Council Meeting Date: July 24, 2017 **Agenda Item:** 9(c)

CITY COUNCIL AGENDA ITEM

CITY OF SHORELINE, WASHINGTON

AGENDA TITLE:	Discussion of the District Energy Feasibility Study
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. Electricity is sometimes also produced as part of a Combined Heat and Power (CHP) system. The draft District Energy Feasibility Study, Attachment A, examines the feasibility of DE and CHP systems in areas of Shoreline that are most likely to redevelop in the foreseeable future. The study will focus on the 185th Street Station Subarea, but findings could apply to the 145th Street Station Subarea, the Community Renewal Area at Shoreline Place, and Town Center.

RESOURCE/FINANCIAL IMPACT:

This discussion does not have financial implications. Should Council decide to move forward with strategies to implement District Energy or Combined Heat and Power systems in Shoreline, there would be resource and financial impacts. These will be further articulated in the next draft of the feasibility study.

RECOMMENDATION

Staff recommends that Council review the draft District Energy Feasibility Study and provide direction about whether and how to move forward. If there is direction to proceed, staff will return for additional discussion and Council authorization as appropriate.

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

BACKGROUND

Since the 2008 adoption of the City's Environmental Sustainability Strategy, Shoreline has positioned itself to be a regional and national leader on how local governments can work to reduce the potential severity of climate change. Other City initiatives that have focused on environmental sustainability and climate action include:

- Analysis of City and Community Carbon Footprints (2009 and 2012);
- Launching of the forevergreen indicator tracking website (2012);
- Adoption of the Climate Action Plan (2013);
- Adoption of King County-City Climate Collaboration (K4C) Joint Letter of Commitments (2014);
- Development of Carbon Wedge Analysis and Strategies (2015);
- Completion of significant capital projects with a variety of climate and other benefits, such as the construction of a LEED Gold certified City Hall (2010) and the Aurora Avenue Corridor project (completed in 2016);
- Promoting transit-oriented development and multi-modal transportation systems through subarea planning for light rail stations opening in 2023 (2013-2016); and
- Adoption of a Deep Green Incentive Program to encourage development of green buildings that meet the most stringent certification standards available (2017).

The draft District Energy Feasibility Study (Attachment A) expands upon 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 designated a District Energy Feasibility Study as a 2016-2019 Priority Recommendation to implement the Climate Action Plan (CAP). The staff report and attachment can be found at the following link: http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2015/staffreport091415-9b.pdf.

Council also received additional information about District Energy at their February 1, 2016 meeting. The staff report for this discussion can be found at the following link: http://cosweb.ci.shoreline.wa.us/uploads/attachments/cck/council/staffreports/2016/staffreport020116-8a.pdf.

DISCUSSION

Originally, the scope of the District Energy Feasibility Study was to focus on the technical, financial, and regulatory viability of implementing District Energy to serve the 185th Street Station Subarea. 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 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 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.
- 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 in Attachment A 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.

Specifically, five actions are described to facilitate future viability of DE:

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 and Combined Heat and Power Systems

If these conditions are met, the assessment found that innovative district-scale infrastructure systems that leverage planned growth and existing City infrastructure assets demonstrate tremendous potential to reduce energy consumption and greenhouse gas emissions. This would significantly contribute to Shoreline meeting the emission reduction targets adopted through the CAP. A District Energy system would also generate significant economic benefit to Shoreline residents and businesses.

Please note that the Draft Feasibility Study in Attachment A is formatted for content review and does not include graphs and other illustrations that will be included in the final report. Graphs and illustrations will be included in the Council presentation.

STAKEHOLDER OUTREACH

A Speaker's Series event will be dedicated to this topic on Tuesday, July 25 from 7:00-9:00 pm in the Council Chambers at City Hall.

COUNCIL GOAL ADDRESSED

This agenda item addresses Council Goal #2: Improve Shoreline's infrastructure to continue the delivery of highly-valued public services, and most specifically:

- 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 or Combined Heat and Power systems in Shoreline, there would be resource and financial impacts. These will be further articulated in the next draft of the feasibility study.

RECOMMENDATION

Staff recommends that Council review the draft District Energy Feasibility Study and provide direction about whether and how to move forward. If there is direction to proceed, staff will return for additional discussion and Council authorization as appropriate.

ATTACHMENTS

Attachment A: District Energy Feasibility Study

Attachment A

CITY OF SHORELINE
***DRAFT* DISTRICT ENERGY FEASIBILITY STUDY**
July 24, 2017

ONE GOAL – FIVE ACTIONS – THIRTY YEARS

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 Greenhouse Gas (GHG) emissions. This would significantly contribute to Shoreline meeting the emission reduction targets adopted through the 2013 Climate Action Plan (CAP). A District Energy (DE) system would also generate significant economic benefit to Shoreline residents and businesses.

However, conditions to support District Energy do not currently exist within the 185th Street Station Subarea (185SSS). The following series of actions would contribute to making District Energy and/or Combined Heat and Power (CHP) systems feasible in the future:

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 and Combined Heat and Power Systems

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

INTRODUCTION

What are District Energy and Combined Heat and Power Systems?

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.

Combined Heat and Power, or cogeneration, is the use of a heat engine or power station to generate electricity and useful heat at the same time.

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.

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. 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:

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- 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). 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.

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.

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 storm-water 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 Ancient Rome. 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 are 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 central distribution line, with smaller loops that link buildings together.
- **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

District Energy 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's 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, and cost variability, and the future effects of climate change.
- **Partnership and Investment Opportunity**
  As a commercially viability investment, DE provides cities the opportunity to partner with the private sector to begin non-tax based investments into the city to realize both policy and development objectives.

Building Benefits Include:

- **Reduced Energy Costs and Cost Stability**
  The bottom line for any building owner is cost. Long-term net cost 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 a first cost premium.
- **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.

Challenges to Implementing District Energy

There are normally many 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. But 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 financing 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.

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 scape 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).

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 than 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?

185TH STREET STATION SUBAREA ENERGY USE AND CARBON EMISSIONS

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 Final Environmental Impact Statement (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:

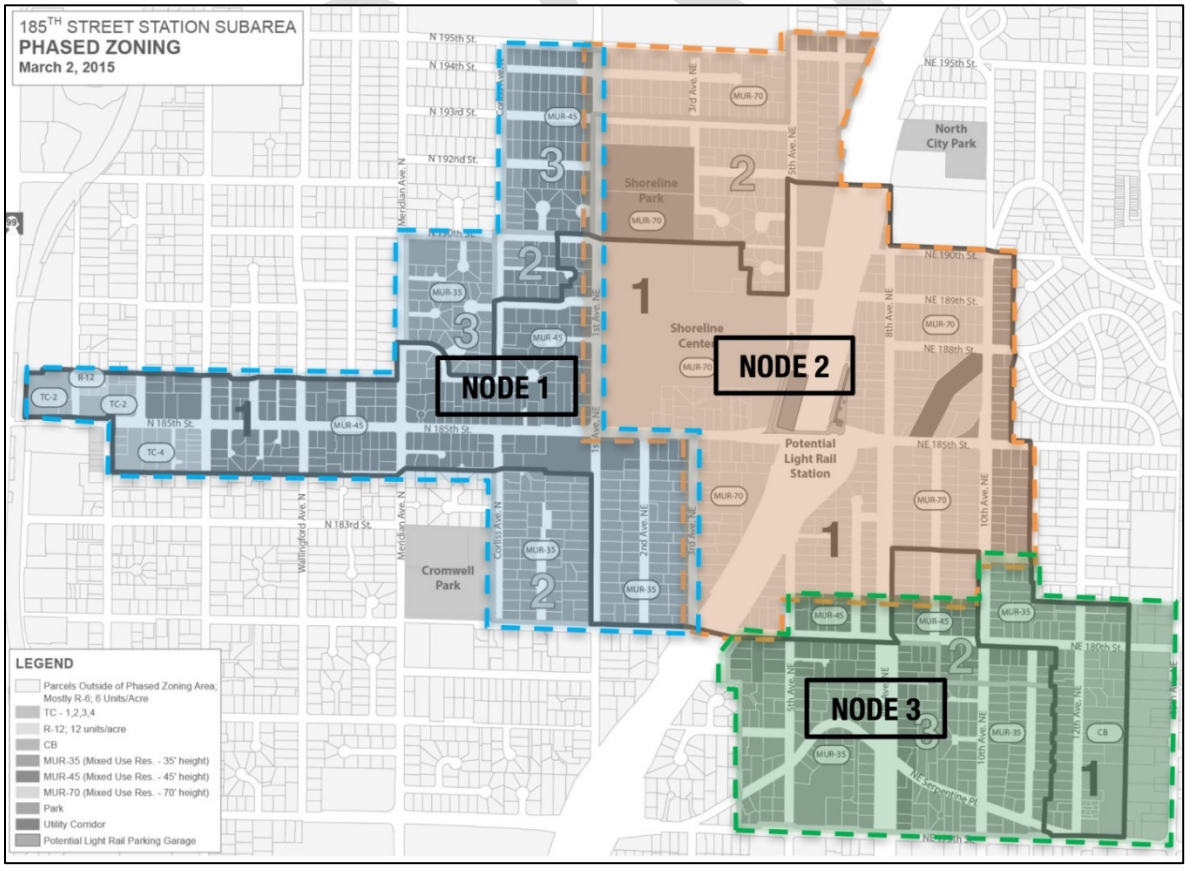
	2014	2035	Full Build-Out
Population	7,944	12,102	56,529
Households	3,310	4,975	23,554
Employees	1,448	2,160	15,340

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 (two years before the light rail station is anticipated to open for service; and Phase 3 zoning will become effective in 2033 (ten years after the beginning of light rail service).

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 three different nodes. A map of the subarea nodes is below:



- **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.
- **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.

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, and does not emit carbon like other fossil fuel-based sources, the extraction process emits a significant amount of methane, which is 20 times more potent as a greenhouse gas.

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 developed in 2015 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 and/or CHP 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

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 tCO2.

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.

Greenhouse gas emissions resulted in 1,917 tCO2 from the existing buildings and 4,253 tCO2 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 significate 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. Having recently conducted a Solarize campaign, the City learned that existing tree canopy and resultant shading can be an impediment to solar power generation in Shoreline, although this could be less of an issue in the 185SSS due to likely loss of existing canopy as a result of redevelopment.

Business As Usual - without use of natural gas as a heating source (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 tCO2.

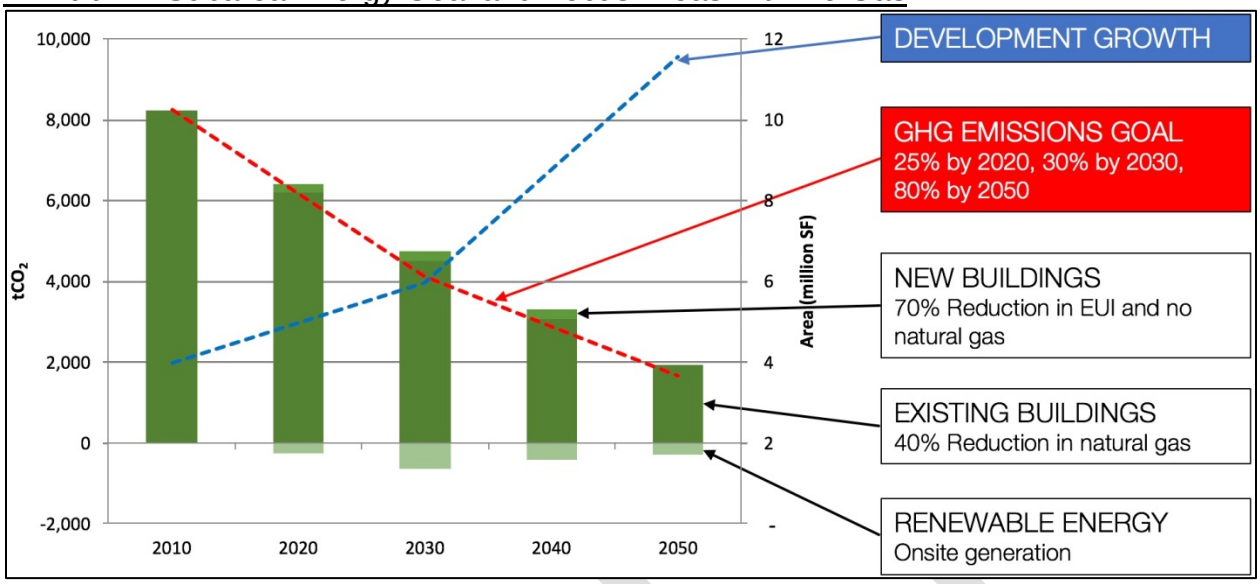
Carbon emissions resulted in 1,917 tCO2 from the existing buildings and no GHG from new development by 2050, since it was assumed that the SCL service will be entirely carbon-free by 2050. The resulting reduction of GHG emissions is approximately 77%, almost meeting the 80% goal with just building efficiency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

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.

ACTIONS TO ACHIEVE CLIMATE ACTION PLAN GOALS

The following graphic demonstrates how the City of Shoreline may utilize development the 185SSS to achieve CAP goals.

Exhibit A – 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:

- ***ACTION 1 – No Gas Policy***
  Since SCL energy is essentially, or will be shortly, 100% renewable, Shoreline should focus on creating development policy/codes to limit or eliminate the use of natural gas within the subarea. This action has the most significant impact on reducing GHG emissions associated with subarea development.

- ***ACTION 2 – New Building Energy Efficiency***
  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.

  To reiterate this point, it is worth noting that the City's GHG emission reduction goals are cumulative, not per capita, so it is necessary to pursue a bold plan to reduce emissions despite projected population growth and a low/no carbon energy supply.

  With new buildings getting all their energy needs from SCL and on-site renewable energy sources, the City could achieve its goal of net-zero GHG emissions in all new buildings.

- ***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.

  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% 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.

- ***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 and scale of development, which creates enough thermal 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%.

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:

- **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.

- **No Gas** – 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.

- **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.

- **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 use.

- **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.

- **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.

- **Living Building 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.

- **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.