PUTTMAN INFRASTRUCTURE

Memo

Puttman Infrastructure, Inc.
620 SW Fifth Avenue, Suite 1007
Portland, OR 97204 USA
P +1 503 224-3454

www.puttman.com

RE: Overlake Village District Energy Concepts (DRAFT)

BACKGROUND AND PROJECT OBJECTIVE

As part of the East Corridor Implementation Support project for the Growing Transit Communities Partnership, an evaluation of the potential for implementing district energy in the Overlake Village station area was conducted by Thomas Puttman of Puttman Infrastructure. District energy is viewed as a potential opportunity to create a market advantage for new development in Overlake Village, and as such, could become a catalyst for urbanizing the neighborhood as envisioned in the adopted neighborhood plan. Implementing green transit oriented development, including district energy as part of the mix, creates multiple social, environmental and economic (people, planet, prosperity) benefits. An exploration of these benefits is addressed in a separate deliverable memorandum for the East Corridor Implementation Support project, *Benefits of Green Transit Oriented Development.*

The objective of the preliminary evaluation presented in this memorandum was to explore the value proposition of developing a district energy system for Overlake Village. This memorandum should be considered a supporting document to the Overlake Village District Energy Concepts powerpoint presentation provided by Puttman Infrastructure, Inc. (see attached).

Focusing on Overlake Village, this preliminary evaluation has been organized into the following sections:

1. Potential District Energy Value Proposition
2. District Energy Implementation Recommendations

The findings and recommendations of this evaluation should be considered preliminary in nature. Additional evaluation should be conducted to further validate these findings and recommendations (see Section 2 for next steps).

POTENTIAL DISTRICT ENERGY VALUE PROPOSITION

Overlake Village Overview and Development Assumptions

Located in the City of Redmond, Washington, Overlake Village is the mixed-use heart of the Overlake urban center as identified in the Overlake Master Plan & Implementation Strategy (City of Redmond, 2007). At 175-acres the district is bounded by SR-520 to the north, 156th Avenue NE to the east, NE 20th Street to the south, and 148th Avenue NE to the west. An exhibit of the potential build out of Overlake Village is provided on Slide 2 of the powerpoint presentation.

Projected 2030 development assumptions for Overlake Village, based on transportation analysis zones overlapping Overlake Village, were provided by the City of Redmond as follows (summarized on Slide 2 of the powerpoint presentation):

Office:	1,610,224 SF (22%)
Retail:	1,113,369 SF (15%)
Institutional:	7,163 SF (<1%)

Memo

Hotel:	99,812 SF (1%)
Residential (multi-family):	4,364,500 SF (61%)
Total:	**7,195,068 SF (100%)**

NOTE: All projected development within the district is assumed to be new development. It should be noted that development assumptions did not include current development specific plans for the GroupHealth/Capstone site located in the NE corner of the district. The reason this area was excluded is that it was thought development plans may be too far along to begin to integrate district energy at that site or to bring the site into the fold of a larger district. However, if that assumption were to change, it is anticipated that integration of the GroupHealth/Capstone site would result in the same potential value proposition as the rest of area covered in this analysis. All development assumptions were based on full build out per the assumptions noted above. A deeper assessment of the future development potential for Overlake Village should be conducted as district energy feasibility efforts progress.

Overlake Village Energy Use, Cost and Carbon Estimates

For each land use type identified in the development assumptions above, energy use intensity factors (EUIs) were established to estimate annual energy consumption. As Overlake Village is envisioned to be a green development, EUIs typical of green building in the Puget Sound region were utilized. As a result, future annual energy use for Overlake Village was estimated as follows (summarized on Slide 4 of the powerpoint presentation):

Office:	104,665 MMBtu/year (27%)
Retail:	53,442 MMBtu/year (14%)
Institutional:	401 MMBtu/year (<1%)
Hotel:	6,787 MMBtu/year (2%)
Residential (multi-family):	218,225 MMBtu/year (57%)
Total:	**383,520 MMBtu/year (100%)**

Multi-family residential and office will generate the majority of energy use within Overlake Village at almost 84% of the energy use estimated because they make up over 80% of the development assumed for the district.

Further assessing energy use for each land use type allows thermal and non-thermal energy uses to be identified. Thermal uses include building heating and cooling while non-thermal energy use includes elements such as lighting, air movement, and plug loads. As a result, thermal energy use for Overlake Village was estimated at 49% of the total energy use for the district and non-thermal was estimated at 51%. Further refinement of energy use allows estimated thermal energy use to be distributed into energy used for building heating (92%) and energy used for building cooling (8%). As a result, building heating and cooling energy use, cost and carbon emissions were estimated as follows:

PUTTMAN INFRASTRUCTURE

Memo

Future Estimated Annual Heating Energy Summary

Energy Use:	1,454,988 therms
Cost:	$480,146
Carbon:	9,748 tCO_2

Future Estimated Annual Cooling Energy Summary

Energy Use:	3,817,695 kWh
Cost:	$343,593
Carbon:	1,985 tCO_2

Overall, annual energy use for building heating and cooling is estimated at over 145,000 MMBtu/year with a cost of approximately $823,000/year and carbon emissions of 11,734 tCO_2/year. This summary will be consider the "business-as-usual" (BAU) scenario as it represents the performance and cost of conventional building with in-building heating and cooling systems. Please note that all cost estimates are represented in 2013 dollars.

District Energy Overview

District energy is a highly efficient solution to produce and distribute thermal energy at a local scale. Not only are transmission losses reduced from conventional centralized utilities but opportunities for recovered thermal load are also realized as well as the potential for future fuel switching to further reduce carbon emissions (see Slide 6 of the powerpoint presentation for further information). As a result, district energy systems allow for enhanced energy efficiency, reduced cost and reduce carbon emissions at a district scale when compared to conventional in-building heating and cooling systems.

Traditional district energy systems are comprised of a central plant to generate heating and cooling energy typically with natural gas boilers (heating) and electric chillers (cooling), a distribution network to supply heating (2-pipes) and cooling (2-pipes) energy to buildings throughout the district, and energy transfer stations at each building to provide heating and cooling thermal energy to building systems (slide 7 provides a diagram of a typical district energy system).

Although more common in Scandinavian and other northern European countries, district energy is not new in the United States. Currently, there are over 700 district energy systems in the United States today. District energy has been increasingly viewed by environmentally and fiscally progressive communities in North America as a more effective energy solution – from a performance, cost and carbon reduction perspective – than convention in-building heating and cooling systems. Advances in more sustainable city development, most notably catalyzed by the EcoDistrict concept, focuses the need for district infrastructure systems like district energy to further accelerate sustainability in the built environment. (See more about EcoDistrict potential at the end of this memorandum.)

PUTTMAN INFRASTRUCTURE

Memo

District Energy systems similar in nature to what would be considered for Overlake Village include South False Creek (Vancouver, BC), Dockside Green (Victoria, BC), Regent Park (Toronto, ON), The Brewery Blocks (Portland, OR), and The Round (Beaverton, OR). New district energy systems are being implemented in Los Angeles, San Francisco, Eugene, Portland, Seattle and Bellingham just on the west coast alone. Some examples of these projects are providing on Slides 8-10 of the powerpoint presentation.

District Energy and Overlake Village

From an energy efficiency, cost and carbon emissions perspective, would district energy make sense in Overlake Village? To answer this question, two conceptual district energy options were established as follows:

Option A – District Energy

District Energy Option A includes a central plant located in the middle of the district to simplify distribution network piping. The central plant is assumed to be located within a building to avoid the need for a stand-alone central plant building that would not fit with the desired urban village vision of Overlake. The central plant would include a natural gas boiler(s) and electric chiller(s) to produce heating and cooling energy for all the buildings in the district. Based on other systems of similar scale to Overlake Village, the footprint of the central plant would likely by around 20,000-30,000 SF. Distribution piping for heating (2-pipe) and cooling (2-pipe) has also been identified. See Slide 11 for further detail.

Option B – District Energy with Geothermal

The efficiency of Option A could be further enhanced with the addition of a ground-source geothermal system to reduce the natural gas and electricity requirements to produce the same amount of heating and cooling energy. District Energy Option B builds on the same central plant and distribution network identified in Option A but includes an open-loop geothermal system. An open loop geothermal system utilizes constant temperature groundwater as a thermal supply input to the central plant. The open loop system would likely include one production well and two reinjection wells. See Slide 12 for further detail.

NOTE: Open Loop vs. Closed Loop Geothermal Options

Both open loop and closed loop geothermal options were considered; however, due to the intensity of development anticipated for Overlake Village a closed loop system, which requires much greater open space than what is available in Overlake, is not likely feasible at a scale that would significantly benefit the district energy system.

Open loop is not without its regulatory and technical challenges however. Further evaluation from a regulatory and technical perspective should be con-

PUTTMAN INFRASTRUCTURE

Memo

ducted to further assess the viability of open-loop geothermal for Overlake Village.

Puttman Infrastructure's proprietary AIM Model (Assess to Invest) was utilized to analyze the performance of each district energy option allowing each option to be compared to each other based on City of Redmond defined criteria including energy use, energy cost and carbon emissions. Moreover, AIM allows proposed district energy options to be compared to the BAU option (i.e., in-building heating and cooling systems).

The results from the preliminary AIM Model evaluation are summarized below (see Slide 14 of the powerpoint presentation):

Heating and Cooling Energy Use

BAU:	145,499 MMBtu/year
DE Option A:	126,521 MMBtu/year
DE Option B:	101,217 MMBtu/year

Heating and Cooling Energy Cost

BAU:	$823,738/year
DE Option A:	$700,178/year
DE Option B:	$350,089/year

Heating and Cooling Energy Carbon Emissions

BAU:	11,734 tCO_2/year
DE Option A:	9,974 tCO_2/year
DE Option B:	7,040 tCO_2/year

From an energy efficiency, cost of energy, and carbon emissions perspective, implementing district energy in Overlake Village appears to have clear benefits as compared to conventional development with in-building heating and cooling systems. Energy used for heating and cooling was estimated at approximately 10-30% less than BAU. Heating and cooling related energy costs were estimated at 10-50% less than BAU. Carbon emissions associated with heating and cooling energy production were estimated at 15-40% less than BAU. See slide 14 of the powerpoint presentation for more detail.

Heating Dominated Energy Use

With 92% of thermal energy use associated with heating, Overlake Village would be considered a heating dominated district creating good opportunity for a district heating system to supply heat to building within the district cost effectively. For a cooling perspective, at only 8% of thermal energy use, Overlake Village likely lacks the cooling load to justify a district cooling system. Redmond could consider a heating only district energy system.

PUTTMAN INFRASTRUCTURE

Memo

DISTRICT ENERGY IMPLEMENTATION RECOMMENDATIONS

Clearly, the value proposition for implementing district energy in Overlake Village is positive. But how are district energy systems developed? What are the next steps the City of Redmond should take to catalyze district energy in Overlake Village? The next sections of this memorandum explore potential answers to these questions.

District Energy Development Models

There are four development models under which district energy is implemented. In the case of Overlake Village, the public development model assumes the City of Redmond would finance, develop and operate the district energy system. Under the private development model, the City of Redmond would engage with a third party, district energy provider to finance, develop and operate the district energy system. A public private partnership development model would be used to leverage the expertise of a third party district energy provider with the low cost financing, public engagement, and policy development capacity of the City of Redmond to finance, develop and operate a district energy system. A cooperative development model would require Overlake Village property developers and owners to come together, typically creating a new non-profit company, to finance, develop and operate a district energy system.

Each model is summarized below and further summarized on Slide 15 in the powerpoint presentation.

Public Development Model

Ownership:	Public
Funding:	Public
Design/Build/Permit:	Public
Operations:	Public
Customer Relationships:	Public

Private Development Model

Ownership:	Private
Funding:	Private
Design/Build/Permit:	Private
Operations:	Private
Customer Relationships:	Private

Public Private Partnership Development Model

Ownership:	Public/Private
Funding:	Public/Private
Design/Build/Permit:	Private
Operations:	Private
Customer Relationships:	Private

Cooperative Development Model

PUTTMAN INFRASTRUCTURE

Memo

Ownership: Property Owners via Non-Profit Company
Funding: Property Owners via Non-Profit Company
Design/Build/Permit: Property Owners via Non-Profit Company
Operations: Property Owners via Non-Profit Company
Customer Relationships: Property Owners via Non-Profit Company

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 Redmond pursue a public private partnership (P3) development model to implement district energy in Overlake Village.

A P3 development model for district energy in Overlake Village would require the City of Redmond to engage with an experienced third party district energy provider (DE Provider). The terms of the P3 would likely include the following:

Overlake Village DE P3 Development Model (Example)

Ownership:	City/DE Provider
Funding—	
Central Plant:	DE Provider
Distribution Network:	City
Design/Build/Permit—	
Design/Build:	DE Provider
Permit:	DE Provider
Policy Support:	City
Operations:	DE Provider
Customer Relationships:	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.

PUTTMAN INFRASTRUCTURE

Memo

Other Partner/Stakeholder Engagement

In addition to the P3 development model recommended above, it will also be important to engage with key stakeholders early in the district energy system development process to ensure support. These stakeholders include:

- Property Developers/Owners – Early in the process, property developers and owners should be engaged with to ensure system acceptance. Particularly outreach should be made to Microsoft as its adjacent campus and employees are such a significant presence in Overlake Village.
- PSE (electricity and natural gas) – Puget Sound Energy should be engaged early to help shape system development, including potential incentives and other forms of support.
- Regulators (Washington UTC) – The Washington Utility and Transportation Commission (UTC) should be engaged early as well to understand permitting requirements including specific requirements of the UTC related to developing district energy systems under a P3 development model.
- Local NGOs – Local non-profits should be engaged to foster support for the district energy system as a means to accelerate sustainability nationally and in the Puget Sound region and Redmond.

District Energy Implementation

Development will drive district energy implementation in Overlake Village. The following steps should be considered to ensure district energy is ready to meet the energy demands of future development when it comes:

1. District Energy Feasibility Evaluation (Consultant Cost = $200,000, Staff Cost TBD, Timeframe = 9-12 months)
   A detailed district energy feasibility evaluation should be conducted to refine the value proposition for district energy in Overlake Village including:
   - Energy, cost and carbon savings.
   - DE system options (including technologies and distribution networks)
   - Detailed cost estimate
   - Cost of energy service comparison (BAU vs. DE with various options)
   - DE utility development model refinement including roles and responsibilities for public and private partners.
   - Identification of key "enabling strategies" to ensure DE system development (i.e., mandatory connection policies).

2. Preliminary Go/No Go Decision (Consultant Cost = $0, Staff Cost TBD, Timeframe = 2 months)
   Based on the findings of the feasibility evaluation, City Council makes a go/no go decision to engage with a third party district energy provider and makes preliminary commitment of capital for distribution network piping.

PUTTMAN INFRASTRUCTURE

Memo

3. Third Party District Energy Provider Selection (Consultant Cost = $0, Staff Cost TBD, Timeframe = 2-3 months)
   City to develop and issue an RFQ to select a third party DE provider. Based on experience with other cities, this effort will probably take about 2-3 months to develop the RFQ including internal review and approval, issue the RFQ, review responses and make a selection (with or without interviews).

4. District Energy Evaluation Refinement and Initial Agreements (Consultant Cost = $0, Staff Cost TBD, Timeframe = 6 months)
   Once the DE Provider is selected, an initial MOU will be established between the City and DE Provider to outline requirements for further evaluation including go/no go decision criteria. Refinement efforts will focus on commercial viability (i.e., cost of service acceptable to building owners, investment requirements acceptable to City and DE Provider).

5. Final Go/No Decision (Consultant Cost = $0, Staff Cost TBD, Timeframe = 2 months)
   Based on the go/no go criteria identified in Step 4, City and DE Provider to make go/no go decision.

6. District Energy Development (Consultant Cost = TBD, Staff Cost TBD, Timeframe = 18 months)
   DE Provider to design, permit and build district energy system.

7. District Energy Operations (Cost = TBD, Time = Ongoing)
   DE provider to operate district energy system.

Overall, development of district energy based on the preliminary implementation schedule identified above should take around three (3) years.

EcoDistrict Development Potential and Application to Other Station Areas, Including 130th Avenue NE

According to the EcoDistricts organization based in Portland, Oregon (formerly the Portland Sustainability Institute), accessible at EcoDistricts.org, more people live in cities than ever before, and development of EcoDistricts provides the opportunity to address several pressing challenges and our world urbanizes. EcoDistricts represent a shared vision for creating sustainable cities from the neighborhood scale up centered on these values:

- Neighborhoods are building blocks of sustainable cities.
- Everyone deserves to live in a healthy, safe, connected, and vibrant neighborhood.

Memo

- Economic opportunity, community well-being, and ecological health are fundamental ingredients for sustainable neighborhoods and cities.
- Neighborhood sustainability requires a new model for action—rooted in collaboration and inclusion—to co-create innovative district-scale projects.
- Organization—the EcoDistricts board and staff—is committed to meeting the mission and reflecting the diversity of the clients and communities served.

What is an EcoDistrict?

An EcoDistrict is a new model of public-private partnership that emphasizes innovation and deployment of district-scale best practices to create neighborhoods of the future—resilient, vibrant, resource efficient, and just. Some common components of EcoDistricts are listed in the graphic below and further described in the document *The EcoDistricts Framework*, May 2013, prepared by EcoDistricts (attached).

Source: The EcoDistricts Framework—Building Blocks of Sustainable Cities

EcoDistricts should include as many of these components as possible, and in the case of the East Corridor transit oriented neighborhoods being planned in Overlake Village and the BelRed corridor, many of these are already being implemented.

Applicability to the East Corridor

Overlake Village and the BelRed Corridor, including the 130th Avenue NE and 120th Avenue NE station areas represent potential opportunities for EcoDistrict implementation

Memo

because wide scale district redevelopment to create vibrant urban neighborhoods is envisioned in these areas. Additionally, the City of Redmond's adopted plan and code provisions for Overlake Village and the City of Bellevue's adopted plan and code provisions for the BelRed already call for many of the components recognized as eco-friendly and relevant to EcoDistricts. In these proposed new districts, some of these components that are considered to be EcoDistrict relevant are required by the cities of new development, while others are voluntary. For example, district energy implementation is one of these key components, but district energy is not required by code. While there is not a specific formula of requirements for EcoDistrict designation and there appears to be some flexibility in how EcoDistricts are recognized, every effort should be made to achieve net zero energy efficiency—as one goal of the program. (Refer to the attached *Framework* document.)

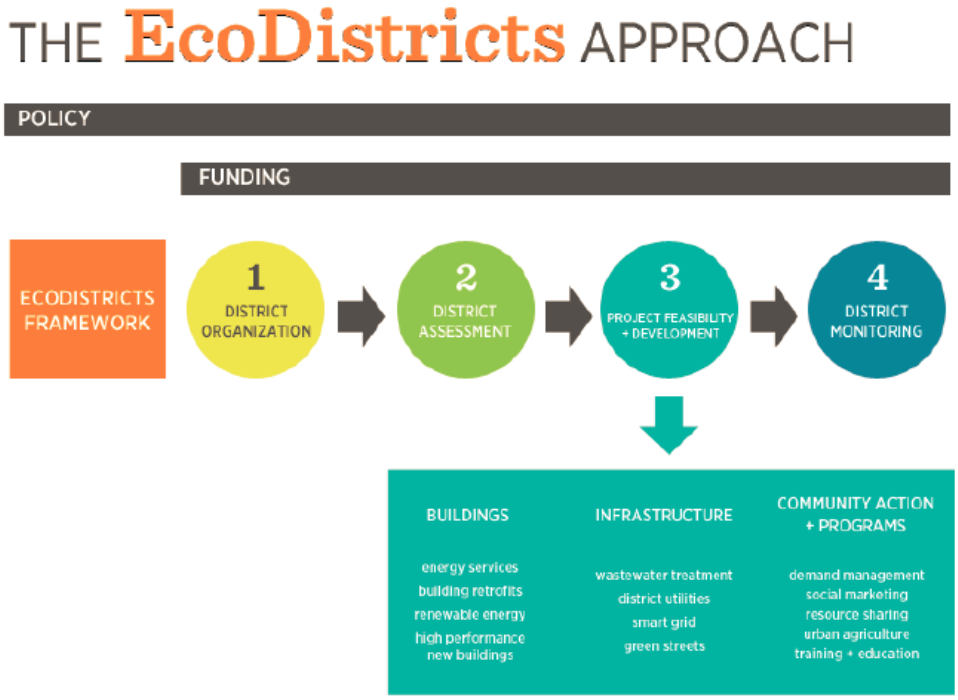
An immediate priority in pursuing formal EcoDistrict designation for either Overlake Village or the 130th Avenue NE station area (or the BelRed corridor as a whole) would be to coordinate with the EcoDistricts organization to confirm how districts can be formed, the advantages of designation, and the implications on potential redevelopment. Again, according to EcoDistricts, urban development leaders from mayors to universities to affordable housing providers see EcoDistricts as a powerful way to address many of the pressing challenges faced in today's world such as climate change, neighborhood degradation, the need to improved health and expanded transportation choices in our communities, and the importance of offering a high quality of life in our cities. In order to facilitate policy-making at the leadership level in both areas, it will be important to clearly explain the economic, environmental, and social benefits achieved through EcoDistrict designation and how these benefits apply to the private sector as well as local governments. As such, it is highly recommended that if either city is interested in moving forward toward EcoDistrict formation, the first step would be a full study of implementation feasibility that would quantify the full-scale benefits, similarly to how this memorandum has quantified the value proposition for implementing district energy in Overlake Village.

One of the key benefits of implementing EcoDistricts is the potential to create a market advantage. More home buyers and renters are demanding to live in walkable, environmentally-friendly urban neighborhoods and in homes where long-term energy and life-cycle costs are lower.

The graphic on the next page depicts the process of EcoDistrict formation. As shown, important principles of EcoDistrict development include establishing a policy with leadership support; organizing and assessing the district; implementing improvements at the site/buildings, infrastructure, and community programs levels; and then ongoing monitoring of district performance. A challenge is obtaining the support and commitment of property owners in the district for implementation. In both the Overlake Village neighborhood and BelRed corridor, there are multiple property owners and some who have already moved forward with redevelopment plans for their sites. Most of the basic principles of EcoDistrict development exist within these proposed developments,

Memo

with the exception of district energy, but perhaps future projects could include retrofitting these sites to connect them to district energy systems.



Source: The EcoDistricts Framework—Building Blocks of Sustainable Cities

The EcoDistricts organization brings together innovative practitioners and policy makers, providing a clearinghouse of information and resources to support EcoDistrict implementation regionally, nationally, and internationally. The organization sponsors an EcoDistrict Summit each year as a key outreach activity. Refer to Ecodistricts.org for additional information.

Attachments:

1. Slide Show - Overlake Village District Energy Concept

PUTTMAN INFRASTRUCTURE

PROJECT:

OVERLAKE VILLAGE DISTRICT ENERGY CONCEPT

LOCATION:

REDMOND, WASHINGTON USA

DATE:

NOVEMBER 2013

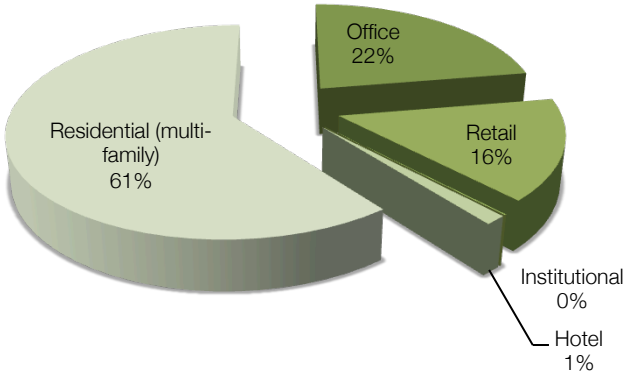
OVERLAKE VILLAGE

CRANDALL ARAMBULA
Revitalizing America's Cities

Visualization- Final Phase
May 27, 2011

DEVELOPMENT

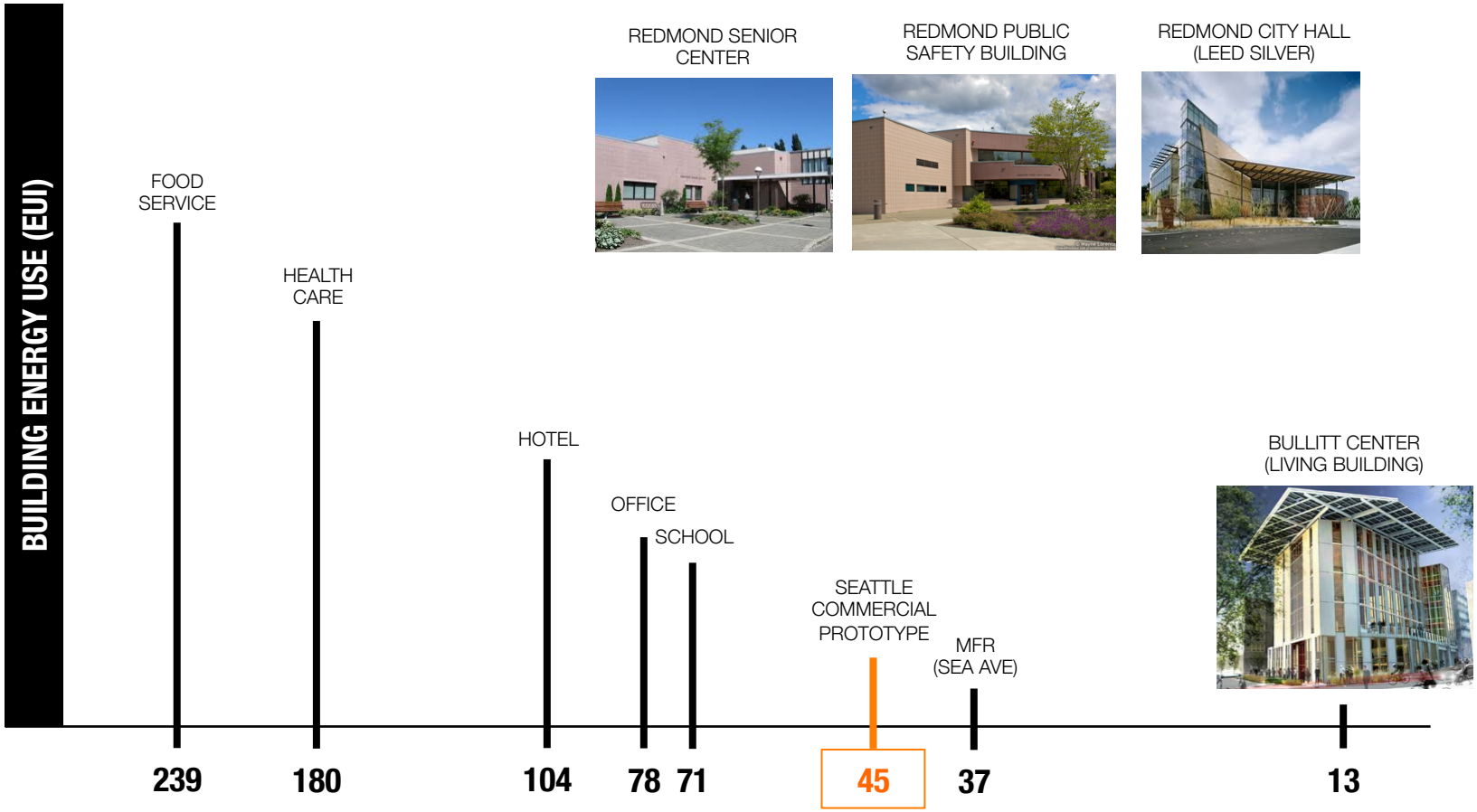
2030 Development Assumptions



Land Use	Area	Units	%
Office	1,610,224		22%
Retail	1,113,369		15%
Institutional	7,163		0%
Hotel	99,812		1%
Residential (multi-family)	4,364,500	4,988	61%
Total	**7,195,068**		**100%**

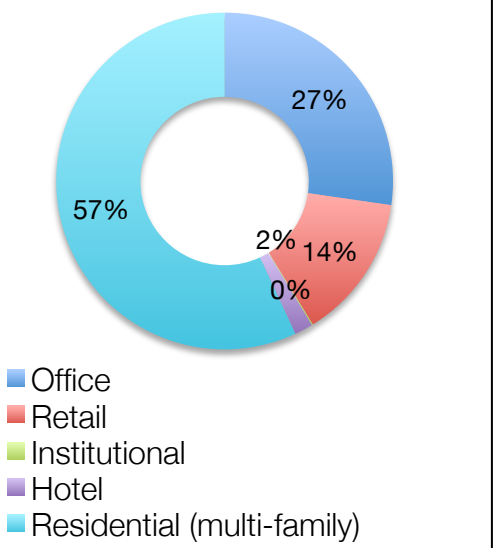
BUILDING PERFORMANCE

Energy Use Intensity (EUI) = kBTU/sf year

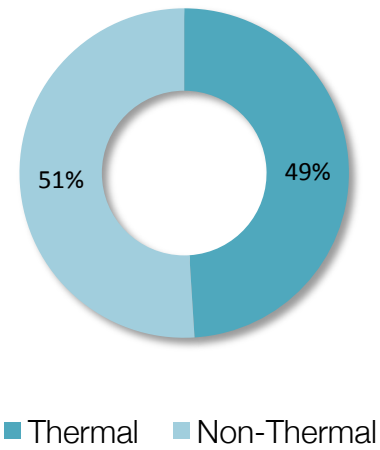


ENERGY DEMAND PROJECTIONS

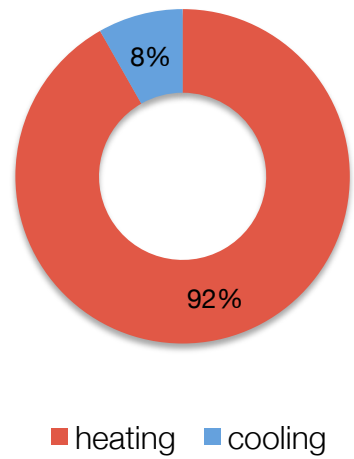
Energy Use Distribution



Thermal Energy Distribution



Heating and Cooling Distribution



FINDINGS

- Total annual energy demand estimated at 383,520 MMBtu.
- Residential and office make up over 75% of the district.
- Almost 50% of projected energy use is related to thermal energy (ie, heating and cooling).
- Heating dominated district with 92% of thermal demand.

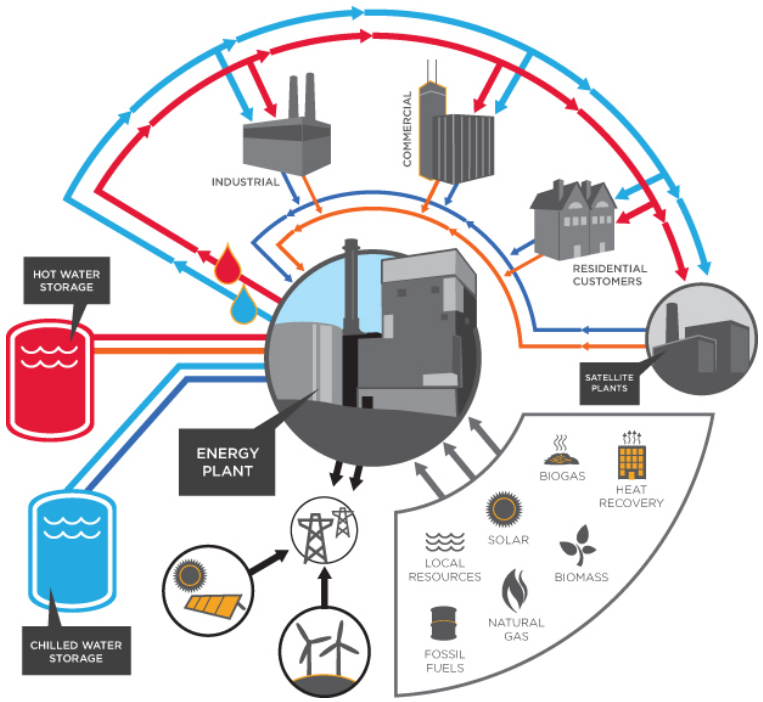
WHY DISTRICT ENERGY?

DISTRICT ENERGY

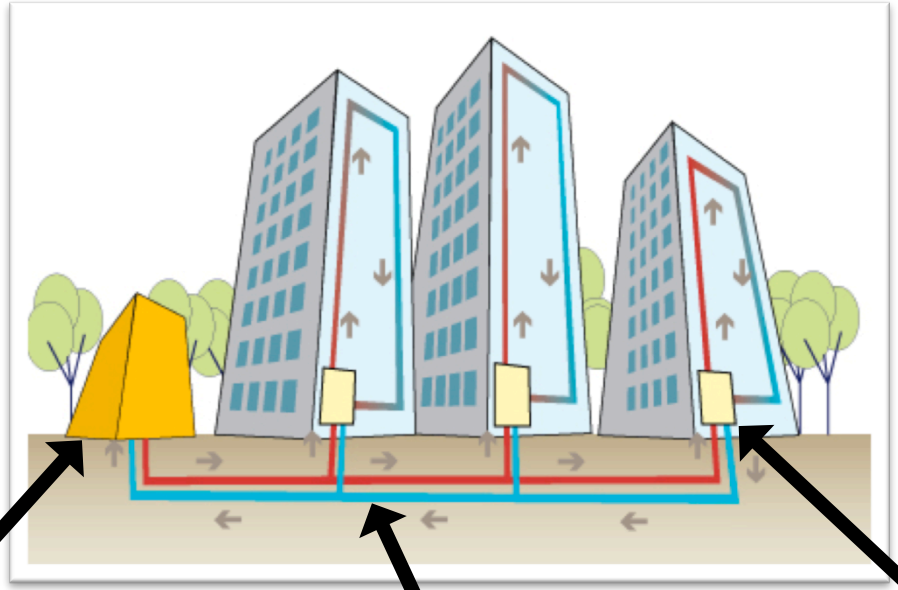
- District energy is the local production and distribution of thermal energy.
- It is a highly efficient means of providing locally generated thermal energy for heating and cooling homes, commercial and institutional buildings, and industrial processes.
- District energy systems are comprised of two main elements: central plant and distribution network.

WHAT THE FUTURE HOLDS

- More efficient use of resources
- Community-based economic engine
- Safe, secure and reliable energy
- Affordable, high-quality thermal services
- Attractive local environments
- Livable towns and cities



DISTRICT ENERGY SYSTEM



CENTRAL PLANT
Plant Integrated into Building

DISTRIBUTION PIPING

BUILDING CONNECTION
Energy Transfer Station

CENTRAL PLANT EXAMPLES

SOUTH FALSE CREEK
Vancouver, BC

DOCKSIDE GREEN
Victoria, BC

REGENT PARK
Toronto, ON

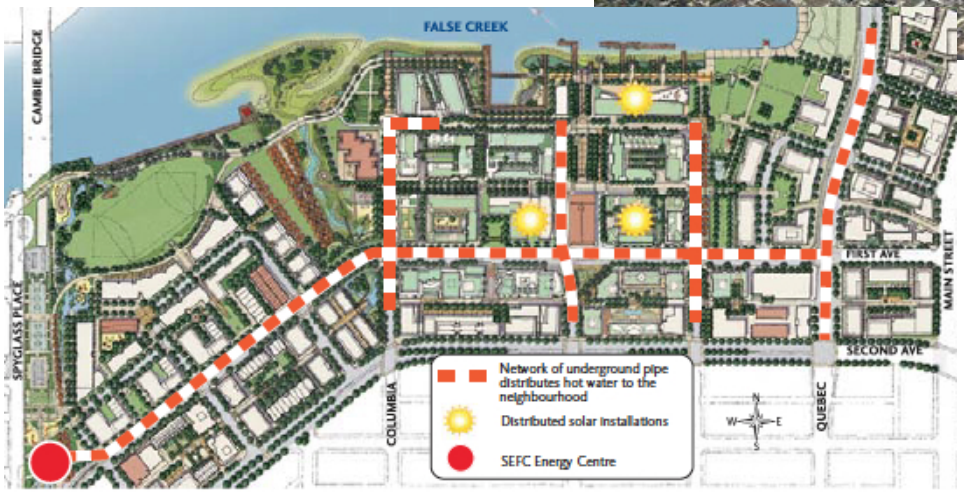
THE BREWERY BLOCKS
Portland, OR

THE ROUND
Beaverton, OR

Hartford Central School District
Hartford, NY

CENTRAL PLANT EXAMPLES

SOUTH FALSE CREEK
Vancouver, BC



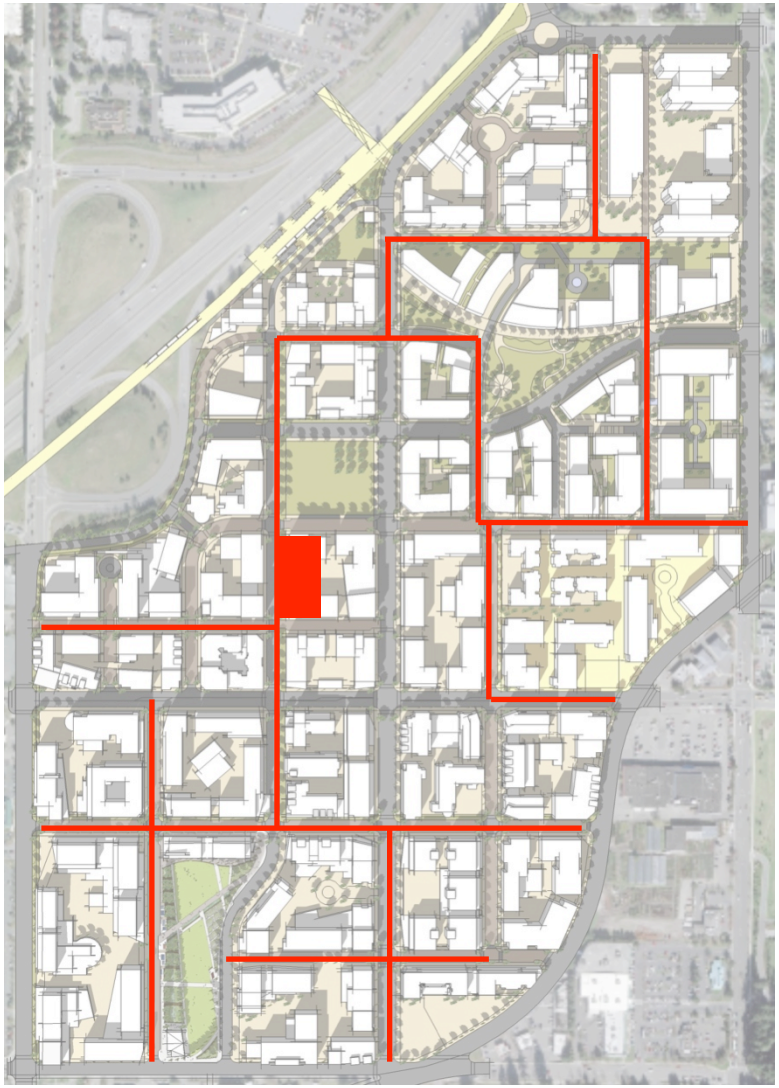
Mixed Use Development
76 acres

CENTRAL PLANT EXAMPLES

REGENT PARK
Toronto, ON

Mixed Use Development
70 acres

DISTRICT SCALE ANALYSIS



CENTRAL PLANT

- Central generation of heating (boilers) and cooling (chillers)
- Boilers to be natural gas fired.
- Chillers to be electric.
- Footprint likely 20,000-30,000 SF.
- Central plant can be integrated into open space or buildings.

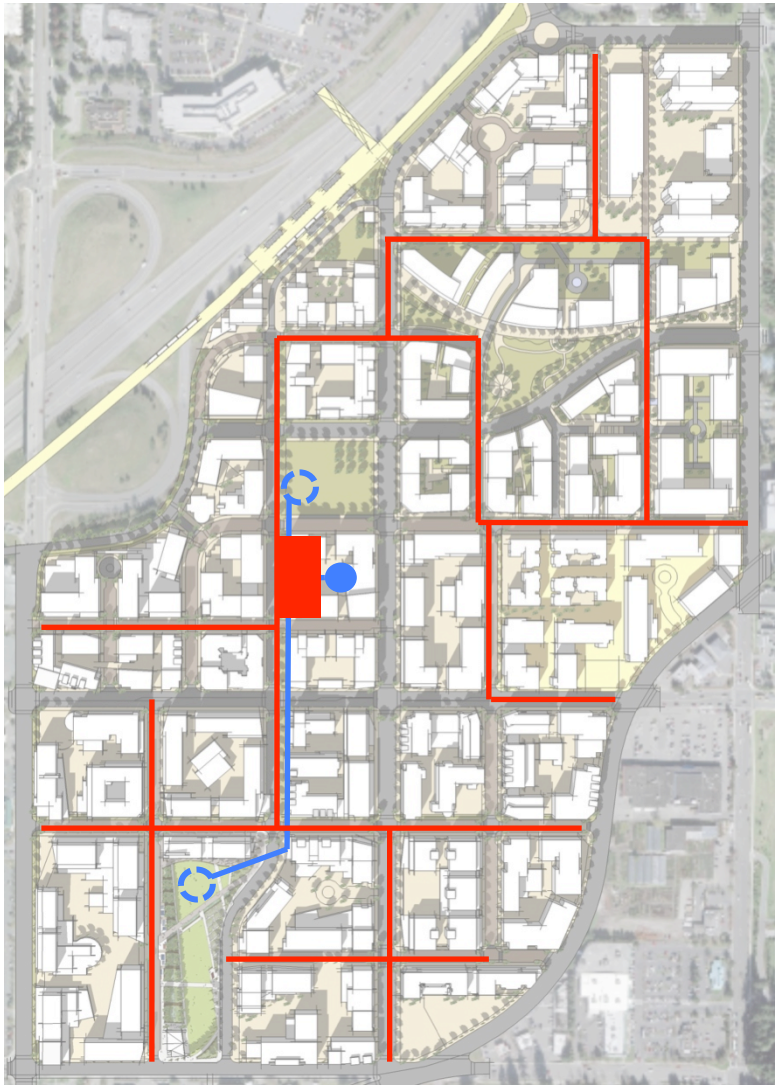
DISTRIBUTION SYSTEM

- Traditional four pipe system.
- 2 pipes for heating (supply and return)
- 2 pipes for cooling (supply and return)

CENTRAL PLANT INTEGRATED INTO URBAN FABRIC

The Brewery Blocks (Portland, OR)

DISTRICT SCALE ANALYSIS



CENTRAL PLANT

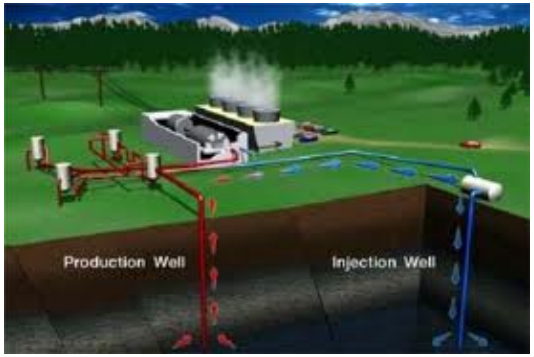
- Central generation of heating (boilers) and cooling (chillers)
- Boilers to be natural gas fired.
- Chillers to be electric.
- Footprint likely 20,000-30,000 SF (to confirm).
- Central plant can be integrated into open space or buildings.

DISTRIBUTION SYSTEM

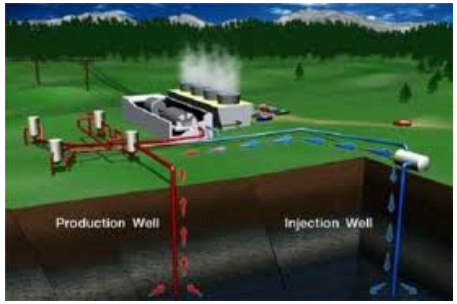
- Traditional four pipe system.
- 2 pipes for heating (supply and return)
- 2 pipes for cooling (supply and return)

GEOTHERMAL SYSTEM

- Open loop groundwater source heat pump
- Production well and injection well system.
- Well locations in open space.



GEOTHERMAL OVERVIEW



OPEN LOOP SYSTEMS

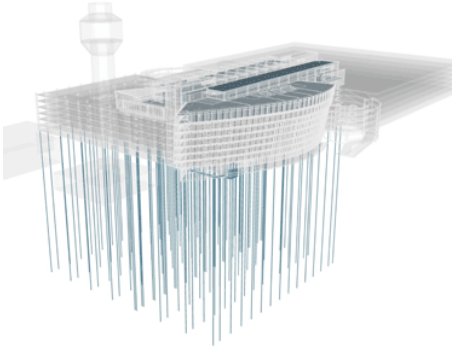
Production well and injections well(s). Groundwater withdrawn and re-injected.

PROS

- Highly efficient
- Simple system (2-3 wells)
- Less space requirements
- Locate in publically owned property
- Least cost (compared to closed loop)

CONS

- Regulatory requirements (water rights)
- Depth to groundwater (TBD)
- Well cost higher (larger diameter)



CLOSED LOOP SYSTEMS

Multiple "wells" but no groundwater withdrawn.

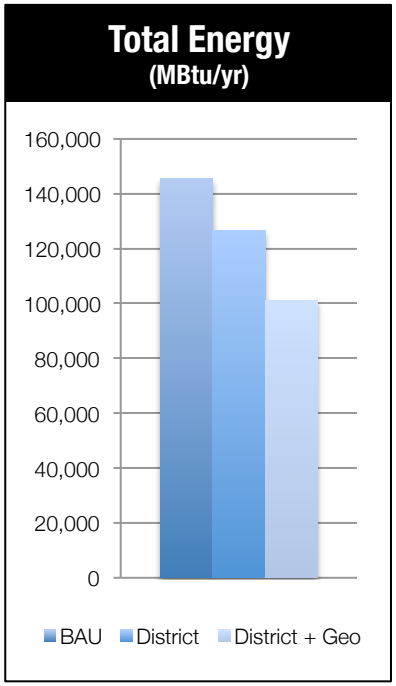
PROS

- Efficient
- Less regulatory hurdles

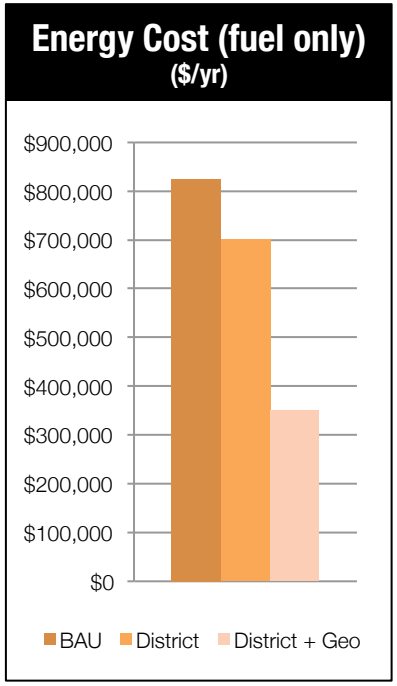
CONS

- More costly
- More complicated system (lots of parts)
- Lots of "wells" (100-1,000s)
- Public space/ROW constraints

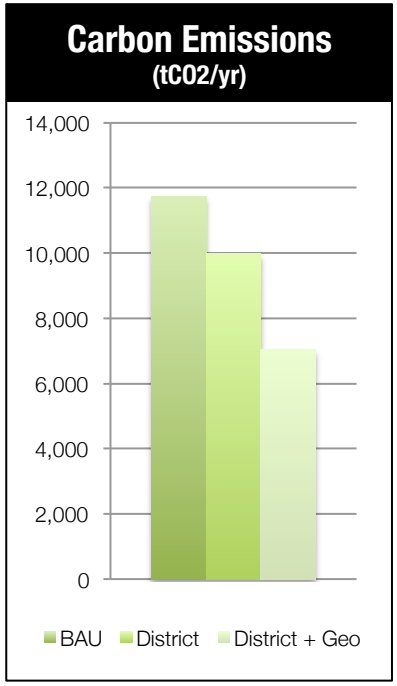
BUILDING VS. DISTRICT ENERGY



10-30% Savings



10-50% Savings



15-40% Savings

FINDINGS

- District energy system reduces overall energy demand, energy cost and carbon emissions within Overlake Village.
- Moreover, district energy allows opportunity for fuel switching and more efficient technology to further improve efficiency and reduce carbon emissions.

OWNERSHIP & DEVELOPMENT MODELS

PUBLIC

- Ownership = Public
- Funding = Public
- Design/Build & Regulatory = Public
- Operations = Public
- Customer Relationships = Public

PRIVATE

- Ownership = Private
- Funding = Private
- Design/Build & Regulatory = Private
- Operations = Private
- Customer Relationships = Private

PUBLIC PRIVATE PART.

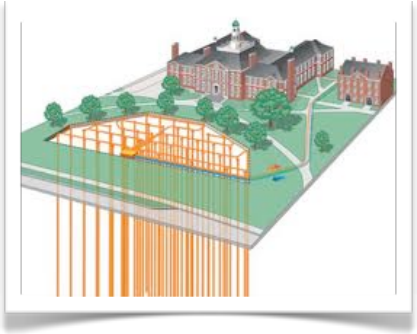
- Ownership = Pr3
- Funding = P3
- Design/Build & Regulatory = P3
- Operations = P3
- Customer Relationships = P3

COOPERATIVE

- Ownership = Properties
- Funding = Properties
- Design/Build & Regulatory = Properties
- Operations = Properties
- Customer Relationships = Properties

BUSINESS RELATIONSHIPS	SERVICE AGREEMENT	OPERATING AGREEMENT	MANAGEMENT AGREEMENT	DEVELOPMENT FEE
Design, Build, Own, Operate and Maintain (DBOOM)	Yes			
Design, Build, Operate and Maintain (BDOM)		Yes	Yes	Yes
Design, Build and Operate (DBO)		Yes		Yes
Design/Build (BD)				Yes
Design, Bid, Build (Conventional)				Yes

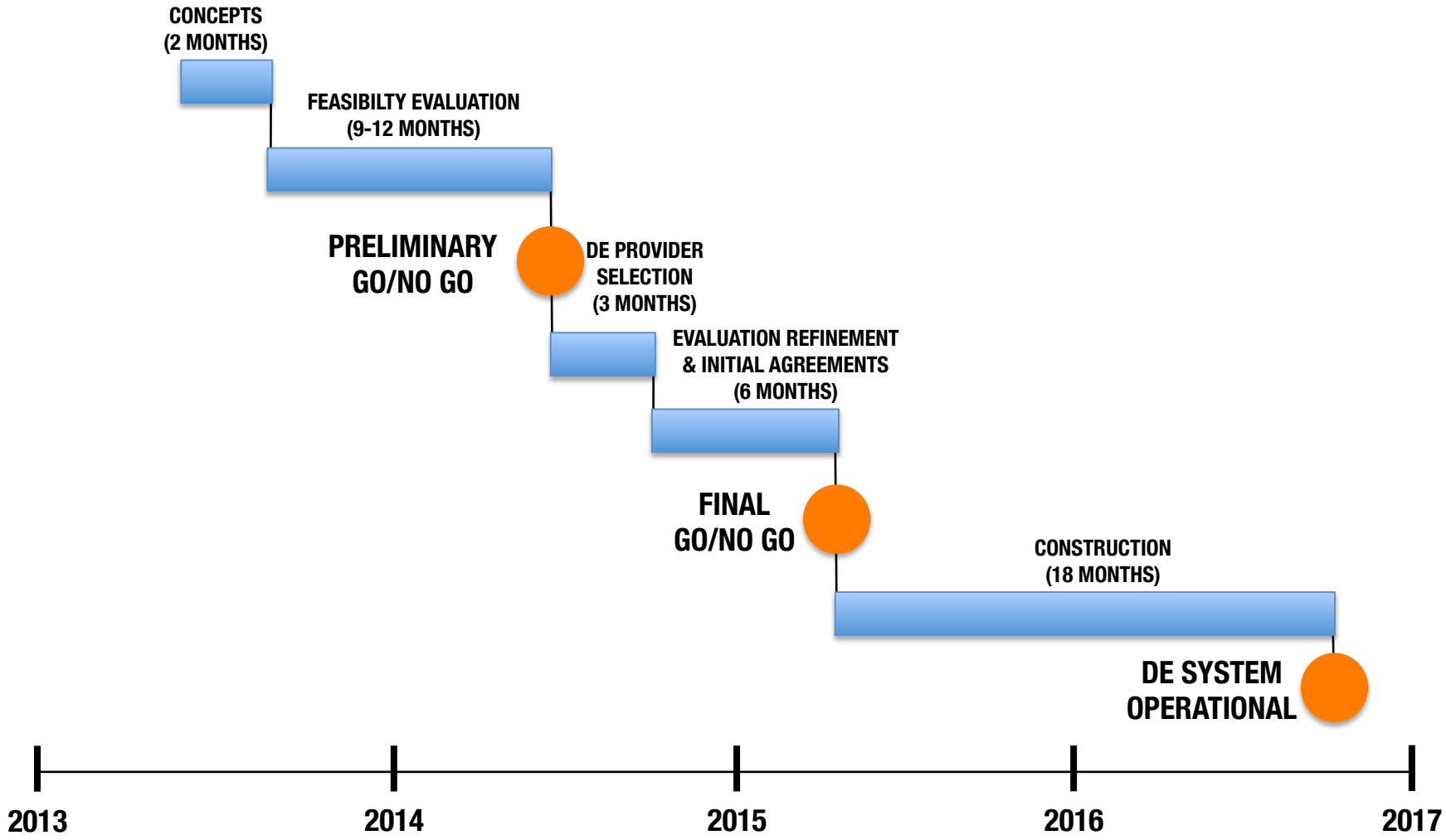
Solar PV



Groundsource Geothermal

Living Machine Wastewater Treatment and Reuse

DEVELOPMENT PATHWAY



THANK YOU

THOMAS J. PUTTMAN, PE, AICP, LEEP AP

PUTTMAN INFRASTRUCTURE, INC.
620 SW FIFTH AVENUE, SUITE 1007
PORTLAND, OREGON 97204
P: +1 503 224-3454
E: THOMAS.PUTTMAN@PUTTMAN.COM

WWW.PUTTMAN.COM