Council Meeting Date: February 26, 2018 **Agenda Item:** 9(a)

CITY COUNCIL AGENDA ITEM
CITY OF SHORELINE, WASHINGTON

AGENDA TITLE:	Discussion of the Climate Action Analysis for the 185th Street Station Subarea
DEPARTMENT:	Planning & Community Development
PRESENTED BY:	Miranda Redinger, AICP; Senior Planner, P&CD
ACTION:	____ Ordinance ____ Resolution ____ Motion __X_ Discussion ____ Public Hearing

PROBLEM/ISSUE STATEMENT:
District Energy (DE) refers to the central provision of heating and/or cooling services within a defined service area. Council identified exploration of the feasibility of District Energy as one of the 2016-2019 Priority Recommendations to implement the Climate Action Plan.

Staff began working with Puttman Infrastructure in March 2017 to develop a DE feasibility study, which was presented to Council in July 2017. At that time it was noted that the project scope was changing from a direct analysis of the feasibility of DE to identifying a suite of strategies that could be implemented in the 185th Street Station Subarea to assist in meeting the City's adopted greenhouse gas (GHG) emission reduction targets. The Climate Action Analysis (Attachment A) that was produced is the outcome of this work. While the Climate Action Analysis focuses on the 185th Street Station Subarea, findings could apply to the 145th Street Station Subarea, the Community Renewal Area (CRA) at Shoreline Place, and Town Center. Tonight, Council will have an opportunity to discuss the Climate Action Analysis and ask questions of staff.

RESOURCE/FINANCIAL IMPACT:
This discussion does not have financial implications. Should Council decide to move forward with strategies to implement District Energy systems or reduce GHG emissions in Shoreline, there would be resource and financial impacts.

RECOMMENDATION

Staff recommends that Council review the Climate Action Analysis and discuss options for future consideration. The recommended next step would be to form an advisory committee in 2020, with consultant support, to discuss how to promote a retrofit program, consider a "No Gas" policy and other incentives or regulations, and examine opportunities related to district energy, sewer heat recovery, and water reuse.

Approved By: City Manager ***DT*** City Attorney ***MK***

BACKGROUND

District Energy (DE) refers to the central provision of heating and/or cooling services within a defined service area. Staff has been exploring DE possibilities in Shoreline for a number of years. Shoreline first began exploring the concept of DE and "EcoDistricts" during the 2012 major update to the City's Comprehensive Plan and the 2013 development of a subarea plan for the Shoreline Place Community Renewal Area (CRA). As part of this work, the City hosted a Speaker's Series for the 2012 Comprehensive Plan update, and two of the presentations included information about DE:

- Matt Kwatinetz- Sustainability, Culture, and Integrated Economic Development Strategies
- Rob Bennett- EcoDistricts

The adopted 2012 Comprehensive Plan contained multiple policies relevant to DE systems, most notably:

- Land Use- LU59: Initiate public/private partnerships between utilities, and support research, development, and innovation for energy efficiency and renewable energy technology.
- Economic Development- ED21: Support public/private partnerships to facilitate or fund infrastructure improvements that will result in increased economic opportunity.

The City's Climate Action Plan (CAP), subsequently adopted in 2013, contained the following policy direction:

- Energy and Water- 2E: Investigate the feasibility of development of district energy system(s) within the city.

Through adoption of the CAP, the City also committed to reducing community greenhouse gas (GHG) emissions 25% by 2020, 50% by 2030, and 80% by 2050, compared to 2007 levels.

District Energy was also mentioned in the 2015 Carbon Wedge Analysis as part of a suite of strategies to reduce emissions from the building sector and promote renewable energy:

- Reduce use of natural gas for heating 40% by 2030 relative to 2012
- Renewable energy demonstration projects
- Building envelope and heating technology incentives
- District energy systems and/or combined heat and power
- Right-of-way for renewable energy
- Community-wide distributed renewable energy plan

As well, while planning for future light rail stations, the City adopted policy direction in the 185th Street Station Subarea Plan:

- Economic Development- Consider incentive program for new buildings to incorporate Combined Heat and Power systems and other innovative energy saving solutions.

The City also considered DE through a white paper, authored by Puttman Infrastructure, which was a product of the 145th Street Station Subarea Plan. The white paper is available as Attachment C to the September 14, 2015 Council staff report where Council directed staff to analyze DE feasibility as a priority recommendation to implement the Climate Action Plan: http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2015/staffreport091415-9b.pdf.

Council received additional information about DE at their February 1, 2016 Council meeting and subsequently reviewed the draft DE Feasibility Study at their July 24, 2017 Council meeting. The staff reports for these Council discussions can be found at the following links:

- http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2016/staffreport020116-8a.pdf
- http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2017/staffreport072417-9c.pdf

Most recently, on October 30, 2017, Council discussed progress on implementation of the Climate Action Plan and 2016-2019 Priority Recommendations. The staff report this Council discussion can be found at the following link: http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2017/staffreport103017-8c.pdf. Since the existing Priority Recommendations will be completed by the first quarter of this year, Council also selected new priorities for 2018-2020, as follows:

- Achieve citywide Salmon Safe certification (2018);
- Explore expanding green building regulations to commercial zoning (2018);
- Encourage retrofits of existing buildings to use water and energy more efficiently, and to fuel-switch from heating oil and natural gas to electric heat pump or other less carbon-intensive technologies (2019); and
- Implement recommendations from the District Energy Feasibility Study (2020).

The Discussion section below provides additional details about how an advisory committee, comprised of residents, utility representatives, developers, and other agency or municipal partners, could accomplish the latter two.

DISCUSSION

Originally, the scope of the District Energy Feasibility Study was to focus on the technical, financial, and regulatory viability of implementing DE to serve the 185th Street Station Subarea. This scope included development of a detailed implementation strategy (i.e. 3-5 year action plan), if Council decided to pursue this option, to ensure DE development aligned well with 185th Street Station Subarea (185SSS) development.

Tasks to analyze feasibility included:

1) Identifying potential district-scale infrastructure systems that generate benefits not achievable through conventional building-centric development;
2) Testing financial performance to ensure commercial viability;

3) Assessing the most appropriate development model – public, private, or public private partnership – in which to finance, build, and operate each system; and
4) Making clear recommendations as to which district infrastructure systems the City of Shoreline should implement for the 185SSS.

Initial assessment of DE for the 185SSS found positive environmental, economic, and social benefits including:

- Energy and Carbon Savings – DE could generate significant energy and carbon savings, up to 12% and 93% respectively.
- Cost Effectiveness – DE could be 46% more cost effective from a life-cycle perspective than building-scale systems.
- Reduced Private Development Cost – DE could reduce private development costs by eliminating capital investments in building-scale heating equipment. It would also likely yield significant positive investment return.
- Brand and Market Differentiation – DE has the potential to generate marketing "buzz" and market differentiation that could prove valuable for supporting local Economic Development initiatives.

The assessment also revealed that financial viability of DE is very sensitive to development build-out and growth rate (i.e., the faster and denser the subarea develops, the better the investment return for DE). Therefore, early in the analysis, it also became clear that because planned development within the subarea would likely take place over a 100-year period, a standard assessment of commercial viability for a DE system that may not be implemented for another 20-30 years was not the most useful path. Since the City's primary interest in understanding the potential role of DE was achievement of CAP goals, a subarea-specific climate action strategy was needed.

The draft District Energy Feasibility Study was amended to describe how new building energy efficiency, existing building energy efficiency, providing alternatives to natural gas heating, and increased reliance on renewable energy (solar, biomass, and geothermal) would facilitate future feasibility of DE strategies and reduce GHG emissions. This shift in focus also necessitated a name change, so the study is now called the Climate Action Analysis for the 185th Street Station Subarea.

Five Action Steps of the Climate Action Analysis

The Climate Action Analysis (Attachment A) examines the 185th Street Station Subarea and potential redevelopment therein as a case study for reducing emissions through buildings and infrastructure. A combination of strategies for new buildings, existing buildings, and the systems that heat, cool, and power them could help Shoreline reach the "ambitious but achievable" GHG reduction targets adopted through the CAP. One of the five Action Steps identified through the analysis (below) focuses on how to promote feasibility of DE as redevelopment within the Mixed-Use Residential 70-foot height limit zone (MUR-70') provides sufficient demand for investment in a DE system.

The five Action Steps outlined in the Climate Action Analysis are as follows:

1. No Use of Combustion or Natural Gas Heating in New Buildings
2. Increased Energy Efficiency in New Buildings

3. Retrofit Existing Buildings for Greater Energy Efficiency and to Fuel-Switch from Combustion/Natural Gas Heating
4. Utilize Onsite Renewable Energy
5. Develop District Energy Systems

The main differences between the draft study that was presented in July and the analysis attached to this staff report are as follows:

- The analysis has been bifurcated to distinguish between recommendations that contribute to meeting the City's adopted GHG emission reduction targets and basic information about DE systems.
- Additional explanation about mechanisms, operational considerations, and case study examples have been provided in the "District Energy 101" section;
- The five action steps have been "fleshed out" to describe benefits and implementation considerations; and
- Graphics have been added to the report.

Potential Next Steps

Chapter 6 of the Climate Action Analysis, *Summary of Findings and Recommended Next Steps*, identifies nine (9) priority recommendations to implement the five Action Steps noted above. The nine recommendations are as follows:

1. **Renewable Grid Energy** – Seattle City Light's fuel mix is currently low carbon, with over 90% of energy coming from renewable sources. SCL's goal of eliminating coal as a fuel source by 2025 will lower their carbon contribution further within the next 10 years, and it was assumed that all GHG-emitting fuel sources will be removed from their portfolio by 2050. As a result, shifting the source of all buildings' energy demands to the electrical grid will decrease the GHG emissions throughout the subarea.

2. **No Gas Policy** – Natural gas is the leading contributor of GHG emissions in buildings. As stated above, shifting reliance to the electrical grid will have the biggest influence on reducing GHG emissions in the subarea. Eliminating gas service in new development is the most important strategy to achieve the aggressive GHG emission reductions.

   The City of Shoreline has a target to reduce use of natural gas for heating 40% by 2030, which was modeled as continuing to a 60% reduction by 2050. As mentioned in the City's Carbon Wedge Analysis, a suite of strategies should be implemented for existing building retrofits. These include City and State incentives, retrofit programs for increased efficiency, and/or retrofit policies requiring upgrades based on different criteria.

3. **New Building Energy Efficiency** – Continue advocating for the State of Washington to outline and adopt a new code pathways for new building efficiencies to improve 70% by 2031 compared to new buildings in 2006.

4. **Existing Building Energy Efficiency Retrofits (including no gas retrofits)** – Existing buildings will need attention to reduce energy use and GHG emissions.

Existing City programs should be continued, including the potential to retrofit existing buildings away from natural gas and heating oil use.

5. **District Energy for Node 2** – Due to the development and thermal demand density in Node 2, DE should be implemented to provide heating, and potentially cooling if needed. Energy sources for the DE system should be non-combusting, utilizing potentially sewer heat recovery, biomass, or ground source geothermal.

6. **Low Carbon District Energy Incentive** – In support of the implementation of a low-carbon DE system, Shoreline should create an incentive to help fund the cost premium associated with low carbon technologies such as sewer heat recovery and biomass. It would make sense that funding for the incentive would be locally sourced from the district as it is focused on achieving climate action plan goals for the 185SSS.

7. **Onsite Renewable Energy Generation** – Onsite renewable energy generation allows for the subarea to better reach the 50% and 80% emission reduction goals, where building improvements and electric/gas improvements alone fall short. In this subarea, solar generation can be distributed throughout rooftops and open spaces such as parks to directly offset energy demand and provide excess energy back onto the grid.

8. **No Gas, Net-Zero Energy Demonstration Project** – Since Shoreline adopted the Deep Green Incentive Program (DGIP) in April 2017, the City should pursue a Living Building demonstration project within the 185SSS. This could be an important, and potentially market transforming, effort to demonstrate the feasibility of the type of low carbon development the City is looking to promote.

9. **Looking Beyond 2050 –** The subarea build-out plan is a longer timeline than the stated Climate Action Plan goals. This allows for GHG emission strategies to be planned in such a way that improvements continue well beyond 2050.

In order to advance the five bigger-picture Action Steps and their implementation strategies, including the nine prioritized Next Steps above, it would be necessary to convene an advisory committee to make recommendations about priorities for City investment and potential incentives or regulations to adopt. It would be necessary to work with utility companies, especially Seattle City Light, Puget Sound Energy, and Ronald Wastewater (if not fully assumed by the City in the near future), to understand their current incentive packages and long-range capital improvement plans. It would be important to work with developers and designers to understand their considerations when determining how to heat and power buildings and how they factor in efficiency of appliances, windows, and other elements. Any potential financing mechanisms that could support more efficient design should be identified. Emerging technologies and building science innovations should be considered.

One of the most significant conclusions of the Climate Action Analysis is that if new construction uses natural gas for heating, it is unlikely that Shoreline will meet its GHG emission reduction targets, but if new construction does not use natural gas, reaching the City's ambitious goal is achievable. However, the low price of natural gas gives it a substantial market advantage, and there do not currently appear to be cost-competitive alternatives or existing policy from other jurisdictions that prohibit the use of natural gas in new construction. If the Council is going to consider a prohibition on natural gas or incentivize alternatives, it will be critically important to have a recommendation from utility and development industry professionals, in addition to residents.

If Council is interested in examining water reuse as well as energy efficiency, it would be important to work with the King County Health Department, North City Water District, Seattle Public Utilities, and maybe even the Brightwater Treatment Facility to explore potential opportunities. Regardless of the scope, it would be critically important to include Shoreline residents in the process to understand their priorities and broaden community engagement.

Convening this stakeholder committee in 2020 would provide time to gather more information about the actual pace and intensity of development surrounding the 185th Street Station, better integration of the Ronald Wastewater District into City operations, and continued conversations with King County and other partners to identify opportunities. This timeline would also allow the City and partners to adopt any necessary policy or regulatory framework prior to major capital project construction or substantial redevelopment of the MUR-70' zoning.

This advisory committee would be the vehicle for implementation of the following 2018-2020 Priority Recommendations to implement the Climate Action Plan GHG reduction targets:

- Encourage retrofits of existing buildings to use water and energy more efficiently, and to fuel-switch from heating oil and natural gas to electric heat pump or other less carbon-intensive technologies (2019); and
- Implement recommendations from the District Energy Feasibility Study (2020).

STAKEHOLDER OUTREACH

A Speaker's Series event was dedicated to this topic on July 25, 2017. The staff recommendation is to further engage stakeholders including residents, utilities, developers, and King County leadership through formation of an advisory committee beginning in 2020.

COUNCIL GOAL ADDRESSED

Council Goal #2: Improve Shoreline's infrastructure to continue the delivery of highly-valued public services.

- Action Step #5- Implement the 2016-2019 Priority Environmental Strategies, including adoption of incentives for environmentally sustainable buildings, exploration of district energy, update of the City's "forevergreen" Website, and continued focus on effective storm-water management practices including restoration of salmon habitat.

RESOURCE/FINANCIAL IMPACT

This discussion does not have financial implications. Should Council decide to move forward with strategies to implement District Energy systems or reduce GHG emissions in Shoreline, there would be resource and financial impacts.

RECOMMENDATION

Staff recommends that Council review the Climate Action Analysis and discuss options for future consideration. The recommended next step would be to form an advisory committee in 2020, with consultant support, to discuss how to promote a retrofit program, consider a "No Gas" policy and other incentives or regulations, and examine opportunities related to district energy, sewer heat recovery, and water reuse.

ATTACHMENTS

Attachment A: Climate Action Analysis for the 185th Street Station Subarea

Attachment A

PUTTMAN INFRASTRUCTURE

CITY OF SHORELINE
CLIMATE ACTION ANALYSIS FOR 185th STREET STATION SUBAREA

FEBRUARY 2018

CITY OF SHORELINE

ONE GOAL FIVE ACTIONS THIRTY YEARS

Potential street and building design concepts illustrated in 185th Street Station Subarea Plan

Attachment A

185SSS

CITY OF SHORELINE
CLIMATE ACTION ANALYSIS FOR 185TH STREET STATION SUBAREA

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EXECUTIVE SUMMARY

The City of Shoreline takes climate change seriously. Whether at the policy-scale or development-scale, Shoreline continues to explore climate actions to help reduce its carbon footprint. The objective of this report is two-fold. First, it explores district energy (DE) – from technology options and development models to supporting policies and community engagement – as a potential strategy to help accelerate greenhouse gas (GHG) emission reduction. Second, it integrates district energy – as one of five key strategies – into an innovative climate action strategy for the 185th Street Station Subarea.

Combined, this report is meant to be both informative as well as instructive. Informative as to what district energy is, its benefits and how Shoreline could use it. Instructive as a guide of next steps for Shoreline to explore to maximize the potential of district energy within the context of a more structured climate action strategy for the 185th Street Station Subarea.

Successfully implementing district energy in Shoreline is more than a technical solution. It must be implemented within the context of a climate action framework. The goal of this report is to identify an appropriate climate action plan framework in which district energy implementation would be successful. Moreover, the report also demonstrates that Shoreline must consider additional climate action strategies – no gas, new building energy efficiency, existing building retrofits and renewable energy – to leverage the full benefit of district energy.

Statement of Findings

Innovative district-scale infrastructure systems that leverage planned growth and existing City infrastructure assets demonstrate tremendous potential to reduce energy consumption and GHG emissions. This would significantly contribute to Shoreline meeting the emission reduction targets adopted through the 2013 Climate Action Plan (CAP). A DE system would also generate significant economic benefit to Shoreline residents and businesses.

However, conditions to support DE do not currently exist within the 185th Street Station Subarea (185SSS). The following series of actions would contribute to making DE systems feasible in the future:

1. Discontinue use of Combustion or Natural Gas Heating in New Buildings
2. Increase Energy Efficiency in New Buildings
3. Retrofit Existing Buildings for Greater Energy Efficiency and to Fuel-Switch from Combustion/Natural Gas Heating
4. Utilize Onsite Renewable Energy
5. Develop District Energy

The following report summarizes why these five key actions would allow Shoreline to meet CAP commitmentss to achieve GHG emission reduction targets of 25% by 2020, 50% by 2030, and 80% by 2050, compared to 2007 levels.

What is Infrastructure?

Infrastructure is the basic physical and organizational structures and facilities (e.g. buildings, roads, and utilities) needed for the operation of a society or enterprise. Provided well, infrastructure allows communities to thrive. Provided in a more integrated and innovative manner, infrastructure allows communities to thrive sustainably.

Conventional Infrastructure Systems

Communities need high-quality water to support health and economic activities and robust sewer systems to manage the wastewater generated from them. Stormwater infrastructure is used to minimize flooding and reduce pollution from impacting natural waterways. Electricity and natural gas infrastructure provides energy for homes, businesses, and industry. Historically, these infrastructure systems have been provided in a "centralized" approach, where large central plants generate electricity and potable water or treat wastewater.

District Infrastructure Systems

Over the last decade, efficient green building has been utilized to minimize the demands on these centralized infrastructure systems. As green building evolves, building-scale efficient design can only push resource conservation so far cost-effectively. Now infrastructure itself has been identified as the next step in building more sustainable and resilient communities.

Providing energy, water, wastewater, and stormwater services through more localized, distributed infrastructure, as opposed to large centralized regional facilities, allows a more integrated and optimized infrastructure service approach - further reinforcing high performance, green building with innovative and efficient district infrastructure systems.

This report highlights the most suitable district infrastructure systems to support Shoreline's CAP. These district infrastructure systems include district energy, district water, district stormwater, and renewable energy.

Why District Infrastructure?

Much infrastructure development of the past century focused on large, centralized, single purpose systems. These systems were highly effective for promoting economic development, public health, and environmental quality in rapidly growing urban areas. And these systems will continue to play an important role in cities. However, aging infrastructure, the densification and expansion of cities, new fiscal constraints, new technologies, and changing societal values are calling for an expanded toolkit to optimize infrastructure and meet sustainability objectives. Not as a replacement of centralized systems, but as an alternative or complementary strategy to address new challenges and seize new opportunities.

Sustainability demands creative and flexible solutions that are sensitive to local context and that produce real improvements in service quality and resource efficiency. In recent years, the focus has been on building-scale alternatives to centralized infrastructure – high efficiency to net-zero green building – but buildings may not always be the most appropriate or cost-effective scale to promote sustainability. District infrastructure systems—neighborhood-scale utilities that provide services such as heating, cooling, electricity, and recycled water—are emerging as a key strategy for cities that are pursuing aggressive sustainability goals.

What is District Energy?

District energy systems utilize a Central Utility Plant (CUP) to generate heating and/or cooling service distributed to multiple buildings, replacing the need for individual building-scale heating and/or cooling systems. DE is viewed as a cost effective approach to reducing energy use and GHG emissions.

Evolving Scope of Feasibility Study

Originally, the scope of this assessment was to focus on the technical, financial, and regulatory viability of implementing district energy to serve the 185th Street Station Subarea (185SSS). In addition, the original scope included development of a detailed implementation strategy (i.e. 3-5-year action plan), if Council decided to pursue this option, to ensure DE development aligned well with 185SSS development.

Tasks to analyze feasibility included:

1. Identifying potential district-scale infrastructure systems that generate benefits not achievable through conventional building-centric development;

2. Testing financial performance to ensure commercial viability;

3. Assessing the most appropriate development model – public, private, or public private partnership – in which to finance, build, and operate each system; and

4. Making clear recommendations as to which district infrastructure systems the City of Shoreline should implement for the 185th Street Station Subarea.

Initial assessment of DE for the 185SSS found positive environmental, economic, and social benefits including:

- Energy and Carbon Savings – DE could generate significant energy and carbon savings, up to 12% and 93% respectively.
- Cost Effectiveness – DE could be 46% more cost effective from a life-cycle perspective than building-scale systems (i.e., heating and cooling equipment that is located within a building and only serves that building).
- Reduced Private Development Cost – DE could reduce private development costs by eliminating capital investments in building-scale heating equipment. It would also likely yield significant positive investment return..
- Brand and Market Differentiation – DE has the potential to generate marketing "buzz" and market differentiation that could prove valuable for supporting local Economic Development initiatives.

The assessment revealed that financial viability of DE is very sensitive to development build-out and growth rate (i.e., the faster and denser the subarea develops, the better the investment return for DE).

Figure 1 — King County Strategic Climate Action Plan and Shoreline Climate Action Plan

Therefore, early in the analysis it also became clear that because planned development within the subarea would take place over a 100-year period (based on a projected growth rate of 1.5-2.5 percent annually), a standard assessment of commercial viability for a DE system that may not be implemented for another 20-30 years was not the most useful path. Since the City's primary interest in understanding the potential role of DE was achievement of CAP goals, a subarea specific climate action strategy was needed.

This report has been amended to describe how new building energy efficiency, existing building energy efficiency, providing alternatives to natural gas heating, and increased reliance on renewable energy (solar, biomass, and geothermal) would facilitate future feasibility of DE strategies and GHG reductions.

1

INTRODUCTION: DISTRICT ENERGY 101

Overview

Buildings are part of a community, and resource sharing is a common practice in communities, from sharing public spaces to water to electricity grids. Cities and building owners will be compelled to look to district-level solutions to meet their clean energy needs, and to meet their needs around other resource and infrastructure issues such as sustainable stormwater management and waste water recycling. The aggregation of energy demand and the customer service model established for DE can serve as the foundation for these other "eco-district" services and infrastructure projects.

About District Energy

District energy is a very old concept used as far back as the Romans. DE helped the initial development of the electric power industry by enhancing the economics of new power plants by generating additional revenue from waste heat recovery. Today, more than 50% of all building stock in countries of Northern Europe is connected to district systems. In Stockholm, Sweden, for instance, the entire city of more than 800,000 people is served by two systems. As they incrementally expanded to serve more people, these systems added new sources of energy. With such systems, technologies tend to evolve on a regular basis, approximately every 15 to 20 years.

Based on 2005 information from the International District Energy Association (IDEA), the U.S. and Canada had about 650 district systems in operation, though a number of systems have begun operations since then. Of this number, more than 75 percent serve either university or hospital campuses, while the remainder serve portions of downtown urban areas. These DE systems provide energy to about 10 percent of non-residential spaces in the U.S.

District Energy Components

- Central Energy Plant – One or more energy-producing plants provide all of the heating and/or cooling energy required by customers within the defined service area. A single, central plant offers significant economies of scale compared to individual systems within every building, and simplifies system design and operation. However, several plants may be better in certain circumstances, notably where development is slow and/or dispersed, or where different energy sources are being integrated in different locations.
- Distribution Piping System (DPS) – Hot and cold water are distributed to individual customers via underground pipes (one supply and one return pipe each for heating and for cooling). While older district heating systems distributed energy in the form of steam, newer systems almost all use hot water distribution. Systems often grow out of a central distribution line, with smaller loops that link buildings together.

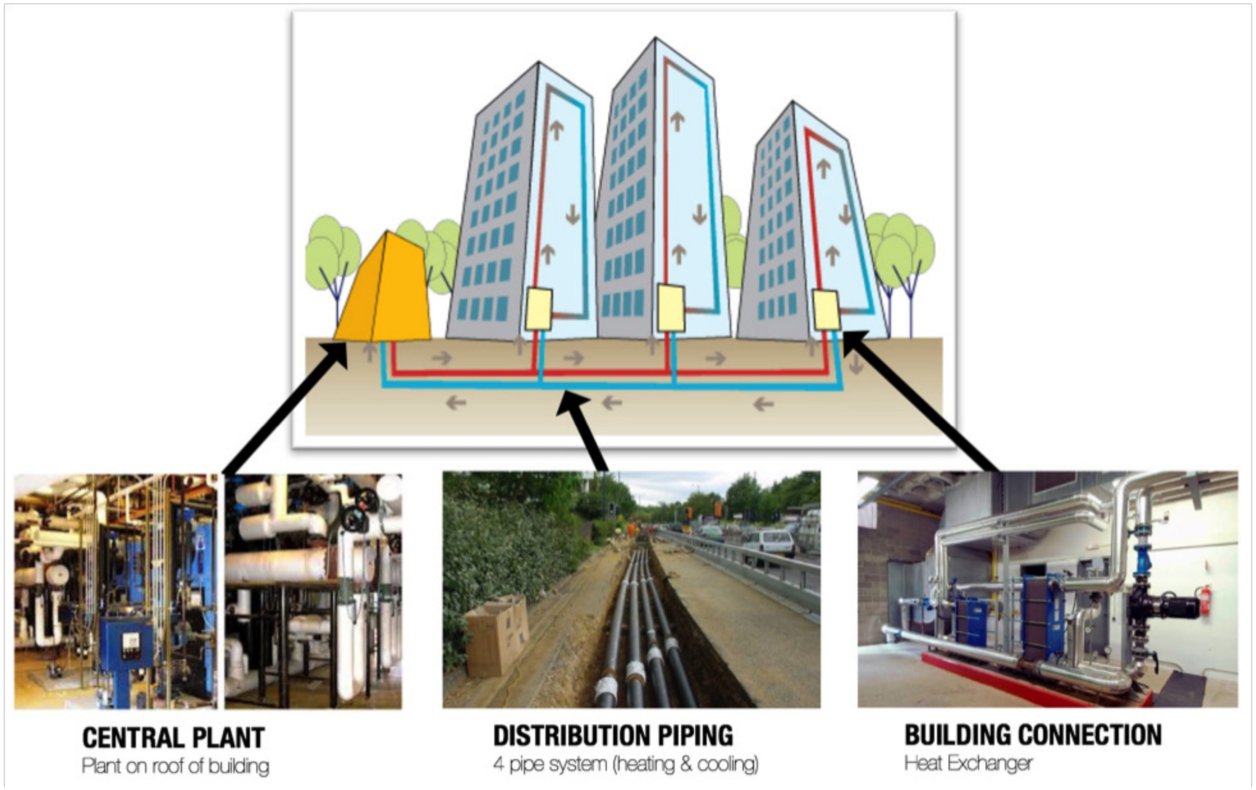

Figure 2 — District Energy Components

- Energy Transfer Station (ETS) – Individual buildings are served via energy transfer stations (ETS) consisting of heat exchangers and meters, eliminating the need for on-site boilers in the case of district heating and chillers, or cooling towers in the case of district cooling. Within buildings, thermal energy must be provided to individual spaces by hydronic HVAC systems, which could include fan coils, hydronic baseboards, or in-floor radiant systems.

In order to deliver DE services, some form of utility service provider (e.g., a local government or a privately-owned utility), assumes responsibility for capital investments (i.e., construction), secures (i.e., generates or captures), and delivers energy that meets the end users' needs, and ultimately charges building owners for use of the system.

A utility is simply an entity that plans, invests in, and operates the infrastructure required to deliver services and recover costs, both capital and ongoing operating costs, whether through user rates or other funding mechanisms.

Benefits of District Energy

DE systems have the potential to generate numerous benefits to the City of Shoreline as well as the owners and tenants of the buildings connected to the system. Making sure that energy consumers and building owners understand the ways that DE directly benefits them is critical. Of course many of these benefits overlap with those of communities—what is good for owners is good for communities, and vice versa. Nevertheless, in order to engage the participation of owners and tenants, cities need to analyze and articulate how DE could benefit the community as well as building owners and tenants through key metrics like energy efficiency, cost savings, and risk management over the long term.

Community benefits include:

Increased Energy Efficiency and Reduced GHG Emissions

District energy systems can produce significant energy savings – up to 20 to 30 percent - compared to stand alone building systems due to load diversification, equipment "right-sizing", and operational efficiency. Enhanced efficiency reduces energy-related GHG emissions while also providing the opportunity for greater emissions reductions by shifting to cleaner energy sources over time.

Improved Resiliency and Risk Mitigation

District energy systems increase community resiliency by providing distributed energy solutions that reduce risk in terms of future energy and environmental policy, carbon costs, fuel availability, cost variability, and the future effects of climate change.

Partnership and Investment Opportunity

District energy provides cities with the opportunity to partner with the private sector to build, operate, and receive ongoing utility revenues while realizing policy and economic development objectives

Building benefits include:

Reduced Energy Costs and Cost Stability

The bottom line for any building owner is cost. Long-term net savings are a key selling point of DE systems. District energy delivers lower cost energy through improved efficiency, load diversification, and economies of scale. Also due to the long-term aggregate nature of demand, a DE system operator can negotiate long-term fuel contracts, which facilitates greater energy price stability for consumers.

Increased Cost Effectiveness

District energy enables incentives and financing that would not otherwise be available. District energy systems can attract sources of financing, such as municipal bonds or community energy grants, which are not available to individual owners. The cost efficiencies gained with a DE utility can in some cases create enough of a revenue premium for cities to offer incentives to owners of existing buildings for installing systems compatible with DE and connecting to the system. This in turn can enable owners to take into consideration the full spectrum of options for replacement of heating and cooling equipment without having to support additional upfront capital costs.

Enhanced Energy Efficiency and Greener Energy

Buyers and renters are becoming more and more aware of the energy performance of existing buildings, which makes energy efficiency a source of either opportunity or risk for owners, depending on how well their buildings compete. Cities are now adopting new policy initiatives around energy performance ratings and disclosure to accelerate the degree to which market forces will distinguish efficient buildings from those that use too much energy. Some cities, like Seattle and Vancouver, B.C., are already moving beyond disclosure policies toward regulations that will require buildings to meet aggressive post-retrofit energy targets in return for flexibility to innovate in how they achieve such targets, including use of on-site renewable generation equipment and/or low-carbon DE sources. District energy offers an essential opportunity to owners in this emerging policy environment.

Reduced Building Operations & Maintenance Responsibility and Cost

With DE, building owners receive reliable and predictable energy service from professional system operators. This means fewer worries for building management staff, in terms of fuel price uncertainty and system maintenance, upgrade, and repair, compared to on-site systems.

Future Technology Benefits

District energy allows cities and building owners to "fuel switch" over time to take advantage of new clean energy technology options and access capital financing for these fuel/technology upgrades.

Low Carbon District Energy Technology Options

District energy systems may include heating and cooling, just heating or just cooling. Generating heating and/or cooling energy at a central utility plant may utilize any number of technology options. From a low carbon perspective, the following technology options are relevant:

Condensing Boilers

Most district energy systems utilize natural gas fired boilers to generate heating service. Advances in boiler technology, in the form of condensing boilers, allow for greater efficiency in heat generation both reducing energy costs and carbon emissions. Condensing boiler units are also often coupled with zero-emissions solutions like biomass or sewer heat recovery to provide an innovative, low-carbon heating source.

Biomass Boilers

Biomass fuels, such as woodchips, may be used instead of oil and gas to generate a renewable heating resource. A number of Canadian district energy systems are utilizing biomass as a sustainable heating source. An example of biomass in action is at the Prince George Biomass District Heating System in Canada.

Figure 3 — Prince George District Energy System The downtown renewable energy system connects numerous buildings through the downtown, providing them with hot water heat.

The biomass-based District Energy System (DES) provides heating for many key buildings in downtown Prince George, while reducing 1,900 plus tons of greenhouse gases per year. The system takes what was previously considered waste heat from the Lakeland sawmill, and transfers it via insulated piping to heat the downtown core of the city. The state of the art District Energy System provides economic and environmental benefits to the City of Prince George.

The District Energy System will:

- Reduce particulate emissions in the city air shed
- Permit the City and its customers to meet greenhouse gas reduction goals
- Reduce the City's reliance on non-renewable fossil fuels
- Help position the City as a leader in bioenergy application
- Assist with energy security and stability
- Keep energy-related funds in the community
- Assist with downtown renewal
- Generate non-tax revenue for the City

Environmental benefits of the project include:

- Reducing total net particulate matter reduction by: 100.7 tons per year
- Reducing total greenhouse gas by: 1868 tons per year
- Supporting forestry, a mainstay of the economy, in a manner that is more cost-effective to implement than any other potential renewable energy sources

Sewer Heat Recovery

A tremendous amount of thermal heating resource is embodied in the wastewater that flows in sewer systems. Innovation in heat pump technology allows for the efficient extraction of this embodied heat from wastewater to cost effectively heat buildings. Two scales of sewer heat recovery are available in the market today:

District Scale Sewer Heat Recovery

Facilities, like the one located in Southeast False Creek in Vancouver, BC, utilize sewer heat recovery from an entire neighborhood to help heat the Olympic Village development. Over a year, most of the development is heated directly by sewer heat and a gas boiler is used to keep up with peak heating demands.

Building Scale Sewer Heat Recovery

Advances in heat recovery technology has allowed the use of small heat pump systems that capture waste heat at the building scale. Although new to the marketplace, these building-scale sewer heat recovery systems show promise. An example is the PIRANHA thermal energy recovery system by SHARC Energy Systems.

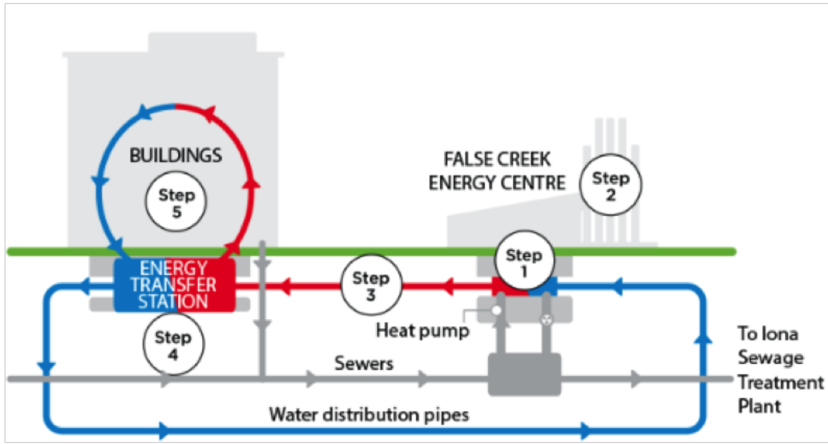

Figure 4 — Southeast False Creek Neighborhood Energy Utility District Scale Sewer Heat Recovery

The Southeast False Creek Neighborhood Energy Utility uses waste thermal energy captured from sewage to provide space heating and hot water to buildings in Southeast False Creek.

This recycled energy eliminates more than 60% of the greenhouse gas pollution associated with heating buildings. The utility is self-funded: it provides a return on investment to City taxpayers, while at the same time, provides affordable rates to customers.

The utility began operations in 2010 and since then has rapidly expanded to serve 395,000 m2 (4,300,000 ft2) of residential, commercial, and institutional space. Over time, the utility will be expanded to serve new developments in the neighborhood and Great Northern Way campus lands.

Figure 5 — Building Scale Sewer Heat Recovery

Wastewater is a constant and inexhaustible resource that can carry ~25% of a building's daily energy consumption and in most cases, is being allowed to go to waste into our sewer systems.

When discharged from buildings, wastewater is higher in temperature than other regenerative energy sources, such as well water or geo-exchange, reaching an average temperature of 77°F at the point of discharge.

Across North America and the EU alone, there is over 8.7 billion gallons of wastewater discharged through the sewer systems each day. This wastewater has the potential to replace 1.5 billion MWh of the natural gas consumption used to provide space heating and domestic hot water every year.

SHARC Energy Systems capture the limitless supply of thermal energy from wastewater to provide sustainable heating and conditioning for a wide range of building types. SHARC aims to significantly reduce global carbon emissions, while reducing current and future energy costs for clients.

The thermo-mechanical methods used in this system are efficient, cost effective, scalable and reliable, providing a truly sustainable and odorless heating and cooling source.

Geothermal (GSHP)

From a thermal perspective, the earth can be used as a battery. Ground source heat pump (GSHP) technology allows district energy systems to utilize the Earth for thermal benefit, supplying or rejecting thermal energy. Whether through an open loop groundwater supply and return system or closed loop system, GSHP has been used successfully to reduce the carbon footprint of district energy systems. GHSP is viable at both the building- and district-scale.

Solar Thermal

Often overlooked, solar thermal shows promising integration into district energy systems. In the northwest, solar thermal can prove financially viable as a renewable energy source. Solar thermal systems produce heat while solar photovoltaic (PV) systems produce electricity.

Figure 6 — Ground-Source Heat Pump

Ground-Source Heat Pumps

Ground-source heat pumps (GSHPs) are well-established systems that can economically heat and cool buildings in most locations. They are in use on campuses throughout the United States because these facilities have buildings with long or year-round cooling requirements and heating loads. GSHPs take advantage of moderate soil temperatures available year-round a short distance underground.

GSHPs operate for many years. These systems use equipment that is the same as or similar to conventional district heating and cooling systems that most campus maintenance staffs are familiar with.

Campus Ground-Source Heat Pump Options

There are two ways campuses use GSHPs.

- Individual Buildings:
  A GSHP should be considered for a new or retrofit building that relies primarily on electric power for heating and cooling. The U.S. Department of Energy (DOE) publishes a fact sheet that helps federal facilities managers evaluate individual buildings for GSHP installations titled *Preliminary Screening for Project Feasibility and Applications for Geothermal Heat Pump Retrofits,* which is a useful tool to determine feasibility of GSHP systems.
- District heating and cooling systems:
  In the future, larger GSHP systems will provide heating and cooling for entire campuses through district heating and cooling systems. Notwithstanding that most GSHP systems currently operate at temperatures suitable for heating and cooling a single building, larger GSHP systems are appearing throughout the world and in the United States. Heated water is hotter and chilled water is usually cooler—called temperature delta—for distribution in district heating and cooling systems that serve multiple buildings.

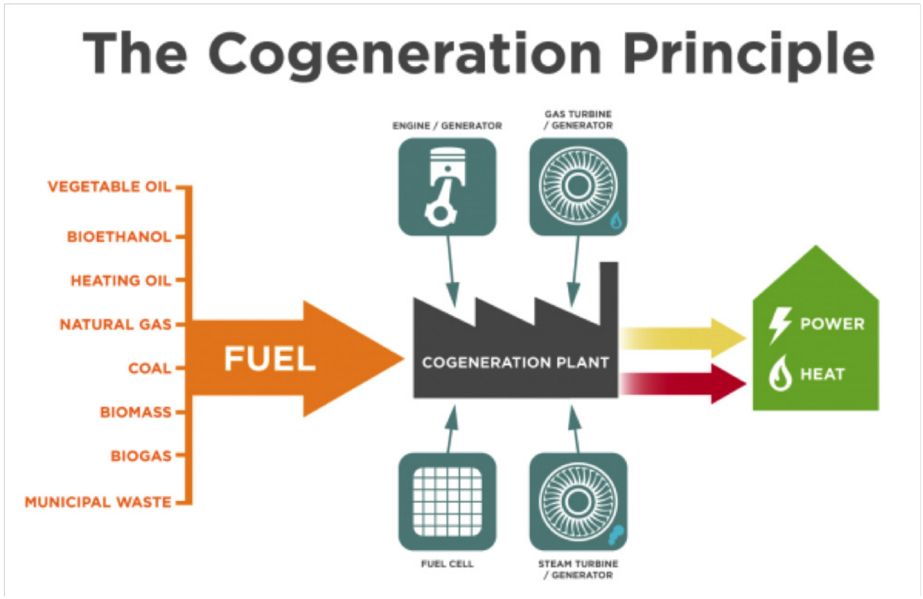

Figure 7 — Combined Heat and Power (CHP)
CHP integrates the production of usable heat and power (electricity), in one single, highly efficient process.

Combined Heat and Power

A combined heat and power (CHP) system generally utilizes a natural gas fired boiler to make steam to turn a turbine to make electricity while capturing and using the heat generated to heat adjacent buildings. The benefit of CHP is the combined efficiency generated by onsite heat and electricity generation (75% efficiency versus 50% from the grid). However, given the potential desire for a no gas district for the 185th Street Station Subarea, combined heat and power (CHP) would not be a likely strategy given the fuel utilized in CHP is commonly natural gas to be financially viable.

Phases of District Energy Development

District energy development may be divided into the following main phases:

Phase 1 - Advocacy, Vision and Policy Development

This work actually precedes the development cycle, nevertheless, it is vital. Many people — even energy experts who work for utilities — consider district energy an "old, outdated" technology whose time has come and gone. If this approach is to once again receive serious consideration, these sorts of misconceptions need to be addressed and debunked.

Phase 2 - Feasibility (Screening, Pre-Feasibility and Feasibility)

This is the pre-feasibility screening and feasibility work required to confirm the basic technical and financial viability of a particular district energy project. There are a number of important steps in this phase outlined in section 3, and it requires both financial, technical, and risk expertise.

Phase 3 - Detailed Investment Analysis

This is an extension of full feasibility, but includes making decisions about ownership and financing details, as well as securing customer commitments.

Phase 4 - Development

This is the design, permitting, construction, and commissioning work.

Phase 5 - Operations, Maintenance and Expansion

This involves operating, maintaining, and expanding the system after it is commissioned, and changing fuel sources if necessary and prudent.

2 INFRASTRUCTURE DELIVERY MODELS

District Energy Players - Roles and Responsibilities

There are seven key players in the process of district energy development. The following pages describe each key player's roles and responsibilities:

District Energy Advocate

This is the general advocate and source of information about district energy. Usually a government or nonprofit organization educates the general public about the benefits of district energy, articulating and promulgating the vision to build support. This entity also engages public agencies and industry representatives to encourage supportive public policy. The main U.S. advocate is the International District Energy Association.

Facilitator/Convener

This role is essentially the City-designated district energy "champion." This is an extremely important role, because the economic benefits of a municipal-scale, multi-stakeholder district energy system are often too dispersed to motivate any one self-interested party to drive the process. Because district energy's benefits accrue to the public as well as the private sector, individual private actors tend not to take on this time-consuming and expensive facilitation role. As a result, without a strong facilitator driving the process, even an economically viable project can easily fall by the wayside.

Pre-Feasibility and Feasibility Consultant

The pre-feasibility consultant looks at a specific geography's current and projected energy and population density, as well as prevailing and projected energy costs, and tries to determine whether or not there is a realistic opportunity for district energy in that location.

A feasibility consultant builds on the pre-feasibility study and prepares a comprehensive study that looks at site-specific energy intensity data, possible right of way alignments, specific sites for energy plants, neighborhood traffic patterns and various potential technologies to determine whether or not a district energy project makes sense in a specific location. It also analyzes the business and technical case, including a pro forma, sensitivity analysis, thermal plant location options and an analysis of the environmental benefits of various technology options and fuel sources. This work is typically funded either by a public sector entity that wants to maximize public benefits from a project, or by a project developer who hopes to develop the project and has a reasonable expectation of doing so.

Project Owner

This entity owns the district energy system's physical assets. Owners are typically either public, private, or a hybrid blend. There are also a few district energy cooperatives. Private Franchisee/Owners are often linked to and/or backed by large financial institutions such as investment banks or pension funds. Sometimes systems have multiple owners (e.g. joint ventures and public-private partnerships) and ownership lines are often split between the energy center and the distribution network.

Project Developer

The project developer delivers the physical assets, such as the energy center and/or the distribution system to the owner/financier. In some cases, project developers have a limited period of engagement with the project, as they focus on winning the development contract, and then designing and building the physical assets. Developers tend to be very bottom-line focused and deadline driven, because they generally succeed by limiting their risks and costs, and by completing high quality projects on time and on budget. In some instances, a developer will also choose to be the long-term owner and operator (see below), but this is not always the case.

Project Operator

The district energy operator is responsible for the ongoing technical operation and maintenance of the district energy system. As already noted, this entity is sometimes also the Developer and the Owner. For example, Veolia Energy North America purchased, rather than developed, most of their American district energy systems, and in some cases they operate district energy facilities that are owned by others.

Regulators

Regulators establish and monitor standards of construction, operational performance, safety, and pricing/consumer protection. They also ensure compliance with standards and other applicable laws.

District Energy Ownership and Operating Models

There are four ownership and operating models utilized to develop and operate district energy systems.

The Municipal Model (Public)

Public district energy companies are typically owned and governed by the local municipality. The City either establishes a full-fledged district energy department to manage the system, or it creates a separate, wholly owned and operated subsidiary to shield the City's general fund from direct and unlimited financial liability. Although the City or a subsidiary usually owns the district energy company under this model, the technical design, construction — and possibly even the operation — is often contracted out to private firms through a traditional public procurement process.

For example, a private developer backed by private investment funds might use a traditional project finance structure to build the system. This might involve a Special Purpose Vehicle (SPV) to finance and develop the system that, once completed and fully operational, could be transferred to the City's full ownership and control. The City would thereby shed the construction risk and purchase the completed system with low-cost bonds secured either through contracted energy purchase agreements or by the City's full faith and credit. In either case, the City would repay the relatively low-cost bonds over time.

In other municipal examples the system's build-out occurs over many years, so there is not a simple design-build phase followed by a bond financing phase. The municipal utility in such cases will require an ongoing source of new design-build capital. This may take the form of a revolving capital pool that is continually replenished by an expanding base of ratepayers.

Strengths of the Municipal Model:

- City procurement guidelines, along with long-term ownership, ensure control and close alignment with the City's goals, including social and environmental policies.
- Development risk can be transferred to a third party via a Special Purpose Vehicle, as described above.
- City controls zoning and building permits, so can create incentives, lower the cost of capital and prioritize sustainability, efficiency, and carbon performance.
- City ownership enables provision of lower-cost long-term financing compared to private sector borrowing.
- Operating profits would flow back to the City and support the delivery of other services. While this is a positive outcome, there is also the potential for losses.
- System expansion or modification can be encouraged, coordinated, and controlled by the City.
- City may have access to grants not available to private sector owners.
- City may recover some costs from taxes rather than customer rates if there are broader public benefits from the project and costs exceed private benefits (sustainable rates) or to minimize revenue risks from voluntary-only participation.

Weaknesses of the Municipal Model:

- Long-term financing costs are reliant on the financial strength (i.e. the credit rating) of the City, and project debt will remain on the City's balance sheet.
- The City carries the long-term debt, and arguably might discourage energy efficiency investments that could reduce its income from energy sales.
- Without a clear commitment to finance expansion and renewal, the system may not reach its full (sustainable) potential and stagnate.

The Private Model

A number of private companies develop, own and/or operate district energy systems. Most of these firms are relatively unknown; however, in Europe and Canada, several very large investor-owned utilities have entered this market, either directly or by buying a stake in a specialist company and providing solid financial backing, but there are still relatively few U.S.-based utilities in this space.

Private companies can arrange external debt financing, but building owners and/or the project developer sometimes may need to make an equity contribution to the project. More common is a connection fee that is required upon connecting to the system. Building owners are sometimes required to make long-term commitments to purchasing energy for no less than the projected or actual 'business as usual' price of energy from more traditional sources. This way the district energy developer can model incoming future cash flows with a reasonable degree of certainty. Sometimes interested public entities also must supply gap financing, especially for distribution systems in areas with relatively few initial customers. This gap financing may be justified on the basis of broader public benefits.

Strengths of the Private Model:

- The private company and its backers typically carry most, if not all, of the financial risk.
- The private company brings substantial expertise to the project with extensive project finance skills, project management experience and technological knowledge, all of which enables them to carry the technical performance risk.
- The developer will continue to own and/or operate the system over the long term, so a City will not have to handle maintenance or operations.
- A private utility will typically continue to capitalize the business for expansion and renewal.

Weaknesses of the Private Model:

- Relatively high rates of return are required to compensate the developer's risk, so energy charges may be higher.
- Unless there is a very strong business case, privately-financed projects often need at least some public support, whether in the form of policies that reduce development risks and barriers or incentives and financing support in recognition of broader public benefits.

- Public sector stakeholders have more trouble exerting control and are less able to direct future development of privately-owned projects, particularly those with a lower rate of return.
- The details of a City's franchise agreement are extremely important, because customers will be tied to a private company with near-monopoly control, and depending on the type of system that is developed, it could be exempt from Public Utility Commission (PUC) oversight.

The Hybrid Model (i.e. Public Private Partnership)

Various hybrid structures, some of which are known as public-private partnerships, may be established in order to share financing, development, ownership and operating risks and functions. The hybrid model — which is actually a "family" comprised of dozens of possible configurations — also shares decision-making power/control between the public and private sectors while still allowing the district energy developer to access capital at the lower interest rates available to the public sector. Hybrid approaches offer tremendous flexibility and the opportunity for innovation in creating a unique ownership/ operating structure.

Several discrete elements of a project can be "hybridized":

- Financial Ownership - For example, a typical joint venture combines all of the assets into a single entity and splits ownership of that entity between the owners.
- Hard Assets - This is not really a joint venture, as actual assets are not shared. An example might be a system where one entity (typically, but not always, a municipality) owns and maintains the thermal distribution system, while a private company owns and operates the energy center.
- Operations, Maintenance and Upgrades - Operations and maintenance can be outsourced via a simple operating agreement. Alternately, a more comprehensive and longer-term concession agreement might also include outsourced responsibility for funding system upgrades and expansions.

One possible hybrid arrangement is for public entities to handle the financing, construction, operation, and maintenance of a thermal distribution (piping) system, while the central plant is handled by one or several different private entities. The municipality would manage the energy distribution system since ongoing maintenance and extension requires tearing up the streets, an activity that municipalities already know how to manage. This work can be closely coordinated with other public utility repairs within the public right-of-way. The thermal distribution and/or other components of a system could also initially be financed, owned, and operated by a municipality, but later sold off once the system is established and its financial viability is clearly demonstrated.

Strengths of the Hybrid Model:

- City still controls zoning and building permits, so can create incentives to connect — and thereby influence — the cost of capital.
- Can readily be influenced by the City's procurement process and regulations to pursue efficiency, carbon performance, the use of locally-sourced renewable fuels, and rapid expansion into new or redeveloping neighborhoods.
- Greater flexibility, in terms of financing sources and risk allocation, than either wholly-public or wholly-private approaches.
- Sometimes provides access to low-cost, public-sector borrowing rates.
- May reduce political risk for elected officials supporting district energy projects.

Weaknesses of the Hybrid Model:

- The public sector (i.e. the taxpayer) often still assumes some financial risk.
- Liabilities are sometimes, but not always, reflected in public sector accounts.
- Process requires compliance with (potentially cumbersome) public sector procurement procedures.

The Cooperative Model

Cooperatives (co-ops) are also sometimes known as stakeholder-owned Special Purpose Vehicles, because ownership is shared among the co-op's customers. Key stakeholders are typically customers receiving the energy, like commercial buildings and/or residents within a defined location and local public agencies.

Strengths of the Cooperative Model:

- This structure is likely to offer maximum accountability and transparency because the owners are also customers.
- Co-op structures can enable projects in areas with limited access to capital by securing relatively small amounts of capital from many different owners/customers.
- By owning the network that serves them, co-op members reduce the

risk of monopoly abuse.

- Offering outside entities an ownership stake can help fund expansion and attract more members.

Weaknesses of the Cooperative Model:

- Decision-making can be cumbersome for cooperatives, since ownership is divided across many stakeholders that may have disparate interests.
- A co-op may lack the expertise that a private firm can offer through a private or hybrid model.
- It may be difficult to utilize the co-op model in newly developed areas without an established base load. This model may work best for purchasing existing district energy infrastructure, rather than building new facilities.

Challenges to Implementing District Energy

There are potential challenges to overcome as well. Some key challenges include:

Building Developer/Owner Buy-In

The most critical challenge to DE development is building developer/owner buy-in (i.e., "will they choose to connect"). Detailed financial analysis will provide these future customers with the necessary information to make informed decisions. Moreover, having the City backing the system will provide additional certainty of energy service and cost now and into the future.

Staging of Capital Investments

Some DE capital investments are "lumpy" and must be staged carefully to minimize carrying costs prior to securing energy service revenues and to minimize stranded investment risk. One strategy to reduce these risks includes interim reliance on temporary or permanent natural gas boilers, which can then be used for peaking and back-up once loads reach sufficient levels to support investment in alternative technologies for baseload supply.

Energy Revenue Risks

Customer capture and retention is critical to ensuring economies of scale while minimizing the risk of stranded capital. Often communities and stakeholders play a critical role in mitigating these risks through vision and policy support.

Project Financing

District energy offers stable, utility-style returns. However, there is a need to finance pre-implementation feasibility studies and design work for new systems. New systems will also typically need a "levelized rate" structure whereby expenses may exceed revenues in early years. Additional capital will be required to finance operating deficits in early years, which would be repaid through surpluses in later years of the investment cycle. Multiple sources of financing may be required to reflect the mix of public and private benefits. For example, customers may pay a small premium over conventional heating and cooling systems to reflect intangibles such as higher reliability, better service, reduced risks, and better environmental performance. However, the willingness of private customers to pay for societal and long-term benefits such as deep carbon reductions and technological flexibility may be limited. Other sources of capital will be required to maximize these societal benefits.

Planning and Coordination

Considerable coordination among land use and infrastructure planning is required to minimize implementation costs, secure energy production sites, and secure certain alternative energy sources such as waste heat sources. Building codes and enforcement can be used to promote voluntary connection and ensure system performance. Careful coordination with building developers and designers is required to ensure optimal system compatibility.

Supply and Price of Alternative Technologies and Fuels

Supply chains for some alternative technologies and fuels are not yet well developed, and there may be both supply and price risks compared to well-established conventional fuels. These can be managed in part through competitive procurement processes, performance contracting, and the staging and diversification of technologies. Governments may also have a role to play in facilitating market development for technology and fuel suppliers, as well as access to resources such as waste streams and heat recovery opportunities.

Electricity Market Interface

The primary focus of DE is on the provision of thermal energy service (heating and/or cooling). Combined Heat and Power (CHP) can reduce DE costs and enhance the efficiency and security of the local electricity system. However, investors will often require long-term and stable power prices to finance the additional costs of CHP. Alternatively, electric utilities or independent power producers may need to build, own, and operate the plants including the management of electricity supply contracts, and then sell waste heat to a DE provider.

3

DISTRICT INFRASTRUCTURE ASSESSMENT APPROACH

Determining the Potential Value Proposition of District Energy

The value propositions, costs and risks of DE must be weighed in project-specific business cases that consider the unique features and local context of every project.

The ultimate business case for DE will depend upon a number of criteria including:

- The ultimate scale of the expected system;
- The density and mix of loads (higher density and greater use mix will typically results in greater ratio of benefits to costs);
- The actual rate and staging of development;
- The security of loads (requirements or incentives for customers to connect and consume);
- The options for on-site energy systems (many building sites may be limited in terms of their ability to access alternative energy sources such as solar orientation or available space and suitable ground conditions for geo-exchange systems);
- The availability and cost of alternative energy sources (e.g., large nearby waste heat sources, local underutilized biomass resources);
- Potential synergies with other infrastructure (e.g., as sources of waste energy and/or in the installation and maintenance of equipment); and
- Other opportunities for future growth or the addition of other services (sometimes referred to as "growth options" in the finance literature).

Figure 8 — Conceptual View of 8th Ave NE Right-of-Way Showuing MUR-35' and MUR-45' Zoning

Assessing District Energy Viability

Based on input from the City of Shoreline, DE evaluation criteria were identified as follows:

1. Technical
Does DE provide for better performance when compared to building-scale solutions?

2. Regulatory and Policy
Do existing regulations and policies allow DE? If not, how should they be evolved? Do the benefits of DE reinforce existing City policies and community values?

3. Financial (i.e., Business Case)
Based on sound cost estimating (including Capital and Operations & Maintenance) and revenue projections, does a DE system make financial sense? Is there an adequate business case to justify the investment?

4. Development Model
Public (i.e., City), private (i.e., 3rd party), or public-private partnership, which is the best development model to finance, own, and operate a DE system? What is the specific role and responsibility of the City to support DE development efforts?

5. Risk Management
Have potential risks been identified and mitigation measures developed to ensure proper finance, design, construction, and operations?

6. Value to Future 185TH Street Station Subarea Development
Does DE provide a strong value proposition to the City and future developers?

4

185th STREET STATION SUBAREA DEVELOPMENT ASSUMPTIONS

The following section summarizes existing and planned development for the 185SSS, projects baseline energy use and carbon emissions, and identifies strategies to reduce energy use and GHG emissions to achieve CAP goals.

Development Assumptions

Expected Growth

The City of Shoreline's anticipated population, households, and employees in the 185SSS were shown in the Subarea Plan FEIS in Tables 3.2-12 and 3.2-13.

Projections were based on a 20-year outlook (to 2035) and a full build-out of 80 to 125 years (2095 to 2140).

The expected growth was estimated as follows:

	2014	2035	Full Build-Out
Population	7,994	12,102	56,529
Households	3,310	4,975	23,554
Employees	1,448	2,160	15,340

Zoning

The 185SSS zoning map, adopted on March 16, 2015, shows the subarea divided into three different phases. Phase 1 zoning became effective upon adoption; Phase 2 zoning will become effective in 2021; and Phase 3 zoning will become effective in 2033.

At full build-out, approximately 86% of the subarea development is projected to be residential, 11% will be office/commercial, and 3% will be retail, by square footage.

For purposes of analysis, the subarea was divided into 3 different nodes.

NODE 1 – Node 1 is the west side of the subarea, west of 1st Ave NE and 3rd Ave NE, mostly zoned as MUR-45' and MUR-35' (Mixed Use Residential - 35 and 45 foot height limits). This node would account for approximately 24% of the projected residential development. The core of this node abuts NE 185th Street and is part of Phase 1, but portions of this node farther from NE 185th Street fall into the boundaries of Phases 2 and 3.

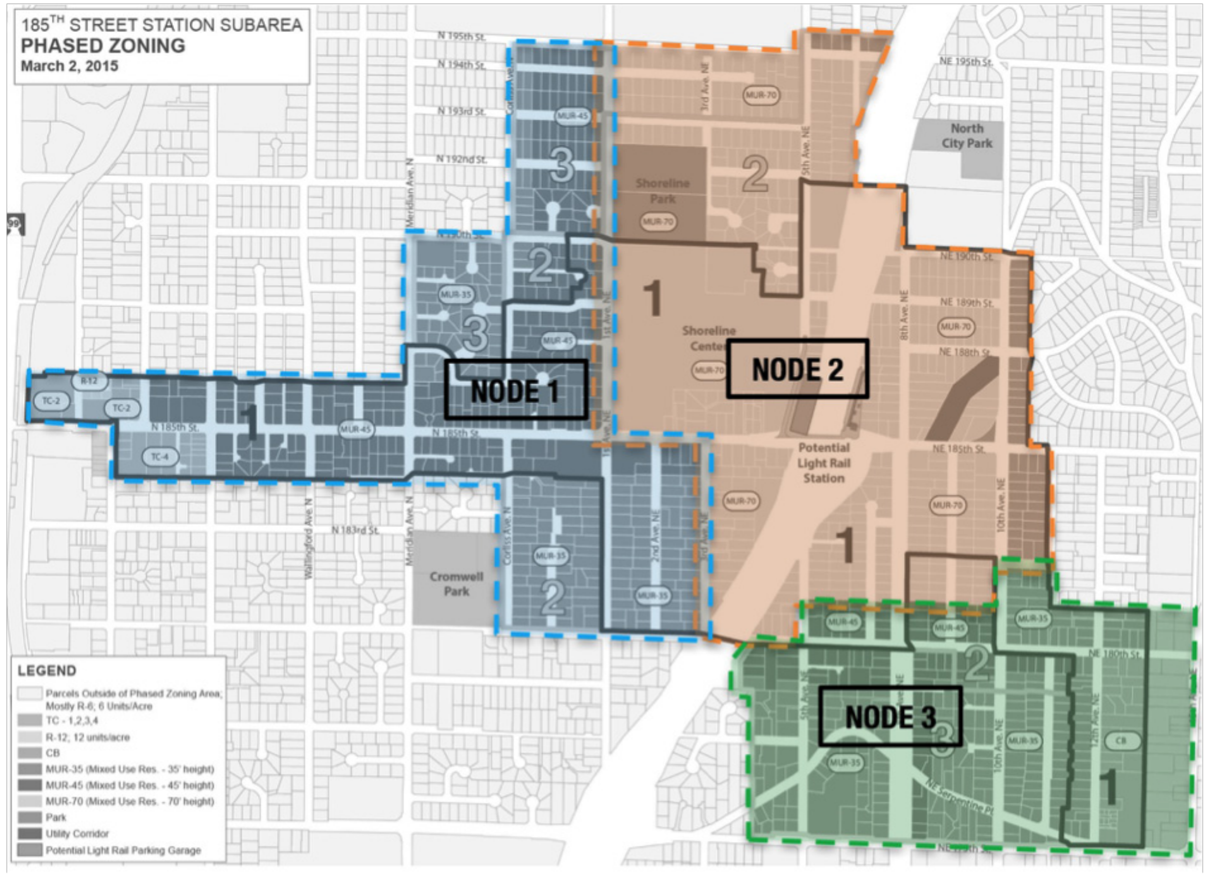

Figure 9 — Subarea Nodes

NODE 2 – Node 2 is in the middle of the subarea, centered around the future light rail station. This is the highest density portion of the subarea, predominantly zoned as MUR-70' (70-foot height limit), which is intended to become "Transit-Oriented Development" (TOD). This node accounts for approximately 57% of the projected residential development. The zoning in this node falls within the boundaries of Phases 1 and 2, unlocking in 2015 and 2021, but the timing of development here is expected to be more closely tied to opening of the light rail station because it will be proximity to transit that makes projects viable.

NODE 3 – Node 3 is the southeast portion of the subarea, marked by the MUR-35', MUR-45', and Community Business (CB) zoning around NE 180th Street. This node consists of approximately 19% of the projected residential development. Most of the new zoning in this node is part of Phase 3, unlocking in 2033.

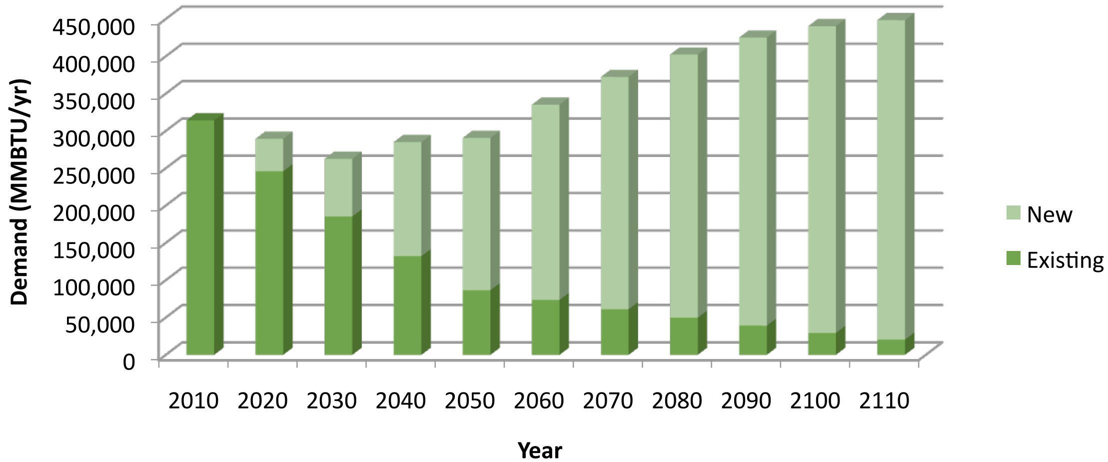

Figure 10 — Projected Energy Demand

Energy Use and Carbon Emissions Assumptions

Electrical power is serviced to this subarea by Seattle City Light (SCL). Based on Seattle City Light's fuel mix in 2014, approximately 97% of their portfolio is from renewable sources. The GHG emissions measured in metric tons of carbon dioxide (tCO2) from SCL is relatively low. With a goal of the elimination of coal as a fuel source by 2025, and the increase in other renewable power options, it was modeled that the electrical power supply would not contribute to any GHG emissions by 2050.

Natural gas service is provided by Puget Sound Energy (PSE). Natural gas is typically used for heating purposes. While it is currently a lower cost option than electricity for the equivalent amount of energy produced, it will contribute to GHG emissions both within the subarea during use and through its extraction and supply chain.

Existing buildings and new development were evaluated by the common measure of energy performance in buildings, Energy Use Intensity (EUI). Buildings were categorized by three different uses: office, multi-family residential, and retail, as each type of building use has different needs for heating and cooling.

Existing buildings were assumed to have EUI values like other existing Seattle-area buildings. The existing buildings were modeled to have reductions in EUI over time, to match the targets described in the City's Carbon Wedge Analysis (CWA), which was adopted in 2013 to provide a pathway for the City to meet CAP emission reduction targets.

According to the CWA, the City target for new buildings should be to achieve zero net GHG emissions in 100% of new buildings citywide by 2030. A combination of State code changes and other policy decisions will help to achieve this goal. For example, the Washington State Energy Code will ensure that new buildings constructed after 2030 must use 70 percent less energy than new buildings constructed in 2006. Another advantage for Shoreline is that Seattle City Light's fuel mix is low carbon, so electrical power to new buildings will have minimal GHG impact, and coal power as a source is expected to phase out entirely by 2025.

For this analysis, new building EUI values were initially based on the 2015 Seattle Energy Code Target Performance Path, which was used as a benchmark for EUI standards. These values were lowered by about 15%, as Shoreline's light rail station subareas have green building requirements that will result in buildings more energy efficient than code. These EUI values were also modeled to reduce over time to reflect future potential for DE systems and other building efficiency improvement brought to market or mandated by code.

In existing buildings, retrofits should be utilized to achieve the City goal of 40% reductions of natural gas for heating by 2030. Renewable energies will be sought after as a replacement source for heating, and existing building electrical use must reduce by 25%.

Baseline Energy Use and Carbon Emissions Estimates

Business as Usual (BAU) Scenario

Business as Usual (BAU) conditions were modeled with the existing and new building EUI values described above. BAU modeling assumed a typical use of natural gas for heating in new development.

The baseline energy demand with no new development is 314,000 million British Thermal Units (MMBtu) for approximately 4 million square feet of interior space. A BTU is a measure of the energy content in fuel, and is used in the power, steam generation, heating and air conditioning industries. The GHG emissions of the original existing development are approximately 8,229 tCO_2.

The results of a BAU projection to 2050 resulted in the subarea consuming approximately 290,500 MMBtus of energy annually, based on 2.5 million square feet of existing buildings and 9 million square feet of new buildings by 2050.

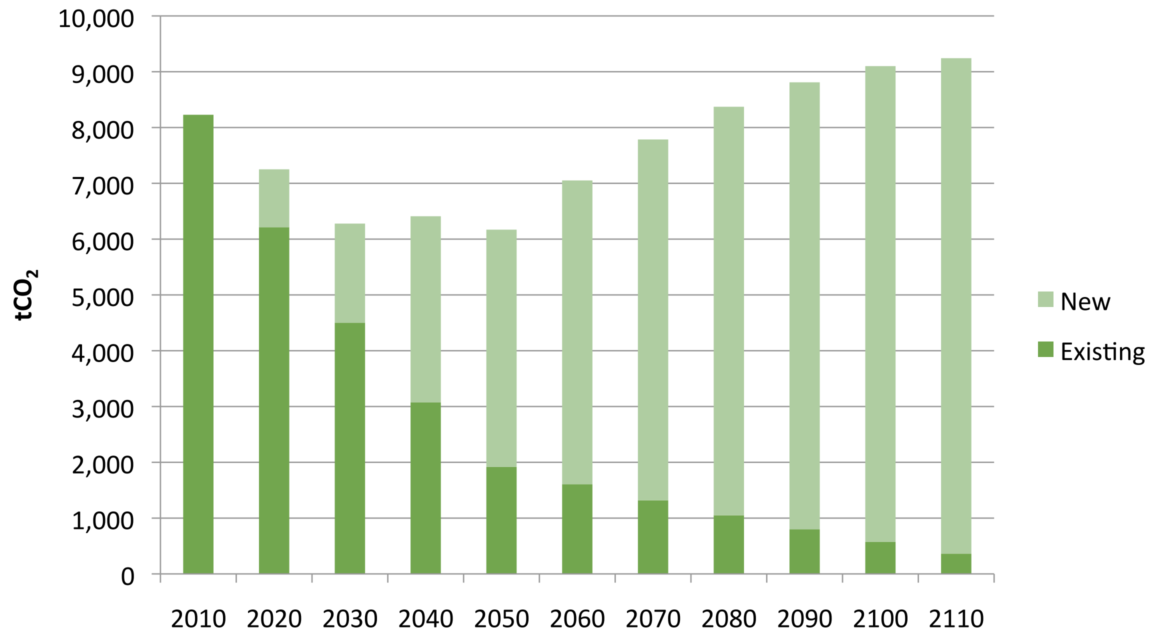

Figure 11 — Projected GHG Emissions (with Natural Gas)

Greenhouse gas emissions resulted in 1,917 tCO_2 from the existing buildings and 4,253 tCO_2 from new development by 2050. The resulting reduction of GHG emissions based on new building and existing building energy efficiency is approximately 25% – well short of the 80% goal by 2050.

To achieve the CAP reduction goal would require a significant amount of onsite renewable energy generation. For example, the amount of on-site solar generation required to offset the GHG emissions in 2050 would be the equivalent of over 20 MW (megawatts) of solar PV (photovoltaic) generation, which is approximately 1.75 million square feet worth of solar arrays.

BAU - NO GAS Scenario

After the BAU conditions were modeled, a scenario with no natural gas used in new development was analyzed. The same strategy for reducing existing and new building EUIs was modeled. As a result, the energy demand in 2050 is the same 290,500 MMBtu as the BAU condition, but it will be met entirely with electrical service for the 9 million square feet of new buildings, and a mix of gas and electric for the remaining 2.5 million square feet of existing buildings. Electrical options for heating include heat pumps, which also have the ability to provide air conditioning.

Again, the baseline energy demand with no new development is 314,000 MMBtu for approximately 4 million square feet. The GHG emissions of the original existing developments are approximately 8,229 tCO_2.

Carbon emissions resulted in 1,917 tCO2 from the existing buildings and no GHG from new development by 2050, since it was assumed that the SCL service will be entirely carbon-free by 2050. The resulting reduction of GHG emissions is approximately 77%, almost meeting the 80% goal with just building efficiency improvements (combined with targeted DE service within high density areas, such as Node 2) and elimination of natural gas in new development.

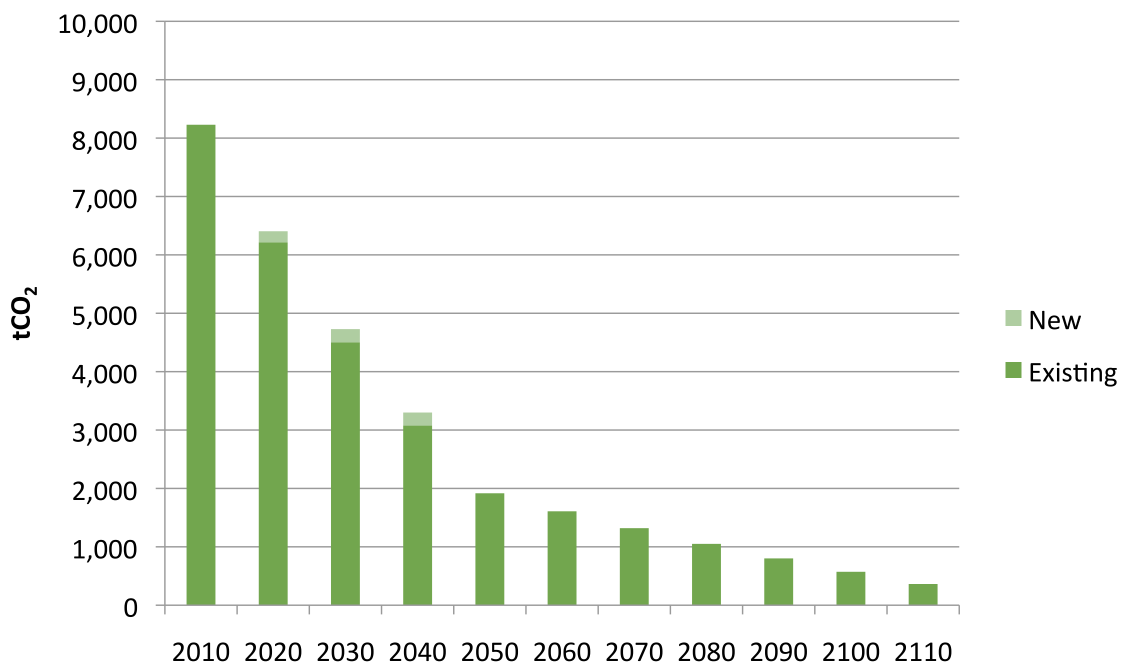

Figure 12 — Projected GHG Emissions (no Natural Gas)

Achieving CAP goals would require implementing onsite renewable energy generation. The amount of on-site solar generation required to offset the GHG emissions in 2050 would be the equivalent of approximately 1.25 MW of solar PV, which is approximately 100,000 square feet worth of solar arrays.

As shown in Figures 11 and 12, natural gas use is the determining factor in meeting GHG reduction targets in 2050.

5 ACTIONS TO ACHIEVE CLIMATE ACTION PLAN GOALS

Shoreline Climate Action Plan goals are achievable at the 185th Street Station Subarea but it will take a mix of actions. The following graphic demonstrates how the City of Shoreline may utilize development the 185SSS to achieve CAP goals.

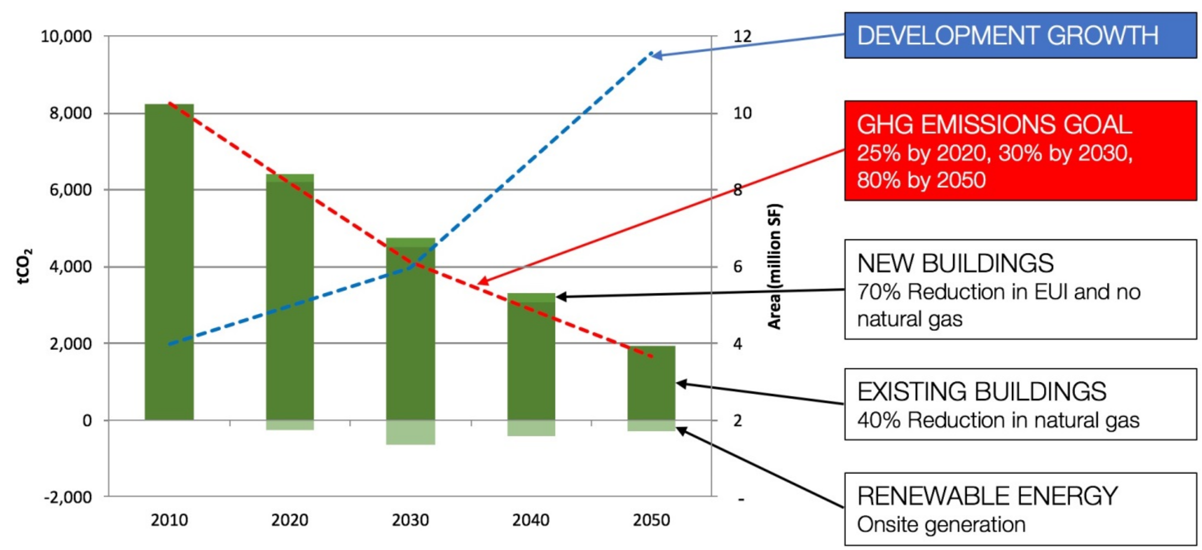

Figure 13 — Subarea Energy Goal and Focus Areas with No Gas

Current development is approximately 4 million square feet and 2050 development is projected to be approximately 11.5 million square feet. The graphic above shows that even though the 185SSS could triple its population over the next 30 years, GHG emissions can be reduced to 80% below 2007 levels.

Achieving this goal will require the following actions:

1. No Use of Combustion or Natural Gas Heating in New Buildings

2. Increased Energy Efficiency in New Buildings

3. Retrofit Existing Buildings for Greater Energy Efficiency and to Fuel-Switch from Combustion/Natural Gas Heating

4. Utilize Onsite Renewable Energy

5. Develop District Energy

ACTION 1 – No Natural Gas Program Trial / Demonstration Pilot Project(s)

Since SCL energy is essentially, or will be shortly, 100% renewable, Shoreline should focus on creating development policy and support standards/codes to limit or eliminate the use of natural gas within the 185th Street Station Subarea. This action has the most significant impact on reducing GHG emissions associated with subarea development.

Recommended Next Steps

Convincing the market to implement no gas development will take considerable effort and strategy engagement with stakeholders. Shoreline should complete the following:

1. No Gas Working Group – Form a "no gas" working group to explore the benefits and disadvantages of adopting a no gas policy for the 185th Street Station Subarea. This working group would be ad hoc and would meet for approximately 12 months to assess and develop recommendations to Council, followed by regular updates by City staff as a potential no gas program is evaluated. Members of the working group would include City staff, Puget Sound Energy, Seattle City Light, and a few members of the community. The working group should be no larger than 10-12 members.

2. Environmental, Financial, and Legal Assessment – Shoreline should work with a consultant to assess the environmental, financial, and legal impacts of a "no gas" policy. It would be wise to include in the assessment case studies relevant to the type and scale of development projected for the 185th Street Station Subarea. These case studies will be critical elements of the stakeholder engagement process. For budgeting purposes, an assessment like this may cost approximately $50,000.

3. Community Outreach and Engagement – City staff, with support from the No Gas Working Group, should implement a stakeholder engagement process to both help craft the environmental and financial assessment as well as to refine the case study assessments. Stakeholders would be from two groups: new building and existing buildings. The new building members of the stakeholder group should be comprised of local developers in Shoreline that are working on single family residential, multi-family residential, and commercial projects. Existing building stakeholders would represent similar building types. It will be important to understand how each stakeholder group would consider a potential no gas policy in Shoreline.

4. Preliminary No Gas Program – Based on the results of the environmental and financial assessment of a no gas policy and stakeholder input, Shoreline should craft a preliminary no gas program for the 185th Street Station Subarea. That program should be shared with the stakeholder group for input and refinement and then shared with Council for review.

5. No Gas Program Trial Period / Demonstration Pilot Projects – Based on input from stakeholders and Council, Shoreline should implement the no gas program for a trail period of 5 years. This period would cover project predevelopment, permitting, construction, and at least 2 years of operation. The City should monitor and track the project from an environmental and financial performance perspective. These initial development projects would serve both the community and City well from the educational perspective, plus it would add real data and results to the No Gas Program.

6. Implement No Gas Program – Should the trial no gas program results prove positive, Shoreline should adopt the no gas program for the 185th Street Station Subarea – and potentially other areas in the city.

Policies and Incentives

Shoreline should work with SCL to explore potential incentives for no gas development. This likely will be a critical component of the no gas program trial period and demonstration pilots. Incentives could range from discounts/rebates on electric appliances and HVAC equipment to technical resources to help developers/building owners with assessing no gas options for new building or retrofit projects. Shoreline should also connect with the National Renewable Energy Lab (NREL) and International Living Future Institute (ILFI). See below for more information.

Seattle City Light would also potentially be a great partner to structure a no gas incentive in the form of package that funds electric heating combined with solar hot water. Electric heating generally has a lower capital cost than gas heating. The savings help to offset the higher capital cost of solar hot water. The result would be a cost neutral solution for a developer to implement a no gas heating and hot water system for their development.

Resources

There are no current examples of City-mandated no gas policies in effect. However, on a smaller scale, developers have started designing and constructing new projects without any natural gas. It appears that these developers are driven by aggressive sustainability goals, such as those outlined in the International Living Building Challenge (LBC), and the potential for lower upfront capital and operating costs associated with all electric systems (which combine electric heating with solar thermal hot water).

According to the Living Building Challenge 3.1 – A Visionary Path to a Regenerative Future, imperative 6 requires "one hundred and five percent of the project's energy needs must be supplied by on-site renewable energy on a net annual basis, without the use of on-site combustion."

In addition, the National Renewable Energy Lab (NREL) has created a research on net-zero buildings and ecodistricts. They are tracking projects that have selected or implemented no gas solutions. It is recommended that Shoreline connect with NREL to share knowledge and resources. NREL may have sources/incentives to support Shoreline's exploration of a no gas policy for the 185th Street Station Subarea.

ACTION 2 – New Building Energy Efficiency (including a no gas, net-zero demonstration pilot)

A 70% reduction in energy use, combined with no gas, is needed to achieve CAP goals for the subarea. This would be equivalent to LEED Platinum buildings, which use no gas, for all new development within the subarea. A goal of this magnitude will require significant engagement with the local development community and likely some form of incentive.

To achieve the GHG emissions goals, new buildings should not use natural gas as an energy source. Between now and 2050, there is projected to be an approximate three-fold increase in population and development square footage. Accommodating that type of growth while reducing overall GHG emissions by 80% would not be possible with the addition of new natural gas buildings, even with the aggressive improvements in building efficiencies.

Luckily, Shoreline has already taken a tremendous step to advance and incentivize high performing green buildings through its launch of the Deep Green Incentive Program (DGIP).

DGIP provides flexibility in the application of development standards, expedited permitting, and fee reductions to promote construction of green buildings that meet the most stringent levels of available certification. These include the US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Platinum level; the International Living Future Institute's Living Building Challenge (LBC), Petal Recognition, and Net Zero Energy Building (NZEB) programs; and Built Green's 5- and Emerald-Star certifications.

Shoreline's Deep Green program is modeled after the City of Seattle's Living Building Challenge Ordinance, which was catalytic in making the net-zero Bullitt Center, the greenest office building in the world, a reality.

Recommended Next Steps

Aggressively energy efficient new buildings, combined with onsite renewable energy and sourcing energy from SCL, would allow Shoreline to achieve its goal of net-zero GHG emissions in all new buildings. But Shoreline will need to help lead the way.

1. Deep Green Incentive Program (DGIP) – The DGIP is in its infancy and should be continued. In addition to the incentive program, the City also

requires Built Green 4-Star certification in the light rail station subareas. In October 2017, the Council directed staff to develop a proposal for expanding this mandate to commercial zoning and adding certification options that would be equivalent to Built Green 4-Star, potentially including LEED Gold and Passive House

2. No Gas, Net-Zero Demonstration Pilot – The most powerful action Shoreline can take related to new building energy efficiency is to actually build a no gas, net-zero building. Through doing, Shoreline would learn, definitively, the challenges and required solutions to overcome them. From the planning and design process, funding and incentives, commission, start up and operations, a tremendous amount of work is required. Moreover, an innovative public private partnership would be helpful to support the development.

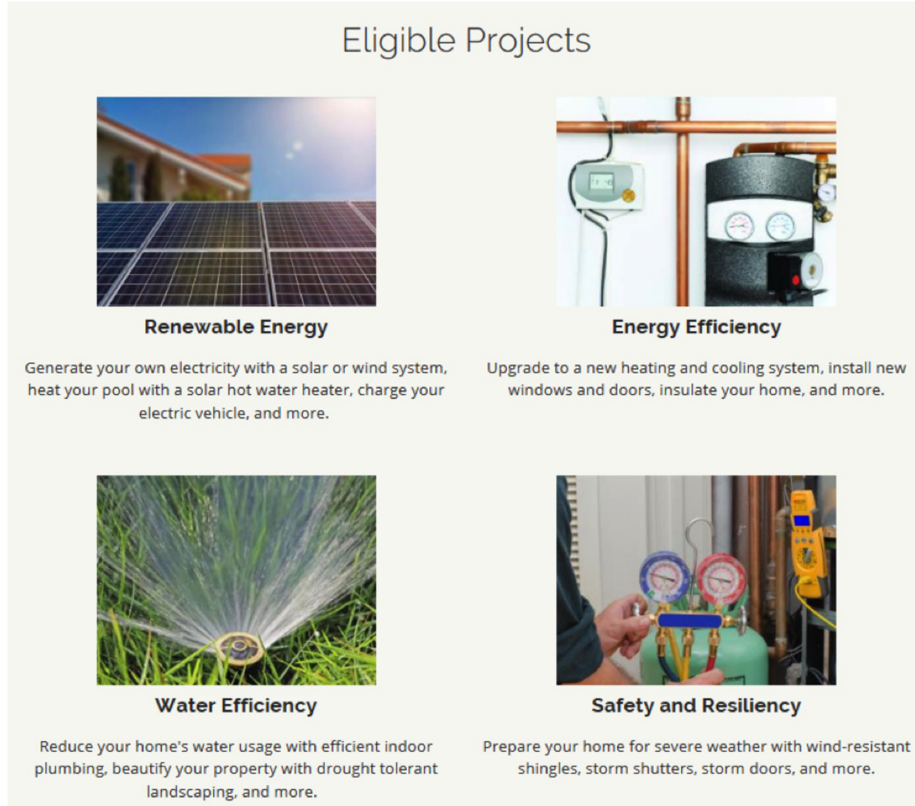

Figure 14 — Retrofit Project Types

ACTION 3 - Existing Building Energy Efficiency Retrofits

The target of 40% reduction in natural gas for existing building heating would allow the subarea to keep pace with CAP goals.

One way to achieve that goal, or improve upon the 40% number, is to promote the removal of natural gas heating in existing buildings. With a 30+ year outlook to 2050, and a projected full subarea build-out of approximately 100 years, it is natural for existing buildings to need system upgrades and replacements over that time. The City and/or State could incentivize building owners and managers to replace natural gas systems with electric systems that will have little-to-no GHG emissions.

Retrofitting existing buildings includes a range of actions from light retrofits to deep retrofits. Identifying the correct mix of retrofits requires an energy assessment from a specialized contractor, adequate funding, and experienced contractors.

Light Retrofits

Light retrofits include simple actions like replacing lighting with energy efficient LEDs and replacing old appliances with energy efficiency appliances. Light retrofits can often reduce energy use within a home by 10-15%, require little capital, and generally have a payback of less than 5 years.

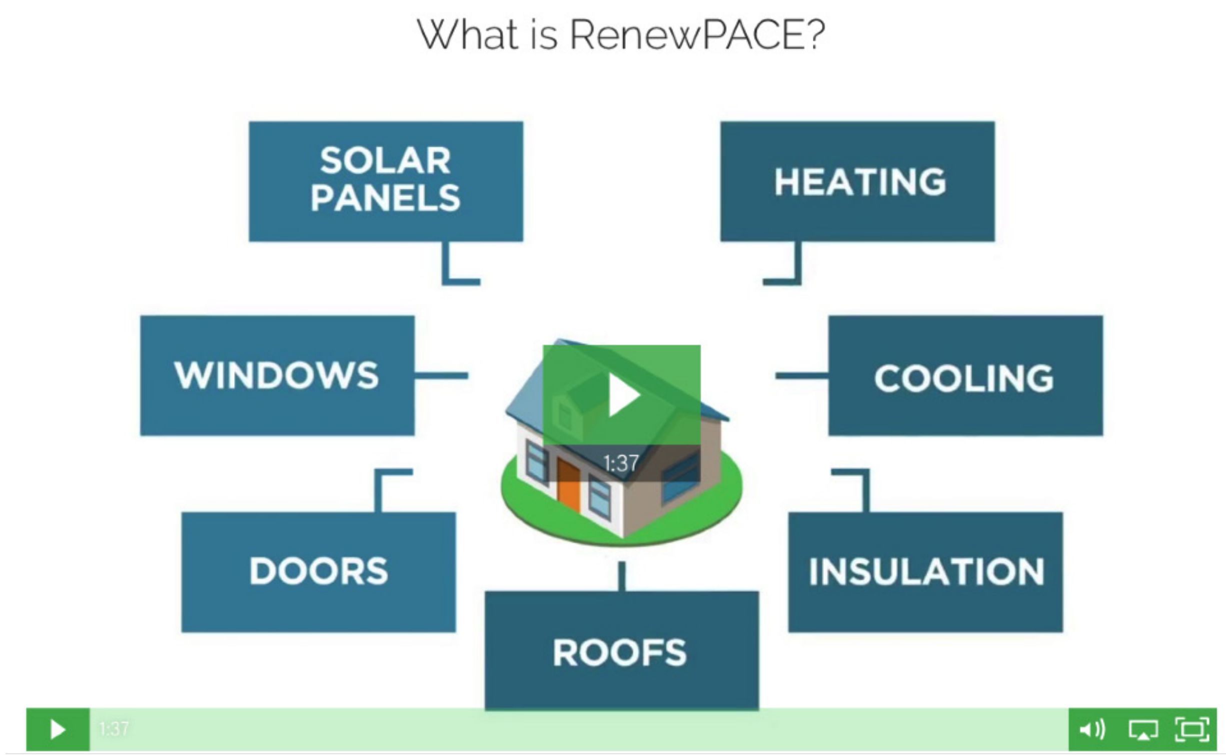

Figure 15 — RenewPACE Program

Deep Retrofits

To push beyond that level of efficiency, deep retrofits must be completed. Deep retrofits range from building envelope improvements to reduce heating and cooling loads such as window replacements and upgrading insulation to new HVAC equipment (including oil furnace replacement) and onsite renewable energy (such as solar PV). Deep retrofits can reduce energy use by well over 50% but are more capital intensive and have a longer payback period.

Funding Energy Retrofits

A key stumbling block to retrofitting existing buildings is funding. In 2008, the City of Berkeley, CA took this challenge head on. The innovation of the Berkeley energy retrofit program allowed a property owner to finance an energy retrofit and pay for it on their property taxes. Called property assessed clean energy (PACE), the solution revolutionized how existing building energy retrofits are implemented. While the PACE solution is not currently allowed in Washington, this is one example of a creative opportunity for funding retrofits.

Accelerating Energy Retrofit Actions

Communities across the US are realizing that technology may be used to help scale the effectiveness and impact of their energy retrofit programs. Spurred by the use of PACE financing, web-based community engagement programs integrated home energy assessments, project delivery, financing, and contractor selection into one, easy to use platform. The US leader in this space is Renew Financial. To learn more: https://renewfinancial.com.

Recommended Next Steps:

1. Energy Retrofit Task Force – Form an energy retrofit task force within the City to focus specifically on financing and catalyzing energy retrofits.

2. Research Existing Programs – Meet with local utilities and communities to identify existing programs and incentive programs applicable to Shoreline.

3. Prepare Energy Retrofit Program – The program should be considered multi-phase; however, initial (phase 1) efforts should focus on a 5-year period. Engaging with an experienced energy retrofit program manager and implementer (like Renew Financial) would define this program. Their RenewPACE program is a powerful program template that could be used.

4. Select Energy Retrofit Provider and Launch Program – Utilize an energy

retrofit program provider like Renew Financial to deliver the program.

Resources:

Clean Energy Works in Portland is a program where the utility and building owners work together for cost-effective energy upgrades. The utility pays up-front for the work, and assesses a fixed charge on the customer's monthly utility bill that is less than the estimated savings generated by the upgrade.

Oil Free Washington (www.oilfreewashington.enhabit.org/), recently convened a focused, short-term coalition of city planners, policy makers, utility partners, and carbon analysts to support Enhabit's efforts to eliminate residential heating oil in Washington State. The City of Shoreline was represented in the coalition during the initial phase, which worked to develop:

- A model policy and 2-5 year implementation plan to successfully transition residences off of home heating oil.
- Agreement on a regional baseline for carbon impacts of residential oil-heating and lower carbon alternatives.
- Inform and develop an assistance program from the Carbon Reduction Incentive Fund (CRIF).
- Create an incentive plan for King County cities, with the goal to ultimately promote the program throughout the state.

The main focus of the project was to encourage property owners to convert from gas furnace heating, which Shoreline has a higher percentage of than most King County cities, to more sustainable options like electric heat pumps. Yet it is possible that the results of this work could create meaningful incentives and public education materials to promote heat pumps as an attractive alternative to both heating oil and natural gas.

ACTION 4 – Onsite Renewable Energy

The model shows that with an improvement of existing building EUI and the elimination of gas for heating in new buildings, there is still a small gap to make up to get to an 80% reduction of GHG emissions by 2050. On-site renewable energy would allow the subarea to achieve a net-80% reduction goal by producing energy equivalent to the tCO2 above the limit.

The estimated on-site solar PV required would be approximately 1.25 MW, or just over 100,000 square feet worth of solar array. This amount of solar PV distributed throughout the rooftops in the subarea should be easily achievable. Existing City strategies, such as the standardization of solar installation process, could encourage on-site renewable energy.

Recommended Next Steps

1. Solar PV Master Plan – Prepare a solar PV master plan for the 185th Street Station Subarea. Particular attention should be paid to Node 2 of the development as it shows the greatest promise for solar PV generation due to the type and scale of development. Alone, Node 2 has the potential to meet the solar PV goal for the subarea.

2. Solar Delivery Partnership Model – Shoreline could partner with the private sector to ensure development of the 100,000 SF of required solar. The City could help by establishing a special development zone in Node 2 that would require installation of solar PV on all new buildings. In addition, Shoreline should work with SCL to estimate a solar PV delivery structure that would not cost building developers additional capital cost. The Shoreline Solar Project would be a great partner to help implement this focused strategy.

ACTION 5 – District Energy

Specific to Node 2, DE should be implemented utilizing a "no gas" source such as sewer heat recovery, biomass, or ground source heat pumps. Node 2 is a ripe location for DE due to the mix of uses (residential and commercial), scale (greater than 2M SF) and pace (likely a large initial development adjacent to the light rail station) of development, which creates enough thermal demand density to make DE viable. Preliminary assessments conducted for the subarea identified Node 2 as having the most financial potential, while reducing energy use of buildings connected to the system by 10-25%.

As redevelopment of Node 2 is anticipated by begin by the early 2020's (which aligns with light rail development), Shoreline has only a few years to craft a district energy strategy for the area. Development planning for Node 2 would likely begin approximately 2-3 years prior to the start of construction.

Recommended Next Steps

Beginning in 2020, Shoreline should re-initiate its district energy feasibility efforts for Node 2.

1. Initiate Partner Engagement City should initiate engagement with key project partners, including potential future developers and SCL, to gauge

preliminary support for implementation of a district energy system. Assuming initial support, the City would work with partners throughout the following steps to ensure their interests are incorporated into system development.

2. Assess Low Carbon District Energy Technologies for Node 2

Node 2 has the projected development density that makes for a viable application of district energy. Special emphasis should be placed on sewer heat recovery, biomass, and potentially GSHP.

3. Develop Public Private Partnership Framework and Roadmap

Based on the recommended DE development model (see below), a detailed partnership framework should be established identifying roles, responsibilities (including capital contributions), and timeline for financing, developing and operating the district energy system. The partnership framework should also be coupled with a district energy development roadmap to demonstrate tasks and major milestones for implementing district energy.

4. Confirm Partner Interest

Once a preliminary draft of the public-private partnership (P3) framework and roadmap has been completed, City should reconvene a meeting with Node 2 stakeholders to confirm support of a public private partnership to implement district energy. The partners, assuming they are interested, should work together to finalize the P3 framework and roadmap. Upon finalization, each partner should formally confirm support of the P3 through a letter of interest (LOI).

5. Confirm City Capital Contributions and Enabling Strategies

Capital contributions from the City to the district energy P3 will be necessary to ensure adequate investment returns. Moreover, specific "enabling strategies" to minimize project risk, such as mandatory connection standards, also need to be agreed to.

The City should consider incentivizing low-carbon technologies such as sewer heat recovery and biomass. Shoreline would be entering into unchartered territory by creating this incentive. No examples could be found of other City's providing incentives for low-carbon district energy system.

One incentive opportunity could be the creation of a local improvement district (LID) to help fund district energy or at least the cost premium for a district energy system to implement low-carbon technologies like sewer heat recovery and biomass. The City would provide its district energy developer an upfront capital contribution for the low carbon technology and then would collect LID revenue from the properties within the district over a period of time. .

6. Initiate Formation of District Energy Utility

Based on supportive partner interest and agreed upon P3 framework, the City could initiate formation of a district energy utility to serve Node 2. Formation of the utility needs to be initiated prior to Node 2 development. Plan on 2-years prior to land use/development pre-application work occurring within the district to ensure enough time for stakeholder engagement and integration into real estate development efforts.

Recommended Development Model

Recent district energy development efforts in Portland, Oregon and Seattle, Washington initially began as private development models where the City engaged with a third party district energy provider through a competitive, public procurement process. However, based on the results of these initial efforts, it became evident that the third party district energy providers needed some type of partnership with cities – either financially or policy wise – to ensure commercial viability for the district energy system.

As a result of these recent efforts, it is recommended that the City of Shoreline pursue a P3 development model to implement district energy within the 185th Street Station Subarea.

A P3 development model for implementing district energy near the 185th Street Station would require the City of Shoreline to engage with an experienced third party district energy provider (DE Provider).The terms of the P3 would likely include the following:

185th Street Station DE P3 Development Model (Example)

Ownership:	City/DE Provider
Funding:	
Central Plant:	DE Provider
Distribution Network:	City
Design/Build/Operate:	
Design/Build:	DE Provider
Permit:	DE Provider
Policy Support:	City
Operations:	DE Provider
Customer Relations:	DE Provider

The City and DE Provider would jointly own the district energy system. Each partner would be responsible for financing specific components of the system consistent with financial return needs and risk profiles. This would likely result in the City financing the distribution piping network – to be constructed with public street improvements – and the DE Provider financing the central plant – based on the timing of heating and cooling energy growth within the district. The DE Provider, utilizing their expertise and experience, would design/build/permit the system as well as operate and manage customer relationships.

The City would support system development through the creation of support policies such as mandatory connection requirements for each building developed in the district to connect to the district energy system. Revenue generated from the district energy systems would be shared by the City and DE Provider based on the capital and risk invested into the system.

Policies and Incentives:

Establish a district energy zone around Node 2 that requires new buildings to connect to the DE system. When Node 2 development nears, complete a district energy feasibility assessment to confirm district energy viability (including technology type) and identify the most appropriate implementation model.

Resources:

Progressive cities across the US are exploring the use of district energy to support climate action plan goals. Most cities are exploring district energy specific to a development area (i.e., district energy feasibility assessment) but no specific policy to catalyze district energy development could be identified. The City of Portland Climate Action Plan identifies district energy as a potential strategy to utilize to help achieve carbon reduction goals.

6 SUMMARY OF FINDINGS AND RECOMMENDED NEXT STEPS

The Climate Action Plan goals within the 185th Street Station Subarea are achievable by following the right steps in promoting new development requirements and retrofits to existing development. The GHG emissions reductions of 50% by 2030 and 80% by 2050 goals are aggressive, especially when considering that the population of the subarea is projected to triple by 2050.

Even with the large increase in building area, the aggressive targets for new and existing building efficiency resulted in no net increase in energy demand by 2050. Energy demand on its own is not enough to decrease GHG emissions to the level required to achieve the goals, but the following steps can be taken to achieve further GHG emissions:

1. Renewable Grid Energy

Seattle City Light's fuel mix is currently low carbon, with over 90% of energy coming from renewable sources. SCL's goal of eliminating coal as a fuel source by 2025 will lower their carbon contribution further within the next 10 years, and it was assumed that all GHG-emitting fuel sources will be removed from their portfolio by 2050.

As a result, shifting the source of all building's energy demands to the electrical grid will decrease the GHG emissions throughout the subarea.

2. No Gas Policy

Natural gas is the leading contributor of GHG emissions in buildings. As stated above, shifting reliance to the electrical grid will have the biggest influence on reducing GHG emissions in the subarea. Eliminating gas service in new development is the most important strategy to achieve the aggressive GHG emission reductions.

The City of Shoreline has a target to reduce use of natural gas for heating 40% by 2030, which was modeled as continuing to a 60% reduction by 2050. As mentioned in the City's Carbon Wedge Analysis, a suite of strategies should be implemented for existing building retrofits. These include City and State incentives, retrofit programs for increased efficiency, and/or retrofit policies requiring upgrades based on different criteria.

3. New Building Energy Efficiency

Continue advocating for the State of Washington to outline and adopt new code pathways for new building efficiencies to improve 70% by 2031 compared to new buildings in 2006.

4. Existing Building Energy Efficiency Retrofits (including no gas retrofits)

Existing buildings will need attention to reduce energy use and GHG emissions. Existing City programs should be continued, including the potential to retrofit existing buildings away from natural gas and heating oil use.

5. District Energy for Node 2

Due to the development and thermal demand density in Node 2, DE should be implemented to provide heating, and potentially cooling if needed. Energy sources for the DE system should be non-combusting, utilizing potentially sewer heat recovery, biomass, or ground source geothermal.

6. Low Carbon District Energy Incentive

In support of the implementation of a low-carbon district energy system, Shoreline should create an incentive to help fund the cost premium associated with low carbon technologies such as sewer heat recovery and biomass. It would make sense that funding for the incentive would be locally sourced from the district as it is focused on achieving climate action plan goals for the 185SSS.

7. Onsite Renewable Energy Generation

Onsite renewable energy generation allows for the subarea to better reach the 50% and 80% emission reduction goals, where building improvements and electric/gas improvements alone fall short. In this subarea, solar generation can be distributed throughout rooftops and open spaces such as parks to directly offset energy demand and provide excess energy back onto the grid.

8. No Gas, Net-Zero Energy Demonstration Project

Since Shoreline adopted the Deep Green Incentive Program in April 2017, the City should pursue a Living Building demonstration project within the 185SSS. This could be an important, and potentially market transforming, effort to demonstrate the feasibility of the type of low carbon development the City is looking to promote.

9. Looking Beyond 2050

The subarea build-out plan is a longer timeline than the stated Climate Action Plan goals. This allows for GHG emission strategies to be planned in such a way that improvements continue well beyond 2050.

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