads
Scenario 1 **– Status quo**	Seattle Steam	BAU heating (combination of gas and electric resistance)	Seattle Steam	Natural gas (minor amount of oil)	BAU heating (combination of gas and electric resistance)
Scenario 2 **–Hospitals and Other Existing Steam Loads Convert to Own Gas Systems**	Stand-alone natural gas-fired steam (all facilities)	BAU heating (combination of gas and electric resistance)	Stand-alone natural gas boilers (hot water)	Natural gas (minor amount of oil)	BAU heating (combination of gas and electric resistance)
Scenario 3 **– Hospitals and Other Existing Steam Loads Convert to Own Gas Systems + Stand-alone DE System for Yesler**	Stand-alone natural gas-fired steam (all facilities)	DE (range of GHG emission factors)	Stand-alone natural gas boilers (hot water)	Natural gas (minor amount of oil)	BAU heating (combination of gas and electric resistance)
Scenario 4 **– 100% DE for Existing Compatible and New Loads**	DE (range of GHG emission factors)	DE (range of GHG emission factors)	DE (range of GHG emission factors)	DE (range of GHG emission factors)	DE (range of GHG emission factors)
Scenario 5 **– Status quo + 100% Electricity for New Loads**	Seattle Steam	100% Electric	Seattle Steam	Natural gas (minor amount of oil)	100% Electric

[1] For status quo, we assume an average Business as Usual heating fuel mix of about 2/3 natural gas and 1/3 electricity. This is a reasonable approximation for the full mix of uses. For example, domestic hot water is most typically provided by natural gas and represents about 1/3 of heating loads. Gas is used for heating in many commercial loads. In a multi-family residential building with electric resistance heating in suites, between 30 and 60% of total heating load can come from the gas-fired make-up (ventilation) air, as demonstrated in analysis of existing multi-family buildings in Seattle and Vancouver.

The emission factors in Table 3 are used to estimate GHG emissions in each scenario. [2] For the hospitals and other existing steam loads, we assume a continued reliance on steam and emission factor equivalent to Seattle Steam, whether the source of energy is Seattle Steam or not. A lower emission factor may be possible through a combination of efficiency upgrades and supplemental bioenergy supply, but this is highly speculative.

Table 3: GHG Emission Factors

	kg per MW.h (delivered)
Steam (inc. Biomass)	121
Natural Gas	180
Electricity	-
Other DE	40 to 65

The results of the GHG scenarios for First Hill are summarized below in Tables 4 and 5. This chart shows the contribution of each load to total GHG emissions under each scenario. The table that follows shows the annual new electricity load from heating under each scenario (relative to current loads). A range is shown in some cases to reflect uncertainty over whether electricity heat would be supplied from resistance or heat pump technology. In the case of DE, heat pumps are only one option for the source of district energy. No significant electricity would be used in the case of a bioenergy or high-grade waste heat source.

[2] Steam reflects emission intensity of delivered steam after expected average contribution from new biomass plant. Natural gas emission factor is for delivered fuel. This must be further adjusted to reflect average efficiency losses in converting fuel to useful heat, assumed to be 85% for the following scenarios. Higher average efficiency may be possible with careful design and maintenance, and higher upfront capital costs. For electricity, we assume an emission factor of zero. This assumes all new heating demand is provided by new build green generation. Electricity must come from new build in order to ensure a net reduction in system-wide GHG emission (versus a re-allocation from other existing uses). New green build costs more than average retail rates (e.g., Seattle City Light assumes average cost of new build wind power of $110/MWh, including integration costs).

Emission factors for other DE reflect the emission intensity of delivered heat. They assume a hot water system using a mix of alternative energy and gas for peaking and back-up. In many configurations, natural gas peaking and back-up will supply 20 – 30% of the annual heating load. This is still the most economically optimal configuration given the load profile of heating, capital costs of alternative energy systems, and expected price of gas. It is technically possible to increase the amount of energy from renewables, but at a rapidly rising unit cost. The portion of economically optimal renewable supply will typically vary with the type of source. The lower end reflects a typical system based on bioenergy. The upper end reflects a typical system based on a district-scale heat pump (geoexchange or sewer heat recover for example). For heat pumps, we assume an electricity emission factor of zero but again this assumes new build green resources will be acquired. A high-grade waste heat source (e.g., from industry) may have an average emission factor of near zero under optimal conditions (e.g., a large and continuous source of high-grade waste heat).

Table 4: Annual GHG Emissions by Scenario

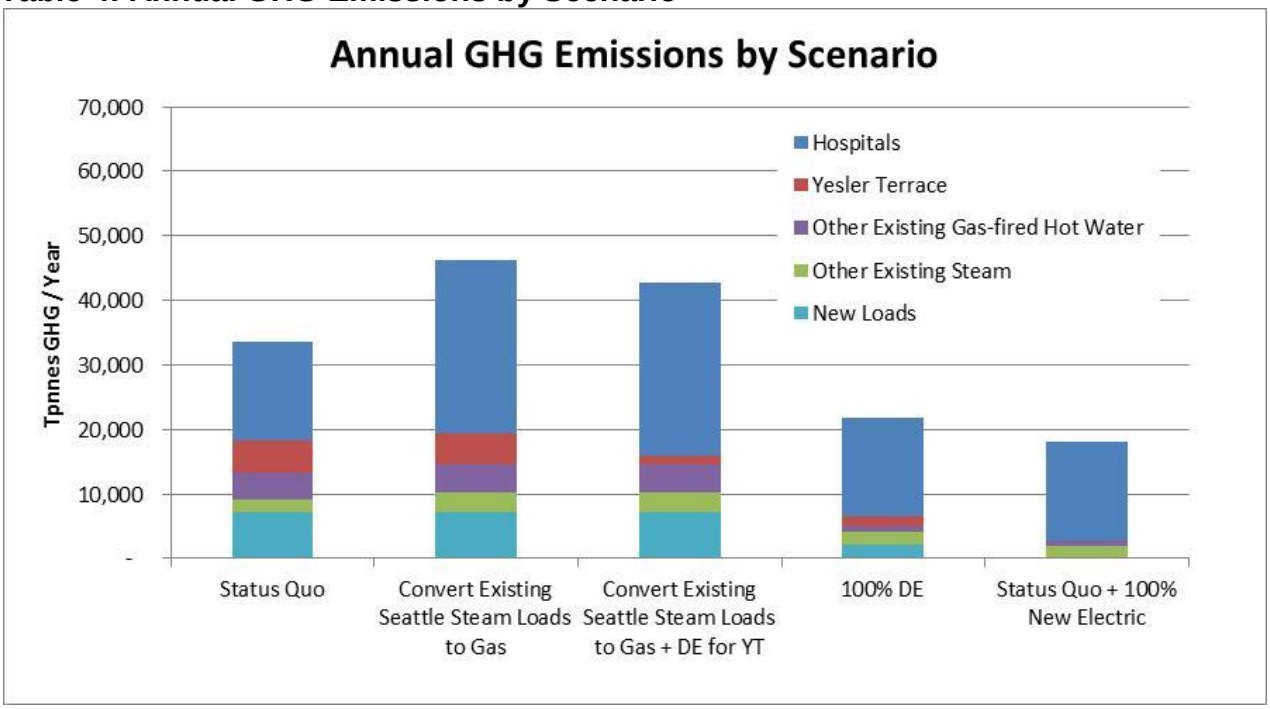

Table 5: New Electricity Demand for Heating (MWh)

	Status Quo	Convert Existing Seattle Steam Loads to Gas	Convert Existing Seattle Steam Loads to Gas + DE for YT	100% DE	Status Quo + 100% New Electric
New Electricity Use (Heating)	28,000	28,000	16,500	0 to 24,500	28,400 to 85,000

The range of electricity use for district energy reflects whether bioenergy, high grade waste heat, or heat pump technologies are used (e.g., sewer, geoexchange). In the last scenario, the range reflects whether 100% of the load is met by heat pumps or electric resistance.

Question E: Compass describes examples of district energy elsewhere, including in St. Paul, MN, and Vancouver, B.C. What are their similarities to, and differences from, Seattle in terms of legal framework, regulatory framework, existing conditions, energy types and prices, etc.?

It is important to note that there are thousands of district energy systems at campuses and communities throughout North America. Vancouver and St. Paul were selected as examples of relatively recent, unique, and large-scale community-driven district energy initiatives. They are not necessarily representative of the full application or impacts of district energy.

Broader Urban and Climate Context

Table 6 summarizes the urban and climate context of Seattle, Vancouver and St. Paul. The urban context is provided as a high-level reference point for comparisons. Seattle and Vancouver are comparable sized cities in terms of population; however, Seattle is part of a larger metropolitan area. St. Paul is a smaller city but part of a comparable metropolitan area to Seattle. As a City, Seattle has a slightly lower average density than St. Paul and significantly lower average density than Vancouver, reflecting the very compact nature of Vancouver. Density is a driver of the integration costs for district systems. However, city-wide average densities are not particularly relevant to district energy development as district energy systems encompass a subset of the denser portions of these cities. Representative comparable data are difficult to obtain but several neighborhood-level comparisons of energy density on First Hill and areas containing district energy in Vancouver are shown for reference. The heating energy density of Vancouver's downtown core is higher than First Hill (but comparable to 2030 projections for First Hill). The heating energy density of Vancouver General Hospital (one of the largest hospital campuses in Canada) is comparable to current First Hill energy density. Both Vancouver's downtown core and Vancouver General Hospital Campus (located along Broadway corridor near City Hall) are served by district energy systems.

No information was readily available on energy densities for the downtown core in St. Paul, which is the service area of St. Paul District Energy.

The economics of district energy, and most other heating technologies, is also a function of average energy use characteristics, which is a function of climate. Heating degree days (HDD) and cooling degree days (CDD) provide a simple comparison of heating and cooling requirements in buildings (non-process loads) across jurisdictions. Vancouver has about 13% more HDD on average compared to Seattle. St. Paul has nearly 58% more HDD.

Table 6: Comparison of Urban Context and Climate Conditions

	Seattle, WA	Vancouver, BC	St. Paul, MN
Population	610,000 city 3.4 million metro	580,000 city 2.1 million metro	285,000 city 3.6 million metro
City area	142.5 sq mi	44.3 sq mi	56.2 sq mi
Average Population Density (City)	4,281	13,093	5,071
Representative Heating Densities (MWh/acre/year)	Current First Hill: 786 2030 First Hill: 1,125	Business Core (2008 Est): 1,150 Vancouver General Hospital Campus (existing): 833	N/A
Average Heating (HDD) and Cooling Degree Days (CDD)	4,800 HDDs 200 CDDs (65 F base)	5,400 HDDs 200 CDDs (65 F base)	7,600 HDDs 700 CDDs (65 F base)

Figure 1: Comparison of Monthly Average Low, High and Mean Temperatures

Broader Energy Context

In addition to density and heating/cooling demands, the relative economics of district energy are also a function of local energy prices. Current prices should be considered but price trends are also important to consider given the long-lived nature of buildings, heating equipment, and infrastructure.

Seattle and Vancouver have very similar electricity prices, GHG emissions from existing electricity sources, and projected escalation. With the introduction of stepped rates, commercial general service costs are actually higher in Vancouver, which affects the competitiveness of district-scale heat pump technologies. Both systems predominantly use hydroelectricity and have low GHG emissions (SCL offsets residual emissions, which are comparable to BC Hydro). As a result, BC's carbon tax has almost no impact on electricity prices. Note that the US/CDN dollar exchange rate is approximately at parity so Canadian dollar values are approximately equivalent to US dollar values.

The costs of new green build are also very similar although actual average prices from recent BC Hydro calls for green energy (100% of new electricity must come from domestic green energy projects) are slightly higher than estimated cost of new build for SCL (representative wind project, including integration costs). St. Paul appears to have slightly lower average annual rates but seasonal and time of use differences make comparison more difficult.

Table 7: Electricity Prices and Market Features

	Seattle, WA	Vancouver, BC	St. Paul, MN
Electric Utility	Seattle City Light (City-owned)	BC Hydro (Provincially owned)	Excel Energy (Private)
Residential Rates	Stepped rates Residential tier 1: 4.6 c/kWh Residential tier 2: 9.6 c / kWh Average 2012 residential rate: 8.4 c / kWh Tier 1 allotment increases 60% in winter.	Stepped rates Residential tier 1: 6.7 c / kWh Residential tier 2: 9.62 c / kWh Average 2011 residential rate: 7.68 c/kWh (Note Seattle and Vancouver had same average residential rates in 2011, adjusted for exchange rates)	Seasonal rates Customers with electric space heat: 5.1 c / kWh rate during winter, 7.4 c / kWh during summer. Customers without electric space heat: 6.4 c in winter, 7.4 c in summer. Time of day use metering available.
Commercial Rates	Commercial small network (<50 kW): 6.7 c / kWh.	Commercial General Service: 8.8 c / kWh	2.3 c / kWh general service rate, plus $7.08 per kW monthly demand charge (winter) or $10.48 (summer). Average effective commercial rate not available.
Other Rates		BC Hydro has a standing offer to purchase energy from projects under 15 MW that meet green energy definitions without a competitive bidding process. Current average rate for standing offer is ~$100/MWh. Same rate is offered for annual surplus from net metering customers. This rate is less than the average cost of new build projects acquired under competitive calls. Rate is updated periodically based on latest competitive acquisition prices.	Standard offer generation purchase rates (applies to cogeneration at District Energy St, Paul): 4.1 c / kWh winter peak, 4.5 c / kWh summer peak, 2.5 c / kWh winter off peak, 2.3 c / kWh summer off peak Additional 1.2 c / kWh summer, 6 c / kWh winter for delivery of firm power with a capacity factor of at least 65%.
Projected General Rate Escalation	4.2% nominal, to 2016 (From revenue requirements projections no forecast available beyond 2016)	3.9% nominal, indefinitely (BC Hydro is facing growing demand, provincial requirements for 100% new green build, a need to update aging infrastructure, and growing deferral account balances, projected rate increases are conservative)	5% nominal, to 2016
Existing Supply Mix	88% hydro, 6% nuclear, 2.5% coal, 3.5% other.	~90% hydro, 10% gas, biomass, wind and other resources (no nuclear)	50% coal, 25% natural gas, 12% nuclear, 13% misc renewable
Existing Electricity GHG Emission Factor	0 (SCL purchases offsets of small amount of residual emissions)	62 lbs per MWh (2008)	1,400 lbs per MWh (2010)
Cost of New Build Green Electricity	11 c/kWh (new wind project , including integration costs)	12 c/kWh	N/A

Delivered natural gas prices are a function of three key components: commodity costs, mid-stream transportation and storage costs, and local delivery costs. Projected commodity cost increases are driven by broad market dynamics and similar across jurisdictions. Current natural gas commodity costs are at historical lows but are expected to rise.

The delivered costs of natural gas in winter is about 25% higher in Seattle than in St. Paul, but some of this difference could reflect regulatory lags (lags in adjustments to commodity price trends). Carbon taxes can also affect delivered natural gas costs. Only B.C. currently has a carbon tax. At $25 / metric ton, the carbon tax adds approximately $5.4/MWh to the cost of natural gas in Vancouver. However, the total delivered cost of natural gas in Vancouver is still slightly lower than Seattle, even with the carbon tax. The carbon tax in B.C. is set to increase 20% next year. The provincial government has made no other commitments for further increases at this time.

In addition to the economy-wide carbon tax, B.C. has also established GHG neutrality requirements for the public sector, including Crown corporations and provincially funded institutions such as schools, universities, and hospitals. Under these requirements, government ministries and agencies, Crown corporations and publicly-funded institutions must also purchase offsets for GHG emissions at current rates of approximately $25 / tonne, effectively doubling the carbon cost of natural gas for these entities (from $5.7/MWh for the carbon tax alone to $11.4/MWh). These requirements do not apply to other sectors.

Table 8: Natural Gas Prices and Market Features

	Seattle, WA	Vancouver, BC	St. Paul, MN
Gas Utility	Puget Sound Energy (Private)	FortisBC (Private)	Xcel Energy (Private)
Residential Rates	Basic charge of $10 per month Delivered gas cost of $37.64/MWh No carbon taxes	Basic charge of $12 per month Delivered gas cost of $30.82/MWh Carbon tax adds additional $5.40/MWh	Basic charge of $9 per month Delivered gas cost of $26.70/ MWh (summer) and $28.70/ MWh (winter) No carbon taxes
Commercial Rates	Basic charge of $32 per month Delivered gas cost of $35.41 per MWh	Basic charge of $25 per month, plus $28.76 per MW.h, plus $5.40 per MW.h for carbon tax.	N/A

District energy rates vary depending upon the form and age of system, sources of heat, customer profile, underlying commodity costs (e.g., natural gas prices) and annual weather (affecting the ratio of fixed to variable charges). Comparable rates are difficult to gather in the absence of public filings. Below is a comparison of some readily available information from each City. Many rates are a flow through of underlying commodity costs. For example, rates for both Central Heat (Vancouver) and Seattle Steam are linked in part to prevailing natural gas prices. Rates therefore vary from year to year. Comparables are not available for all years in each case so several years are shown where data are available. DESP rates reflect the impact of long-term investments in biomass technology, which have resulted in a discount to gas-fired heating systems such as Central Heat in Vancouver.

Table 9: District Energy Rates for Several Systems ($/MWh)

	2009	2010	2011
Seattle Steam			$70
Central Heat (Vancouver)		$78-85	
SEFC (Vancouver) – Effective Residential Rate		$86	$91
District Energy St. Paul	$61.1	$62.4	

Existing District Energy Systems

All three cities have both existing district energy systems and proposed new district energy developments.

There are large systems serving the downtown core of all three cities. Established in the late 1890's, Seattle Steam is a private company that currently serves about 200 buildings in the downtown core and on First Hill, including three large hospitals. Established in the 1960s by private investors, Central Heat in Vancouver serves about 155 buildings in the downtown core, including one hospital. Like Seattle Steam, Central Heat is a steam-based district energy system, but has a newer system Central Heat gas condensate return for most of its system. Central Heat currently uses natural gas for 100% of its heat production. Unlike Seattle Steam and St. Paul District Energy, Central Heat is regulated by the B.C. Utilities Commission.

District Energy St. Paul or DESP (featured as a case study in the Compass report) is a hot water-based district energy system serving about 185 buildings in the downtown core, including one hospital and the Minnesota State Capitol campus. In addition to heating (sales approximately equal to Central Heat in Vancouver), St. Paul also runs a smaller district cooling scheme. DESP was established in the 1980s as a response to the demand among building owners for reliable and predictably priced heating service following the 1970s oil crisis. DESP was constructed to replace a pre-existing coal-fired steam system. DESP is a non-regulated, non-profit, public private partnership between customers, the City, and the State. Unlike Seattle Steam and Central Heat, the City of St. Paul was involved in establishing DESP and remains actively involved.

There are several other large existing or proposed district energy systems in each city / region. These are described further below.

City of Vancouver

There are two very large steam-based campus district energy systems at Vancouver General Hospital (VGH) and Children and Women's (C&W) hospital in central Vancouver (outside the downtown core). These campuses are connected via a one mile steam line (not currently in service). Together, these facilities represent one of the largest hospital campuses in Canada. VGH recently replaced its central steam plant (located in a pedestrian plaza / park across from the old plant). C&W needs to refurbish its existing steam plant. The hospitals are currently in negotiations with a private utility company to take over ownership of both steam plants (and sell steam to the hospitals), develop a biomass-fired baseload steam plant at C&W, install a new gas-fired peaking and back-up steam plant at C&W, bring the existing steam link back in service (to allow sharing of alternative energy capacity and optimize back-up requirements), and expand district energy to surrounding non-hospital development (to achieve additional economies of scale, rationalization of capacity, additional GHG offsets, and opportunities for recovery of sunk capital costs as hospitals continue to increase efficiency of their existing facilities). The outsourcing and fuel switch are driven in part by the needs for a new steam plant at C&W, carbon pricing in B.C., provincial grants, and a desire by hospitals to focus on core functions of health care delivery. The outsourced system would be regulated by the BC Utilities Commission (BCUC).

The City of Vancouver developed (and currently retains ownership of) a new district energy system to serve the Southeast False Creek (SEFC) Neighbourhood, which includes Vancouver's Olympic Athlete Village. Encompassing about 6 million square feet of new development at build out, the system is based on hot water (not steam) and uses a combination of natural gas and sewer heat recovery. Connection is mandatory within the Official Development Plan area. The City is currently considering expansion of the system to the False Creek flats. Nearby Science World has recently connected voluntarily in lieu of replacing its existing natural gas boiler plant, which was at the end of its useful life. A case study of this system was featured in the Compass report.

The City's newest significant system received regulatory approval in December 2011. River District Energy (RDE) is a developer-owned utility established to serve the River District development in the southeast corner of Vancouver (along the Fraser River). At build out, RDE will be slightly larger than SEFC. Also a new hot water system, the master developer (Parklane Homes) established the system in order to meet environmental commitments of rezoning. The City attached rezoning conditions precluding electric heat and requiring connection to a district energy system if it is available at the time of development. Parklane intends on selling individual development parcels with development rights and conditions attached. As a privately-owned system, RDE is subject to BCUC regulation, similar to Central Heat. Initially, the development will be served via a temporary gas-fired plant. A permanent gas-fired plant will be established within 4 years. Once development reaches about 50% of build out (sooner if grants or economic drivers change), the current plan is to construct a pipeline to recovery waste heat from an existing solid waste to energy plant owned by Metro Vancouver about 2.5 miles from the development.

There are numerous smaller developer- or utility-led district energy systems under consideration or development in Vancouver, including Arbutus Village, Marine Gateway, Northeast False Creek, and South Burrard. In each case, the City of Vancouver has been a key driver of system development through rezoning conditions. The Northeast

False Creek proposal encompasses five separate major redevelopments adjacent to Central Heat facility. The City is exploring options to include connection conditions as part of the rezonings and to establish a formal franchise that would include GHG reduction goals (contingent on development timelines).

City of St. Paul

The University of Minnesota has a central heating and chiller plant for its Twin Cities Campus, including a large coal/biomass fired cogeneration plant. The facility is owned by the University of Minnesota and run by University staff, with some outside operators. University distribution systems are steam and chilled water.

NRG Thermal (private company) owns a natural gas fired heating and cooling system in downtown Minneapolis adjacent to St. Paul. The system contains some steam and some hot water distribution. There is over 40 million sq ft of development connected to the heating system, with a total installed heating capacity of 375 MW. There are a further 22 million sq ft connected to a smaller cooling system, with 140 MW of installed cooling capacity. These NRG systems are not regulated.

City of Seattle

In addition to Seattle Steam, there are district energy systems at the University of Washington and Seattle Center. These are described further in the Compass and AEI reports and elsewhere in the briefing package.

Municipal Involvement in District Energy Development

City of Seattle

To date, the City of Seattle has had little direct policy support or involvement in district energy.

With respect to state legislation, the main policy tool directly related to district energy is RCW 35.97 Enacted in 1983, Chapter 35.97 RCW authorizes a municipality (including counties, cities, towns, port districts and water-sewer districts) “to establish heating systems and supply heating services” through a municipal heating utility through an ordinance or resolution, without any public hearing or vote. Once established, there are a variety of ownership structures possible, from full municipal ownership to a public-private partnership to a full contracting out model. Further analysis will be required to determine whether this statute is necessary or useful to assist in the maintenance or expansion of district energy in Seattle where that is in the public interest.

City of Vancouver

District energy in Vancouver is considered a public utility and subject to regulation by the B.C. Utilities Commission (BCUC). Regulated utilities are required to submit applications to operate (Certificate of Public Convenience and Necessity), approval of major capital expenditures, extension tests, rates of return, and end user rates. The Commission can at its discretion use a “light-handed” form of regulation for small utilities or unique circumstances. This may include a less frequent, more complaints-driven form of oversight. Under the Utilities Commission Act, municipally owned utilities (including municipal district energy utilities) that operated entirely within municipal boundaries are exempt from BCUC regulation, the assumption being they are regulated by their elected Council. In Vancouver, Central Heat (serving downtown) is regulated by the BCUC.

SEFC, which is owned by the City, is exempt and is regulated by Council, with review by an independent rates panel appointed by Council. RDE, the newest DE system in Vancouver, is regulated by the BCUC as it is owned by a private developer. Campus district energy systems (e.g., systems serving Vancouver General Hospital and Children & Women's Hospital) are not subject to regulation because they serve only their own facilities. However, outsourcing of their energy systems and expansion beyond their campus borders would be subject to regulation.

The City of Vancouver's first significant foray into proactive district energy development and support was the system created for SEFC (which includes the Olympic Athlete's Village). The City initiated a screening and then full feasibility of a system as one strategy for meeting environmental performance objectives for the neighbourhood as part of a master planning and rezoning process. The City considered a wide range of technologies and ownership structures before landing on sewer heat recovery and City ownership. The City recognized a need to be involved in initial development because of timelines and integration with other municipal infrastructure, Council established a requirement to evaluate ongoing ownership following three years of commercial operation or before any significant expansion. The SEFC Neihghbourhood Energy Utility was featured as one of the case studies in the Compass report. [3]

In response to the proposed development of the SEFC utility, the Province of British Columbia amended the Vancouver Charter (enabling legislation governing the City of Vancouver, which differs from the Community Charter governing other communities in BC) in the spring of 2007 to provide the City with authority to provide energy utility services. Subsequent to this, the City enacted the *Energy Utility System By-law* ("By-law"). Beyond basic provisions required to regulate energy services, the By-law makes connection to the NEU mandatory for all new buildings within the SEFC Official Development Plan area (which is generally bounded by Cambie Street, Main Street, 2nd Avenue and the False Creek waterfront). Connection beyond the SEFC ODP area is voluntary and subject to an extension test approved by Council.

The City does not currently use its bylaw authority to require connection to any other district energy system in Vancouver, including Central Heat downtown. However, the City has employed its powers under rezoning to mandate or incent connection to district energy systems. Several years ago the City established a policy requiring major rezoning requests (sites exceeding 2 acres) to conduct a screening study of opportunities for connecting to an existing district energy system or establishing a new system, and the City may include conditions in rezoning based on the outcomes of these studies.

The City of Vancouver has adopted a LEED Gold standard for new buildings, and district energy may be used as one way to achieve credits

The City is currently developing a long-term, city-wide strategy for district energy. The process is examining high priority areas for district energy development (areas of high density, rapid growth, mixed development, large anchor loads and promising energy sources) to help focus planning and policy making. The spatial analysis is also

[3] A recent detailed annual report to Council on the system containing rates information and other background information is also available at http://vancouver.ca/ctyclerk/cclerk/20111213/documents/a2.pdf.

considering logical franchise boundaries and large-scale infrastructure and supply considerations (e.g., transmission and larger supply plants to serve several service areas). As part of the strategy, the City is also considering specific policies to facilitate and promote district energy that will achieve GHG and Green City objectives, including links to green building requirements, rezoning conditions, approach to franchising, coordination of infrastructure policy, taxation, and other instruments.

City of St. Paul

Despite repeated phone calls and inquiries to the St. Paul city staff, OSE and Compass were unable to attain detailed information about municipal involvement with St. Paul district energy systems. DESP is a non-profit organization, and early indications are that coordination with the City of St. Paul was similar to that of standard utilities.

Should City Council approve the RFQ, OSE will continue to reach out for further information as it pertains to the City of Seattle's district energy strategy.

First Hill District Energy Pilot Project Timeline