

District Energy Systems in Eugene, Oregon:

An analysis of opportunities + obstacles for success

Hannah Bryant
Graduate Exit Project
Masters in Community + Regional Planning
Spring 2011

Dedication

Thank you to Jude + Peter for reading this whole thing -- twice! -- and providing detailed edits. Thank you to Cyrus for unending patience and support. I'm so grateful for all of your support.

TABLE OF CONTENTS

Executive Summary	1
Why District Energy?.....	1
Obstacles + Opportunities	2
Conclusions	5
Chapter I : Introduction	7
Goals of this report	8
Defining the Terms.....	8
Benefits of District Energy Systems	9
For Communities.....	10
For Municipalities	11
For Developers.....	11
For Customers.....	12
Negative Impacts of District Energy	14
Relevance	14
For Eugene	14
Relevance to Other Communities	17
History of District Energy.....	17
Background and Significance	17
Chapter II: Research Framework.....	20
Research Question	20
Research Framework.....	20
Case Studies	20
Local Case Study: Walnut Station	21
Additional Sites to Consider.....	28
Chapter III: Municipal Leadership	30
Chapter IV: Platforms	34
Basic Configuration	34
Determining Energy Sources.....	36
Determining Feasibility	36

Chapter V: Obstacles + Opportunities	38
Oregon	38
Eugene	39
Governance	40
Legal Limits to City Support of District Energy	41
District Energy Ownership In Eugene	41
Public and Private Support	41
Financial Opportunities	42
General Funding	42
City of Eugene	44
District Energy Developer	45
Walnut Station	48
Chapter VI: Conclusions + Recommendations	49
Opportunities	49
Obstacles	51
Recommendations	52
Next Steps	57
Conclusion	58
Appendix 1: Methodology	59
Community Context	59
Local Case Study: Walnut Station	59
Interview and Research Design	62
Data Gathering	62
Data Analysis	63
Appendix 2: Case Studies	64
Montpelier, Vermont	64
Portland, Oregon	67
Appendix 3: Alternative Sites	70
Riverfront URA	70
EWEB Riverfront Site	72
Appendix 4: Platforms	75

Specific Technology Options.....	75
Appendix 5: Conditions for Success.....	79
Appendix 6: Regulatory Hurdles	81
Permitting Process	81
Process.....	81
Appendix 7: Governance Models	92
Appendix 8: Funding Sources.....	101
Appendix 9: SELP-Funded Projects.....	104
Appendix 10: State Energy Loan Program (SELP).....	106
Appendix 11: Business Energy Tax Credits (BETC).....	108
Appendix 12: Key Questions for District Energy.....	116

EXECUTIVE SUMMARY

The City of Eugene has set aggressive goals to lower its greenhouse gas emissions, reduce community fossil fuel use and adapt to a changing climate and increasing fossil fuel prices over the coming decades. Its Climate and Energy Action Plan named implementation of district energy in Eugene by 2015 as a goal of the City and its citizens, to be initiated by removing “legal, technical, policy, governance, and financial barriers to district energy systems.”¹ The goal of this study is to identify the range of policy, governance and financial opportunities and obstacles to a district system in Eugene. It concludes with recommendations and next steps for removing these barriers.

This project was sponsored by the City of Eugene department of Waste Reduction and Green Building. It presents an analysis of opportunities and obstacles to district energy in Eugene with the objective of identifying a spectrum of possible next steps for the municipal government. To identify possible obstacles, one neighborhood in Eugene – Walnut Station – was used as a model.

While the study identifies local barriers and universal risk factors inherent to district energy, it also highlights some of the unique conditions that may assist the possible development of a district energy system. It finds that the key characteristic of feasibility is political will and public support for a system. Therefore, the primary goal of this study is to serve as an educational tool for policy makers when determining the extent of municipal involvement in a future district energy system.

Why District Energy?

District energy is one platform for reducing energy consumption and greenhouse gas emissions through flexibility of energy sources and economies of scale. While not the only means for achieving community environmental goals, it is easier to adapt or evolve with changing conditions than either regional energy or individual building scale systems. Most

¹ City of Eugene, "A Community Climate and Energy Action Plan for Eugene," (Eugene, OR2010).

importantly, the obstacles to district energy are often also barriers to other local energy projects, so identifying and removing these barriers in the short term increases the prospects for success of future sustainable energy projects in this community.

Obstacles + Opportunities

Research finds that the primary obstacle to district energy is its complexity and lack of recent precedents in the United States. Other obstacles include the financial risk of building a system that depends on future new development; the difficulty of building public support and understanding, and the lack of policy language around energy generation projects.

This report identifies opportunities for the municipality to support a district energy system. These recommendations range in time, financial investment and risk, from internal policy clarification and education around district energy to municipal development, ownership and operation of a new system. Below is a brief overview of the primary obstacles identified and key recommendations.

LACK OF UNDERSTANDING ABOUT DISTRICT ENERGY

Through interviews with local developers, architects, engineers and City staff it became clear that there is a lack of general understanding about the concept of district energy, the potential benefits of these systems or the basics of their development and operational models. If the municipality opts to promote district energy, it will be imperative to have a broad understanding among the general public and City staff of what the systems are and how they can achieve stated community energy goals.

- **Public educational outreach** is needed to introduce new concepts around energy efficiency technology and policy to the community and City Staff to help prepare it for the introduction of new energy issues that the community will deal with in coming years.

UNDEVELOPED MUNICIPAL CAPACITY

Lack of institutional understanding at the municipal level is a primary obstacle to development of district energy systems. Further, there is no department that is situated to assume responsibility for energy policy and planning. If a

private developer were to propose a district energy system for Eugene today, there is no clear ally or partner within the city administration to help support and manage the project.

- **Internal education of City Staff.** Leadership from the city administration and department heads is crucial to developing the understanding of the systems, familiarity with its benefits, clarity of policies and regulations around district energy and the environment of interdepartmental planning and communication that is crucial to its success.
- Decide on and empower a **single entity or department to champion district energy** in Eugene.
- Establish an **Inter-Department District Energy Working Group** tasked with developing a manual for district energy development in the City of Eugene. This group could include representatives from many City departments, local and regional experts and EWEB

MUNICIPAL ENERGY PLANNING GOALS AND DESIRED ROLE UNCLEAR

While the Climate and Energy Action Plan names the creation of a district energy system as a community goal, there is no municipal policy framework to support this goal. Clarifying language around energy generation and planning will indicate to property developers that Eugene is a conducive environment for energy investment and will facilitate the planning, permitting and developing of energy systems. The City needs to determine its objectives for community energy planning and the roles it is willing and able to play to achieve these goals. Below are recommendations that may be appropriate, depending on the City's chosen role.

- Use any upcoming code amendment processes to **update regulatory framework** to include language about district and small-scale energy production. This language should outline the regulations and expectations of such a facility, including how it's licensed and who oversees licensure. This ordinance could be based on the existing codes for telecommunications facilities, as well as the recent Regulatory Improvement Code Amendment Process (RICAP 5) adopted in Portland.²
- Create **clear permitting and planning guidelines** — to support expedited site selection for district energy centers.

² Portland, "Highlights of RICAP 5."

- Develop a **comprehensive district energy assessment map** of Eugene that details underground linear infrastructure, scheduled capital improvement projects within the Right of Way (e.g. road improvements, sewer and stormwater infrastructure projects), building types, building energy use intensity, and building equipment and distribution systems, including age of equipment. This would promote and support coordinated planning and installation of infrastructure installation and repairs. To minimize overall cost and disruption, road reconstruction and resurfacing should be coordinated with the installation of sewer pipes and bioswales, fiber optic cable, streetcar and bus rapid transit alignments and district energy distribution pipes.³
- Develop a **loads profile map** of Eugene that outlines the desired district energy zone and the load profiles within it. Buildings with sympathetic loads that complement those that exist should be promoted in this zone to strengthen the economics of a future system.⁴

TRADITIONAL FINANCING MODELS PUT ALL RISK ON DEVELOPERS

The standard financing models require the developer to incur all the cost of building a district energy system prior to the full build out of the adjacent buildings that will ultimately be the system's customers. If the subsequent development is delayed or falls through, the district energy developer is left with the debt for an unpredictable time. Since the financial downturn of 2008, both lenders and developers are less willing to incur this level of financial risk, especially when it's so dependent upon future development. There are opportunities in this area for the municipality to mitigate some of the risk to a private district energy developer and to support rapid build out of a new district energy system.

- Identify or **create a low-cost source of financing** for district energy. The inter-departmental working group may also be assigned the role of staying abreast of new district energy grants and loan opportunities from the state and federal government. Other funding strategies may include tax increment financing or urban renewal area designation to subsidize district energy infrastructure.
- **Provide gap financing** for new systems in areas with relatively few initial customers or a prolonged build out. This financing bridges the gap between development and financial neutrality for the developer, and can be justified as a broader public good.

³ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

⁴ Church, "Is District Energy Right For Your Community? Part 1: The Concept." 32.

- **Define a thermal energy district** based on ORS 198 – Creation of Special Districts.⁵ Creating a new, exclusive district will help to attract a district energy developer and aid that developer’s financing process. The district will have the power to issue bonds, set rates, etc. A local example similar to this is the Metropolitan Wastewater Commission.⁶
- **Commit to connecting all municipal buildings** to district energy systems as soon as it is cost-effective to do so. In other words, any municipal building with “district energy ready” radiant heating and cooling systems would connect to a distribution system as soon as the line is accessible.
- Offer partial (temporary or ongoing) **property tax relief** to property owners connecting to district energy.
- **Establish core district energy zones** with strong connection incentives, along with streamlined policies for system extensions beyond the core area.⁷
- **Establish a municipal energy finance district** such as those in Montpelier, Vermont and Santa Barbara County, California. Similar to TIF or URA districts, these areas are targeted for energy investment with the long-term understanding that municipal investment will yield higher tax returns in the future. If the initial investment funds are used to support an array of energy efficiency measures including retrofits of existing buildings, it may increase political support for district energy funding.
- **Make connection to district energy systems mandatory.** The most successful municipal district energy systems are developed in places where the City actively leads the policy, and views district energy connections as it views storm water, septic, and water connections -- making them mandatory for all new buildings.

Conclusions

This project reaches the following conclusions:

- District energy offers many opportunities for progress in meeting community energy efficiency and greenhouse gas goals in the short term as well as the flexibility to meet more rigorous environmental benchmarks in the future. Further exploration of policies to promote district energy is an appropriate measure for the City of Eugene to take toward achieving its sustainability goals.
- This research concludes that Eugene is not prepared to attract significant private investment in an energy system as it lacks a

⁵ State of Oregon, "Chapter 198 - Special Districts Generally," (2009).

⁶ Tom Osdoba, January 26, 2011.

⁷ — — —, "Streamlining Portland's District Energy Regulations."

framework for supporting community energy generation projects. The City should take proactive steps in the near-term to create a policy foundation for future projects. This is critically necessary to attract outside development and will facilitate the process for City staff and private developers working on the initial projects.

- District energy systems in Eugene will require extensive new development, and the current lull is an opportune time to implement policies to support future development while minimizing missed opportunities. Given the complexity of incorporating energy planning into an existing governmental structure for the first time, it is essential that the City not wait until development rates increase to begin evaluating how to add this new layer to its planning.
- District systems will be most successful in large sites with new construction scheduled to come online in a condensed timeframe. In Eugene a district energy system may require 250,000-500,000 square feet to be economically feasible, so identification of large parcels preparing for development or re-development is key to designating zones for district energy promotion.

CHAPTER I : INTRODUCTION

The City of Eugene has set aggressive goals to lower its greenhouse gas emissions, reduce community fossil fuel use and adapt to a changing climate and increasing fossil fuel prices over the coming decades. The City of Eugene's Climate and Energy Action Plan named implementation of district energy in Eugene by 2015 as a goal of the City and its citizens, to be initiated by removing "legal, technical, policy, governance, and financial barriers to district energy systems."⁸ Additionally, planning for climate change and climate uncertainty is one of the seven pillars of the 'Envision Eugene' planning process, which specifically states that it make "energy efficiency, in both buildings and vehicles, the first line of action in reducing energy dependence and greenhouse gas emissions."⁹ The first step toward removing barriers and strengthening policies that support energy efficiency is to identify and clarify what the obstacles are, as well as who has the authority and ability to remove them. While the City of Eugene is primarily interested in identifying its role in facilitating district energy systems and therefore this study focuses on the role of municipalities, it also strives to identify all obstacles to district energy systems and the parties capable of removing them.

According to the US Energy Information Administration, space and hot water heating represented about 20% of total US energy demand in 2006.¹⁰ Given that most of this demand is met by electricity, or by burning natural gas, propane, and fuel oil, an enormous opportunity exists to improve our utilization of these fuels or seek alternative, more sustainable energy sources for our heating needs. District energy is one mechanism for improving how we meet our energy needs.

⁸ City of Eugene, "A Community Climate and Energy Action Plan for Eugene," (Eugene, OR2010).

⁹ "City of Eugene", "Envision Eugene: Draft Proposal," ed. Planning and Sustainability (Eugene, ORMarch 2, 2011).

¹⁰ Hildigunnar Thorsteinsson and Jefferson Tester, "Barriers and enablers to geothermal district heating system development in the United States," *Energy Policy* 38(November 1, 2009).

This study uses one site in Eugene to illustrate both the opportunities for developing local district energy systems as well as the very complex obstacles that will require extensive municipal involvement and coordination. In particular, this research focuses on the legal, financial and governance barriers to district energy. The case study site is chosen to highlight the widest range of opportunities and obstacles involved in development of a district energy system. It is not the only, or necessarily the best, site for such a development.

This report distills its findings into a set of questions and considerations that help facilitate easy and efficient identification of opportune locations for district energy in Eugene and also questions for evaluating those sites?

Goals of this report

- Explain the **regulatory conditions** for district energy in Eugene;
- Explore the **financing opportunities** for making district energy systems;
- Illustrate a variety of development and **governance models**;
- Recommend **next steps** for further exploration of district energy and other shared energy systems.

Defining the Terms

For the purpose of this report, and in keeping with common terminology, the term 'district energy' is used to refer to central provision of heating and/or cooling within a defined district. In this paper, district energy is same thing as a 'neighborhood energy utility' (NEU). "In and of itself, district energy is not a stand-alone technology: it does not actually produce any energy whatsoever. Physically, it is a thermal network: piping that links an energy supplier to an energy consumer. Philosophically, though, it is an energy management system that operates at a community level."¹¹

While district energy can refer to a variety of scales, ranging from an entire downtown to a single complex, this study assumes it is a neighborhood scale. Given the development patterns and trends in Eugene, it is unlikely that

¹¹ Ken Church, "Is District Energy Right For Your Community? Part 1: The Concept," *Municipal World* November 2007.

the City will reinstate a large district system the size of its former downtown steam system. Rather, this report presumes that a new system will initially be sized as small as can be feasible – potentially as small as a few medium-sized commercial buildings with diverse loads, such as a grocery store with residences above as well as a few hotels or office space.

Unless otherwise stated, this study focuses on district heating, since that is the most financially feasible due to our climate and building loads. It also considers the additional opportunities or barriers to ‘combined heat and power’ or co-generation (CHP) systems. These systems supply local thermal needs while also creating electricity through the heating process, and in doing so diversify the regional electrical system and further bolster community energy security.

Benefits of District Energy Systems

In a modern district energy system, hot or chilled water is produced in a central plant and distributed to multiple buildings via insulated, underground pipes. These systems eliminate the need for heating or cooling equipment in each building, reducing upfront costs for the building owner. In the right application, some of the key benefits of a district energy system include: reduced energy consumption; improved flexibility to switch to more efficient, sustainable or cost effective energy sources; energy security; environmental performance; cost savings for building owners and tenants and local economic development.¹²

The rationale supporting district energy systems is primarily financial and environmental. The actual benefits derived from a specific system vary widely, and depend on many factors including its age, size, location, fuel platform, and local rates for conventional energy. The following are benefits widely attributed to district energy systems. Most will be addressed in greater detail elsewhere in this paper.

¹² Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations," (March 31, 2011); (PoSI) Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations," (March 2011).

For Communities

FLEXIBLE ENERGY SOURCES

District energy systems can utilize a wide variety of technologies and fuels, including traditional fossil fuels, solar, geothermal, waste energy from adjacent buildings, extracted sewer heat, biomass, and other alternative fuels. Since there are many variables in energy decision making, including but not limited to market price fluctuations for fuels, new local opportunities for utilizing waste energy, local policies, innovative technologies and changing demand, district energy offers a system that facilitates switching mechanical systems or fuel sources at a central plant more efficiently and affordably than at the building level. This allows for increased flexibility to choose more sustainable energy options and to ensure long-term affordability for customers on the system.

IMPROVED ENVIRONMENTAL PERFORMANCE

Higher efficiency systems, combined with increased flexibility to switch between energy platforms, can result in lower greenhouse gas emissions and feasibility of using more renewable energy sources (such as geothermal) that may be cost-prohibitive at single-building scale. Energy efficiency improvements of “20 percent are a reasonable expectation in areas where density and building mix contribute to an economically viable system.”¹³

LOCAL ECONOMIC DEVELOPMENT

The ability to take advantage of a variety of technologies and local energy sources is one way in which district energy can support local economic development and community energy security. “In many cases, district energy facilities can utilize local fuel resources (such as waste wood in St. Paul or oat hull by-products at the University of Iowa). This keeps energy dollars re-circulating in the local economy.”¹⁴ While the wood industry in Oregon is very efficient, and therefore has minimal unused by-product that might be harnessed for a district energy facility, certainly purchasing local biomass

¹³ Preservation Green Lab and University of Oregon, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings," (June 2010). 5.

¹⁴ (IDEA) International District Energy Association, "IDEA Report: The District Energy Industry," (August 5, 2005).

would keep energy dollars in the local economy and decrease the community's dependence on imported fuel sources. Montpelier, Vermont found that even after any negative employment impacts from decreasing purchases of fossil fuels, its biomass facility would create at least three permanent new jobs in harvesting, processing and transporting biomass to its facility.¹⁵

For Municipalities

ALTERNATIVE REVENUE SOURCE TO MUNICIPALITIES

Whether through direct ownership or an increased tax base, the municipality stands to benefit financially from a district system.¹⁶

HAZARD MITIGATION

Operational reliability, even through periods of weather and earthquake emergencies, has been a hallmark of the district energy industry. "When conducting due diligence on operating history, the former owners of Minneapolis Energy Center reported only three hours of unscheduled outage over 25 years of operations. Similarly, with the natural disasters of the San Francisco earthquake of 1989; the great Ottawa ice storm in 1998; and the Seattle earthquake of 2001, the only utilities that reported continuous and uninterrupted service were the respective district steam systems in San Francisco, Montreal and Seattle."¹⁷ This high level of reliability is important, especially when serving hospitals and other care facilities.

For Developers

REDUCED RISK AND FIRST/LIFECYCLE COST

Building owners who connect to district systems reduce upfront financial investment and long-term maintenance costs in boilers and heating systems. This stabilizes their financial portfolios and reduces unanticipated costs

¹⁵ Anna Austin, "Montpelier Building Biomass District Energy System," *Biomass Power & Thermal* 2011.

¹⁶ Compass Resource Management, "Business Analysis for a Neighborhood Energy Utility in the North Pearl District," (Portland, OR: City of Portland, March 31, 2009). 7.

¹⁷ International District Energy Association, "IDEA Report: The District Energy Industry."

associated with the buildings. Additionally, not having a boiler or other combustion heating in the building may reduce insurance costs.¹⁸

For Customers

From a customer perspective, there are numerous advantages to district energy over individual building systems, including “ease of use and simplified building operations; avoided capital costs for in-building heating and air conditioning equipment; reduced labor, repair and maintenance expenses; space is made available for alternative uses; highly reliable energy service, and less fuel and chemicals stored and combusted on site.”¹⁹

REDUCED ENERGY CONSUMPTION

District energy systems offer the potential to significantly reduce energy usage over conventional, individual building heat systems, and thus to reduce greenhouse gas emissions as well.²⁰ “The consideration of district energy as a management system comes from the fact that people, buildings and industries consume energy at different rates and in different patterns, and by linking them together, management of energy consumption becomes possible.”²¹ When multiple building loads are aggregated, “the district energy system can employ industrial grade equipment designed to utilize multiple fuels and employ technologies that would otherwise simply not be economically or technically feasible for individual buildings.”²² Due to mechanical efficiencies, it is often easier to operate large, central boilers at maximum efficiency than it is to keep a single-building boiler in its most efficient range. Further, central plants with trained, full-time operators tend to be well-maintained and thus more efficient than individual boilers that are often poorly maintained.²³ Last, the integration of diverse loads and the ability to tap energy sources that are not available at individual building scales add to the benefits of energy production at a district scale.

¹⁸ Compass Resource Management, "Business Analysis for a Neighborhood Energy Utility in the North Pearl District," (Portland, OR: City of Portland, March 31, 2009). 7.

¹⁹ International District Energy Association, "IDEA Report: The District Energy Industry."

²⁰ Carolyn Gochenour, "District Energy Trends, Issues, and Opportunities," (Washington, DC: The World Bank, 2001).

²¹ Church, "Is District Energy Right For Your Community? Part 1: The Concept." 31.

²² International District Energy Association, "IDEA Report: The District Energy Industry."

²³ Gochenour, "District Energy Trends, Issues, and Opportunities." 28.

ENERGY PRICE STABILITY

When multiple buildings with diverse heating loads are aggregated in one system, it allows the efficient management of fuels to meet demand while minimizing cost and vulnerability to fuel price fluctuations to the customers. Since district mechanical systems can utilize multiple fuels, switching to alternative fuels can mitigate price fluctuations in the market, stabilizing the cost of heating and enabling building owners to plan ahead with predictable heating bills.²⁴

IMPROVED QUALITY OF SERVICE AND PEACE OF MIND

Business owners and occupants connected to district systems are not responsible for maintenance, repairs or expansion of the infrastructure. Because district systems have full-time employees overseeing their operations, the equipment tends to be better maintained and operates at a higher efficiency than individual building systems, providing customers with reliable and predictable energy with less worry or responsibility.

LESS SPACE REQUIRED FOR HVAC

“In a dense urban environment, there is often a premium value for space that can be reclaimed for their productive uses by displacing mechanical equipment, flues and cooling towers. In particular rooftop and penthouse space can be shifted from a cost center for large mechanical systems to profit center for third parties (i.e. cell and microwave towers; restaurants, leasable footprints).”²⁵ Connection to district energy systems create an opportunity to utilize all valuable space in buildings and to avoid unsightly ductwork and chases.²⁶

ENABLES BETTER BUILDINGS

“Hydronic heating and cooling are considered premium services, offering better comfort and less dust and airborne contaminants than forced air

²⁴ Church, "Is District Energy Right For Your Community? Part 1: The Concept." 31.

²⁵ International District Energy Association, "IDEA Report: The District Energy Industry."

²⁶ Preservation Green Lab and Oregon, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings." 9.

systems, and far more comfort than electric resistance options. Many upscale residential buildings offer hydronic heating as an amenity."²⁷

Negative Impacts of District Energy

Negative impacts of district energy include the costs associated with: construction the use and the decommissioning of the plant; impacts of the fuel supply chain (production, transport, use and disposal); emissions; thermal discharges into water; leaks; waste; noise; visual intrusion; land use and occupational hazards.²⁸ These are impacts associated with all scales of energy generation, not only the district scale.

In general, it is easier to control the negative variables of energy production at a centralized plant than it is in dispersed individual building boilers or large, regional production facilities. Emissions can be reduced in numerous ways: through improving thermal efficiency of the heat production process and infrastructure; installing flue cleaning technologies; switching to cleaner fuels; using renewable energy sources and implementing energy savings incentives at the consumer level.²⁹ Other negative impacts, such as construction and noise, are temporary, local and easily mitigated.

Relevance

For Eugene

District energy is not new in Eugene. For most of the past century there have been district heating systems serving both the downtown core and the University of Oregon campus. While not a district energy facility, the development of the Seneca biomass energy generation facility, has set a recent precedent for local regulatory approval of small-scale energy generation projects in Eugene.³⁰

²⁷ — — —, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings." 9.

²⁸ Gochenour, "District Energy Trends, Issues, and Opportunities." 40.

²⁹ — — —, "District Energy Trends, Issues, and Opportunities." 40.

³⁰ Eugene Water and Electric Board (EWEB), "Seneca biomass energy project," <http://www.eweb.org/biomass>.

EUGENE WATER AND ELECTRIC BOARD (EWEB)

The EWEB downtown district steam system was acquired from a private operator in 1962. EWEB has operated the increasingly inefficient system for almost 50 years and is now in the process of transitioning the last customers off the system and fully decommissioning it by September 2012.³¹

Over the past two decades, EWEB found operation of its steam plant to be increasingly inefficient and contrary to its environmental goals. The system once served many businesses in the downtown core, but with the loss of major customers such as Agripac and Chase Gardens, the fixed rates for operation have skyrocketed as the total sales decreased from a high of 450,000 klbs/year in 1985 to less than 180,000 klbs/year in 2007.³²

Steam is an unforgiving platform for district energy systems, and one that is rarely used in new systems. Because of the nature of the platform, it requires the same amount of energy to fill the system with steam to serve one building as it does to serve 100 buildings. When there were 124 customers on EWEB's system, the per-customer cost of the fuel used to create the steam was reasonable. However, as major customers transitioned off the system or went out of business, the per-customer cost to make the same quantity steam increased exponentially. Future changes, such as increased natural gas prices, the planned shifting of PeaceHealth services away from its downtown hospital toward its RiverBend campus (with subsequent reduction in demand of EWEB steam for heating its downtown facility), and an aging system that will require expensive capital investments to stay operational, have all contributed to the decision to shut down the plant.³³

Some see the current decommissioning of EWEB's steam system as a lost opportunity for district energy in Eugene. Regardless of whether the system could have been better maintained or updated historically, it is debatable whether the current configuration would be financially feasible now, even with

³¹ (EWEB) Eugene Water and Electric Board, "Steam Utility Transition Plan," <http://www.eweb.org/steam>.

³² Mike Logan, 2010.

³³ Eugene Water and Electric Board, "Steam Utility Transition Plan," <http://www.eweb.org/steam>.

more current technology. District energy systems are costly to install, particularly beneath public right of ways, and a dispersed system such as EWEB's current configuration would require a huge upfront investment in laying new replacement pipes and retrofitting existing buildings with more efficient, district energy compliant heating systems. (In 2008, it was estimated that fixing or replacing the existing 6 miles of pipe infrastructure would cost \$500-600 per foot.)³⁴ Other considerations support a different opinion. This system's decommissioning may benefit future systems in Eugene since it has resulted in extensive media coverage, which serves to familiarize the public with the key concepts behind district energy. It also serves as a local example against which a new system can be contrasted to highlight the key ingredients for success: anchor customers, a condensed district zone with sufficient adjacent development, efficient technology and a flexible fuel platform.

UNIVERSITY OF OREGON

The University of Oregon also has significant experience with district energy. It runs both a district combined heat and power (CHP) plant and district chilling plant to most of its campus. Its CHP plant has been recently offline while it undergoes renovations. It currently has 4-5 million square feet being served by the university's heating plant. The cooling system currently serves about half of campus, but is being expanded.³⁵

The university runs its district heating and cooling infrastructure through a network of tunnels beneath its campus. These tunnels, mostly installed in the early- to mid- 20th century, make the maintenance, repair and installation of new pipes much less expensive and invasive than if earth moving were required each time. While the current system extends as far east as the new Matthew Knight Basketball Arena, there are no plans to extend it further east beyond that site. To extend it further would be very expensive, as the university would have to run through municipal right-of-way or private property. In an interview with the campus architect, Chris Ramey, he

³⁴ Hu Jia et al., "Eugene Water and Electric Board Report," (University of Oregon, May 24, 2010). 2.

³⁵ Chris Ramey, December 9, 2010.

expressed some interest in the idea of a second university-owned district energy facility at the former Romania dealership a quarter miles east of the basketball arena.³⁶

The university uses natural gas to fuel its plants, although it is now considering a future transition to biogas. Chris Ramey hopes that one day it can utilize a gasification plant to capture methane from trash to create biogas to fuel its plants. While his idea may not come to fruition, it is indicative of the high level of commitment toward reducing energy consumption that is driving many university policies.³⁷

Relevance to Other Communities

This study primarily utilizes extensive interviews with key local stakeholders to illustrate the potential for a district energy system in Eugene, Oregon. While some circumstances and findings may be unique to Eugene, many of the findings are relevant to other communities, making this study a transferable tool to a wide range of communities throughout the United States that are considering the promotion of district energy systems.

History of District Energy

Background and Significance

District energy has existed for hundreds of years, with the earliest systems developed in Europe and Turkey. Today it is a primary source of heat in many Scandinavian and Asian countries. In the United States, the beginning of district heating can be traced back to the late eighteenth century when Benjamin Franklin sold heat to several adjacent residences in Philadelphia.³⁸ In 1877, Birdsill Holley designed the first profitable district heating system in Lockport, New York. His system was quickly copied and within ten years, there were twenty district heating systems in operation in the United States.³⁹

Today there are over 6,000 district energy systems in the United States, with most on large campuses, such as universities or corporate sites, owned by a

³⁶ Ramey.

³⁷ — — —.

³⁸ Gochenour, "District Energy Trends, Issues, and Opportunities."

³⁹ — — —, "District Energy Trends, Issues, and Opportunities."

single entity. "The number of customer buildings served by a typical district energy system may range from as few as 3 or 4 in the early stages of new system development to as many as 1800+ customer buildings served by Con Edison Steam Business Unit in Manhattan, the largest district steam system in the world."⁴⁰ Historically, district energy systems were common in downtown cores, but increasingly these have been phased out. By 1980 there were only 60 urban systems remaining in the US.

This decline was due to the increased transmission capacity of the electric grid, which permitted inexpensive, efficient transport of electric power from non-local plants. As power plants moved out of the urban core, district systems could no longer utilize excess heat and steam resulting from electricity generation for their district heating systems, and began operating heat-only boilers.⁴¹ This led to a decline in fuel (and economic) efficiency and resulted in increased pricing for the district steam heat. In the 1980s, as customers left the system and aging infrastructure required costly repairs, system performance worsened and further eroded customer bases.⁴² Eugene's experience with its downtown steam system is characteristic of many downtown systems throughout the US.

While multi-owner systems are common in Northern Europe and Asia, it is unusual in the United States to have district energy systems installed to connect existing and new buildings on sites with numerous property owners. Logically, this adds a significant degree of complexity, raising questions about maintenance, ownership, access and more. However, it also offers numerous financial and environmental benefits that, while difficult to quantify, may be appealing to developers, building owners and the community. In Europe, there are higher instances of large systems serving many buildings because government policies encourage "district heating for its energy efficiency and environmental benefits, along with historically higher per capita energy costs."⁴³ In Stockholm, Sweden, the entire city of 800,000 people is served

⁴⁰ International District Energy Association, "IDEA Report: The District Energy Industry."

⁴¹ — — —, "IDEA Report: The District Energy Industry."

⁴² Gochenour, "District Energy Trends, Issues, and Opportunities." 8.

⁴³ International District Energy Association, "IDEA Report: The District Energy Industry."

by two systems that grew incrementally over time and have shifted their energy sources as new energy sources were deemed more affordable and sustainable.⁴⁴

Today district energy (primarily district heating) delivers “about 3.5% of the total final energy demand in the industrial, residential, public and commercial sectors. About 6.5% of commercial buildings in the US are heated with district heating.”⁴⁵

⁴⁴ Preservation Green Lab and Oregon, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings." 3.

⁴⁵ International District Energy Association, "IDEA Report: The District Energy Industry."

CHAPTER II: RESEARCH FRAMEWORK

Research Question

Using one local district as a case study, what are the key regulatory, governance and financial obstacles and opportunities to developing district energy systems in Eugene?

Research Framework

The purpose of this project is to develop a framework for evaluating the opportunities and obstacles to developing a district energy system in Eugene, Oregon, and to identify strategies for the municipality to mitigate or eliminate some of the identified barriers. This report hopes to serve as a guide for the City of Eugene as it considers whether to devote human or financial resources to further technical or business studies of district energy systems in Eugene. It also illustrates opportunities for the City to make administrative changes that will, at minimum, make future development of a private district energy system more streamlined, attractive and feasible.

The research process for this study included interviews and case studies. Over 20 interviews were conducted with local and national planners, developers, architects, engineers, municipal district energy project managers, consultants, and private district energy companies. Extensive research into the costs and benefits of district systems was conducted, using examples of biomass, geothermal and natural gas powered steam and hydronic systems. One local neighborhood was used as a testing ground to identify some of the unique opportunities and obstacles that may exist. Two national case studies were used to explore the issues discovered by other communities through their development processes. More detailed information about the methodology for this research can be found in Appendix 1.

Case Studies

Montpelier, Vermont and Portland, Oregon are used as case studies to illustrate the problems, successes and learning experiences of other communities. While many communities with established district energy

systems could serve as case studies, these case studies were chosen for their relevance and applicability to Eugene in one or more of the following criteria:

- Scale;
- Municipal role;
- Climate and geographic similarities;
- Fuel sources (potential and likely);
- Legal environment, and
- Governance structure.

In general, the successful examples of district energy systems are either at a far larger scale than Eugene, or are in Canada, which has a very different set of obstacles for its systems. To provide a local context for identifying the unique opportunities and obstacles to district energy in Eugene, Walnut Station is used as a local test site. For more detailed information on case study communities and the lessons learned from each community, see Appendix 2.

Local Case Study: Walnut Station

SITE CONTEXT

Located on the eastern edge of Eugene, Walnut Station is a narrow strip of primarily commercial development lining Franklin Boulevard between the University of Oregon Matthew Knight Arena and Glenwood. It is bordered by the Willamette River to the north, and 15th Avenue to the south and is approximately 75-acres total.⁴⁶ While City plans may define this area more narrowly, for the purposes of this report, the larger district was included and in some instances identified opportunities and obstacles include the adjacent University of Oregon and Glenwood.

TRANSIT

Walnut Station is bisected by Franklin Boulevard (which is also Highway 99 and Highway 126), a six-lane, bisected highway with a separate bus rapid

⁴⁶ Inc. Urbsworks, "Walnut Station Mixed-Use Center Existing Conditions Report," (2005); Urbsworks Inc., "Walnut Station Mixed-Use Center Existing Conditions Report," (2005).

transit (BRT) lane in the middle. This is a major thoroughfare and entry point into Eugene with nearby access to Interstate 5. A major reconstruction of Franklin Boulevard is planned in the coming decade.

REGULATORY CONTEXT

The Walnut Station Mixed Use Plan was finalized in July 2010. This plan formalizes the Walnut Station Special Area Zone designation, (S-WS), which primarily details development patterns desired for this area. This zone is a trial for the form-based codes alternative to traditional municipal building code. These codes outline new-construction requirements that specify site orientation, building massing, quality of the pedestrian environment, solar access and more.⁴⁷

The Walnut Station Mixed Use Plan is supported by both the 2001 Eugene-Springfield TransPlan and the City's Growth Management Policies, both of which promote the development of "nodes" around transit centers as a means of reinforcing the City's urban form goals.

The properties in this zone are mostly zoned community commercial (C-2), with the exception of those along 15th avenue, which are zoned residential.

OWNERSHIP + DEVELOPMENT PATTERNS

This district has "a highly-fragmented land use pattern with multiple ownerships and many existing businesses."⁴⁸ It is comprised of a commercial corridor along Franklin Boulevard with a Market of Choice grocery store, multiple hotels, a few restaurants and bars, and various other small commercial enterprises, as well as residential and office space.

This zone is primarily existing development, with few large parcels or undeveloped lots. The University of Oregon is one of the primary landowners, with a site the size of four city blocks that includes the former Romania car dealership and the former ODOT site to the south of the dealership.⁴⁹

⁴⁷ City of Eugene, "S-WS Walnut Station Special Area Zone - Draft," (2010).

⁴⁸ Urbsworks, "Walnut Station Mixed-Use Center Existing Conditions Report."

⁴⁹ Ramey.

FUTURE DEVELOPMENT POTENTIAL

While there are few undeveloped sites in this district, there are many sites that may be ripe for redevelopment.⁵⁰ A recent study by the City of Eugene and Sera Architects found that “by 2025, the Walnut Station Mixed Use Neighborhood has the potential to accommodate up to an additional 1400 residential units (between 1 and 1.4 million square feet), 200,000 square feet of retail, and 278,825 square feet of open space.”⁵¹ However, a second study found that, “the lower density models are largely feasible under current market conditions, while the higher density model with structured parking is not considered feasible.”⁵² While this area clearly has potential for new development, and is already one of the few areas in Eugene that has experienced extensive new development throughout the recent economic downturn, the extent and timeframe of new development will have great impact on the feasibility of a district energy system.

New development in this zone is driven by its proximity to the University of Oregon and the construction of Matthew Knight Arena. Interviews with architects, developers, city planning staff and university campus planners identified numerous opportunities for Walnut Station to support the kind of square footage and diverse building programs that are necessary in a small, economically feasible district energy system. These opportunities and obstacles, as identified through interviews, are listed below.

OPPORTUNITIES IDENTIFIED IN WALNUT STATION

The following are some of the unique conditions that may serve to support a future district energy system in Walnut Station.

EXISTING CONDITIONS

- **Riverfront Urban Renewal Area.** The northern section of Walnut Station, along the Willamette River, also falls into the existing Riverfront Urban Renewal Area. This may provide additional financial

⁵⁰ City of Eugene and Sera Architects, "Detailed Development Program for Walnut Station," (February 15, 2009).

⁵¹ — — —, "Detailed Development Program for Walnut Station." 7.

⁵² Jerry Johnson, "Financial Analysis of Selected Redevelopment Programs in Walnut Station, Eugene, Oregon," (October 31, 2008).

assistance for development in this zone that could be used to promote district energy.⁵³

- **Hotels.** Walnut Station is already home to a number of hotels, primarily catering to the University, and located on the west end of Franklin Boulevard, within walking distance of Autzen Stadium and Matthew Knight Arena. Numerous interviews and documents have indicated that there may be a need for new hotels in the future.⁵⁴ If new hotels are developed, or the existing stock redeveloped to utilize compatible heating systems, participation in a district energy system may be a great benefit all parties.

According to the US Environmental Protection Agency, hotels represent an “excellent but underutilized market for combined heat and power (CHP).”⁵⁵ Further, more than 10% of the hotels with energy characteristics suitable for current CHP technology are likely to meet a payback on their investment within 5 years.⁵⁶ While local hotels in Eugene do not have sufficient loads to warrant independent district energy or CHP plants, certainly they can play a pivotal role in the success of a neighborhood-scale plant and reap many economic benefits as a result.

Seventy-five percent of a hotel's energy use is spent heating water and guest rooms, on air conditioning and lighting. CHP plants can supply all these loads efficiently, or the heating loads can be met through district heating. In the one-mile of Franklin Boulevard that runs through Walnut Station, there is significant demand for heat and hot water in area's five hotels.⁵⁷ Certainly the heating load provided by these hotels alone could have a major role in creating a financially feasible district energy system if they were all on the same system. Since energy represents one of the few costs within a hotel's control, the opportunities to reduce price fluctuations of energy through higher efficiencies and economies of scale, as well as the reduced costs of heating equipment maintenance offer appealing means for reducing risk, ensuring more predictable operating costs and maximizing profit.⁵⁸

For the developer of a district energy system, hotels are an appealing anchor customer. With relatively predictable and diverse heating loads, both on a daily and annual basis, hotels can provide a large demand for heating as well as a source for excess heat that can be recaptured by the district system. If so, these uses provide prime

⁵³ Strategic Economics, "Key Findings From the Market Overview of Walnut Station and Implications for Future Development." 4.

⁵⁴ Skeehan. Ramey. Urbsworks Inc., "Walnut Mixed Use Station Existing Conditions Report," (City of Eugene, Oregon2005).

⁵⁵ United States Environmental Protection Agency, "Combined Heat and Power Partnership: Hotels and Casinos," <http://www.epa.gov/chp/markets/casinos.html>.

⁵⁶ Agency, "Combined Heat and Power Partnership: Hotels and Casinos."

⁵⁷ Data gathered from phone calls to individual hotels, March 8, 2011.

⁵⁸ — — —, "Combined Heat and Power Partnership: Hotels and Casinos."

opportunities to serve as anchor tenants for a district heating or combined heat and power system.

DEMAND FOR NEW DEVELOPMENT

- **Demand for campus housing.** Student demand for new housing within walking distance to campus is a major driver for all new development in this area.⁵⁹ Recent construction includes Skybox and Courtside, modern multi-bedroom apartments catering to students, adjacent to the new basketball arena. Non-residential development in this area will likely be heavily influenced by the increasing student population and may include more pubs, small restaurants and retail.⁶⁰
- **Underserved Retail Markets.** This area is well positioned to serve demand for increased retail and services from adjacent Fairmount Neighbors, university students, area employees, visitors staying in area hotels or attending university sports events and people traveling through the area on the way in or out of Eugene.⁶¹

PLANNED REDEVELOPMENT

- **University development of Romania/ODOT site.** The university put out a RFP for phased development visions and business plans for this site in January 2011. It is interested in commercial, revenue-generating uses on its large site east of Market of Choice. Past studies have identified the Romania site as good for mixed-use development with housing over retail and the ODOT site as potential for condominiums or apartments.⁶² It predicts that it will choose one of the RFPs for further development.

The university plans to develop this site in a similar manner to its Riverfront Research Park. In this model, developers ground-lease the land for a 50-99 year period, after which any buildings on the site would be turned over to University ownership. This same model can be used for a district energy system on university property: a chosen third-party (such as Corix, or Veolia) would make the initial capital investment and might pay the university a micro-franchise fee. Since the upfront investment in district energy systems is the major expense, and the systems are generally more profitable once the upfront investment has been paid off and the system is able to generate energy at a rate lower than conventional energy costs, this model offers the university revenue in the short term as well as some combination of revenue and cost savings in the long term.⁶³

⁵⁹ Ramey.

⁶⁰ Heather Skeehan, February 9, 2011.

⁶¹ Strategic Economics, "Key Findings From the Market Overview of Walnut Station and Implications for Future Development." 2-3.

⁶² — — —, "Key Findings From the Market Overview of Walnut Station and Implications for Future Development."

⁶³ Ramey.

As a public institution, the university has access to the low-interest loans often necessary to make district energy feasible. It also can utilize those same low-interest funds to support development of sufficient square footage that it can be its own primary anchor customer. Excess capacity can be sold to adjacent buildings, but if there is sufficient square footage developed on the university site, no additional anchor tenants may be required.⁶⁴

- **Planned reconstruction of Franklin Boulevard.** This major six-lane arterial highway, running through Walnut Station, is proposed for large-scale reconstruction in the next decade. This reconstruction would create a multi-way boulevard, separating the through lanes from adjacent businesses with the addition of local access streets. These streets would create a buffer between the high volume of through traffic on the Boulevard and the neighborhood, while allowing slower speed auto access to businesses and local collector streets, as well as safe corridors for bicyclists and pedestrians.

OTHER OPPORTUNITIES

- **Branding Walnut Station as a ‘green’ district.** The new housing in this district is marketing itself as environmentally sensitive, transit-oriented development. New housing projects were allowed a reduction in minimum parking spaces and even with the reduced supply; many of the parking spaces have not been filled as residents opt not to bring vehicles. A district energy system may tie into that branding.
- **University support for development of Walnut Station.** The university depends upon the attractiveness of its larger community to appeal to students, faculty and staff. “The attractiveness of the community is important to getting quality students and faculty here, particularly as they become more tuition-driven.” The university would like to see a quality environment in Walnut Station with a walkable center where residents are not dependent upon cars.
- **Connection between affordable housing and district energy.** Affordable housing projects and district energy systems share similar financing model time frames, and the two have the potential to complement one another.

The section of Franklin Boulevard running from Walnut Station east through Glenwood toward Springfield has been identified as an area the City of Eugene would like to target for future affordable housing development. The Tiger II grant application, written by Eugene and Springfield, highlighted the district’s proximity to public transportation and convenient amenities, as well as the high demand for student housing that drives up market rental prices, as key reasons for investment in affordable housing along this corridor.

⁶⁴ Dean Pape, February 9, 2011. Interview with Dean Pape.

Financing affordable housing is a difficult and fragile process, with new developments often barely able to meet the upfront costs. District energy systems offer a number of cost savings opportunities for affordable housing: buildings without individual mechanical systems have reduced maintenance and operations costs and responsibilities and may have lower insurance premiums, since they do not have boilers or on-site combustion. More importantly, participation in a district energy system provides a buffer or protection from short-term fluctuations in energy pricing and ensures low utility rates for tenants in the long term as well. Affordable housing developers recognize the long-term cost benefits of energy efficiency and prioritize low utility bills for tenants.

From a system developer's perspective, affordable housing developments may provide a stable customer base that is not subject to the uncertainties associated with commercial customers (i.e. going out of business, moving, etc.). In this area, affordable housing developers are some of the most experienced with district-energy values and benefits, and may be ideal partners to have at the table as a new system is planned.

OBSTACLES IDENTIFIED IN WALNUT STATION

Most of the identified obstacles in Walnut Station are relevant to other sites in Eugene. Many of them are within the realm of municipal influence and highlight the need for municipal support if a district energy system will succeed.

EXISTING CODES LIMIT DEVELOPMENT

- **Primarily mid-rise development.** The form based code overlay in this district includes height restrictions that will have great influence over the types of development that may be built here. Mid-rise limits the feasibility of certain building uses and the return on investment a developer can get. This may also limit any large-scale development that could be a key anchor for a district energy system. In the near future, we are likely to keep seeing 'podium' construction, with a concrete first story and wood framed upper stories built 4-6 stories high.⁶⁵
- **Current parking code.** Current code requires a specified number of parking spots for new development to be on the site. A more relaxed interpretation of the code that allowed for fewer required parking spaces or a district approach to parking would allow for greater compact density.⁶⁶ Current limit the type of development

⁶⁵ Skeehan.

⁶⁶ City of Eugene and Sera Architects, "Detailed Development Program for Walnut Station." 6.

possible in the area. As long as they are in place, new development will likely be of the type and quality that exists now.⁶⁷

LIMITED DEMAND FOR DISTRICT ENERGY COMPLIANT DEVELOPMENT

- **Housing for university students fast tracks building schedules.** Because of the set timeline of academic schedules, the recent private housing developments have been fast-tracked in order to lease up in time for the upcoming school year. This does not afford developers or architects much time to research new technologies, or to accommodate additional permits or delays. Developers are unlikely to consider connecting to a district energy system unless it is comparable or better, in time and price, than conventional heating or power systems.⁶⁸
- **Lack of market demand for sustainability.** College students looking for rental housing are not necessarily demanding more sustainable design unless it has attractive aesthetics. Parents (often the ones paying for the students' housing) may be attracted to the district energy system but it's unclear whether they might be willing to pay more for it.⁶⁹
- **Limited demand for office space.** The potential for new office development in this area is limited. Studies have found that most office users would prefer to locate in suburban or downtown locations. Further, high office vacancy rates and low rents indicate low demand.⁷⁰ From a district energy perspective, office space is an ideal complement to the timing of loads from residential and hotels.

PUBLIC INVESTMENT NEEDED TO MOTIVATE DEVELOPMENT

- **Public investment needed to prompt development.** While this site clearly has potential for significant growth in future years, property values are unlikely to increase and prompt redevelopment without significant public infrastructure or development investment.⁷¹

Additional Sites to Consider

Walnut Station was chosen as a local testing ground for potential district energy issues because of its complex nature, not because it is the best, or easiest, place to develop a system in Eugene. In general, a district energy system will be most easily and affordably developed in a previously undeveloped (or entirely redeveloped) site with a large volume of new

⁶⁷ — — —, "Detailed Development Program for Walnut Station." 12.

⁶⁸ Pape.

⁶⁹ Skeehan.

⁷⁰ Strategic Economics, "Key Findings From the Market Overview of Walnut Station and Implications for Future Development." 3-4.

⁷¹ City of Eugene and Sera Architects, "Detailed Development Program for Walnut Station." 12.

construction built in a short timeframe. Other qualities that will facilitate a system include funding opportunities, such as tax increment financing (TIF); an Urban Renewal Area (URA) designation; municipal planning initiatives that designate higher density or direct capital improvement funds to the area. The list below names a few other sites in Eugene that may be considered for future district energy, and some of the benefits or unique conditions to each. More information about some of these sites is in Appendix 3.

- **Riverfront URA.**
- **EWEB Riverfront.**
- **Civic Stadium** redevelopment.
- **Rexius** redevelopment.
- **New PUDs** such as Crescent Village.

CHAPTER III: MUNICIPAL LEADERSHIP

Municipal involvement is imperative to the success of district energy. The most successful systems are those that are owned or developed by municipalities.⁷² Short of that, access to public low-interest funds increases financial feasibility and reduces risk to developers. At minimum, major policy, administrative and community education support by municipalities is crucial. District energy as a concept can pencil out in many places, however private developers look for communities with municipal commitment, lack of regulatory barriers, and public support to pursue development of new systems.⁷³ While the City roles may vary, there is certainly a place for municipal involvement in every stage of the process.

PHASES OF DISTRICT ENERGY DEVELOPMENT

1. Advocacy, vision, policy development
2. Feasibility assessment
3. Detailed investment analysis – decisions about ownership and financing, as well as securing customer commitments
4. Development – design, permitting and construction
5. Operations, maintenance, expansion

The City has a number of unique and essential roles to play in creating this favorable environment for district energy. First, it can determine value of the positive externalities of district energy systems that benefit public health and community goals but are difficult to quantify in advance. Examples include lower greenhouse gas emissions, decreased price volatility and improved community energy security. Second, it can plan ahead for district energy, and add installation of necessary infrastructure, such as insulated pipes, to other public works projects such as road repair. If the majority of the infrastructure can be installed without the major expenses of land moving and tearing up

⁷² Alisa Kane, February 9, 2011. Gwen Hallsmith, 2011.

⁷³ Hallsmith.

roads, this will significantly lower the total cost of the system, resulting in lower rates for customers and increased confidence for investors. Third, it can create a policy framework to provide incentives for building owners to connect. Fourth, it can use its financial tools to promote new development in areas ideal for district energy systems. Fifth, exercising its authority to set rates, it can ensure that rates set are commensurate with the required risk and investment. Last, it can create an exclusive franchise territory to reduce competition between the district energy utility and other energy providers.⁷⁴

Below is a list, based on that compiled by the PoSI, of the types of roles required in a district energy development process.

- **District energy advocate.** This may be a governmental agency or non-profit that educates public about district energy. The City is an ideal entity to fulfill this role.
- **Facilitator/Convener.** This is the City: "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.... As a result, without a strong facilitator driving the process, even an economically viable project can fall by the wayside."⁷⁵ The City plays this role regardless of whether it intends to retain ownership
- **Pre-feasibility consultant.** Considers the location's current and projected energy costs, population density, development trends and analyzes whether or not there's an opportunity for district energy in that location.
- **Feasibility consultant.** Prepares a comprehensive study that looks at site-specific energy intensity data, right of way alignments, specific sites for energy plants, and other factors. Also analyzes the business and technical case, including pro forma, sensitivity analysis, plant locations and fuel source options and benefits.
- **Franchisee/Owner.** Is public, private, or a public/private hybrid. This entity owns the district energy system's physical assets. Private owners are often backed by large financial institutions, investment banks, or pension funds. Owners can act as operators (e.g. Veolia Energy and Corix Utilities) or hire operators.

⁷⁴ Tom Osdoba, interview by Hannah Bryant, *Managing Director for the Center for Sustainable Business*, (December 6, 2010).

⁷⁵ (PoSI) Portland Sustainability Institute, "District Energy for Portland: Development, Ownership & Governance Models," (2011). 7.

- **Project Developer.** Delivers the physical assets (energy center, distribution) to owner/financer.
- **Operator.** Responsible for ongoing technical operation and maintenance of the district energy system. (I.e. Veolia Energy)
- **Regulators.** Establish and monitor safety standards for construction, performance, and pricing/consumer protection.⁷⁶

MUNICIPAL SUPPORT

“Without an active, engaged local government, efforts to create district energy systems face insurmountable challenges.”⁷⁷ Examples of missed opportunities related to district energy are abundant, and serve to further reinforce the need for local government leadership. In municipalities with numerous planning divisions, it can be hard to facilitate projects that require support and participation from many divisions. A project like district energy spans neighborhood development, public works, planning, green building and other departments. In general, planning for district energy is very similar to planning for a community social and commercial node. Any area identified as a potential future development site, where policies support higher residential density with adjacent commercial uses, especially where streets may be replaced or repaired and other infrastructure improvements are scheduled should be considered for district energy.

Eugene may be hindered by its lack of municipal resources and experience promoting and directing development. In contrast, Portland has the Portland Development Commission (PDC), which has its own funding sources and a long history of influencing the direction of development in Portland. In addition to incentives or financial assistance, PDC may provide administrative support to help projects keep moving forward and to aid in getting through “the hoops at the city” level.⁷⁸

To build internal understanding and to encourage staff to “buy into” the project, a combination of educational workshops for department heads and staff, as well as support from the City Manager directing this to be a work-

⁷⁶ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

⁷⁷ Preservation Green Lab and Oregon, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings." 12.

⁷⁸ Pape.

item on numerous departments' agendas may be necessary. It may be useful to hire a departmental coordinator who is both knowledgeable about district energy systems; experienced with implementing them; and unencumbered by personal or historic issues with various departments and personnel involved to spearhead this coordination effort.

CHAPTER IV: PLATFORMS

Basic Configuration

A district energy system consists of one or more energy centers for producing hot and/or chilled water, underground distribution pipes to individual buildings, and energy transfer stations within individual buildings. Internal hydronic (water-based) heating and cooling systems within buildings are the responsibility of developers and owners. District energy eliminates the need for on-site boilers and in the case of central cooling, on-site chillers and cooling towers.⁷⁹

The simplest piping network has two parallel lines (a supply and a return line). At one end they are joined to the heating supply, at the other end to each other. "Customers draw hot water from the heated supply line, extract their energy needs and return the cooled water through the return line. In this way, all customers, regardless of their exact location, access the same supply temperature."⁸⁰ While most existing hot water systems supply pressurized hot water at about 194 degrees Fahrenheit, the trend is for newer systems to supply water at a lower temperature, with lower pressure. This is a more efficient heating method, and reduces costs of generation significantly.⁸¹

Most modern district heating networks use insulated carbon steel pipe laid in trenches beneath the right of way to transport hot water from a central facility to nearby buildings. Although pre-insulated pipes can be laid directly in the ground, and these are widely used in Europe, in the US pipes are generally installed in concrete trenches. This trend may change, however, as "improvements in insulation techniques, construction standards and operating practice are reducing piping heat loss to a minimum, allowing the pipes to be direct-buried at a depth of one meter rather than the three to four meters normally associated with water or sewer lines."⁸² Because piping and its installation are such a significant portion of the project budget (possibly up to 60 percent), well-planned district energy networks are built around a large

⁷⁹ Compass Resource Management, "Business Analysis for a Neighborhood Energy Utility in the North Pearl District."

⁸⁰ Church, "Is District Energy Right For Your Community? Part 1: The Concept." 32.

⁸¹ — — —, "Is District Energy Right For Your Community? Part 1: The Concept." 32.

⁸² — — —, "Is District Energy Right For Your Community? Part 1: The Concept." 32.

anchor customer, “in clusters with hub and spoke arrangements or connected sequentially and without dead-ended spur lines.”⁸³

Buildings served by district energy are often isolated from the system by an energy transfer system that comprises heat exchangers, control valves and instrumentation. Often, these components are custom designed, owned and maintained by the district energy utility.⁸⁴ Individual buildings are metered to monitor and bill energy usage. Metering also makes it easier to detect and locate any insulation failures and leaks in buildings.⁸⁵

From the energy transfer station, the energy can be distributed throughout the building in a number of ways. Most common are hydronic (hot-water based) radiant systems installed under floors or above ceilings. Other energy distribution systems include fin-type baseboard convectors, wall or floor-mounted perimeter radiators or fan coils with forced air. Fan coils are typically used when both heating and cooling are required while hydronic systems are primarily for heating.⁸⁶

There are two alternatives for billing structure. The first includes a combination of fixed and variable costs. The fixed costs represent a ‘capacity charge’ or the customer’s share of the installation cost for the system. The variable costs represent the cost of operating the system, including fuel costs. Some argue that this billing structure passes all risk and responsibility for the costs to the initial group of customers, and may stifle growth at the expense of the rate of return. The second billing structure amortizes the project costs over an extended term, which shares the risk over many more customers and many years. “This would lead to lower cost for initial customers and an incentive for system expansion.”⁸⁷

⁸³ — — —, “Is District Energy Right For Your Community? Part 1: The Concept.” 32.

⁸⁴ — — —, “Is District Energy Right For Your Community? Part 1: The Concept.” 32.

⁸⁵ Preservation Green Lab and Oregon, “The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings.” 4.

⁸⁶ — — —, “The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings.” 4.

⁸⁷ Ken Church, “Is District Energy Right for Your Community? Part 3: Supporting Resources,” *Municipal World* January 2008.

Determining Energy Sources

Flexibility of fuels and energy sources and the ability to take advantage of unique local conditions is one of the appeals of district energy systems. As a result, there is no 'typical' district energy source or system configuration. It is important when considering a new system that the fuel source is not the primary driver. District energy professionals and project managers interviewed for this study emphasized that it is imperative not to get caught up in the engineering of district energy systems before determining the feasibility. The technology was never identified as a barrier to system development and should be assumed to be possible. Engineering studies and preliminary designs are costly and should not be enlisted until after preliminary feasibility studies have demonstrated positive potential for a system.⁸⁸

District systems can utilize a wide range of energy sources, including natural gas; biomass; geothermal; waste heat from industry, municipal sewage or other sources; biogas, etc. Interestingly, in one tiered rating of ideal fuel sources, renewable energies were placed near the bottom. The hierarchy placed fuels that are also pollutants (i.e. landfill gases, sawdust, municipal solid waste, etc.) at the top of the list, since using those fuels "addresses both health and energy issues."⁸⁹ The second choice for fuel would be "emissions that are relatively benign, such as industrial waste heat." Third is renewable energy, including intentionally produced biomass, and last is fossil fuel.⁹⁰

Appendix 4 offers a brief explanation of some of these platforms, and their costs and benefits. Those listed are neither the most common, nor the most appropriate to Eugene, but are included to demonstrate the variety of energy sources that can be tapped.

Determining Feasibility

First steps to determining district energy feasibility include:

⁸⁸ Tom Osdoba, December 6, 2010.

⁸⁹ Church, "Is District Energy Right For Your Community? Part 1: The Concept." 32.

⁹⁰ — — —, "Is District Energy Right For Your Community? Part 1: The Concept." 33.

- **Site-specific opportunities.** Are there sources of industrial waste heat? Are there other unique conditions?
- Determine **energy consumption** for existing buildings (including peak demand, annual energy consumption and daily energy use profile).
- Consider **potential demand** based on future development.
- Examine **fuel source options and supply availability**, starting with conventional sources.
- **Capital cost and system complexity** of a plant using different available fuels.
- **Site and space requirements** of different fuel options.
- **Energy efficiency, greenhouse gas emissions and water use** of different fuels.
- Finally, consider **more renewable options.**⁹¹⁹²⁹³

For a more extensive list of criteria to evaluate when determining the feasibility of particular district energy sites, please refer to Appendix 5.

⁹¹ Compass Resource Management, "Business Analysis for a Neighborhood Energy Utility in the North Pearl District."

⁹² Kane.

⁹³ Ken Church, "Is District Energy Right for Your Community? Part 2: Sizing the System," *Municipal World* December 2007.

CHAPTER V: OBSTACLES + OPPORTUNITIES

Eugene, the State of Oregon and the Pacific Northwest in general are well known for progressive policies that promote sustainability and energy efficiency in the built environment. These values translate easily to support of district energy, however the actual implementation of district systems often encounters roadblocks because policy framework has not been updated to facilitate its development, regulations are complicated and redundant or financing is inadequate for this business model. This chapter illustrates the range of policy, regulatory and financial obstacles to development of district energy, as well as unique opportunities or conditions that support these systems, at the state, local and neighborhood scales.

Oregon

Oregon has been a testing ground for many innovative energy efficiency policies and technologies over the past decades. It has a history of both state and local support for new programs that share the underlying values of district energy: energy security, utilization of local resources, reduced consumption and lower greenhouse gases. Indeed, the state has offered financial support for a municipal district energy system in Klamath Falls, Oregon, as well as assistance identifying regulatory issues and opportunities to streamline permitting for the proposed project in Portland. In January 2006, then-Governor Kulongoski issued an Executive Order addressing and promoting state support of sustainability measures. This order included a directive to promote sustainable economic investment and development with the goals of “promoting renewable and efficient energy use, reducing greenhouse gas emissions and reducing material use and costs.”⁹⁴ These are the same goals that district energy systems have been successful at addressing in other communities.

⁹⁴ Ted Kulongowski, "Executive Order 06-02," (January 19, 2006).

Eugene

CITY OF EUGENE

Recent community planning initiatives, including the Climate and Energy Action Plan and the Envision Eugene process, have identified increased promotion of energy efficiency in the built environment as a key goal. Three of the primary objectives in the Envision Eugene Draft Proposal include:

- Plan for changes in electricity generation and distribution methods and the resulting effect on land use.
- Take full advantage of energy efficiency opportunities in retrofits and renovations to existing buildings as a form of energy efficient redevelopment.
- Facilitate the use and generation of renewable energy for buildings as part of redevelopment....⁹⁵

Due to the lack of comparable, modern systems in the region, the permitting process is not entirely clear. In its recent document '*Streamlining Portland's District Energy Regulations*,' the Portland Sustainability Institute (PoSI) suggests "regulatory reforms will be most successful if they are made while an actual project is wending its way through the regulatory process."⁹⁶ To some extent this is inevitable, as every district system is unique and may encounter unexpected permit and licensure requirements. However, given the strong language in recent community-driven plans naming the creation of a district energy system and planning for changes in electrical generation as goals, it seems appropriate to begin the process of increasing municipal staff capacity and regulatory structure for energy related projects before a district energy system is underway.

This study finds that every community with a complete or in-process district energy system surveyed went through a regulatory update process to create a framework for the systems. Montpelier, Vermont had a public vote on changing City Charter language. Vancouver, BC had to change its Constitution in order to make district energy systems legal. Most recently, Portland, OR completed its regulatory improvement process to add language

⁹⁵ City of Eugene, "Envision Eugene: Draft Proposal," ed. Planning and Sustainability (Eugene, OR March 2, 2011).

⁹⁶ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations." 4.

that specifically addresses small-scale energy production.⁹⁷ If there is a regulatory improvement or code amendment processes planned in Eugene, one recommendation is to use that opportunity to strengthen and clarify policies regarding district energy.

Appendix 6 lists the identified processes and permits that will likely be required of any district system in Eugene, with the goal of providing a manual for City staff and future developers.

Governance

“While the technologies are relatively established and simple, the process for starting and growing new district energy systems that supply buildings with multiple owners and varied development timelines, while pursuing energy sources with both public and private benefits, can be complex and challenging. It requires strong vision, clear public policy and mechanisms to facilitate development and secure public benefits, and considerable coordination. There are many paths to successful development of a district energy system, and the most appropriate path will depend upon local conditions and circumstances unique to each development.”⁹⁸

As with most aspects of district energy, there is no single ownership or governance model. Models range from public ownership and operation, to a public/private hybrid, to purely private ownership. Regardless of ownership model, almost all instances of district energy development will require the policy support of the local municipality.

District energy ownership can take many forms, and the most appropriate structure for a system is dependent upon many factors. “Generally, projects can be through of as taking the form of municipal ownership or private ownership. However, private ownership need not exclude municipal involvement and municipal ownership need not exclude private involvement.”⁹⁹ This section addresses issues related to governance of district energy systems as illustrated through interviews and research for this report, while Appendix 7 outlines various ownership models.

⁹⁷ City of Portland, "Highlights of RICAP 5," ed. Bureau of Planning and Sustainability (Portland, OR 2011).

⁹⁸ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations." 3.

⁹⁹ Biomass Energy Resource Center, "Forming, Financing, and Permitting a District Energy Facility in Vermont," (August 2009).

Legal Limits to City Support of District Energy

Parties interviewed and literature reviewed vary in their perspectives of how cities can ensure sufficient buy-in to district energy. Some say that cities should require new buildings connect to district energy systems, if there are systems in the area with sufficient capacity. (An example often used is that when electricity infrastructure was developed, owners were not given the option to opt out of installing it – cities mandated all new buildings be wired for electricity. Similarly, cities mandate sewer and water connectivity.)

Portland is exploring the legality of at least requiring a feasibility analysis for district energy as a condition of acceptance of new development proposals. Others claim that is illegal and the city cannot interfere with private commerce and manipulate the marketplace.

District Energy Ownership In Eugene

Based on preliminary research, a governance partnership between the municipality and a private district energy company, such as Veolia Energy, seems most appropriate to the skills, resources and expertise of the City.

This partnership capitalizes on municipal funds, and the municipality's commitment to facilitate the project to protect its funds, with the extensive experience of a private company to guide the project through development and toward full build-out while helping train local employees in the maintenance, operations and business management of the system. After a set period (i.e. 5 years) the partners can choose to renegotiate ownership: the municipality may desire full ownership of the system to capture revenue, support sustainability objectives and facilitate other planning goals.

Alternatively, the municipality may not want to retain any ownership or governance options, in which case the private company can purchase its share, or it can be sold to other investors.

Public and Private Support

Any municipal funding or governance involvement will require some degree of public support. This will likely entail a lot of educational outreach, both in the public and within the municipal government, to build familiarity with the

concept. Business owners in particular will need high confidence in the system in order to relinquish independent ownership of building HVAC systems. For all of this, having a partner in the district energy system with lots of experience (i.e. the University, or a private company such as Veolia Energy or Corix Utilities) as well as a strong, clear business plan showing lower prices in a relatively short period, will be important.

Financial Opportunities

District energy raises concerns about financial feasibility for all parties involved. "District energy is fundamentally a business model."¹⁰⁰ While there are many opportunities for broader community benefits, the primary priority of the system developer must be financial feasibility. As emphasized throughout this study, regardless of public or private ownership, new community district energy systems require municipal support for their success. This support may come in the form of staff hours spent researching permitting requirements; plan reviewers studying code and engineering requirements, etc. Often there is some level of municipal financial investment as well, ranging from reduced fees to incentives to full municipal ownership of a system.

System developers are certainly concerned with the financial feasibility of the system, the timeframe in which it will achieve the minimum square footage necessary to be profitable and the variables that may impact its long-term finances. Building developers and owners question the costs and benefits of relinquishing responsibility for heating infrastructure to an outside utility and the impact of those decisions on their pro formas.

This section begins with an overview of some of the funding opportunities available for district energy systems. It then addresses some of the primary issues that may be of concern to the City and to developers.

General Funding

Funding for district energy systems may be arranged through traditional lending agencies; municipal bonds; investors; third-party infrastructure

¹⁰⁰ Compass Resource Management, "Business Analysis for a Neighborhood Energy Utility in the North Pearl District." 9.

owners; state and local incentives, directly from the company installing the system or through the creation of energy financing districts. Many successful district energy projects have used city bonds as part or all of the significant financing needs. For example, Nashville, TN and Toronto, Canada used revenue and general obligation bonds to raise the capital for infrastructure and energy plant construction. The use of these bonds can be an indication of city support, which is often a factor in federal, state and private investment.¹⁰¹

“Capital funding often depends on the nature and status of the project. The moderate rate of return developed from most district energy projects limits the level of interest shown by the venture capital sector. However, institutions such as pension funds see the pricing stability afforded by district energy as a pathway to long-term stable returns.”¹⁰²

“Funding incentives are available in the form of direct financial grants, tax incentives, low-interest loans, or utility or environmental policies that increase the financial prospects for the project.”¹⁰³ Some incentives target combined heat and power (CHP) projects, while others are designed to promote biomass. The Combined Heat and Power Partnership at the US Environmental Protection Agency maintains a regularly updated funding database that tracks incentives and provides information about how to access various revenue streams that “financially reward, or monetize, the environmental benefits of CHP.”¹⁰⁴ More information about funding is available here: <http://www.epa.gov/chp/funding/funding.html>

Given this strong policy support for energy efficiency and district energy at the state and local level, there may be more opportunities to negotiate funding assistance or other incentives. Below is a list of some known avenues

¹⁰¹ Preservation Green Lab and Oregon, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings." 13.

¹⁰² Church, "Is District Energy Right for Your Community? Part 3: Supporting Resources."

¹⁰³ United States Environmental Protection Agency, "Funding Resources for Combined Heat and Power," <http://www.epa.gov/chp/funding/index.html>.

¹⁰⁴ — — —, "Funding Resources for Combined Heat and Power."

for possible district energy funding. Others, including short-term or one-time loan programs, can be found through links listed at these sites:

- <http://www.rurdev.usda.gov/or/energy.htm>
- <http://energytrust.org/shared-resources/info/tax-credits.aspx?src=business>
- http://www1.eere.energy.gov/financing/types_assistance.html
- http://www.grants.gov/applicants/find_grant_opportunities.jsp
- <http://www.dsireusa.org/incentives/index.cfm?state=us&re=1&EE=1>

More detailed information about funding sources can be found in Appendix 8.

See Appendix 9 for a list of project technologies funded with SELP loans. Appendix 10 is a brochure outlining SELP. Appendix 11 outlines the Oregon Business Energy Tax Credit program.

City of Eugene

STACKING INFRASTRUCTURE IMPROVEMENTS

One opportunity for significantly reducing the costs of district energy development is to pre-install the insulated pipes in the right-of-way when the road is torn up for other reasons (such as replacement of sewers or water pipes). In Walnut Station, a prime opportunity will be if the planned Franklin Boulevard redevelopment project happens. This project should be watched, and public works staff informed of the district energy component ahead of time, so the opportunity is not lost to take advantage of the cost-savings from adding district energy pipes without shouldering the cost of digging up the road again.

PLANNING + COMMUNICATION

Understanding the impacts of various civil engineering projects on future district energy is imperative. For example, while digging up the right of way along a road is expensive, crossing under Franklin Boulevard to connect a district energy system along both sides may be so expensive it's cost prohibitive. In Portland, Portland State University has a district energy system with excess capacity. It wanted to eventually expand the system, but didn't consider the cost of going under the light rail. Now that the MAX runs through

its campus, it will cost millions more dollars just to extend the system under the MAX tracks, and is no longer financially sensible.

PATIENT CAPITAL

Due to low interest rates, municipalities can access low-cost capital that does not require as large or short-term return on investment as private capital. This type of funding is ideal for new district energy system that may not reach full build-out (and therefore profitability) for a number of years.

ENERGY FINANCING DISTRICTS

These districts are designed to incentivize property owners' ability to make energy efficiency upgrades to their property and can be used to support connection to district energy systems. Based on tax increment financing (TIF) or urban renewal area (URA) districts, these programs aim "to minimize the upfront costs of improvements by providing property owners with pay-as-you-go funding options, which include a longer repayment period than might otherwise be possible with conventional financing."¹⁰⁵ In these contracts, the assessments run with the property, so program costs and benefits can be transferred to subsequent owners when the property is sold. This reduces the financial risk of investment to the first property owner. Further, by expanding the financial benefits of energy efficiency policy to a broader spectrum of residents, the City is more likely to garner support for policies or investments supporting district energy. Montpelier, Vermont and Santa Barbara County, California have financing districts based on this model.

District Energy Developer

TRADITIONAL DEVELOPMENT MODELS

Traditional development models mean new projects are often developed by a limited-liability entity created for the sole purpose of that project. As a result, projects have to pencil out based solely on their own resources and cannot consider future development on their pro formas, even if future phases are anticipated. From a district energy standpoint, it is almost impossible for a district energy system to pencil out to serve only one building, but if future

¹⁰⁵ Santa Barbara County, "Municipal Energy Financing District: Feasibility Study," (November 19, 2009).

phases of planned buildings (i.e. phased apartment or office complexes) can be incorporated into the financial analysis, it may be more achievable.¹⁰⁶

MINIMUM SIZE REQUIREMENTS

While district energy does afford the potential for a competitive advantage resulting in cost savings, “a high level of fuel savings must be obtained or otherwise building boilers will have an advantage.”¹⁰⁷ While there is no precise breakeven point for determining how many buildings, or the amount of square footage required, to make a district energy system financially viable, Tom Osdoba, of the Center for Sustainable Business at the University of Oregon says that based on his extensive experience with district energy, between 250,000 and 500,000 square feet of built space on a system is required. He says that in Eugene, especially in this economic climate, he would lean toward the smaller number, however a system with fewer than 250,000 square feet is unlikely to pencil out.¹⁰⁸

Other factors that impact financial feasibility include: the timing and size of the heating loads on the system (it’s ideal to have sympathetic load profiles and sizes to maximize efficiency), and the distance between buildings on the system (the closer together they are, the lower the cost of pipes and the less heat is lost through transmission).¹⁰⁹

DISTRICT DENSITY

In addition to the square footage being served by the system, the distance between buildings being served is another variable that impacts finances. “The disadvantage of district heating as compared to individual building boilers is related to the cost of transporting heat from the centralized heat production plant to the consumers.... Therefore, in order for district heating to be competitive, the level of fuel savings would have to more than offset the high costs of transportation to the individual consumers.”¹¹⁰ Since the cost of fuel is typically 50-80% of the total heat supply costs, district energy system

¹⁰⁶ Pape. Osdoba. Skeehan.

¹⁰⁷ Gochenour, "District Energy Trends, Issues, and Opportunities." 27.

¹⁰⁸ — — —, "District Energy Trends, Issues, and Opportunities." 27.

¹⁰⁹ Tom Osdoba, 2011.

¹¹⁰ Gochenour, "District Energy Trends, Issues, and Opportunities." 27.

configurations that emphasize density and proximity to the central plant are most financially attractive.¹¹¹ For this reason, “district energy investments have historically occurred where there is either significant vertical density of floor space or common ownership... the market sectors typically served by district energy systems are commercial office space, large hotels, convention centers and sports arenas and increasingly, apartment buildings and condo conversions.”¹¹²

ANCHOR CUSTOMERS

All interviewed emphasized that any system needs at least one large, committed customer with high demand. Ideally this customer is also involved in owning or managing the system to ensure long-term commitment. Examples of uses with high demand include grocery stores (high cooling demand/producers of waste heat); indoor pools (high heating demand); multi-family residential (high demand in early mornings and evenings) in conjunction with office/commercial (high demand during working hours).

PROFILE LEVELING

A level profile is the balancing of energy loads throughout the day to achieve maximum efficiency of energy production using the least equipment and fuel. “A level profile may be achieved through several means, including the creation of land-use planning policies that encourage mixed development.”¹¹³

EXISTING BUILDING STOCK

Along with climate conditions, the age and condition of buildings have a great impact on their energy efficiency. The type of heating systems currently installed determine the feasibility of retrofitting existing buildings to district energy compliance. The majority of Eugene’s building stock was built prior to more stringent energy efficiency requirements were in place, and very little of it uses hydronic systems for heating. Unfortunately, this means that our oldest buildings, in greatest need of efficiency upgrades, are the hardest to convert to district compliance. For these reasons, a district system in this

¹¹¹ — — —, “District Energy Trends, Issues, and Opportunities.” 29.

¹¹² International District Energy Association, “IDEA Report: The District Energy Industry.”

¹¹³ Church, “Is District Energy Right For Your Community? Part 1: The Concept.” 32.

community will be more successful utilizing new construction as its base customers rather than depending on conversion of existing buildings.

Walnut Station

ANCHOR CUSTOMERS IN WALNUT STATION

As it runs through the study area, the north side of Franklin Boulevard is lined with hotels catering primarily to visitors associated with the university. In the five hotels on this one-mile stretch there is a total of 369 guest rooms; two indoor heated pools; one outdoor year-round heated pool; four commercial hot tubs and two saunas. In addition, most of these hotels have on-site laundry facilities for guest use, as well as in-house laundry facilities for washing linens. This constitutes a large, concentrated demand for heat and domestic hot water and potential for some of these existing facilities, if converted to a district system, to serve as anchor customers.

CHAPTER VI: CONCLUSIONS + RECOMMENDATIONS

The items below are generalized findings for Eugene based on the regulatory, governance and financial issues outlined above, as well as on interviews and existing literature about district energy.

While many issues have been identified throughout this report, two are worth highlighting as they provide the most basic obstacle and opportunity for district energy in Eugene. The primary obstacle to district energy is the standard development model in which financing is contingent upon pro formas demonstrating short-term profit. The traditional economic framework for development inhibits district energy, as well as many other long-range planning goals, because the financing of these projects does not fit within the pro formas of individual buildings. While building pro formas generally need to demonstrate a profit within a short timeframe, district energy systems that are contingent upon neighborhood development can take years to achieve a profit. It is difficult for any one party to shoulder this level of financial risk. This is an opportunity for the City to help with bridge funding, to help offset the gap between investment and profit.

Opportunities

The primary opportunity in Eugene, for district energy or any other kind of energy efficiency program is a high level of governmental and public understanding of energy efficiency measures in the built environment. Just the fact that Eugene has so many recent planning initiatives that align with district energy, or name it specifically, is encouraging. The public and the municipal staff are much more knowledgeable and supportive of innovative sustainability policies than many communities. While this enthusiasm may carry over to support of a district energy system, it is important for the City to carefully consider the lower-hanging fruit of energy efficiency before pushing for district energy. There are many other strategies that will help to accomplish its goals of lower energy consumption and reduced greenhouse gas emissions that may be less financially or politically risky. These should be explored before a district system is pursued. These opportunities include:

LOW-GRADE ENERGY SHARING

There are many different scales and technical systems that fall under the broad term 'district energy.' Of these, many opportunities at the district scale exist to exchange waste heat and coolth between buildings, using an interconnected hydronic system and heat pumps. This form of district energy sharing does not require a central heating or cooling plant. Rather, each building uses its own existing heating infrastructure, but instead of releasing excess heat into the atmosphere, it is used to heat water in low-velocity, low-temperature (55-85 degrees) hydronic systems. It can then be stored in insulated chillers until extracted by heat pumps for use by other buildings on the system, allowing that waste energy to provide usable heating (125-130 degrees) for another building or another time period without having to generate any new heat through combustion. This is a far cheaper option, since the infrastructure (hydronic pipes and heat pumps) is inexpensive compared to creation of a new district energy plant, and it may be more comfortable for building owners who like the idea of increased efficiency and re-use of waste heat, but are hesitant to give up their own individual systems.

For owners or developers willing to relinquish in-house heating systems in favor of a shared system, one option in Eugene is a closed loop ground coupled heat pumping in deep (300'), vertical ground bores. Due to hydrology and geology, it's difficult to achieve this kind of depth in other places; but in Eugene, due to the 'Eugene Formation' geology (consolidated volcanic ash), "it's like Jell-O to drill through and the bores hold open for pipes to be put in."¹¹⁴ Additional infrastructure, such as heat pumps, may be able to utilize local and state incentives such as those provided by the Energy Trust of Oregon: <http://energytrust.org/public-sector/incentives/Other/equipment-upgrades/HeatingAndCooling/>

Benefits to this type of system include:

- Can be **modular**, or expanded in phases.
- Is **not reliant upon fuel** input. This system is merely facilitating an energy exchange between buildings. Each building still maintains its

¹¹⁴ Michael Hatten, January 31, 2011.

own HVAC infrastructure or shares a common source of renewable, low-grade heat.

- May be **more comfortable for building owners**, developers and lenders.
- **Utilizes low-grade energy** rather than high quality fuels such as natural gas. As Mike Hatten explained, “to heat a room to 72 degrees, one only needs a heat source that’s 73 degrees.” This heating platform utilizes excess heat to fulfill low grade heating needs, rather than combusting high quality fuels that would best be used for other purposes. This is the type of project proposed for the EWEB Riverfront site, utilizing geothermal wells and heat pumps rather than central boilers to provide building heat.¹¹⁵

Obstacles

DIFFICULTY OF RETROFITTING BUILDINGS.

Retrofitting buildings with non-compliant HVAC systems to make them district energy compliant is difficult and expensive. It entails installing or replacing pipes for hydronic systems with those that are suitable for the desired temperature range and pressure of the district heating system. While some cities have a historic building stock already installed with pipes that can be easily retrofitted to district heating, Eugene does not. Most buildings in Eugene have gas or electric forced air heating which is extremely difficult to retrofit to hydronic systems.

The implication of this obstacle is that district energy in Eugene will be most successful in an area with a large volume of new construction. Given the high minimum square footage (estimated to be 250,000 -- 500,000 square feet in this area) necessary to make a district system feasible, this is a policy that should only be promoted in a location at which a lot of new construction connected to the district system will come online in a short time period.

In the meantime, retrofitting our existing building stock is one of the most effective ways to reduce our community’s energy footprint, as well as improve comfort and indoor air quality of our buildings. It is significantly less expensive than new construction and creative strategies for how to continue upgrading the existing buildings should be considered. EWEB, HACSA, St.

¹¹⁵ Hatten.

Vincent de Paul and the State of Oregon all offer assistance and incentives to promote retrofits of existing building stock.

Recommendations

In order to move from the community goal articulated in the Climate and Energy Action Plan toward having a district energy system in Eugene, the City of Eugene can take a number of concrete steps toward streamlining the process of district energy development and attracting system developers.

Following are a wide spectrum of recommendations and options for district energy support, drawn both from the Portland Sustainability Institute and from this research. These recommendations vary widely in their scope, resources required and political implications. All are included, however, as a resource for the municipality, while it identifies its preferred role and level of involvement in supporting district energy.

REMOVE BARRIERS

These strategies are the ‘low-hanging fruit’ for supporting district energy. They require minimal municipal investment of time or resources and are supportive of a wide array of energy efficiency projects and goals, not solely district energy.

- **Community Education.** Many of the emerging energy efficiency policies and technologies are unfamiliar to the general public. Others, like district heating, may have negative connotations in this community due to misunderstandings and historic problems. Fundamentally, people resist change, and changing to unknown systems that are perceived as ‘untested’ requires a higher level of education than switching between different conventional energy sources. Consequently, educational programs to increase public awareness of district energy or any other new energy efficiency policies and technologies are important in helping accelerate public acceptance. If Eugene has any thought that it might pursue a system in the future, it should begin the process of educating the community about the benefits of district energy systems now. The Montpelier, Vermont case study illustrates the benefits of long-term education programs when the community is asked to vote to support a system.
- **Strengthen Municipal Capacity for Energy Efficiency Projects.** Almost unanimously, literature and interviews about the barriers to district energy systems cites lack of institutional

understanding at the municipal level as a primary obstacle to development. The complexity of these projects demands a high level of support and understanding at the municipal level. Leadership from department heads and City Council in creating an inter-departmental district energy project team to work through municipal policies around energy generation will help to build capacity. Further, continuing to educate staff about the range of small-scale energy generation projects that are being developed in other communities and the costs and benefits of each will aid in building municipal staff enthusiasm and understanding of these topics.

- **Develop + Promote Energy Modeling Tools.** Most architects and developers are unfamiliar with tools available to quickly calculate energy (and cost) savings and tax credits available from various energy efficiency strategies. This may present an opportunity for the City and EWEB to help make that information more accessible and/or to expand incentive programs to include more varied energy efficiency strategies and technologies.
- **Building envelope improvements.** In a climate such as Eugene's, a well-designed and insulated building has a very low heating demand, even in the coldest months.¹¹⁶ In terms of reducing greenhouse gas emissions and lowering energy consumption, building highly efficient building envelopes in all new construction will almost invariably have a much greater impact than if new buildings are built to conventional standards and connected to a district energy system. While district energy is one avenue toward energy efficiency in the built environment, this policy has fewer political or cost implications.
- Decide on and empower a **single entity or department to play the role of district energy Facilitator** — i.e. “district energy champion” — in Eugene.
- Establish an **Inter-Department District Energy Working Group** tasked with the explicit goal of developing a manual for district energy development in the City of Eugene. This group could include representatives from many City departments, local and regional experts and EWEB. It would comb through the entire regulatory framework — a good portion of which is discussed in the appendices of this paper — and look for opportunities to streamline it.
- Create **clear permitting and planning guidelines** — to support expedited site selection for district energy centers.
- **Remove code requirements mandating redundant heating systems.** For example, ensure that local code does not require a backup boiler for a building connected to geothermal heat.

¹¹⁶ Mark Miksis, December 7, 2010.

- Use any upcoming code amendment processes to **update regulatory framework** to include language about district and small-scale energy production. This language should outline the regulations and expectations of such a facility, including how it's licensed and who oversees licensure. This ordinance could be based on the existing codes for telecommunications facilities, as well as the recent Regulatory Improvement Code Amendment Process (RICAP 5) adopted in Portland.¹¹⁷
- Develop a **comprehensive district energy assessment map** of Eugene that details underground linear infrastructure, scheduled capital improvement projects within the Right of Way (e.g. road improvements, sewer and stormwater infrastructure projects), building types, building energy use intensity, and building equipment and distribution systems, including age of equipment. This would promote and support coordinated planning and installation of infrastructure installation and repairs. To minimize overall cost and disruption, road reconstruction and resurfacing should be more easily coordinated with the installation of sewer pipes and bioswales, fiber optic cable, streetcar and bus rapid transit alignments and district energy distribution pipes.¹¹⁸
- Develop a **loads profile map** of Eugene that outlines the desired district energy zone and the load profiles within it. Buildings with sympathetic loads that complement those that exist should be promoted in this zone to strengthen the economics of a future system.¹¹⁹
- **Define a thermal energy district** based on ORS 198 – Creation of Special Districts.¹²⁰ Creating a new, exclusive district will help to attract a district energy developer and aid that developer's financing process. The district will have the power to issue bonds, set rates, etc. A local example similar to this is the Metropolitan Wastewater Commission.¹²¹

PROVIDE INCENTIVES

These strategies require financial incentives from the City in the form of direct grants, tax relief, support accessing state and federal funds, or the City serving as an anchor customer for a district energy system.

- **Promote more sustainable heating systems.** The Courtside housing project installed individual electric resistance heaters in each unit because the cost savings to the developer was more important to

¹¹⁷ Portland, "Highlights of RICAP 5."

¹¹⁸ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

¹¹⁹ Church, "Is District Energy Right For Your Community? Part 1: The Concept." 32.

¹²⁰ State of Oregon, "Chapter 198 - Special Districts Generally," (2009).

¹²¹ Tom Osdoba, January 26, 2011.

the pro forma than long term cost savings to future tenants. In Skybox there are individual hot water boilers in every unit. These were installed because it was cheaper than installing central boilers to serve the entire building. A program to incentivize more sustainable heating in new construction might help prevent future projects from utilizing such energy intensive systems and could promote installation of systems that can be easily connected to district energy systems.¹²²

- Help identify or **create a low-cost source of financing** for district energy. The inter-departmental working group may also be assigned the role of staying abreast of new district energy grants and loan opportunities from the state and federal government. Other funding strategies may include tax increment financing or urban renewal area designation to subsidize district energy infrastructure.
- **Commit to connecting all municipal buildings** to district energy systems as soon as it is cost-effective to do so. In other words, any municipal building with “district energy ready” radiant heating and cooling systems would connect to a distribution system as soon as the line were accessible in the adjacent right of way.
- **Disclose the expected replacement date of municipal buildings’ mechanical systems.** This would let district energy developers know when an additional load may be ready to connect to a district system. The City, the County and all federal government buildings could presumably publish the anticipated replacement dates for their own buildings’ HVAC systems, as well as those buildings’ compatibility with district energy. Private building owners could also either be required or offered incentives to disclose this information.¹²³
- **Encourage affordable housing developments to be district energy compliant.** City financial support to decrease any high upfront costs associated with district energy will make it more feasible for new housing projects to install the low temperature hydronic systems required for compliance with future systems, or to connect to an existing district energy system. Encouraging affordable housing developments to connect to a district energy system will help to provide the long-term stable customer base that a district energy developer needs to see. While none of the affordable housing developments proposed along the Franklin corridor are of sufficient size to constitute an anchor customer unto themselves, certainly if all of them were connected to a district energy system they would have sufficient demand to constitute an anchor.
- Offer partial (temporary or ongoing) **property tax relief** to property owners who connect their buildings to district energy.

¹²² Skeehan.

¹²³ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

- **Establish core district energy zones** with strong connection incentives, along with streamlined policies for system extensions beyond the core area.¹²⁴
- **Establish a municipal energy finance district** such as those in Montpelier, Vermont and Santa Barbara County, California. Similar to TIF or URA districts, these areas are targeted for energy investment with the long-term understanding that municipal investment will yield higher tax returns in the future.
- **Provide gap financing** for new systems in areas with relatively few initial customers or a prolonged build out. This financing bridges the financial gap between development and financial neutrality for the developer, and can be justified on the basis of a broader public good.

MANDATES

The following strategies are examples of requirements the City could impose if it wanted to take a decisive role in ensuring the success of a district energy system. Due to the financial implications on the public and development community, they are more politically risky than merely removing barriers or providing incentives.

- **Require district energy feasibility studies** for large buildings and master plans. For example, the City of Vancouver, BC requires such studies for master plans greater than two acres. Similar requirements could potentially be incorporated into the Eugene Planning Department process. The Planning Department should also explore the possibility of adding feasibility study requirements to local zoning regulations.
- **Make connection to district energy systems mandatory.** The most successful municipal district energy systems are developed in places where the City takes an active role in leading the policy, and views district energy connections the same way it views storm water, septic, and water connections -- making them mandatory for all new buildings. The success of district energy requires that perspective in order to achieve the necessary critical mass of buildings to render the system economically viable.
- Levy a **municipal carbon tax** on energy purchases. This would have a similar effect as reducing franchise fees for district energy, but it would encourage all kinds of emissions reductions rather than explicitly favoring district energy over other measures. The resulting revenue stream could be used to capitalize the previously referenced low-interest investment fund. Boulder, Colorado, Quebec, and British Columbia, as well as Sweden, Finland, Great Britain and New Zealand

¹²⁴ — — —, "Streamlining Portland's District Energy Regulations."

have all levied carbon taxes. In most of these countries, the revenues are used either to reduce payroll taxes or to fund green energy or sustainable infrastructure investments.¹²⁵ A full discussion of carbon taxes as a funding mechanism for district energy is beyond the scope of this paper.¹²⁶

Next Steps

Subsequent research and feasibility studies based on an identified site should consider applying for an Oregon Community Renewable Energy Feasibility Fund grant or EWEB-funded feasibility studies for further analysis (see more information in this paper under Financial Issues).

MORE RESEARCH

- Invest in **next-step studies**, including a location-specific preliminary feasibility study that includes a sensitivity analysis. Rather than evaluating ‘under what conditions will a district system work?’ this study should use the perspective of ‘how wrong can the economic assumptions be and still have this system work out?’¹²⁷ Data and projections to consider include:
 - Square footage of planned new construction?
 - Feasibility of retrofitting any adjacent buildings to district system compliance?
 - Projected energy use (based on building program, square footage, construction type) of all buildings on planned system?
 - Amount of pipe that would need to be installed
 - Cost per square foot for installation (including permitting, right of way access fees, material and labor costs)?
 - What kind of revenue will be necessary to justify the capital used?

This work may be contracted from private consultants, or local university resources such as the Community Planning Workshop (CPW) or the Lundquist School of Business.

¹²⁵ For a country-by-country review of carbon taxation, please see <http://www.carbontax.org/progress/where-carbon-is-taxed/>

¹²⁶ Institute, "Streamlining Portland's District Energy Regulations."; Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

¹²⁷ Osdoba.

Conclusion

District energy systems are simple in concept, but very complex to develop. Throughout the process, the municipality is a crucial player, although its chosen roles can vary. Without municipal support, a proposed district energy system will almost certainly flounder in the planning phases.

“In summary, city leadership is needed over the long-term process of creating district energy systems, and includes strategic vision, stakeholder engagement, policy priority and management capacity. This is especially true in neighborhoods of existing buildings, where the timing issues with respect to aggregation of demand requires cities to play a critical coordination role. In light of the long-term nature of district energy, cities need to begin crafting strategies, policy proposals and infrastructure development plans today, with future district energy systems in mind.”¹²⁸

This paper illustrates the benefits and obstacles to district energy systems, as well as additional opportunities to fulfill community objectives around energy with policies and programs that may be less time and resource intensive than district energy. Many of the recommendations around policy clarification, municipal capacity building and resource allocation are applicable to a wider range of energy efficiency and energy generation projects than just district energy. The municipality has a diverse spectrum of roles it can choose to play in promoting a more energy efficient and sustainable built environment, but it is clear that its leadership is key if Eugene is to achieve its progressive sustainability goals.

¹²⁸ Preservation Green Lab and Oregon, "The Role of District Energy Systems in Achieving Sustainability For Neighborhoods of Existing and Historic Buildings." 13.

APPENDIX I: METHODOLOGY

It is important to note that throughout this project there was not a goal to conclude that district energy is necessarily the best mechanism for achieving community goals outlined in the Climate and Energy Action Plan, nor is it necessarily feasible. Many subsequent site-specific levels of environmental, siting, political and financial analyses must be completed before that determination can be made. The goal for this report is to provide useful information to staff at the City of Eugene from which they can derive whether or not pursuing district energy fulfills their policy objectives.

Community Context

Some data is applicable to all sites within Eugene. For example, energy sources available in this area, and regulatory issues. These findings can be assumptions applied to all sites in this area.

Local Case Study: Walnut Station

Due to time constraints, it was decided that only one district in Eugene would be investigated at a site level, but with the understanding that many of its findings would be applicable to other areas and sites in the City. The site chosen offers some unique opportunities and barriers, however it was chosen for its ability to apply to other areas. It is neither the best, nor the worst, place in the city to develop a district energy system.

CHOOSING THE SITE

The site was chosen through a broad level evaluation of four preliminary site options. These included: Crescent Village PUD; EWEB Riverfront; The Riverfront URA and Walnut Mixed-Use Node. This investigation considered ownership patterns at these sites; legal and policy barriers to district energy in these sites; financing and governance conditions; known future development plans and more. This selection process included interviews with individuals involved with planning and development at these sites, as well as examination of their planning documents: The Climate & Energy Action Plan; EWEB Master Plan; Riverfront URA Guidance; Walnut Street Node and Crescent Village PUD.

Ultimately, it was found that while the EWEB Riverfront Site may offer the most conducive conditions for a district energy site, that investigation into the Walnut Station/East Campus district would be most beneficial to gaining an understanding of the local conditions impacting district energy development. Due to its fragmented ownership patterns, development pressures resulting from the adjacent university, delineation as a transit-oriented development (with associated funding opportunities and future street re-development plans) and mixed-use land use patterns, this site offers potential for district energy but also presents many issues. It is through investigating these issues that this study hopes to identify next steps and implementation strategies for the community to support district energy.

DEFINING THE AREA

Due to the importance of new development to the success of a district energy system, it is unfeasible to restrict this study area to any predefined neighborhood or district. Since much of the new development is resulting from the university – either university-owned projects or to provide services to the university community – it was important to expand the study area to include not only Walnut Station but also the East Campus area adjacent to the university. As a result, some characteristics of the study area become less definite. For example, while there may be funding opportunities for some of Walnut Station due to its transit-oriented commercial designation, these may not extend to the East Campus. However, we consider it more important to reflect the true opportunities of the district, including those immediately adjacent to it, than to rigidly adhere to a municipally defined neighborhood with consistent funding and regulatory structures and ignore opportunities outside its borders.

PARTICIPANTS

Data was primarily gathered in the form of open-ended interviews with key stakeholders involved in planning, development, financing and engineering locally, as well as with district energy planners and owners in other communities. The open-ended interview style was chosen to ensure that

interviewees are able to express their concerns and experiences with district energy and to share stories that may lead to additional lines of questioning.¹²⁹

Interviewees were asked questions about their professional experiences with district energy; their perceptions about barriers to district energy; what changes might increase its feasibility; and their views about whether it is something they would want to pursue if it ‘pencils out.’ Gathering perceptions from key stakeholders about the opportunities and barriers to district energy in Eugene is an important element to feasibility, since perceptions of local professionals can heavily influence public opinion.

The first round of interviewees was identified through their role participating in planning and development in the Walnut Station/East Campus district. After identifying an initial contact person, they were telephoned or e-mailed them to give an overview of the project and to request an interview. Prior to our scheduled interview, each interviewee was sent a memo reiterating the background and the purpose of the project and outlining the questions they would be asked. These memos clearly stated that the interviewee is a graduate student partnering with staff at the City of Eugene to conduct a research project that will serve as both her graduate school terminal project and also become a public document that may be referenced or used to guide future projects.

Interviewees include University of Oregon campus planners, developers, and City of Eugene planning staff. At the end of each of these interviews, interviewees were asked who else should be included in this conversation. This technique, called the ‘Snowballing Interview’ or ‘Referral’ method, helps to ensure that saturation is achieved and that the most information is gathered.

Additionally, interviews were conducted with individuals involved with developing municipal district energy systems in other communities, including Vancouver, British Columbia; Portland, Oregon, and Montpelier, Vermont.

¹²⁹ William Foddy, *Constructing Questions for Interviews and Questionnaires: Theory and Practice in Social Research* (New York, NY: Cambridge University Press, 1993).

Interview and Research Design

Since the purpose of this study is to investigate the actual and perceived conditions that may impede the development of local district energy systems, the interview was a primary component for data collection. To help shape the interviews, a series of interview guides were created for certain demographics. These guides were tailored for each individual interview based on the interviewee's background and affiliation with district energy. The open-ended interview methodology was utilized to create a conversational interview and to encourage individuals to expand upon their answers or to offer additional information or stories.

Data Gathering

INTERVIEWS

For all interviews conducted by phone interviewees were asked for their permission to use a digital voice recorder to record the interview. Interviews were begun with an explanation of the interviewer's role and the focus of the project. Interviewees were reminded that as a researcher for the City of Eugene, and given the identifiability of people in our small community, their identities could not be kept anonymous. Any comments made that they would like to be 'off the record' should be identified and would be deleted.

CASE STUDIES

Case studies are used to apply diverse sources of evidence and experience to the research questions. These exploratory case studies were done prior to the bulk of interviews with local subjects, and they informed the interview questions and additional data gathered.¹³⁰ Like the selection of a local district for evaluation, case study communities were chosen to present a wide range of potential issues and opportunities for the development of district energy. Neither community is heralded as a best case or worse case example, but both offer a number of important lessons for Eugene and had involved developers and planners who were willing to share their experiences.

¹³⁰ Robert K. Yin, *Applications of Case Study Research*, vol. 34 (California: Sage Publications, Inc., 1993).

Montpelier, Vermont was chosen for a number of reasons: its small population (8000 people) is an indicator that community size is not a barrier in Eugene. It is an example of a unique partnership between diverse entities: the City of Montpelier and the State of Vermont, which offers lessons for Eugene should the city wish to partner with the university, or a private developer to create a district energy system. Further, Montpelier's district energy system is still in the process of being developed, so there are many individuals with current knowledge and opinions about the obstacles to district energy development willing to share their experiences.

Portland, OR was chosen as a second case study. Portland and Eugene share so many conditions (climate, state legal ordinances, building typology, etc.) that it was an obvious choice for inclusion. Like Montpelier, the Portland district energy system is still in the planning and research phase. While this means there is no complete system to learn from or to gather data on, it also means there are far more people who can speak to the role of the municipality in developing the system and ways in which the city could or should facilitate the project.

Data Analysis

After each interview, extensive notes were typed. Interviews were not transcribed verbatim, but rather organized by subject in order to ensure easy cross-referencing with other interviews. Key topics, questions, areas for further research and contacts were highlighted for further action.

The snowballing methodology was applied not only to interview contacts, but also to the research process. Due to the unprecedented nature of this type of study, it was impossible to know all the relevant research questions from the outset. Rather, each interviewee was asked what they felt the early analysis needed to include, and these areas were evaluated for applicability to this community. Relevant research areas were rolled into the project and undertaken as part of the local context data collection. While unconventional, this iterative process was the only way to ensure that this report evolved with the discovery of new information and was not inappropriately limited by preliminary research questions.

APPENDIX 2: CASE STUDIES

Montpelier, Vermont

Montpelier has “committed to a goal of reducing greenhouse gas emissions and fossil fuel by the City, its citizens, and its business community by at least 80% by 2030.”¹³¹ As one of its concrete approaches to reducing fossil fuel usage and greenhouse gas emissions, it proposed building a state of the art biomass-fueled district energy system to heat State, City and private downtown buildings.

POLITICAL CONTEXT

Montpelier is a small city of less than 8000 people in central Vermont. As the state capital, it has an estimated daytime population of almost 20,000. While this community is not one that is known for pushing innovative policies or undertaking major planning projects, Vermont does have a history of progressive efforts toward sustainability, particularly around energy efficiency. Montpelier is somewhat unique in the state for having a higher than average education rate and a high rate of political participation, which its planners feel helped give early traction to the concept of district energy.

GEOGRAPHIC CONTEXT

Downtown Montpelier is bisected by the North Branch running north-south and the Winooski River flowing east along the south edge of town. Every few years the downtown area is in danger of flooding due to heavy rains or rapid winter thaws. When this happens, gas and oil boilers in building basements become an extreme environmental hazard. The city’s downtown is compact – just a few blocks of brick, two-story buildings with the State complex only a few blocks away. City offices, library, schools, fire department and police station are also located in the central downtown.

DISTRICT ENERGY PROJECT HISTORY

It was with the hazard mitigation goal of eliminating downtown Montpelier’s individual building boilers that the city residents first began undertaking preliminary investigations into district energy in 2003. A group of residents,

¹³¹ Vermont City of Montpelier, "Montpelier Community Renewable Energy Project," (2009).

some of whom were involved in energy efficiency policy -- including the founder of Biomass Energy Resource Center (BERC), a national resource center on biomass with a focus on thermal energy and combined heat and power -- were the early promoters of district energy. This group of citizens gave early talks on the topic, including a slideshow and talk at the local library. BERC has continued to act as an advisor to the city, reviewing RFPs and contractors' bids, as well as conducting preliminary feasibility studies.

The concepts of a district energy system were not difficult to sell to Montpelier residents or to state legislators. The state capital complex already utilizes an obsolete district heating system. Two of its three boilers are over 64 years old and in need of replacement. Thus, it made sense that the State and City would partner to fulfill their mutual and independent goals with a single system.

In 2010 the City was awarded an \$8 million Department of Energy Recovery Act grant – the largest granted in the country. The grant will help to fund the building of a 41 MMBtu combined-heat-and-power (CHP) biomass district energy system. The system will heat the state complex, including the capital building, as well as 175 other public and private buildings downtown. Additionally, it will provide an estimated 1.8 million kilowatt hours of electricity into the grid.¹³² A feasibility study performed by Veolia Energy North America estimates the construction costs for preliminary build-out will be approximately \$22.8 million and construction will take 16-18 months.¹³³

The system will burn locally-sourced, sustainably-harvested biomass for all of its fuel source – estimated at 10,000-15,000 green tons per year.¹³⁴

According to a feasibility study conducted by BERC in 2008, even after accounting for potential job loss due to decreased dependence on fossil fuels, this system will create at least 35 new permanent jobs locally harvesting, processing and delivering fuel to the district energy system.¹³⁵ In 2009 the state Legislature authorized a minimum of \$100,000 toward the

¹³² Austin, "Montpelier Building Biomass District Energy System."

¹³³ — — —, "Montpelier Building Biomass District Energy System."

¹³⁴ — — —, "Montpelier Building Biomass District Energy System."

¹³⁵ City of Montpelier, "Montpelier Community Renewable Energy Project." 19.

connection fees to the district energy system for private businesses and homeowners.¹³⁶

Following the receipt of the 2010 grant, the City had to pass a bill to change its City Charter in order to legalize municipal governance of a district energy system. Further, a ballot measure to pass a municipal bond to fund the City's share of construction costs was put up for vote simultaneously. This measure created an energy efficiency district in all of Montpelier that provides a range of efficiency benefits, including financial assistance for any property owner wanting to install renewable energy systems or implement energy efficiency measures. Its broad efficiency objectives and larger target area helped to build political support for the district energy system among those it would not benefit directly.¹³⁷ The bills both passed with over 80 percent of the vote. The city is now working on engineering design, final permitting and acceptance of RFPs, as the Recovery Act grant monies must be obligated by 2012.¹³⁸ Ultimately, the City and the State will jointly own the project. It will be an educational model for district energy, with promotional materials and advertising throughout the State Capital.¹³⁹

ISSUES IDENTIFIED THROUGH MONTPELIER'S PROCESS

Lessons learned from interviews with Montpelier's Planning Director (who is also serving as project manager for the district energy project) include:

- **Working with multiple partners can be difficult.** If multiple partners are involved from the outset, a clear delineation between roles and responsibilities is necessary. A mutually-agreed upon strategy and timeline for the process may help prevent confusion and misunderstandings.
- **A project of this scale requires a team.** One person, even in a full-time role, may not be sufficient to juggle all the complex parts. It is not realistic to think that a sole project manager can oversee a district energy system while maintaining an unrelated workload.
- **Community education is critical.** Montpelier's success in voter referendums to support district energy is attributed to the many years

¹³⁶ — — —, "Montpelier Community Renewable Energy Project." 1.

¹³⁷ — — —, "Montpelier Community Renewable Energy Project." 11.

¹³⁸ Austin, "Montpelier Building Biomass District Energy System."

¹³⁹ City of Montpelier, "Montpelier Community Renewable Energy Project." 2.

of community education that preceded any political action. By the time the system was introduced as a ballot measure, voters were very familiar with key concepts.

Portland, Oregon

Located just 110 miles north of Eugene, Portland shares a similar climate and demonstrates very similar heating load patterns in its buildings.

DISTRICT ENERGY PROJECT HISTORY

While Portland has a historical steam district heating system (now inactive) built in the 1950s that is still in place beneath much of downtown, its current district energy project was initiated in the early 2000s. At that time, the City was especially interested in district energy as a way to meet its climate action goals.¹⁴⁰

In 2008, the City hired the consulting group Compass Resource Management to conduct a district energy feasibility study for the North Pearl District. This district was chosen for its recent development activity and potential for future development. The study made the basic case for district energy using a few alternative scenarios, loads and capital supplies. In each case district energy was found to save its customers money and to reduce greenhouse gases.¹⁴¹ While the subsequent construction slump caused many developable lots to sit vacant, the study has given the City the quantitative evidence that district energy is a worthy cause and one to promote when construction resumes in that area and others. Since this study was completed, four other sites in Portland have been identified as potential areas for future district energy development.

Following the positive conclusions of the Compass Resource Management study, Portland Bureau of Planning and Sustainability wrote proposals for stimulus grants to support further analysis, outreach and research. The money was granted, as part of a larger package, and has encouraged the City to pursue district energy. Ultimately the City may be a partner in a district energy facility, but will likely not pursue full ownership. It may be happy to

¹⁴⁰ Kane.

¹⁴¹ — — — .

have a private company come in and own a facility and have no ownership role of its own. Possible partners for future systems include OHSU (which, as a quasi-public institution also has access to public funding) or a private company such as Veolia Energy.

In 2009, in an effort to ensure that future energy-sharing projects were permissible and streamlined, the City of Portland underwent a regulatory process to change its code. This process, the regulatory improvement code amendment process (RICAP) has facilitated a number of innovative energy sharing projects since it was adopted. One example of a new project in Portland, made possible by the adoption of RICAP, is Columbia Biogas. This company will produce biogas out of up to 195,000 tons of local food waste annually, with a secondary production of high-quality fertilizer and soil amendments created out of the solid byproducts.

While Portland has not started its engineering or construction phases, it has done extensive research into the obstacles to district energy development. It recently contracted with the Portland Sustainability Institute (PoSI) to establish the necessary public utility commission processes for regulation of sales of energy produced by district energy systems, as well as other regulatory obstacles. That study was used extensively when writing the Regulations chapter in this paper.

ISSUES IDENTIFIED THROUGH PORTLAND'S PROCESS

- **Right-of-Way Access.** Who regulates the street right-of way? Who regulates the infrastructure and who regulates the finances? Can a city reserve space in a right of way for future development plans? There's no main infrastructure bureau that coordinates bus rapid transit construction, road repair, pipe replacement and all other projects in the right-of-way.
- **How to ensure future district energy customers?** Can the city mandate feasibility studies for master district energy plans? Can it ask developers to do that feasibility study and/or hook up to a proximate site with district energy capacity? Is that interfering with the marketplace?
- **Build-out timeframe.** Unlike Vancouver, BC, which had such an influx of capital due to the Olympics that it knew it would achieve short-term full build out, Portland has a slower growth trajectory. How

does the City ensure sufficient build-out to render a new district energy system profitable in an acceptable timeframe?

- Portland Bureau of Planning and Sustainability recognizes the possibility that there may be **minimal environmental benefit** to a district energy project, especially in the short term.
- **Development review.** The complexity of this type of project will make it difficult to review in a timely manner, and yet the City knows that a long-delay might kill the project from a developer's perspective.

Patient capital. While the City has access to low-interest loans that can allow it to not see a return on its investment for many years, private developers seek a much shorter return on investment. In sites such as the N. South Waterfront, this means that a private developer will be unlikely to invest in a district energy system since the site will not reach full build-out for 20-30 years.¹⁴²

¹⁴² Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

APPENDIX 3: ALTERNATIVE SITES

Riverfront URA

SITE DESCRIPTION

This 'site' is actually 178-acres along the southern banks of the Willamette River, stretching from the EWEB Riverfront site and Coburg Road on the west to I-5 on the east, bounded by Franklin Boulevard to the south and the Willamette River to the north. Much of this site is bisected east to west by the railroad, as well as the Millrace.

RELEVANT ZONING OR PLANS

Much of this area is under the Willamette Greenway Overlay Zone. This zone, outlined by Oregon State Planning Goal 15 aims to, "Protect, conserve, enhance and maintain the natural, scenic, historical, agricultural, economic and recreational qualities of lands along the Willamette River."¹⁴³ This Goal further states that land use within this zone shall be maintained as it was in 1975, unless use changes are approved by the City, as per its comprehensive plan and the Department of Transportation (DOT).¹⁴⁴

Perhaps most importantly, this site is defined by its inclusion in an Urban Renewal Area (URA), created in 2004. A URA is a municipal tool to support economic development in a particular area. It enables the city to use public funds to incent development or improvements to attract development.

OWNERSHIP/GOVERNANCE

This zone has many property owners, including EWEB and the University of Oregon. In the western half of this site, there are many large parcels of land owned by a single-owner. However, the eastern half of the site is primarily zoned residential or community commercial, with small parcel sizes and many property owners.

¹⁴³ Oregon State Department of Land Conservation and Development, "Statewide Planning Goals," *Department of Land Conservation and Development*, www.oregon.gov/LCD/goals.shtml (accessed December 2, 2010).

¹⁴⁴ Oregon State Department of Land Conservation and Development, "Statewide Planning Goals," 6.

FUNDING

Tax increment financing is an economic tool available through the establishment of an Urban Renewal Area to use public funds to finance community development. It uses future tax revenue gains resulting from improved properties in the URA to finance current projects. It is used to motivate development in designated areas, based on municipal goals.

FUTURE DEVELOPMENT PLANS

The Riverfront Research Park is a University of Oregon plan to develop 1 million square feet of commercial real estate to “attract and promote the growth of technology and the economy of Oregon by providing an environment conducive to research and innovation.”¹⁴⁵ Thus far, approximately 25 percent of the planned development is built out. Currently, plans are moving forward on proposed construction of the next phase (800 River Front Parkway), a 79,800 square foot LEED-proposed building for the Oregon Research Institute.

This 67-acre site is state-owned and development here is financed through the Oregon University System. Buildings are designed, constructed, owned and managed by private developers for the duration of their leases (50-98 years) at which point they become the property of the University of Oregon. The City of Eugene has constructed some public infrastructure on this site, using tax increment revenues from the Riverfront URA.¹⁴⁶

UNIQUE CONDITIONS

The existence of a URA and its financing opportunities, combined with university support and plans for some of this area, and large areas of university-owned greenfields may help to drive growth in this area faster than in other parts of Eugene. However, the geographic shape of this area – long and thin, with a railroad running through it, may make it difficult to build a district energy system here, based on the likelihood of a more dispersed development pattern. District energy systems are most financially feasible

¹⁴⁵ Riverfront Research University of Oregon, "Riverfront Research Park Information," <http://researchpark.uoregon.edu/html/information.html>.

¹⁴⁶ Oregon, "Riverfront Research Park Information."

when there are many buildings in a dense development and opportunity to grow the system without large distances or major hurdles, such as roads and train tracks, to cross.

CONCLUSIONS ON THE RIVERFRONT URA

This site has many discreet planning and ordinance conditions within its boundaries, making it hard to apply any findings to the entire URA. While its funding opportunities are appealing, as an evaluative case study it may not provide data that is widely transferable to other parts of Eugene.

EWEB Riverfront Site

SITE DESCRIPTION

EWEB currently owns a 27-acre parcel along the riverfront, near downtown Eugene. Since the recent move to its new Roosevelt Operations Center, approximately 15-acres of this site is vacant, as are much of its two administrative buildings on site.¹⁴⁷

RELEVANT ZONING OR PLANS

The EWEB Riverfront Master Plan was developed during a 2-year public master planning process. This non-binding plan specifies the type of development the community would like to see at this site. Additionally, this site is within the Riverfront URA. This may make future development on this site eligible for URA funding. Last, and most importantly, the EWEB site already has a completed District Energy Study completed by a local engineering firm. This is the only known site in Eugene to have this level of analysis completed.

OWNERSHIP/GOVERNANCE

Importantly, the EWEB Riverfront Site has only one owner – the Eugene Water and Electric Board. As a result, the development of a district energy system in this area might be much easier. In the next year or so, parcels of the 35-acre property will be put up for sale, with the assumption that the northern parcels (north side of 4th Ave.) will sell first.¹⁴⁸

¹⁴⁷ Rowell & Brokaw Architects, "EWEB Riverfront Master Plan," <http://eweb.org/riverfront>.

¹⁴⁸ EWEB Management Group Interview, 2010.

FUNDING

While there are no concrete funding scenarios for the EWEB site, it does fall within the Riverfront Urban District, making development in this area qualified for some public funding assistance. See Riverfront Urban Renewal Area for more details on tax-increment financing.

FUTURE DEVELOPMENT PLANS – INCLUDE NOTES FROM MEETING

EWEB currently plans to vacate most of its riverfront site in phases over the next 5-10 years. Already, the majority of its staff and operations have moved to its new headquarters at Roosevelt Avenue. EWEB recognizes that many of its operations are not the highest and best uses for the site, and proposes that after its move is completed in November 2010, that the site be redeveloped in a manner more appropriate to community and environmental goals.

From 2008-2010, EWEB partnered with local architecture firm Rowell-Brokaw to undertake a public participation process, resulting in a master plan for the complete redevelopment of this site. This report, approved by the EWEB board of commissioners in June 2010, “envisions a riverfront easily accessible to downtown with restaurants, cycling paths, retail shops, walking trails and housing.”¹⁴⁹

Next steps in this process include hiring a consultant to help finalize its land use application and then submitting both the land use application and the Riverfront Master Plan to Eugene City Council for approval. These documents will create a framework for future development based on community goals.

Importantly, mixed-use buildings such as those desired on the EWEB site are ideal for district energy due to their load diversification. Also, they are likely to have significant square footage – far more than a residential or existing neighborhood – and to have a large amount of development happen in a condensed timeframe, rather than piecemeal building over many years. This type of development would make the creation of a district energy system in this area more feasible.

¹⁴⁹Rowell & Brokaw Architects, "EWEB Riverfront Master Plan."

UNIQUE CONDITIONS

In 2010, EWEB hired the local engineering firm Solarc to complete a district energy feasibility report. This report summarizes the likely costs and requirements for a district energy system on this site. As such, this is the only known site in Eugene with a current district energy feasibility study, which offers invaluable information to this report.

CONCLUSIONS ON EWEB RIVERFRONT

The fact that this site has existing master plans for new development, a current district energy plan, a single owner who supports the DE concept and is an expert in energy regulation, and a large parcel ready for new development make it a 'best case' for district energy. These same conditions make it unique and not wholly applicable to other sites in Eugene.

APPENDIX 4: PLATFORMS

Specific Technology Options

GEOTHERMAL WELLS

More than 20% of US energy use is for space and water heating. Of this, most heating is provided through the combustion of natural gas, propane or heating oil, primarily imported from other countries. In 2006, domestic space heating, hot water and cooking in the United States was responsible for about 470 million metric tons of CO₂ emissions.¹⁵⁰ Other heating sources include electric resistance heat or air-to-air heat pumps, powered by electricity that is often derived from coal or natural gas.¹⁵¹ Given the environmental and energy security benefits, geothermal heating is a good option for a district scale system in Eugene.¹⁵² In the recent EWEB Riverfront District Energy Study, a closed-loop ground source heat pump was determined to be a financially and technically feasible form of sustainable district energy in Eugene.¹⁵³

Geothermal heating offers an opportunity to utilize natural local resources without carbon emissions or reliance on non-local energy sources. It is currently a small fraction of US energy generation (.5% in 2006). Some estimates say that by utilizing shallow geothermal resources, more than 1,000,000 MW of US heating and air conditioning demand could be met using efficient ground source heat pumps.¹⁵⁴ This technology is widely used in Iceland, where about 90% of space heating needs are met through the use of geothermal district heating systems.¹⁵⁵

Barriers to geothermal district heating include:

¹⁵⁰ Thorsteinsson and Tester, "Barriers and enablers to geothermal district heating system development in the United States." 804.

¹⁵¹ — — —, "Barriers and enablers to geothermal district heating system development in the United States." 803-4.

¹⁵² Hatten.

¹⁵³ Solarc, "EWEB Riverfront District Energy Study," (April 14, 2010).

¹⁵⁴ Thorsteinsson and Tester, "Barriers and enablers to geothermal district heating system development in the United States." 804.

¹⁵⁵ — — —, "Barriers and enablers to geothermal district heating system development in the United States." 804.

- **High upfront costs.** The cost of drilling bores increases with higher oil prices. Cost increases have affected shallow geothermal wells, such as those suggested for the EWEB Riverfront site, the most.¹⁵⁶
- **Environmental concern over return water temperatures.** Extensive monitoring will likely be required to ensure that water returned to the aquifer at a temperature higher than that extracted does not have negative environmental impacts.
- **Directed policies and incentives.** Some communities require customers of existing geothermal systems to maintain a backup heating system. "This requirement presents an added cost to the customers, can decrease the perceived reliability of the system and thus be a barrier to expansion."¹⁵⁷
- **Unpredictability of wells.** "Unlike wind or solar where the resource quality can be measured relatively easily, in geothermal development nothing is 100% certain about the resource until a well has been drilled and an economical flow of water or steam has been proven."¹⁵⁸
- **Inconsistency of federal support.** US geothermal policy has not been consistent, as demonstrated by government funding levels. Federal funding was essential to the construction of geothermal systems such as Klamath Falls, Oregon. However, in recent years federal support has been limited. The State of Oregon has historically supported geothermal district heating projects. Unlike federal funding, state funding is often in the form of grants, rather than loans.¹⁵⁹

BIOGAS GENERATION FROM WASTE PROCESSING

This strategy for energy production from waste is dependent upon the implementation of other local sustainability measures. Anaerobic digesters (i.e. 'Living Machines') are fed with biodegradable waste and through the processing of the waste, biogas is produced. The biogas can then be used to fuel gas-powered engines or equipment such as boilers for district heating or CHP plants.

Anaerobic digestion provides an alternative to the landfill for large quantities of waste, and therefore reduces landfill emissions into the atmosphere. It is an

¹⁵⁶ — — —, "Barriers and enablers to geothermal district heating system development in the United States." 805.

¹⁵⁷ — — —, "Barriers and enablers to geothermal district heating system development in the United States." 807.

¹⁵⁸ — — —, "Barriers and enablers to geothermal district heating system development in the United States." 809.

¹⁵⁹ — — —, "Barriers and enablers to geothermal district heating system development in the United States." 811-812.

alternative to fossil fuels, while still using the equipment developed for conventional fuels, which is often less expensive than less common equipment.

This strategy is dependent upon large quantities of biodegradable wastes, and is best situated near those sources. While the equipment carries a high upfront cost, this form of energy generation is scalable and ideal for dispersed generation.¹⁶⁰

THERMAL ENERGY

The steam and hot water systems common in the United States require temperatures up to 390 degrees Fahrenheit. Traditionally, the transport medium for district heat in the United States has been high-pressure saturated steam at 250-390 degrees Fahrenheit. Steam is more energy intensive and less easily incorporated into new buildings. It requires larger pipes and has a higher upfront cost. For these reasons, among many others, new systems are primarily hot water systems and no longer use steam.

“A transition to hot water based systems, and especially to systems designed around temperatures in the 100-130 Celsius range, will increase the fuel efficiency of the district energy systems in the United States.”¹⁶¹ Increased use of heat exchangers to separate the transmission and distribution medium from building systems further increase reliability and control of systems. These technologies are widely used throughout Europe.

COMBINED HEAT AND POWER (CHP)

Originally, combined heat and power developed when waste heat resulting from electricity generation was captured for heating buildings. In these systems, energy generation was the primary purpose, and the waste heat was in excess of all cumulative local heating demand. Now, CHP plants are generally sized to meet heating needs, and the electricity is the by-product of

¹⁶⁰ (PoSI) Portland Sustainability Institute, "Lloyd Crossing: Sustainable Urban Design Plan & Catalyst Project," ed. Portland Development Commission (2010). 49.

¹⁶¹ Gochenour, "District Energy Trends, Issues, and Opportunities." 12.

heat generation. This results in less electrical production, but is a more efficient utilization of energy.¹⁶²

¹⁶² — — —, "District Energy Trends, Issues, and Opportunities."

APPENDIX 5: CONDITIONS FOR SUCCESS

The following are early questions to ask when evaluating a site for district energy feasibility. The questions are listed roughly in the order in which they should be considered. Meeting all of these criteria is not a guarantee of system success, as other obstacles may exist. For a graphic representation of the 'go or no-go' process of planning for district energy, please see Appendix 12.

- Is there **sufficient development planned?** Municipal plans and overlays for the area may indicate capital investment. A buildable lands analysis of the particular district and adjacent zones may demonstrate potential for new construction or redevelopment. City planners may know of potential future development. These indicators should be considered before investing significant time and money in further analysis. If the zone is ripe for significant new development in a relatively condensed timeframe, it may warrant more research.
- Is there **municipal investment planned?** City plans that identify an area as targeted for new investment, capital improvements, high-density designations or other development support will increase probability of district energy compliance and maximize municipal staff resources by allowing more focus on a single area. Examples of City designations in Eugene that may indicate optimal district energy sites include: core commercial zones; 20-minute neighborhoods; transit-oriented development; and compact urban development districts.¹⁶³
- **What opportunities exist at the proposed site?** Existing conditions, such as geothermal; waste heat from adjacent industry, and nearby sites with large energy loads (preferably diverse loads, with peak demand occurring at different times for major buildings) all present opportunities for a more sustainable, integrated, financially feasible system.
- **Who are the anchor customers?** Try to identify potential anchor customers with large and diverse loads, such as hotels with heated pools; grocery stores; multi-family housing; office buildings and schools.
- **What funding opportunities exist in the region?** Are there local, state or federal grants, loans or other funding sources that might be utilized to support a new district system? Are there funds available to help retrofit existing buildings with district energy compliant systems?

¹⁶³ Eugene, "Envision Eugene: Draft Proposal."

- **What regulatory conditions may change?** Are there proposed or planned zone changes; code amendments; enhanced energy conservation measures or other regulatory changes in the pipeline? How might these impact the short-term development and long-term growth or expansion of a district energy system?
- **What are the likely fuel/energy sources for the system?** Considering the local resources, the current financing environment, the planned governance model and the difficulty of various regulatory schemes, what energy platforms are most likely to be utilized? It may be useful to develop a few hypothetical scenarios for energy, including basic modeling of the following:
 - What is the current and projected cost for the fuel?
 - What are the primary variables in its cost? (i.e. for biomass, the cost is tied to the price of diesel, since diesel trucks generally haul the wood and the fuel is used for the chippers that process it.)
 - What are the greenhouse gas emissions for each proposed fuel?
- **What are the loads profiles for potential district customers?** Identify the minimum and peak heating profiles, as well as the yearly average for the region. Blocks can be characterized -- profiles do not have to be specific to every building in the neighborhood. This will help to lead to long-range forecasts based on different fuel pricing and a financial pro forma. This is best done by someone with extensive knowledge of HVAC and energy management. Lane Community College's Energy Management program may be a resource for students or faculty who can do this work.

APPENDIX 6: REGULATORY HURDLES

Permitting Process

The following is an overview of the recommended process for a developer interested in a district energy system. It includes information on how to begin developing a team of City staff and local experts; as well as information about likely permits and fees and the processes entailed in each. It is meant to provide an overview, but should not be considered the complete list of potential required permits or fees, as each district system is unique. Final requirements will depend on size of plant; site location; energy platform; transportation and environmental impacts and more.

Process

A district energy developer should begin by initiating a limited consultation process with staff at the City of Eugene Building and Permit Services. "Limited Consultations provide an opportunity for staff and applicants to build relationships and share information."¹⁶⁴ This process allows customers to ask questions and obtain information about regulations that affect their proposed projects and to ensure that building plans are compliant with regulations prior to initiating construction. Limited Consultation can be requested for any projects, but is required by the City of all projects that will be phased (which many district energy projects are). The limited consultation process also fulfills the 'pre-application conference' criteria required by land use code for all Planned Unit Developments (PUD), conditional use (CUP), or Willamette Greenway permits.¹⁶⁵

The City's goals for this process are to establish a professional rapport with designers and developers; to provide clients with a contact person within Building and Permit Services for project-related inquiries; to facilitate and

¹⁶⁴ City of Eugene Building & Permit Services, "Limited Consultation Staff Procedures," [Undo](#) [Redo](#) [Bold](#) [Italic](#) [Underline](#) [Subscript](#) [Superscript](#) Building and Permit Services [Save](#) [Cancel](#) (Eugene, OR: City of Eugene, November 1, 2010).

¹⁶⁵ Building & Permit Services, "Limited Consultation Staff Procedures."

streamline the permitting process; to identify potential issues and avoid surprises for clients down the road.¹⁶⁶

The project will be assigned a project coordinator, who will review plans and serve as a contact through the permitting process. For a district energy system, staff in multiple departments may be involved.¹⁶⁷ Additional departments may include, but are not limited to: Land Use, Public Works (underground pipes, right of way access), Commercial Plan Review (to ensure code compliance), and Plumbing inspector.

PERMITS AND FEES

As of November 1, 2001, limited consultation meetings have a flat fee of \$100. Meetings are scheduled as close to, but no sooner than, two weeks after the City receives a completed application and the \$100 fee. If the developer has questions within those two weeks, they may speak with staff at the Planning & Building Services counter. Applicants must provide the site location and description of their proposed project, and are encouraged to provide as much additional information as possible. Further, applicants may request specific work teams comprised of City staff. The City makes final decisions regarding the makeup of work teams.¹⁶⁸

A stand-alone commercial energy plant will require a land use review; commercial building permit and structural plan review. The fees associated with both are percentages of the estimated value of the work and include: plan check fees, administrative fees, permit fees, and a state surcharge when applicable.¹⁶⁹ A calculator for estimating these costs can be found at:

<http://www.eugene-or.gov/portal/server.pt?open=512&objID=225&PageID=365&cached=true&mode=2&userID=2>

¹⁶⁶ — — —, "Limited Consultation Staff Procedures."

¹⁶⁷ Jenna Garmon, April 25, 2011.

¹⁶⁸ Building & Permit Services, "Limited Consultation Staff Procedures."

¹⁶⁹ City of Eugene, "Building and Permit Services Fees," <http://www.eugene-or.gov/portal/server.pt?open=512&objID=225&PageID=365&cached=true&mode=2&userID=2>

ZONING CODE

PoSI found that in Portland, current code says that in open space or residential districts, energy sources for small-scale facilities must be either located on site or powered by natural gas. This does not accommodate alternative fuels. In commercial, industrial or employment-zoned areas, a maximum of 10 tons of biomass per week may be brought in.¹⁷⁰ This restricts the size of the facility and limits the extents of its service capacity. "To contextualize these limits, Compass Resource Management estimates that a district energy system running on biomass in the North Pearl District would likely require 40-80 tons of biomass per day during the peak heating season."¹⁷¹

In addition, Portland's code currently limits the amount of energy production to 1MW and small-scale district energy systems are subject to off-site impact rules that control noise, vibration, odor and glare in residentially- and commercially-zoned areas.¹⁷² "The 1MW threshold was chosen to be consistent with the 20-customer limit for residential district energy systems per ORS 757.005, and at least some of the CHP district systems envisioned by the City would generate more than 1MW of electricity."¹⁷³ To deal with some of these issues, Portland completed a regulatory improvement process known as the 'RICAP 5' to take steps toward accommodating small-scale district energy in residential and commercial zoned areas.

LICENSING AND RIGHT-OF-WAY

RIGHT-OF-WAY

As mentioned elsewhere in this study, district energy piping often requires installation in the public right-of-way (ROW), beside or below roads. While road improvement provides an opportunity to piggy-back and install district energy infrastructure while the ground is already open, thus lowering the cost, limited right of way space and opaque policies around reserving space in the right of way for future growth are a few issues in this realm.

¹⁷⁰ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

¹⁷¹ — — —, "Streamlining Portland's District Energy Regulations." 9.

¹⁷² — — —, "Streamlining Portland's District Energy Regulations."

¹⁷³ — — —, "Streamlining Portland's District Energy Regulations."

In Eugene, a license is required to access any public right-of-way in the city. Licensing of telecommunications services is outlined in chapter 3.405 of the City Code. While nothing in the code specifically refers to provision of district energy, this section can be assumed to provide a template for similar registration and licensure procedures. These procedures include: annual registration and licensure fee. (For telecommunications licenses, the annual registration fee is 2% of the registrant's annual gross revenue derived from its activity within the city. The annual licensing fee is 7% of the annual gross revenue from its activity within the city. Both these fees are paid quarterly.) Interestingly, city code provides for an exchange of services in lieu of fee payment for telecommunications services. This may set a precedent for a private district energy provider to provide its services in lieu of annual license and registration fees as well.¹⁷⁴

Assuming that district energy providers are subject to similar regulations as telecommunications providers, per city code 3.420, facilities may be subject to periodic inspections and testing by the city to determine compliance with code, license and franchise agreements and other enforceable laws. Operators of facilities with underground facilities must be a member of the regional notification center for subsurface installations (Underground Services Alert) and shall field mark the locations of its underground facilities upon request.¹⁷⁵

REMOVAL OF FACILITIES; TERMINATION OF USE OF RIGHT-OF-WAY

If a licensee discontinues operation of a facility located within the right-of-way for two years, the City may request its removal and restoration of the property and right-of-way to the condition prior to installation. The city may require a licensee, prior to installation of infrastructure into the right-of-way, to post a bond in an amount sufficient to cover the cost of removal of the facility and restoration of the property and right-of-way.¹⁷⁶

RECOMMENDATIONS

¹⁷⁴ City of Eugene, "City Code," (Eugene, OR).

¹⁷⁵ Eugene, "City Code." Section 3.420.

¹⁷⁶ — — —, "City Code." Section 3.425.

Given the lack of any specific regulation around district energy systems or infrastructure installation into public right-of-ways in the city code, licensing of a new system in Eugene could be a lengthy and complicated process. As an example, when Enron and Portland Gas and Electric built the district cooling facility in Portland, the franchising process took 18 months.¹⁷⁷ Such a lengthy and frustrating process is a major deterrent to private developers. To facilitate the development of district energy systems, the City of Eugene could begin by drafting a model ordinance for future adoption by the City Council that outlines the regulations and expectations of such a facility. This ordinance could be based on the existing codes for telecommunications facilities, as well as the recent Regulatory Improvement Code Amendment Process (RICAP 5) adopted in Portland.¹⁷⁸

RATE SETTING

There is no state law mandating whether license or franchise agreements deal with rate setting or not. In Portland, the franchise agreement for the Brewery Blocks district cooling plant does not include language about rate restrictions. The assumption was that rates would be limited by the marketplace, however future franchise agreements for that facility, or others in the state could include rate-setting provisions.¹⁷⁹

PUBLIC UTILITY COMMISSION

“District energy facilities, particularly those operating mostly on renewable resources, are statutorily exempt from PUC regulatory oversight. Oregon Revised Statutes Chapter 757 (Utility Regulation Generally) details the types of utilities that are subject to Public Utilities Commission oversight as per definition 757.005; the following entities do not fall under PUC authority:

Any plant owned or operated by a municipality; Any entity providing heat, light or power: From any energy resource to fewer than 20 residential customers, as long as the entity serves only residential customers; or from solar or wind resources to any number of customers; or from biogas, waste heat or

¹⁷⁷ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations."

¹⁷⁸ Portland, "Highlights of RICAP 5."

¹⁷⁹ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations." 11.

geothermal resources for non-electric generation purposes to any number of customers; and any entity furnishing heat, but not delivering electricity or natural gas to its customers. While that statute does not specifically exempt district cooling the way it does district heating, the Brewery Blocks in Portland are not under PUC authority, so it seems logical to conclude that a similar facility in Eugene would also be exempt.

“While chapter 757 of the State of Oregon Regulatory Statutes deals with retail energy sales, a district energy provider that sells electricity on the wholesale market is subject to different rules. As long as a CHP plant sells power into the grid rather than directly to its customers, it is also unlikely to be regulated. Per ORS 758.505, district energy facilities selling wholesale energy are treated as small-scale energy production facilities, which are not subject to PUC authority if they meet all of the following criteria:

- Produces energy primarily by the use of biomass, waste, solar energy, wind power, water power, geothermal energy or any combination thereof; andIs more than 50 percent owned by a person who is not an electric utility, an electric utility holding company, an affiliated interest or any combination thereof; andHas a power production capacity that, together with any other small power production facility located at the same site and owned by the same person, is not greater than 80 megawatts.¹⁸⁰

Based on this criteria, it appears that an entity that is 51% owned by an organization or person other than an electric utility or the City of Eugene, since it may be considered an electric utility holding entity and does not sell retail energy will not be regulated by the PUC. However, this is not certain since a wholesale supplier of energy is subject to regulation by the Federal Energy Regulatory Commission (FERC), and the FERC can authorize states to set the rates for wholesale energy sales, which implies that the FERC can preempt a local PUC exemption for district energy.

“Finally, per ORS 757.007, even entities that are exempt from regulation by the PUC still must file with the PUC, no later than 30 days prior to their coming into effect, all contracts and schedules establishing rates, terms and conditions for the provision of heating services, and before the facility’s exemption can be finalized, the

¹⁸⁰ — — —, "Streamlining Portland's District Energy Regulations." 12.

PUC must find the contracts and schedules to be reasonable. If at any time the PUC finds that the activities of an exempt entity have an adverse effect upon the customers of public utilities and that the benefits of regulation outweigh any adverse effects on the public generally, the non-regulated entity's exemption can be overruled. This ever present potential for intervention and re-regulation by the FERC and the PUC provides protection to energy consumers engaged in private contractual arrangements – even with entities that are not officially regulated by the PUC.”¹⁸¹

The FERC's and the PUC's legal authority to overrule a company's exemption from regulation can be applied to district energy systems supplying heating and cooling and apparently power generation. And regardless of any exemption from PUC rate regulation, CHP systems that include electricity distribution infrastructure will still be governed by PUC safety regulations for that distribution infrastructure. These safety regulations are found in Oregon Administrative Rule 860-024 and are consistent with the National Electric Safety Code.

Per the definitions listed above, net-metering regulations and rate control under Oregon Administrative Rule 860-039 do not apply to any entity not considered a public utility. However, any net-metering infrastructure of a district energy system will be subject to the above-referenced safety regulations.¹⁸²

OREGON DEPARTMENT OF ENVIRONMENTAL QUALITY (DEQ)

There are few DEQ rules that address district energy systems in particular, however these systems fall under a few DEQ regulatory realms. Since district energy development is no longer common and each development will incorporate unique conditions, there are no clear precedents to indicate which DEQ frameworks will apply. The following are the possible DEQ permits that may be required on a case-by-case basis. Each of these permits requires a public process, possibly including public notice periods and public hearings.

¹⁸¹ — — —, "Streamlining Portland's District Energy Regulations."

¹⁸² — — —, "Streamlining Portland's District Energy Regulations."

SITE CLEANUP

Prior to beginning development of a new district energy system, the site should be thoroughly evaluated for potential environmental hazards. Because thermal distribution systems are generally installed underground, it is important to establish the site history and potential for contamination before the start of construction.

DEQ is a resource for evaluating potential sites, as it has an extensive list of sites with known contamination. "This is an especially important issue considering that franchise agreements and potentially city code, assign the financial responsibility for environmental cleanup to the district energy developer."¹⁸³ Additional site cleanup information can be found at this site:

<http://www.deq.state.or.us/lq/cu/index.htm>

UNDERGROUND STORAGE TANKS

District energy systems often incorporate backup fuel (generally for emergency diesel generators). "Biomass and biogas systems may also require fuel storage. In addition, some systems include thermal storage systems (e.g. stratified hot water tanks) to balance out heating or cooling demand and production. Some of these storage systems could be constructed underground, depending on the type of storage and local site constraints. All of these tanks, if more than 10% underground, would require DEQ permits. <http://www.deq.state.or.us/lq/tanks/index.htm>."¹⁸⁴

AIR QUALITY

To some extent the energy platform utilized in the district energy system will determine the extent of necessary air quality permitting, however most district energy systems will require a Simple Air Contaminant Discharge Permit, or a Simple ACDP. These permits are granted in 5-year increments and regulate emissions on combustion processes. The permit costs \$6000 and has additional annual expenses resulting from required testing, monitoring, recordkeeping and reporting to ensure compliance with the Plant Site Emissions Limits (PSEL) and other emissions benchmarks.

¹⁸³ — — —, "Streamlining Portland's District Energy Regulations." 14.

¹⁸⁴ — — —, "Streamlining Portland's District Energy Regulations." 15.

Other potential permits include a Basic ACDP, required of natural gas and propane boilers of 10-30 MMBTU/hr and constructed after June 9, 1989. Larger boilers require a General ACDP.¹⁸⁵

More information on air quality permitting and standards can be found here:

<http://www.deq.state.or.us/aq/permit/acdp/acdp.htm>.

SOLID WASTE

District energy facilities that use municipal solid waste to fuel combustion or anaerobic digesters to create energy (i.e. biogas) will require a solid waste permit from the Oregon DEQ. Facilities that use domestic solid waste must also comply with OAR 340-096 Special Rules Pertaining to Incineration, which covers air quality control regulations and permitting. "The cost of the solid waste permit, per OAR 340-097, is \$10,000 if more than 7,500 tons/year of solid waste will be received, or \$5,000 if less than 7,500 tons/year. Other ongoing compliance fees may be determined on a case-by-case basis. Additional information on DEQ solid waste requirements can be found at <http://www.deq.state.or.us/lq/sw/index.htm>."¹⁸⁶

In addition to state DEQ permitting, a district energy facility in Eugene that processes municipal solid waste into energy must apply for franchise with the City of Eugene Waste Prevention and Green Building division.

In Eugene, the transporter of any waste will need to have a solid waste collection license. The City only issues 8 licenses for the collection of solid waste, recyclables and yard debris from within the city, and seven of these licenses have been issued. This means a district energy developer wishing to utilize municipal waste as an energy source will likely need to contract with an existing licensed transporter to provide their waste.¹⁸⁷

"It is unclear whether an urban biomass-fired district energy plant would be classified as a Solid Waste facility by the DEQ and would therefore need a Solid Waste Management permit. It appears to depend on whether or not the

¹⁸⁵ — — —, "Streamlining Portland's District Energy Regulations." 15.

¹⁸⁶ — — —, "Streamlining Portland's District Energy Regulations." 16.

¹⁸⁷ Eugene, "City Code."

facility is classified as an “energy recovery facility” and whether the facility would receive waste that is “delivered by the public or by a solid waste collection service.”¹⁸⁸ These definitions may result in the exemption of a facility using pellets or wood chips delivered straight from a factory or from the woods. Several small biomass energy plants (i.e. boilers) were recently developed in Oregon, through not in major urban centers, and they were not classified as solid waste facilities by the DEQ. There is more about permitting bio-energy facilities in Oregon at:

<http://www.oregon.gov/ENERGY/RENEW/Biomass/bioenergypermitting.shtml>.¹⁸⁹

STATE STORMWATER MANAGEMENT PERMITS (EUGENE PUBLIC WORKS AND DEQ)

The Department of Public Works has stormwater development standards designed to protect from construction and post-construction runoff. These standards are outlined in the Stormwater Management Manual and address a number of situations that may occur at a local district energy facility.

Regulation 9.6795 Source Control Standards applies to: exterior storage of liquid materials including petroleum products in above ground containers, in quantities of 50 gallons or more; facilities that collect and store solid waste; developments that stockpile or store materials in outdoor containers (i.e. biomass or waste); development projects that disturb property known or suspected to contain contaminants in the soil or groundwater.

This department also manages the Erosion Prevention and Construction Site Management Program to address federal water quality mandates and set local policies to protect stormwater-related waterways. All construction activities that will cause land disturbance are included in this program and must follow its best practices. Failure to comply may be subject to enforcement.

On sites greater than 1 acre, or where construction will impact over 500 square feet or displace 20 cubic yards of material in a sensitive area (one that has a slope greater than 10% or has highly erodible soils or has potential to drain directly into a water feature or designated buffer area) an erosion

¹⁸⁸ Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations." 16.

¹⁸⁹ — — —, "Streamlining Portland's District Energy Regulations." 16.

prevention permit must be obtained and a Construction Site Management Plan¹⁹⁰ filed prior to any ground disturbing activities. Additionally, Best Management Practices (BMPs) must be installed to prevent erosion and an Erosion Inspector must inspect the site. There is a fee of \$385-\$825 for the commercial erosion prevention permit based on the type of permit required and the size of the disturbance.¹⁹¹ More information about Eugene's stormwater management can be found here: <http://www.eugene-or.gov/portal/server.pt?open=512&objID=689&PageID=1738&cached=true&mode=2&userID=2>

State permits for stormwater management may include a 1200-Z Industrial Stormwater Permit for a facility with unenclosed biomass fuel storage where the wood debris might run off during rainstorms. More information about this permit is at: <http://www.deq.state.or.us/wq/wqpermit/stminfo.htm#1200c>

THERMAL POLLUTION OF COOLING WATER

"Additional permitting may be required for cooling water and other water discharge, depending on the chosen district energy technology. More information on the uses requiring permitting can be found here:

<http://www.deq.state.or.us/wq/wqpermit/genpermits.htm>.¹⁹²

¹⁹⁰ Note: Construction Site Management Plans for projects such as a district energy facility must be prepared by a professional – an engineer, architect, landscape architect, geologist, or someone certified by the International Erosion Control Association.

¹⁹¹ City of Eugene, "Erosion Prevention and Construction Site Management Program," <http://www.eugene-or.gov/portal/server.pt?open=512&objID=689&PageID=1738&cached=true&mode=2&userID=2>.

¹⁹² Portland Sustainability Institute, "Streamlining Portland's District Energy Regulations." 17.

APPENDIX 7: GOVERNANCE MODELS

PUBLIC MODEL

In the municipal model, the local municipality owns public district energy companies. The City can either incorporate the district energy system into the governance and operations of its local utility (i.e. EWEB); create a new department to manage the system, or alternatively, create a “separate, wholly owned and operated subsidiary to shield the city’s general fund from direct and unlimited financial liability.”¹⁹³ “Municipal ownership can take the form of an entire facility or portions thereof, such as the underlying land or the means of transmission.”¹⁹⁴ In this model, while the City retains ownership of the system, design, construction and operation may all be contracted to private firms.

“The viability of any municipal model rests on a determination that the district energy facility will be of financial benefit to the municipality. There must also be the political will to communicate that benefit to the public and then to carry out the development and operation of such a facility.”¹⁹⁵

The advantages of municipal ownership include more flexible funding and development options. Cities can access low-interest funds with longer repayment terms than those available to private developers. This extended timeframe with lower interest rates may allow a more extended build out of the system without jeopardizing the financial feasibility of the project.¹⁹⁶

Southeast False Creek, in Vancouver, BC is an example of a municipal-owned, operated and developed project.

An additional advantage to municipal ownership is the ability to ensure that district energy systems support larger community values related to energy usage, greenhouse gas emissions and local economic development. Michael

¹⁹³ Portland Sustainability Institute (PoSI), "District Energy for Portland: Development, Ownership & Governance Models," (2011).

¹⁹⁴ Biomass Energy Resource Center, "Forming, Financing, and Permitting a District Energy Facility in Vermont."

¹⁹⁵ — — —, "Forming, Financing, and Permitting a District Energy Facility in Vermont."

¹⁹⁶ Osdoba.

Hatten, principal engineer at local Solarc Architecture and Engineering, says: "It's a hard slog for private ownership to function. District energy works best in a non-profit or public ownership model where larger community values have meaning that can be translated to financial meaning."¹⁹⁷

Alternatively, if the city is unwilling or unable to shoulder the financial investment but desires ownership, a private developer backed by private investment monies can use a special purpose vehicle to finance and build the system and then transfer ownership to the city upon completion. Project finance "is the financing of infrastructure and industrial projects, typically with no-recourse loans, meaning that they are secured only by the project assets and are paid entirely from the project's cash flow rather than from the general assets or creditworthiness of the project sponsors. Generally a special purpose vehicle is created for each project, thereby shielding other assets owned by a project sponsor from the detrimental effects of a project failure."¹⁹⁸ This method allows the City to avoid the risk of investment through the design and construction phase, and then to purchase the completed project with low-cost bonds secured by the City's full faith and credit, or through pre-contracted energy purchase agreements with customers. "The greatest disadvantages to a municipal model are the political hurdles that must be overcome in approving a facility."¹⁹⁹

A second municipal ownership example is that of Montpelier, Vermont. In its system, the City and the State are partnering to fund the development of a phased district energy system that will be built out over an extended timeframe. Funded in large part with Department of Energy grant money, the financing package also includes City bonds, State allocations and a phased development approach. Future development phases will be funded using the revolving capital pool of the initial development.

The **strengths of the municipal model** include the following, as identified by the Portland Sustainability Institute:

¹⁹⁷ Hatten.

¹⁹⁸ (PoSI), "District Energy for Portland: Development, Ownership & Governance Models."

¹⁹⁹ Biomass Energy Resource Center, "Forming, Financing, and Permitting a District Energy Facility in Vermont." 2.

- City ownership can ensure that the system is **operated in alignment with city goals**, including social and environmental policies.
- Development **risk can be transferred to a third party** using a Special Purpose Vehicle.
- City **control of building permits** allows it to create incentives, lower 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 flow back into the city** and support its delivery of 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.²⁰⁰
- Ensure **public confidence and achievement of community sustainability goals**.

The **weaknesses of a municipal model** include:

- 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.²⁰¹
- **Limited expertise** can inhibit the growth or success of the system.

Municipal ownership issues in Eugene:

²⁰⁰ (PoSI), "District Energy for Portland: Development, Ownership & Governance Models."

²⁰¹ — — —, "District Energy for Portland: Development, Ownership & Governance Models."

- The City of Eugene has never expressed interest in owning a district energy system.
- There is no clear department or division that would be responsible for the development or operations and maintenance of a system. Municipal ownership would either fall under the auspices of EWEB, or would require an existing City department to expand its responsibilities to include district energy, or a new department would be required at the City.
- A municipal system that is not operated by EWEB may be unpopular or not trusted by the public as well as with the EWEB itself.
- From a political perspective, this option is only worth exploring if the Mayor and City Council are genuinely interested in public ownership.
- From a municipal finance perspective, Eugene has a good credit rating, making low-cost capital a possibility if there is sufficient political support.
- Eugene has a history of lengthy public processes that may deter private developers or lead to higher costs and longer timelines for development. For this reason, design of a system that avoids hot button issues such as eminent domain, biomass, and land use zone changes may speed the process and improve public reception.
- The University of Oregon may be an ideal candidate for a quasi-public district energy developer. The University has an extensive history operating its own district heating and chilling plants to serve its own campus. Its recent increased focus on using its property for revenue-generation purposes may increase its interest in owning and operating a district energy system that sells excess capacity to non-university customers. It's former-Romania dealership site in Walnut Station is an ideal location for such a plant: the site will have significant amounts of new development over the next few years; it is adjacent to a district with heavy redevelopment pressure and demand for increased housing and it's close to the existing university cogeneration plant, which will make maintenance and staffing easier.

PRIVATE MODEL

A private ownership model can take various forms; most often a for-profit corporation or a limited liability company. While often viewed as the opposite of a municipal model, "private ownership should not be seen as detached

from community involvement.”²⁰² Community values can be reflected in this model, even without community ownership.

There are a few private companies who operate district energy systems throughout the United States and Canada. Of these, Veolia Energy and Corix Utilities are two of the largest. Private developers generally sell thermal and electrical energy to a few large customers (rather than to a local utility) since retail sales net a higher price for the energy than wholesale and this model guarantees a relatively stable base load demand.²⁰³ The success of any private ownership model is dependent on the availability of private capital, as well federal and state tax incentives.

This section provides an overview of three types of private ownership models, and then lists the merits and drawbacks of private ownership from a municipal perspective.

CORPORATION

Corporations are the most common private ownership structure. While they are generally private entities, “it is possible to make a corporation more of a community enterprise. The concept of community corporations is still relatively novel but involves setting parameters such as residential restrictions providing that only community members can own shares.”²⁰⁴ However, if community ownership is a desired goal of the district energy system, “it may be more appropriate to consider a non-profit corporation structured as a mutual benefit corporation as opposed to the commonly understood public benefit corporation.”²⁰⁵

LIMITED LIABILITY COMPANY (LLC)

This type of entity “provides limited liability protection like a corporation, but has pass-through tax characteristics like a general partnership. An LLC offers great flexibility in attributing financial and management rights to members,

²⁰² Biomass Energy Resource Center, "Forming, Financing, and Permitting a District Energy Facility in Vermont." 2.

²⁰³ (PoS), "District Energy for Portland: Development, Ownership & Governance Models." 18.

²⁰⁴ Biomass Energy Resource Center, "Forming, Financing, and Permitting a District Energy Facility in Vermont." 2.

²⁰⁵ — — —, "Forming, Financing, and Permitting a District Energy Facility in Vermont." 2.

thus allowing for novel structures that recognize the roles and expectations of different member owners."²⁰⁶

COOPERATIVES

This entity allows "the producers or consumers of a product to jointly own the means of production or distribution of that product."²⁰⁷ These products can include energy. Cooperatives are generally owned by their members, and are often not-for-profits, governed by member votes.

The **strengths of a private model** include:

- **Private company carries the financial risk.**
- Private company brings in **expertise to manage project**. Most likely, any private developer of a district system will have or contract with a firm with great expertise in the management, operations, technical knowledge and financing of these systems. This eliminates the learning curve for a municipal entity to hire and train people to deal with these functions and will likely increase the short-term success of the system.
- A private utility will continue to **capitalize the business** for expansion and renewal.²⁰⁸

The **weaknesses of a private model** include:

- Relatively high rates of return are required to compensate the developer's risk, so **energy charges may be higher.**²⁰⁹
- 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.²¹⁰
- 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.²¹¹ As a result, a private developer of a district system may choose to use conventional fuels to run the system and it may not achieve any of the more sustainable objectives of the community.

²⁰⁶ — — —, "Forming, Financing, and Permitting a District Energy Facility in Vermont." 2.

²⁰⁷ — — —, "Forming, Financing, and Permitting a District Energy Facility in Vermont." 2.

²⁰⁸ (PoSI), "District Energy for Portland: Development, Ownership & Governance Models." 18.

²⁰⁹ — — —, "District Energy for Portland: Development, Ownership & Governance Models."

²¹⁰ — — —, "District Energy for Portland: Development, Ownership & Governance Models."

²¹¹ — — —, "District Energy for Portland: Development, Ownership & Governance Models." 18.

- **Difficulty of financing** -- While private companies can arrange external financing, they have more limited access to capital than public institutions. As a result, building owners or project developers sometimes make an equity contribution to the project. Alternatively, a connection fee is charged to connect to the system to help recoup upfront costs more quickly.
- **Future demand uncertainty** – Because of the higher costs of capital in the private model, it becomes even more important to ensure sufficient demand to meet pro forma objectives in a short timeframe. To address this issue, “building owners are sometimes asked 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 flow with a reasonable degree of certainty.”²¹² Alternatively, public entities occasionally supply gap financing for distribution systems in areas with few initial customers.

Private ownership issues in Eugene:

- The City will have **limited financial risk**.
- Local **elected officials will avoid significant political risk**.
- Private ownership **reduces City influence** over extent to which district system addresses and achieves community sustainability objectives.

HYBRID MODEL

Also known as a public private partnership, the hybrid model generally uses the public entity’s access to low-cost capital and pairs it with the expertise of a private developer. It allows the public entity a continuous avenue to influence decisions such as fuel platforms that address high-level community goals. Through the interview process, this was most often cited as the ideal, or most successful model. “Hybrid models offer tremendous flexibility and the opportunity for innovation in creating a unique ownership/operating structure.”²¹³ Since the upfront investment in district energy systems is the major expense, and the systems are generally more profitable once the upfront investment has been paid off and the system is able to generate energy at a rate lower than conventional energy costs, this model offers some

²¹² — — —, "District Energy for Portland: Development, Ownership & Governance Models." 18.

²¹³ — — —, "District Energy for Portland: Development, Ownership & Governance Models." 22.

revenue in the short term as well as a combination of revenue and cost savings in the long term.

An example of a university using the hybrid ownership model to capitalize on its district energy systems as a revenue-generating tool is the partnership between Corix Utilities and the University of Oklahoma. The university needed revenue in the short term to compensate for reduced tuition, and did not want to invest in upgrades for its aging and inefficient multi-utility (CHP; chilled water; natural gas; electric; potable water, and wastewater) infrastructure. The university solicited bids for management, operation, maintenance, renewal and reconstruction of its system over 50-years; while mandating that the new operator must retain all of its utility system employees at comparable wages and benefits. Corix Utilities was the only company able to comply with all the university's stipulations. The utility services agreement "grants OU immediate access to the embedded capital value of its utility assets, freeing the school to pay down debts and direct its resources toward educational initiatives such as research and development. Ownership and legal title to the fixed utility assets remain with OU."²¹⁴

The list below outlines the various parts of the project that can be flexibly "hybridized", as identified by the Portland Sustainability Institute:

- **Financial Ownership.** For example, a typical joint venture combines all of the assets into a single entity and splits the ownership of that entity between the owners.
- **Hard Assets.** This is not really a joint venture, as actual assets aren't shared. An example might be a system where one entity (typically 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. An example of this is that of the University of Oklahoma's partnership with Corix Utilities.

²¹⁴ Corix Utilities, "University of Oklahoma -- Long Term Operating and Maintenance Agreement," (2010).

The **strengths of a hybrid model** include:

- **Capitalizes on the strengths and existing resources of each partner.**
- **Greater flexibility of financing** sources and risk allocation than private or public approaches.
- **Reduced political risk** for elected officials.

The **weaknesses of a hybrid model** include:

- **Can be complicated** to mix private business with public and political processes at the municipal level.
- **Public sector still bears some financial risk burden.**
- Requires **compliance with public sector procurement policies.**

COOPERATIVE MODEL

The cooperative model, also known as a stakeholder-owned Special Purposes Vehicle, is owned cooperatively by its customers. This model is best suited for situations in which the location, scale or project type makes more traditional financing and ownership structures unlikely. Co-ops reinvest any profits into infrastructure or distribute them as dividends to owners.²¹⁵

The **strengths of a cooperative model** include:

- Maximum **accountability and transparency** to public.
- **Enable projects** in areas that would not otherwise get funding.

The **weaknesses of a cooperative model** include:

- **Cumbersome decision making** since ownership is divided among stakeholders.
- Historical **aversion to co-ops** in Eugene due to unsuccessful cooperative ventures in various fields.
- **Difficult to use this structure without established base-load.** May work better when buying an existing system.²¹⁶

²¹⁵ Portland Sustainability Institute, "District Energy for Portland: Development, Ownership & Governance Models." 28.

²¹⁶ — — —, "District Energy for Portland: Development, Ownership & Governance Models.," 28.

APPENDIX 8: FUNDING SOURCES

FOR FEASIBILITY STUDIES

- **Oregon Community Renewable Energy Feasibility Fund Program (CREFF).** This grant program offers monies for feasibility studies for renewable energy, heat or fuel projects. Studies may include initial resource assessments; siting and permitting requirements; environmental surveys; transmission and interconnection issues; ownership structure and funding mechanisms; project costs and economic viability; financial incentives; available output contracts and price; fatal flaw analysis.²¹⁷ Qualifying projects may incorporate a wide array of energy sources, including biogas, biomass, municipal solid waste, natural gas and waste heat recovery, among others. Eligible projects can be 25kW to 10MW in size. The maximum award is \$50,000, and proposals that leverage non-state funding sources are preferred. This grant cycle occurs twice a year. This program is designed to be a revolving fund, and projects that are ultimately constructed and are profitable are required to repay the state for their initial grants.²¹⁸ More information is available at: <http://www.oregon.gov/ENERGY/RENEW/CREFF.shtml>
- **Renewable Energy Feasibility Fund (REFF).** This funding is available to public agencies including cities, schools, counties, tribal councils, ports, districts (as defined by ORS 198.010) and airport districts. Awards from this program may come in the form of loans or grants, with a maximum grant award of \$50,000 (or 75 percent of project costs). A call for proposals is issued once or twice a year, depending on availability of funding within the Special Public Works Fund. The next round is anticipated to occur in September 2011.²¹⁹ More information at: <http://www.orinfrastructure.org/dev/www/IFA/Learn-About-Infrastructure-Programs/Interested-in-a-Special-Project/Renewable-energy-feasibility/>
- **Renewable Energy for America Program (REAP).** The USDA administers this program. It offers grants for small businesses, ranchers and farmers to help pay for professional, detailed, independent feasibility studies for renewable energy projects. While most of the Eugene/Springfield metropolitan area does not qualify as rural, and is thus ineligible for the grant monies, some urban farms may be eligible. Assistance is limited to \$50,000 or 25 percent of the total cost of the study. In fiscal year 2010, approximately \$3 million was awarded. REAP feasibility studies must evaluate all preliminary data and reach a determination as to the viability and profitability of

²¹⁷Oregon Department of Energy, "Renewable Energy Grant: CREFF."

²¹⁸United States Environmental Protection Agency, "Combined Heat and Power Partnership Funding Resources."

²¹⁹Infrastructure Finance Authority, "Renewable Energy Feasibility Fund."

the proposed energy project. The funds may be used to pay for a transmission, environmental or resource assessment study that would inform the final determination. REAP applications are accepted year-round, but are only funded during specific windows. The application deadline for fiscal year 2011 funding is June 30, 2011. Awards will likely be announced in September 2011.²²⁰ More information is available online at: http://www.rurdev.usda.gov/or/reap_fs.htm

- **Eugene Water and Electric Board.** In Eugene, EWEB has a long history of leading the country in residential energy efficiency programs. Further, its policy of promoting energy conservation means EWEB offers financial support and a wealth of information for developers interested in pursuing energy efficiency measures. For example, if a developer were interested in a district energy feasibility study, EWEB would likely provide some funds to pay for the study. If the project were built, the money provided would be deducted from other incentives offered from the utility for energy conservation measures and renewable energy generation. If the project is not completed, EWEB does not require the initial funds to be re-paid.

FOR ALL PROJECT PHASES

- **Energy Trust of Oregon.** The Energy Trust of Oregon offers grants and incentives for projects that utilize biopower, particularly resulting from industry waste such as food scraps. Grant support includes up to \$40,000 or 50 percent of the cost of hiring professionals for assistance with grant writing, feasibility studies, final design, permitting, utility interconnection and construction management.²²¹ Additional incentives are based on the project's above-market costs, with no maximum.²²² In return for its contribution, the Energy Trust asks for a negotiated share of the project's Renewable Energy Certificates,²²³ which are held in trust for the ratepayers who contribute to Energy Trust.

FOR PROJECT DEVELOPMENT

- **Oregon Business Energy Tax Credit (BETC).** This program offers a corporate tax credit for investments in energy conservation, recycling, renewable energy resources, sustainable buildings and less-polluting transportation fuels. The credit is an offset against owed Oregon income and corporation excise taxes.²²⁴ Any Oregon business can qualify for the credits, which can be applied to cover costs directly related to the project including equipment costs, engineering and design fees, materials, supplies and installation costs. For

²²⁰ United States Department of Agriculture, "REAP grants for feasibility studies."

²²¹ Energy Trust of Oregon, "Biopower."

²²² For more information about above-market costs:

<http://energytrust.org/business/incentives/info/above-market-costs.aspx>

²²³ For more information about Renewable Energy Certificates: <http://energytrust.org/shared-resources/info/green-tags.aspx?src=business>

²²⁴ Oregon Department of Energy, "Business Energy Tax Credits."

renewable energy generation including high efficiency CHP, the BETC grants up to a 35 percent tax credit distributed over 5 years (10 percent annually).²²⁵ The maximum credit available for this type of project is \$10 million. Application fees are \$500 for initial application review and .6% of the project's eligible costs, up to \$35,000.²²⁶

Projects must receive final certification before July 1, 2012 to use this tax credit.²²⁷ Additional information can be found at:

http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OR03F&state=OR&CurrentPageID=1&RE=1&EE=1

Also, please see Appendix 10 for an Oregon Department of Energy overview of the BETC credits.

- **State Energy Loan Program (SELP).** This program aims to promote energy conservation and renewable energy resource development. It has previously been used to help fund a district geothermal heating system. It offers low-interest loans that may apply to district energy systems that produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat.²²⁸ Loans can be used for engineering and design, permitting, project management and post-construction take-out financing.²²⁹ Loans are available at fixed interest rates for 5-20 year terms. Application fees range from \$100-200 (or .1% of the loan). Loan fees are 1% of the loan amount.²³⁰ Loans of up to \$100,000 are generally approved within 2-3 weeks. Larger loans amounts may take up to 60 days. Loan amounts range from \$20,000 to \$20 million.²³¹

²²⁵ — — —, "Business Energy Tax Credits."

²²⁶ — — —, "Energy Conservation."

²²⁷ United States Environmental Protection Agency, "OR Business Energy Tax Credit."

²²⁸ Oregon Department of Energy, "State Energy Loan Program."

²²⁹ — — —, "State Energy Loan Program."

²³⁰ — — —, "SELP Fees."

²³¹ — — —, "State Energy Loan Program."

APPENDIX 9: SELP-FUNDED PROJECTS

OREGON DEPARTMENT OF ENERGY ENERGY LOAN PROGRAM

Technologies Funded With SELP Loans

- **AIR HANDLING SYSTEM IMPROVEMENTS** such as energy saving motors, motor controls and/or sizing, high efficiency fans and fan system improvements, ducting, dampers, volume controls, etc.
- **AIR-TO-AIR HEAT EXCHANGERS** to reduce ventilation energy losses.
- **BIOMASS WASTES** used to produce substitute fuels.
- **CENTRAL PLANT AND DISTRIBUTION SYSTEM IMPROVEMENTS**, including boilers and boiler systems, chillers, cooling towers, steam/water distribution system and condensate line improvements or replacements, steam traps, controls, overhauls, and other improvements.
- **COGENERATION**
- **CONTROLS**, energy management, system controls such as computerized control systems, programmable controls, and non-computerized control systems.
- **DISTRICT GEOTHERMAL HEATING SYSTEMS.**
- **EARTH SHELTERED** construction.
- **ENVELOPE** improvements including: increased levels of insulation in walls, ceilings, and floors; glazing improvements; external shading; and addition of vestibule entry.
- **HEATING, VENTILATION, and AIR CONDITIONING (HVAC)** system improvements.
- **HEAT PUMPS**, air-to-air heat pumps when in lieu of other electrical or wood burning heating systems [special conditions apply].
- **HEAT PUMPS**, interfaced with solar collectors, surface water, ground water, wastewater, waste heat, or the ground itself.
- **LIGHTING** components, such as lamps, fixtures, controls, and other components that reduce energy consumption.
- **METHANE GAS RECOVERY** from landfills, including electric generation.
- **MOTOR CONTROLS**, such as variable frequency controls.
- **MOTORS**, energy saving items such as high efficiency motors, controls, load balancing, and staging.
- **TRANSPORTATION SAVINGS** when off-site transportation costs are saved as a result of on-site process changes.
- **PUMP SYSTEM IMPROVEMENTS** such as energy saving motors, motor controls, load balancing, staging, distribution system pressure reduction, irrigation systems, etc.
- **SOLAR** heating and lighting—passive.
- **SOLAR** space and water heating—active.
- **SWIMMING POOL** evaporation reduction measures including pool covers and controls.
- **WASTE HEAT RECOVERY** by heat pumps or by heat exchangers and applied to space heating, water heating, industrial process heating, or other beneficial use.
- **WASTEWATER TREATMENT LAGOONS** and system components.
- **WASTEWATER TREATMENT** plant process changes that save, produce, or recover energy.
- **WATER HEATING** and distribution system improvements.
- **WATERPOWER** used to generate electricity, and used for direct water-powered pumping, i.e. hydraulic ram.
- **WATER SYSTEM**, gravity distribution in lieu of pump pressures.
- **WEATHERIZATION**, such as weather-stripping, caulking, and other items to reduce infiltration
- **WIND POWER** used to generate electricity, or wind-powered pumping.

Continued...

OREGON DEPARTMENT OF ENERGY
ENERGY LOAN PROGRAM

Technologies Funded With SELP Loans

- **AIR HANDLING SYSTEM IMPROVEMENTS** such as energy saving motors, motor controls and/or sizing, high efficiency fans and fan system improvements, ducting, dampers, volume controls, etc.
- **AIR-TO-AIR HEAT EXCHANGERS** to reduce ventilation energy losses.
- **BIOMASS WASTES** used to produce substitute fuels.
- **CENTRAL PLANT AND DISTRIBUTION SYSTEM IMPROVEMENTS**, including boilers and boiler systems, chillers, cooling towers, steam/water distribution system and condensate line improvements or replacements, steam traps, controls, overhauls, and other improvements.
- **COGENERATION**
- **CONTROLS**, energy management, system controls such as computerized control systems, programmable controls, and non-computerized control systems.
- **DISTRICT GEOTHERMAL HEATING SYSTEMS.**
- **EARTH SHELTERED** construction.
- **ENVELOPE** improvements including: increased levels of insulation in walls, ceilings, and floors; glazing improvements; external shading; and addition of vestibule entry.
- **HEATING, VENTILATION, and AIR CONDITIONING (HVAC)** system improvements.
- **HEAT PUMPS**, air-to-air heat pumps when in lieu of other electrical or wood burning heating systems [special conditions apply].
- **HEAT PUMPS**, interfaced with solar collectors, surface water, ground water, wastewater, waste heat, or the ground itself.
- **LIGHTING** components, such as lamps, fixtures, controls, and other components that reduce energy consumption.
- **METHANE GAS RECOVERY** from landfills, including electric generation.
- **MOTOR CONTROLS**, such as variable frequency controls.
- **MOTORS**, energy saving items such as high efficiency motors, controls, load balancing, and staging.
- **TRANSPORTATION SAVINGS** when off-site transportation costs are saved as a result of on-site process changes.
- **PUMP SYSTEM IMPROVEMENTS** such as energy saving motors, motor controls, load balancing, staging, distribution system pressure reduction, irrigation systems, etc.
- **SOLAR** heating and lighting—passive.
- **SOLAR** space and water heating—active.
- **SWIMMING POOL** evaporation reduction measures including pool covers and controls.
- **WASTE HEAT RECOVERY** by heat pumps or by heat exchangers and applied to space heating, water heating, industrial process heating, or other beneficial use.
- **WASTEWATER TREATMENT LAGOONS** and system components.
- **WASTEWATER TREATMENT** plant process changes that save, produce, or recover energy.
- **WATER HEATING** and distribution system improvements.
- **WATERPOWER** used to generate electricity, and used for direct water-powered pumping, i.e. hydraulic ram.
- **WATER SYSTEM**, gravity distribution in lieu of pump pressures.
- **WEATHERIZATION**, such as weather-stripping, caulking, and other items to reduce infiltration
- **WIND POWER** used to generate electricity, or wind-powered pumping.

Continued...

New Energy Efficiency Technologies

Recent or underutilized efficiency improvements for buildings, large and small.

Construction Practices

- ◇ Building products with recycled content

Electrical Systems

- ◇ Dimming with daylighting controls
- ◇ Direct current distribution lighting system
- ◇ High efficiency office equipment—computers, printers, copiers, fax
- ◇ LED exit signs
- ◇ Optimized occupancy and sweep controls
- ◇ Resource efficient appliances: E-rated
- ◇ T5 fluorescent lamps

Envelope

- ◇ Controlled shading glazing
- ◇ Low emissivity or low shading coefficient windows as dictated by building orientation
- ◇ Orientation—natural lighting and control of solar heat gain
- ◇ Photovoltaic roofing

Heating, Ventilation, and Air Conditioning

- ◇ Direct digital terminal regulated air volumes: links from lighting controls
- ◇ Evaporative cooling
- ◇ Indoor air quality controls: CO₂-based ventilation

System Commissioning

Utility Options

- ◇ Direct gas purchases
- ◇ Electric deregulation: alternative purchase options
- ◇ Fuel cells

Financial Assistance

Federal Government

- ◇ Fuel Cell incentive payments
- ◇ Miscellaneous tax credit programs, <http://www.eren.doe.gov/EE/>

State Government

- ◇ Business Energy Tax Credit, Linda Kutnar 503-373-7803
- ◇ DEQ Pollution Prevention Tax Credit, Maggie Vandehey 503-776-6878 - Portland

Utility Programs ask us for the latest information

Project Assessment Services

- ◇ SELP Public Energy Package—free energy audits, “no risk” studies for the government sector
Kathy Estes 503-378-5048 or Kip Pheil 503-378-4442
- ◇ Utility energy audits—your local utility
- ◇ Regional Bioenergy Program, Mark Kendall 503-378-6043

**For more information call 1- 800-221-8035 or 503-378-4040
or visit our web site at: <http://egov.oregon.gov/ENERGY/>**

Loan Approval

We usually approve loans of up to \$100,000 within two to three weeks. Larger loans usually take at least 60 days to approve and are reviewed by the program's citizen advisory committee.

Oregon Business Energy Tax Credit

Applicants for the Energy Loan Program may also qualify for the Business Energy Tax Credit administered by the Oregon Department of Energy.

The Business Energy Tax Credit is available for Oregon businesses that invest in energy conservation, recycling, renewable energy resources or less-polluting transportation fuels. The tax credit covers a percentage of eligible project costs — the incremental cost of the system or equipment that is beyond standard practice.

For More Information

Energy Loan Program loan officers and technical experts will be happy to discuss your project with you. Call the loan program at 503-378-5048 or toll-free in Oregon at 1-800-221-8035. You can also visit our Web site listed below for more information.



OREGON
DEPARTMENT OF
ENERGY

Oregon Department of Energy

625 Marion St. N.E., Salem, OR 97301-3737
(503) 378-4040 • Toll-free: 1(800) 221-8035

Fax: (503) 373-7806

Web site: www.oregon.gov/energy



Oregon Energy Loans

Loans for:

- Energy conservation
- Renewable energy
- Recycling projects
- Alternative fuels

OREGON
DEPARTMENT OF
ENERGY

ENERGY LOAN DOLLARS AT WORK



◀ UNIVERSITY OF OREGON, LILLIS BUSINESS COMPLEX

The Lillis Business Complex design surpasses all standards for energy efficiency and environmental sustainability. Features include solar electric panels, water-conserving fixtures, and occupancy sensors for lights. The facility uses about 40% less energy than a similar building using conventional methods. The Energy Loan Program was pleased to provide a \$1 million loan for this sustainable building.

AGRIPLAS, INC. ▶

Every year, the agriculture industry generates millions of pounds of plastic waste. AgriPlas collects and processes these plastics that are later made into new products. A state loan allowed the recycling facility to install three new buildings to handle the volume of recyclables and keep them out of our landfills.



◀ SEQUENTIAL BIOFUELS

Biodiesel is a renewable, biodegradable, non-toxic fuel made from vegetable oil. Biodiesel replaces conventional petroleum diesel in almost any application. SeQuential-Pacific Biofuels used their energy loan to build Oregon's first biodiesel production plant in Salem. SeQuential-Retail built a public fueling station in Eugene with their loan.





One of the best ways to ensure that Oregon has clean and affordable energy in the future is to conserve the energy we use now. That's why the Legislature created the state Energy Loan Program (SELP) in 1979. It offers low-interest, fixed-rate, long-term loans for qualified Oregon projects that invest in energy conservation, renewable energy, and alternative fuels, or create products from recycled materials.

The program is self-supporting and uses no tax dollars for administration. Oregon general obligation bonds provide funds for the loans. Borrowers pay back the full cost of their loans, which cover bond payments and program costs. Most loans are structured so that energy savings cover the loan payment. Some applicants see additional savings above their loan payments. Once the loan is paid off, energy savings can be applied toward other needs.

The program has made more than 700 loans for more than \$345 million. These loans have financed projects that together have saved enough electricity, natural gas and oil to heat more than 150,000 Oregon homes each year.

Who Can Apply?

Individuals, businesses, municipal corporations, federal agencies, public corporations created by the state or federal governments, tribes, state agencies, schools and non-profit organizations may apply.

What Projects Qualify?

Eligible projects must be in Oregon and generally fall into one of four categories: energy conservation; producing energy from renewable resources such as water, geothermal, wind, solar, or biomass; using recycled materials to create new products; or promoting alternative fuels.

Examples of Previous Projects Include:

- lighting improvements
- weatherization
- solar and geothermal heating
- wind and solar electric systems
- motors and motor controls
- building management and control systems
- district heating
- HVAC systems
- methane gas recovery
- central steam plants
- cogeneration and hydroelectricity
- water heating improvements
- irrigation system improvements
- recycling projects
- alternative fuels for transportation

Eligible Costs

Loans can cover most energy-related project costs: engineering and design, permits, loan fees, project management, building commissioning and general project construction. They may also be applied as matching funds for grants. Applicants with multiple projects or facilities can bundle them together under one loan process to create more flexibility and reduce costs.

Loan Terms

Loans can be as small as \$20,000 or as large as \$20 million. Terms can range from five to 20 years or longer and are based on the type of project, the amount of energy saved, and other financial considerations. Loans are usually structured so that repayment is made from energy savings or income produced by the project.



Loan Rates

Interest rates are based on bond rates and are fixed for the full term of each loan. The bonds sell at favorable rates because they are backed by the State of Oregon and, in some cases, the interest earned by bond buyers is tax exempt.

Pre-Application Help

Loan officers and technical staff are available to meet with potential borrowers before they apply to discuss their energy projects and ensure a thorough and sound application. When we receive a loan application, we review the project's technical feasibility.

Technical Help

The program's staff often works with project engineers and designers early in the design phase, long before the loan process begins. The engineer reviews project reports and other documents to find ways to save energy, often suggesting ideas or technologies that may have been overlooked.

In addition, public facilities may qualify for a free preliminary on-site energy audit to help make the decision on whether to apply for a loan. If the results are positive, many facilities undergo a larger-scale, comprehensive energy study. The cost can be included in the loan.

Loan Fees

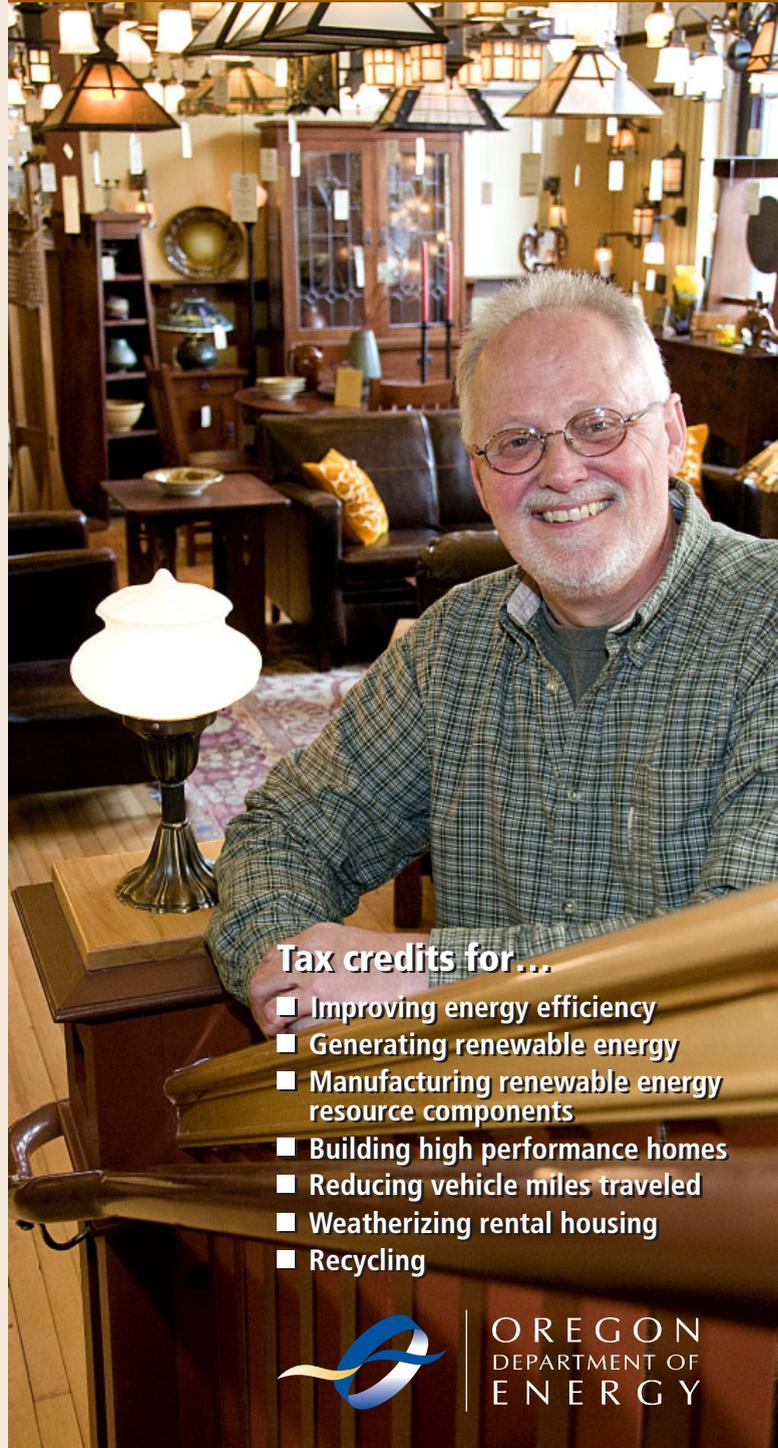
Loan fees and closing costs vary with each project. An application and underwriting fee is charged at the time of the application. A loan fee is charged at the time of closing. The loan fee can be paid out of loan funds.

Oregon Business Energy Tax Credit

FOR MORE INFORMATION

Call the Oregon Department of Energy toll-free at 1-800-221-8035. Or visit our Web site at www.oregon.gov/energy. You'll find application forms, administrative rules, information on the tax credit program and examples of businesses that have earned a tax credit for investing in energy efficiency.

Cover photo: Rejuvenation on SE Grand Avenue in Portland is the largest manufacturer and leading direct marketer of authentic production period lighting and house parts. The retailer received a \$16,322 Business Energy Tax Credit in 2007 for replacing 370 of its warehouse lamps and fixtures with energy efficient ones. The project is expected to save nearly 65 percent of its previous electricity use worth \$15,000 per year. Dave Misel, facilities maintenance supervisor, pictured on the cover, was the project manager.



Tax credits for ...

- Improving energy efficiency
- Generating renewable energy
- Manufacturing renewable energy resource components
- Building high performance homes
- Reducing vehicle miles traveled
- Weatherizing rental housing
- Recycling



OREGON
DEPARTMENT OF
ENERGY

625 Marion St. N.E., Salem, OR 97301-3737

1-800-221-8035 (toll-free)

(503) 378-4040 (Salem)

Fax: (503) 373-7806 • www.oregon.gov/energy



03/08
ODOE CF-104



OREGON
DEPARTMENT OF
ENERGY



Helping Oregonians save energy is part of our mission. That's why the Oregon Department of Energy offers the Business Energy Tax Credit to those who invest in energy conservation, recycling, renewable energy resources and less-polluting transportation fuels.

To date, more than 12,000 Oregon energy tax credits have been issued for energy projects valued at \$989 million. Altogether, those investments save or generate energy worth more than \$425 million a year.

HOW MUCH IS THE TAX CREDIT?

For qualifying renewable resource projects, the tax credit is 50 percent of the eligible project costs. For other projects, the tax credit is 35 percent of the eligible project costs — the incremental cost of the system or equipment that's beyond standard practice. The tax credit for building a qualified High Performance Home is up to \$12,000.

You take the tax credit over five years: for the 50 percent tax credit at the rate of 10 percent for each year; for the 35 percent tax credit at the rate of 10 percent in the first and second years, and 5 percent each year thereafter. If you can't take the full tax credit each year, you can carry the unused credit forward up to eight years. Projects with eligible project costs of \$20,000 or less are taken in one year.

WHO CAN GET A TAX CREDIT?

Trade, business or rental property owners with a business site in Oregon are eligible to apply for the tax credit. The business, its partners or its shareholders may use the credit. The applicant must be the project owner or the contract buyer of the project.

The business must use the equipment for the project or lease it for use at a site in Oregon.

A project owner also can be an Oregon non-profit organization, tribe or public entity that partners with an Oregon business or resident. This can be done using the Pass-through Option.

PASS-THROUGH OPTION

The Pass-through Option allows a project owner to transfer the Business Energy Tax Credit project eligibility to a pass-through partner in exchange for a lump-sum cash payment. A project owner who uses the Pass-through Option may be an Oregon public entity or non-profit organization with no tax liability or an Oregon business that chooses to use the Pass-through Option. Project owners and pass-through partners are advised to consult with their tax preparers when using the Pass-through Option.

The Oregon Department of Energy sets the Pass-through Option rates for the cash payment. Check the Web site for the current rates. For additional information and the Pass-through Option Agreement form, consult the Web site or call.

WHAT TYPES OF PROJECTS QUALIFY?

Many projects qualify. They include:

- Conservation
- Renewable Resource
- High Performance Homes
- Homebuilder Installed Renewable Energy Projects
- Renewable Energy Resource Equipment Manufacturing
- Sustainable Buildings
- Transportation
- Alternative Fuels
- Rental Dwelling Weatherization
- Recycling

Conservation Projects

- Lighting improvements
- Irrigation efficiency improvements
- Agriculture crop frost protection
- Controls for heating and cooling systems
- Improved pumps and motors
- Heat recovery from refrigeration systems

These are just some of the conservation projects that qualify for the tax credit.

To qualify for a tax credit, retrofit projects (except for lighting projects) must be 10 percent more efficient than existing installation. Lighting retrofit projects must be 25 percent more efficient than existing lighting. Project owners must report how lighting fixtures, lamps and ballasts replaced in a lighting project (and thereafter) will be recycled. The project must have a minimum simple payback of 1 year to a maximum of 15 years. Projects over 15 years will be prorated.

You can also qualify for a tax credit for installing energy-efficiency measures during new construction. Measures must reduce energy use by at least 10 percent compared to a similar building that meets the minimum requirements of the state energy code. The tax credit is 35 percent of the incremental (or additional) costs of making the project exceed energy code or standard industry practice. Lighting for new construction projects must be 10 percent more efficient than energy code or standard industry practice. New construction projects must have a simple payback of 1 to 15 years.

Co-generation projects that use the heat by-product of generating electricity also qualify for a tax credit. The Oregon Department of Energy uses the standard of 6,800 BTU/kilowatt-hour produced and requires that the project be 10 percent more efficient and have a simple payback of 1 to 15 years.



The Les Schwab Tire Store

on NW 9th Street in Corvallis was a 4,000 square-foot 33-year-old facility with outdated lighting.

It is open 12 hours a day, six days a week and the lights must be bright as the display racks of black tires absorb the light. The electricity bill was a major expense that was increasing. Management had all of the store's 186 older T12 lamps and magnetic ballasts replaced with energy-efficient T8 lamps and electronic ballasts. The project cost \$16,789. The tax credit amounted to \$5,876.

The project is conserving an estimated 45 percent of the store's lighting energy use or approximately \$380 a month on the utility bill. That's over 70,000-kilowatt hours of electricity per year — enough electricity to meet the needs of 4.5 electrically heated Oregon homes each year.

Renewable Resource Projects

Projects that use solar, wind, hydro, geothermal or bio-mass to produce energy, or displace energy, may qualify for a tax credit that is 50 percent of eligible costs. Renewable resource projects must replace at least 10 percent of the energy used. The energy can be used on site or sold.

Stoller Winery in Dayton installed 224 solar arrays to provide 44,000 kilowatt-hours of electricity per year. Owner Bill Stoller anticipates the electricity generated will provide 40 to 50 percent of the electric load. The PV



system qualified for a \$192,900 Business Energy Tax Credit from the Oregon Department of Energy.

The Selma Community and Education Center in Josephine County in rural Southern Oregon revitalized an abandoned elementary school site with a popular farmer's market. The focal point was a photovoltaic installation that helped offset electric bills and demonstrated renewable energy to the community. The system was eligible for a Business Energy Tax Credit. The non-profit Center partnered with a local resident who provided a lump sum cash payment in exchange for the tax credit.



High Performance Homes

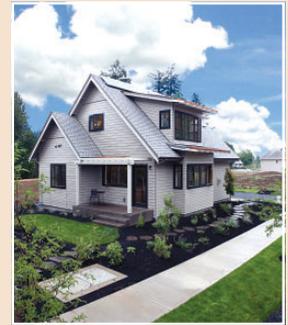
A homebuilder who constructs a new home in Oregon that meets specifications for a High Performance Home and includes a renewable energy system is eligible for a Business Energy Tax Credit. The home must be field-verified by a certified third party.

The amount of the tax credit for a High Performance Home available to the builder is up to \$12,000. Once a homebuilder has applied for a Business Energy Tax Credit for the home, a homeowner would not be able to apply for the Oregon Residential Energy Tax Credit for the same features.

Homebuilder Installed Renewable Energy Projects

Homebuilders who construct a new single-family home in Oregon with photovoltaic, solar water heating, active solar heating, passive solar heating, ground-source heat pumps and other renewable energy resources such as wind or fuel cells that meet specifications may be eligible for a Business Energy Tax Credit of up to \$9,000. Once a homebuilder has applied for a Business Energy Tax Credit for the home, a homeowner would not be able to apply for the Residential Energy Tax Credit for the same features.

Pringle Creek Cottage in Salem met the criteria of a High Performance Home and qualified the builder, Bilyeu Homes, for a Business Energy



Tax Credit. It is one of the first homes to qualify for the tax credit created in 2007. The two-bedroom, two-bathroom 1,350-square-foot home is efficient in its use of space and has extremely low energy consumption. It has solar water heating, solar electric and a geothermal heat pump.

Renewable Energy Resource Equipment Manufacturing Facilities

Oregon facilities that manufacture renewable energy resource equipment may be eligible for a Business Energy Tax Credit. Eligible costs may include the building, equipment and machinery and other costs used to manufacture equipment, machinery or products designed exclusively to use a renewable energy resource. The facilities are eligible for a tax credit of 50 percent of eligible costs, up to a maximum of \$40 million in eligible costs.

Sustainable Building Projects

Business owners who build a sustainable commercial building are eligible for a tax credit from the Oregon Department of Energy. Sustainability is generally defined as the use of today's resources in a manner that enables people to meet their current needs and provides for future generations. Sustainable buildings use energy as efficiently as possible by today's standards. The building must meet an established standard set by the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED™) or other approved green building program. A rating system must be based on accepted energy and environmental principles that evaluate environmental performance from a "whole building" perspective over a commercial building's life cycle. It provides a definitive standard for what constitutes a "sustainable" building.

The sustainable building tax credit offers a new approach for business owners to receive a tax credit. It is based on the square footage of the building and the

level of sustainability achieved. (Traditional tax credits are based on the increased cost of a project above the industry standard or the energy code.) The sustainable building tax credit incentive helps offset the cost of applying for the LEED™ or other rating system and the extra design and commissioning costs. The application form must be submitted within 30 days of when you receive your rating project registration number.



Oregon Health & Science University's new 16-story 400,000-square-foot Center for Health & Healing on Portland's South Waterfront was the first medical and research building to achieve the U.S. Green Building Council's LEED Platinum certification. The goal was to build a structure 60 percent more energy efficient than a standard building at a cost that was 25 percent less. It is expected to save \$660,000 in annual operating costs because of its energy efficiency measures. The building qualified for a Business Energy Tax Credit of \$1.1 million which the university transferred to a private business partner in exchange for a lump sum cash payment using the Pass-through Option program.

Transportation Projects

Projects that reduce vehicle miles traveled may qualify for a tax credit.

Business owners can get a tax credit for purchasing and installing equipment that allows an employee to telework one or more days a week. Computers, fax machines, modems, phones, printers, software, copiers and other equipment necessary for telework qualify. The employee must telework at least 45 days per calendar year.

You can get a tax credit for purchasing transit passes for riders, vehicles for vanpooling or carpooling, bicycles for commuting, equipment for transit shelters or bicycle storage, and vehicles for transporting riders. Other incentives that encourage employees to carpool, take transit, telework, walk or bike also may be eligible for a tax credit, as are membership fees for transportation management services, and carsharing. To learn more see our Web site.



*Employees at **St. Charles Medical Center** in Bend receive gift certificates to local restaurants and retail shops for biking, walking or carpooling to work. The certificates are an incentive to the employee to participate in the program that reduces vehicle miles.*

Alternative Fuel and Hybrid Vehicle Projects

Alternatives to gasoline and diesel help provide cleaner air, diversity of transportation fuels, and reduce demands on foreign petroleum. The alternative fuels include electricity, biofuels, hydrogen, hythane, methane, methanol, natural gas, liquefied natural gas, liquefied petroleum gas (propane), renewable diesel and other fuels the Oregon Department of Energy allows. Many of these transportation fuels burn cleaner, come from renewable sources and originate in North America. Blends of these alternative fuels with conventional fuels will be considered if the concentration of the alternative fuel is 20 percent of the entire volume of the blended fuel or greater. Businesses that invest in vehicles that use alternative fuels or supplying alternative fuels are eligible for a Business Energy Tax Credit.

Businesses that purchase hybrid gasoline-electric vehicles may also qualify for a tax credit. The vehicle must appear on the Oregon Department of Energy list of qualifying hybrid vehicles. Hybrid vehicles must be registered and licensed for roadway use by the Oregon Department of Motor Vehicles to qualify for a tax credit.



www.oregon.gov/energy or 1-800-221-8035

Rental Dwelling Weatherization Projects

If you own rental housing — a single house or a large apartment complex — you can stretch your weatherization dollars by applying for a Business Energy Tax Credit.

Rental property weatherization projects qualify for a tax credit if cost-effective. These projects should have a simple payback of 1 to 30 years.

Some of the measures that qualify for a tax credit are projects such as:

- Thermal replacement windows or doors
- Attic, floor, and wall insulation
- Pipe and duct insulation
- Caulking and weatherstripping



Landlords

Rosalind Carmack (left) and her husband, Jim, have owned a four-plex and a 70-year-old 1,300-square-foot rental home in Eugene's West University neighborhood for several years. The

Carmacks installed new energy-efficient windows that have a special surface coating to reduce heat transfer back through the window. The window project is expected to lower the electric heat usage by 12 percent. The \$3,272 project qualified for a rental weatherization tax credit of \$1,145.

To be eligible:

1. You must have the energy conservation measure listed in an energy audit report

Or

2. You must show that energy conservation measures save 10 percent of the energy used by the system in your dwelling. The Oregon Department of Energy will calculate this energy savings using an industry-accepted formula.

Recycling Projects

Projects that develop new markets for recycled materials or that recycle materials not required by law are eligible for the tax credit. Equipment must be dedicated exclusively for the recycling project. Qualifying equipment includes that which recovers industrial wastes, such as solvent recovery systems and wood waste sorting systems. Equipment used to process recycled materials is also eligible if recycling the materials is not required by law. Crushers, bins, drop boxes, scales, separators, balers, conveyors and compactors qualify. New or replacement equipment for sorting or hauling of beverage cans, bottles, or other materials where their recycling is required by law is not eligible for the tax credit. Other examples of ineligible projects are recycling of chlorofluorocarbons and used motor oil.

Getting an Energy Tax Credit

WHAT COSTS ARE ELIGIBLE?

The tax credit can cover all costs directly related to the project, including equipment cost, engineering and design fees, materials, supplies and installation costs. Loan fees and permit costs also may be claimed. Replacing equipment at the end of its useful life or equipment required to meet codes or other government regulations is not eligible. Operation and maintenance costs are not eligible.

HOW DO I APPLY FOR THE TAX CREDIT?

You must apply for the tax credit *before* starting your project. You may request a waiver, but it will be granted only for business hardships or circumstances beyond your control that caused you to delay your application. The request must be received in writing within 90 days of project start and describe clearly the hardship or circumstances.

Submit the project-specific Application for Preliminary Certification. Your application must be complete and include payment for review charges. The Oregon Department of Energy will send you a Preliminary Certificate when your application is approved. That's your go-ahead to start the project. You will also receive additional information on how to apply for the Final Certificate. Projects with eligible costs of

\$50,000 or more are required to have a letter from a certified public accountant (CPA) who is not a permanent employee of the project owner.

WHAT IF MY PROJECT CHANGES AFTER I BEGIN?

If your project changes (additions, deletions or fundamental changes to the scope of the project) after you have received the Preliminary Certificate, you must re-submit written documentation of the technical changes made and the impact on costs.

Please note that a Final Certificate may not be issued for more than 110 percent of the eligible project costs unless you have submitted written documentation, and the Oregon Department of Energy has issued an amended Preliminary Certification before project completion.

The Oregon Department of Energy performs some follow-up site reviews to verify that equipment has been installed and operates as specified.

LOANS FOR ENERGY-SAVING PROJECTS

The Oregon Department of Energy also administers the Energy Loan Program. The program offers low-interest, fixed-rate, long-term loans for conservation, renewable resource, alternative fuel and recycling projects. Loans can be used to pay most energy-related project costs, including engineering and design, permits, fees, project management, commissioning, equipment and construction. Loans can be secured by the project or other assets. Call the Oregon Department of Energy for details.

www.oregon.gov/energy or 1-800-221-8035



Finley Bioenergy LLC saw an opportunity at Oregon's second largest landfill located southeast of Boardman. They use the methane produced by decomposing waste at the landfill to fuel generators that produce approximately 25,233,000 kWh of electricity each year. In addition, Finley Bioenergy is piping the waste heat from its generators to the neighboring onion processing plant to help dry their onions. With the \$4.4 million energy loan from the Oregon Department of Energy, Finley Bioenergy LLC was able to get its project up and running.

Table 1: District Energy Development – Phases, Steps, Roles and Key Questions

Phases in Developing District Energy

	Advocacy, Vision and Policy Framework				Screening and Feasibility		Detailed Investment Analysis			Development		Operations, Maintenance and Expansion		
Steps in Developing District Energy	Advocacy and Education	Objective Setting	Data Gathering	Project Definition	Options Appraisal	Feasibility Study	Detailed Investment Analysis and Financial Modeling	Detailed Business Modeling	Soft Market Testing	Design, Permitting and Construction	Commissioning	Operations	Maintenance	Expansion
Key Roles:														
District Energy Advocate	[Active]													
Facilitator/Convener	[Active]													
Pre-feasibility Consultant	[Active]													
Feasibility Consultant	[Active]													
Franchisee/Owner/Financier	[Active]													
Project Developer	[Active]													
Utility Operator	[Active]													
Regulators	[Active]													
	<p>What is district energy? Why is our municipality promoting and pursuing district energy? Who will facilitate this process?</p> <p>What is the most efficient way to assemble the required data? Are local energy costs and other market conditions conducive to district energy development? Does the opportunity site currently have sufficient demand and density? Is the opportunity site projected to have sufficient demand & density?</p> <p>Does the proposed project meet our internal hurdle rate/target ROI? What are the most likely right of way alignments for underground piping? What are the best sites for district energy plants? How might fuel deliveries impact neighborhood traffic patterns? What are the best technology options for this location? What are the quantifiable environmental benefits of various technology options and fuel sources? How strong are this project's economics, in terms of a pro-forma and sensitivity analysis?</p> <p>What is the best overall technology solution for the site? What is the best regulatory pathway to succeed? Which technology vendors and subs do we want to work with? Which of our technology offerings can we incorporate into this project?</p> <p>How can we reduce operating costs? How can we expand our customer base? How can we increase profitability?</p>													

- (EWEB), Eugene Water and Electric Board. "Seneca Biomass Energy Project." <http://www.eweb.org/biomass>.
- (PoSI), Portland Sustainability Institute. "District Energy for Portland: Development, Ownership & Governance Models." 2011.
- Agency, United States Environmental Protection. "Combined Heat and Power Partnership: Hotels and Casinos." <http://www.epa.gov/chp/markets/casinos.html>.
- Architects, Rowell & Brokaw. "Eweb Riverfront Master Plan." <http://eweb.org/riverfront>.
- Austin, Anna. "Montpelier Building Biomass District Energy System." *Biomass Power & Thermal*, 2011.
- Biomass Energy Resource Center. "Forming, Financing, and Permitting a District Energy Facility in Vermont." August 2009.
- Board, Eugene Water and Electric. "Steam Utility Transition Plan." <http://www.eweb.org/steam>.
- Church, Ken. "Is District Energy Right for Your Community? Part 1: The Concept." *Municipal World*, November 2007.
- . "Is District Energy Right for Your Community? Part 2: Sizing the System." *Municipal World*, December 2007, 7-9.
- . "Is District Energy Right for Your Community? Part 3: Supporting Resources." *Municipal World*, January 2008, 25-27.
- City of Eugene, and Sera Architects. "Detailed Development Program for Walnut Station." February 15, 2009.
- City of Montpelier, Vermont. "Montpelier Community Renewable Energy Project." 2009.
- Compass Resource Management. "Business Analysis for a Neighborhood Energy Utility in the North Pearl District." Portland, OR: City of Portland, March 31, 2009.
- County, Santa Barbara. "Municipal Energy Financing District: Feasibility Study." November 19, 2009.
- Energy Trust of Oregon. "Biopower."
- Eugene, City of. "A Community Climate and Energy Action Plan for Eugene." 21. Eugene, OR, 2010.
- . "Building and Permit Services Fees." <http://www.eugene-or.gov/portal/server.pt?open=512&objID=225&PageID=365&cached=true&mode=2&userID=2>.
- . "City Code." Eugene, OR.
- . "Envision Eugene: Draft Proposal." edited by Planning and Sustainability. Eugene, OR, March 2, 2011.
- . "Erosion Prevention and Construction Site Management Program." <http://www.eugene-or.gov/portal/server.pt?open=512&objID=689&PageID=1738&cached=true&mode=2&userID=2>.
- . "S-Ws Walnut Station Special Area Zone - Draft." 2010.
- Eugene Water and Electric Board, (EWEB). "Steam Utility Transition Plan." <http://www.eweb.org/steam>.
- Eugene", "City of. "Envision Eugene: Draft Proposal." edited by Planning and Sustainability. Eugene, OR, March 2, 2011.
- Foddy, William. *Constructing Questions for Interviews and Questionnaires: Theory and Practice in Social Research*. New York, NY: Cambridge University Press, 1993.
- Garmon, Jenna. April 25, 2011.
- Gochenour, Carolyn. "District Energy Trends, Issues, and Opportunities." Washington, DC: The World Bank, 2001.

Hallsmith, Gwen. 2011.

Hatten, Michael. January 31, 2011.

Infrastructure Finance Authority. "Renewable Energy Feasibility Fund."

Institute, Portland Sustainability. "Streamlining Portland's District Energy Regulations." March 31, 2011.

International District Energy Association, (IDEA). "Idea Report: The District Energy Industry." August 5, 2005.

Interview, EWEB Management Group. 2010.

Jia, Hu, Tina Orem, Amy Percell, and Walid Wahed. "Eugene Water and Electric Board Report." University of Oregon, May 24, 2010.

Johnson, Jerry. "Financial Analysis of Selected Redevelopment Programs in Walnut Station, Eugene, Oregon." October 31, 2008.

Kane, Alisa. February 9, 2011.

Kulongowski, Ted. "Executive Order 06-02." January 19, 2006.

Logan, Mike. 2010.

Management, Compass Resource. "Business Analysis for a Neighborhood Energy Utility in the North Pearl District." Portland, OR: City of Portland, March 31, 2009.

Miksis, Mark. December 7, 2010.

Oregon Department of Energy. "Business Energy Tax Credits."
———. "Energy Conservation."
———. "Renewable Energy Grant: Creff."
———. "Selp Fees."
———. "State Energy Loan Program."

Oregon, State of. "Chapter 198 - Special Districts Generally." 2009.

Oregon, University of. "Riverfront Research Park Information."
<http://researchpark.uoregon.edu/html/information.html>.

Osdoba, Tom. January 26, 2011.
———. 2011.
———. December 6, 2010.

Pape, Dean. 2011.

Portland, City of. "Highlights of Ricap 5." edited by Bureau of Planning and Sustainability. Portland, OR, 2011.

Portland Sustainability Institute, (PoSI). "District Energy for Portland: Development, Ownership & Governance Models." 2011.
———. "Lloyd Crossing: Sustainable Urban Design Plan & Catalyst Project." edited by Portland Development Commission, 2010.
———. "Streamlining Portland's District Energy Regulations." March 2011.

Preservation Green Lab, and University of Oregon. "The Role of District Energy Systems in Achieving Sustainability for Neighborhoods of Existing and Historic Buildings." June 2010.

Ramey, Chris. December 9, 2010.

Services, City of Eugene Building & Permit. "Limited Consultation Staff Procedures." Eugene, OR: City of Eugene, November 1, 2010.

Skeehan, Heather. February 9, 2011.

Solarc. "Eweb Riverfront District Energy Study." April 14, 2010.

Strategic Economics. "Key Findings from the Market Overview of Walnut Station and Implications for Future Development."

- Thorsteinsson, Hildigunnar, and Jefferson Tester. "Barriers and Enablers to Geothermal District Heating System Development in the United States." *Energy Policy* 38 (November 1, 2009): 803-13.
- United States Department of Agriculture. "Reap Grants for Feasibility Studies."
- United States Environmental Protection Agency. "Combined Heat and Power Partnership Funding Resources."
- . "Funding Resources for Combined Heat and Power."
<http://www.epa.gov/chp/funding/index.html>.
- . "Or Business Energy Tax Credit."
- Urbsworks Inc. "Walnut Mixed Use Station Existing Conditions Report." City of Eugene, Oregon, 2005.
- . "Walnut Station Mixed-Use Center Existing Conditions Report." 2005.
- Utilities, Corix. "University of Oklahoma -- Long Term Operating and Maintenance Agreement." 2010.
- Yin, Robert K. *Applications of Case Study Research*. Vol. 34. California: Sage Publications, Inc., 1993.