Staff Assessment: *Alternative Proposal to the Board's Steam Utility Transition Plan - NW Neighborhood Energy's District Heating Study Concept*

Staff has reviewed the attached proposal from NW Neighborhood Energy (NWNE) and has concluded that there are insufficient potential benefits identified to offset the significant risks inherent to diverting our approach or voicing our support for NW Neighborhood Energy's study. Staff has arrived at this conclusion based on these considerations:

1. **Staff Financial Assessment - Insufficient Benefits, Higher Cost:** The attached cost comparison developed absent any preliminary financial assessment from NWNE has concluded there are insufficient quantifiable benefits to offset the significant cost involved with the community energy proposal.

2. **Federal Stimulus Funds Tied to Current Approach:** Staff has worked closely with the city of Eugene to coordinate and prepare our submittals under the federal economic stimulus process. We currently have a $5m proposal submitted under the State Energy Program and the City of Eugene intends to set aside $500,000 of their $1,484,800 allocation under the Energy Efficiency and Conservation Block Grants to convert their buildings. Staff believes it is inappropriate to publicly support the NWNE proposal while simultaneously seeking public funds for an alternative strategy.

3. **"100 Percent Carbon Neutrality" Not Possible:** The largest benefit we understand that would result from NWNE's approach is a "100 percent carbon neutral" alternative to the on-site conversion strategy we are pursuing. While not mentioned in their proposal, we recently learned that some backup fuel, "probably a central natural gas boiler" would be required to offset periods when wind energy was not being produced. The capacity of the boiler required would probably be comparable to the boiler we currently operate, raising new questions on the assumptions for decommissioning our steam and electric generation assets.

4. **Raises Possibility of New Requirements for the Riverfront Master Planning Process:** With this study, the CAT team and architect would need to come up with an alternate design to anticipate an entire new footprint and a complex list of revised assumptions would need to be considered for the property. This would include a large reservoir, electric distribution, smart grid telemetry and switch gear, and back up steam boiler, none of which has been factored into the current contract discussions with the consultant.

5. **Customer Confidence & Trust at Risk:** NWNE proposes a "non-profit" operating model, which poses significant unanswered questions on who would be tasked with the long term operation, maintenance and administrative aspects of running the proposed district heating system. The trust and confidence EWEB has earned with our steam customers could be compromised without a definitive transition strategy to a known service provider, such as the approach we are taking with NW Natural. After years of waiting and speculation by downtown businesses, if EWEB were to endorse this study in any way, it could signal we are now taking a sudden departure from the existing site-specific conversion strategy we've repeatedly discussed. This might be the last chance we have to get NW Natural to partner with us in developing a solution for our small business customers. Losing them as a partner would be a significant setback. This is perhaps the most significant risk of voicing our support for this study.

6. **Time Is Of The Essence:** At the very least, the volatility in the natural gas wholesale market could re-surface during the time required to pursue this study. But perhaps the most time sensitive aspect is to do as much as possible to take advantage of the three year steam sales contract we successfully negotiated with Peace Health. Pursuing this plan could negate the opportunity that customers have been given by Peace Health's willingness to sign with us, which is essential to our current strategy.

EWEB DISTRICT HEATING SYSTEM PLANNING SCENARIOS
"FIRST ORDER" COST COMPARISON

	SCENARIO 1 (BASE CASE)	SCENARIO 2 SYSTEM PHASE-OUT & CUSTOMER CONVERSION	SCENARIO 3 COMMUNITY ENERGY SOLUTION (SORENSON PROPOSAL)	
NUMBER OF CUSTOMERS:	**75**	**75**	**75**	
ANNUAL HEATING LOAD (in KLBS or Equivalent):	**100,000 Klbs**	**100,000 Klbs**	**100,000 Klbs**	Current steam sales, less Sacred Heart, Eugene Hotel
ANNUAL SYSTEM EFFICIENCY:	**50%**	**90%**	**90%**	Fuel Conversion/Distribution Losses
ESTIMATED CAPITAL CONSTRCTION COST:				
Customer On-Site Conversions (75 Customers	n/a	$10,000,000	$15,000,000	Scenario 3 requires more extensive customer retrofits
Distribution System (2.5 miles @$500/ft):	n/a	n/a	$6,600,000	Assumes replacement of less than half of current system
Underground Reservoir (0.5 million gallons):	n/a	n/a	$1,500,000	$3.00 per gallon, based on adjusted water system costs
Backup Boiler (for Scenario 3)	n/a	n/a	$2,000,000	25,000 pounds per hour capacity for peaking/supplemental
System Auxiliaries (Pumps, electrical, controls)	n/a	n/a	$1,000,000	To control distribution loop and circulate water
Smart Grid: (Metering, Telemetry, Software)	n/a	n/a	$2,500,000	To provide 5-10 mw of demand side load control
Total Capital Cost:	**n/a**	**$10,000,000**	**$28,600,000**	Estimated total up front capital cost
ANNUAL FUEL REQUIREMENTS:				
Natural Gas:	**200,000 MMBTU**	**111,111 MMBTU**	**11,111 MMBTU**	10 percent of load at assumed efficiency for Scenario 3
Electricity:	n/a	n/a	**29,300 MWh**	90 percent of load at assumed efficiency for Scenario 3
ANNUALIZED SYSTEM COSTS:				
Operation & Maintenance:	1,300,000 per current budget	300,000	858,000	3 percent of original capital cost for Scenarios 2 and 3
Fuel	1,300,000	1,111,111	2,416,201	Gas/electricity costs at assumed efficiencies and prices
Capital Amortization (10 years, 5% interest)	250,000 per current budget	1,295,046	3,703,831	Annual payment on original capital cost
Municipal Taxes/Franchise Fees	181,915	83,696	215,815	City gets 6% in-lieu or 3% franchise fee
Total Annual Cost	**3,031,915**	**2,789,852**	**7,193,847**	Estimated Annual Revenue/Cost
Avg Operating Cost/ KLB (w/o Capital Recovery)	**$27.82**	**$14.95**	**$34.90**	What heating costs would look like (in todays dollars) after 10 years
Total Cost / KLB (includes Capital Recovery)	**$30.32**	**$27.90**	**$71.94**	Approximate cost/klb in the first 10 years with capital recovery
% Difference (compared to base case):	**n/a**	**-8.0%**	**137.3%**	Higher/Lower than Current System
10-year cost difference	**n/a**	**-$2,420,625 (Savings)**	**$41,619,325 (Loss)**	10-Year Savings/Cost compared to current system
10-Year Simple Return on Investment:	**n/a**	**24.2% (Positive Return)**	**-145.5% (Negative Return)**	

THERMAL CONVERSION FACTORS:

1,000,000 BTU's per KLB
3413 BTU's per Kilowatt-hour

FUEL PRICES:

$80.00 Cost of Electricity (Windpower) Per Megawatt-Hour
$6.50 Wholesale Cost of Gas per MMBTU
$10.00 Retail Cost of Gas per MMBTU

(Received from John Sorenson, May 14, 2009)

Proposed Study:
Eugene, OR - The first Smart-Grid heated city in the US

The Issue: EWEB Steam is operated by Eugene Water and Electric Board. It is a district energy system using steam to heat 3 million square feet for 67 customers in the downtown area. This natural gas-fired steam system is operating at about 54% efficiency with rising costs and a shrinking customer base and is slated for closure in 2013. The present plan being discussed by EWEB is to dismantle the district energy infrastructure and convert current EWEB Steam customers to on-site natural gas boilers which will require extensive retrofitting of the customer's property. While this plan would reduce natural gas usage from present rates, it may not generate optimal economic returns and may hinder Eugene's efforts to achieve admirable and aggressive carbon emissions reduction targets.

The Opportunity: Replace the outdated steam system with a community-owned modern hydronic district heating and cooling system, improving efficiency, achieving price stability, and lowering fuel use immediately. The proposed primary energy resource for the new system is high-voltage electricity to balance and optimize wind power generation in the Pacific Northwest.

The Model: District Heating St. Paul, an award-winning non-profit private utility, operates the largest, most successful hydronic district heating system in North America, serving 33 million square feet in downtown St. Paul, MN. In the early 1980s they replaced an aging steam district energy system with a modern hydronic system, increasing operating efficiency and reducing pollution. They now have an 80% share of the customers in a competitive market, and they are heating twice as much square footage with the same amount of fuel as in 1980. District Heating St. Paul is a leader in green energy, presently deriving about 60% of its energy from renewable sources.

The Innovation: Balancing windpower generation by installing Smart-Grid integration technology at the utility scale. The new district heating and cooling systems can heat or chill water using high-voltage electricity associated with regulated windpower generation, providing a simultaneous benefit to the City of Eugene and Bonneville Power Administration, which has already expressed support for the concept of the study. Massive hydronic storage will allow this thermal energy to be captured when the power is available and used according to demand, achieving efficiency, reliability, and economy.

The Community: Current EWEB Steam customers, including the City of Eugene, Lane County, Hilton, Peace Health Hospital, St. Mary's Episcopal Church, First United Methodist Church, and others; Bonneville Power Administration; EWEB; potential future customers of an expanded district heating and cooling system.

The Feasibility Study: We propose a thorough feasibility study
providing a technical and economic assessment of the potential for a district heating and cooling system serving new and existing developments in downtown Eugene, Oregon. A unique feature of this proposal is a thorough analysis of incorporating an electric utility's time varying Automatic Generation Control signal, in conjunction with heat storage, as the primary energy source. During this study, N2e (Portland, OR) in association with Evergreen Energy (St. Paul, MN), Ecofys US (Corvallis, OR), and ECONorthwest (Eugene, OR), will determine the economic projection of a hydronic district heating and cooling system and develop the initial engineering concepts for downtown Eugene, including expansion and integration from the core service area.

Partners:

N2e – Neighborhood Natural Energy	www.n2e.org
Ever-Green Energy	www.ever-greenenergy.com
Ecofys US	www.ecofys.com
ECONorthwest	www.econw.com

For further information on district heating and cooling:

www.n2e.org
www.districtenergy.com

http://en.wikipedia.org/wiki/District_heating

If you have questions about the proposed study, please contact:

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Neighborhood Energy Heating and Cooling
Feasibility Study Proposal for Eugene, Oregon

For: Bonneville Power Administration (BPA) and Oregon Dept. of Energy (ODOE)

Rough Draft.

Prepared by: N2e (Neighborhood Natural Energy) and Ecofys US.

General:

We propose an initial feasibility study that will provide a broader technical and economical assessment of the potential for using a new district heating and cooling system serving new and existing developments in downtown Eugene, Oregon. A unique feature of this proposal is a thorough analysis of incorporating an electric utility's time-varying Automatic Generation Control signal, in conjunction with heat storage, as the primary energy source. This aspect of the proposal could establish a national model for a large scale Smart Grid technology that provides low-emission, low-cost energy for District Energy (hereinafter referred to as Neighborhood Energy, NE) customers while facilitating the integration of renewable resources on the power grid.

We believe the downtown area of Eugene presents conditions conducive to the economic, environmental, and social benefits of hydronic Neighborhood Heating and Cooling (NH/NC). Among these are four key factors: 1) The retirement of EWEB Steam 2) The existing steam NE customer base is familiar with and has existing on-site infrastructure that accommodates NE 3) Access to carbon neutral, local energy resources such as thermal solar, biomass fuel and smart grid-integrated technology 4) Carbon neutral fuel sources are a critical component of any plan to meet stated CO2 emissions reduction goals articulated by the City of Eugene and the State of Oregon.

During this study, N2e, a nonprofit located in Portland, OR, will affiliate with Evergreen Energy, St. Paul MN, Ecofys US, Corvallis, OR, and ECONorthwest, headquartered in Eugene, OR. We will determine the economic projection of a hydronic NH/NC system and develop the initial engineering concepts for downtown Eugene, including expansion and integration from the core service area.

History:

The Eugene Water and Electric Board (EWEB) is the current operator of EWEB Steam. EWEB plans to retire the existing steam utility for a number of reasons, principally a lack of efficiency and consequent additional cost to their customers. EWEB Steam currently operates at an efficiency of 54%, and the gradual loss of customers adds to the cost of energy. The system operates on Natural Gas with high exposure to price volatility.

Prior to the timber and lumber industry collapse in the region in the late 1970's and early '80's, EWEB Steam's fuel was hog fuel supplied from the lumber industry's many mills in the area. Fuel was free and even net positive to EWEB. The customer base included many downtown customers, the City of Eugene's buildings, Lane County, retirement homes, hotels, North West Christian College (now University) and many local churches. The largest customers, Agri-Pac, a large vegetable packing plant, Chase Gardens, a large scale green-house facility, and Sacred Heart Hospital created substantial demand that allowed the system to remain viable.

Agri-Pac and Chase Gardens closed their businesses. As the timber economy collapsed, so went the free fuel. EWEB sought another fuel resource, ultimately choosing Natural Gas. The steam system was converted to Natural Gas boilers, including a start-up boiler acquired from the retired Trojan Nuclear Power plant near St. Helens, OR.

EWEB Steam has operated with outstanding customer service and reliability for its customers. Rising costs beyond EWEB's control have forced the Board to take the position to retire the system.

In light of these events, EWEB is exploring ways to assist their existing customers to transition to other fuel or energy sources. EWEB is currently seeking funding for a proposed study to discover costs associated with the disconnection of the steam system and the additional cost of installing individual on-site Natural Gas boilers for individual customers.

Also relevant to the study is the steam inter-tie between EWEB Steam and the University of Oregon's Physical Plant. This inter-tie was engineered as a back-up for both systems.

The Opportunity:

The purpose of our proposal is to explore an alternate strategy that may yield superior benefits to EWEB customers (former, existing, and potential new customers), the City of Eugene, Bonneville Power Administration (BPA), EWEB, and to the State of Oregon. This model addresses carbon reduction strategies, stabilizes energy costs, and leverages an economic multiplier effect by recirculating energy dollars in the local economy. Another potential benefit is the development and implementation of "smart grid" technology within the BPA territory as a fuel source for new hydronic NE systems.

Deliverables:

1) **Executive Summary:** Summary of the findings and conclusions of the study as well as recommendations on implementing hydronic NE in downtown Eugene.

2) **Background:**

   2.1) Neighborhood Energy in General. The section will describe hydronic NE in general and summarize the specific conditions in Eugene.

   2.2) Neighborhood Energy Benefits. NE systems provide numerous benefits to the stakeholders. The section will address the potential benefits of the system for downtown Eugene, such as:

   - Provide stable heating and cooling costs
   - Reduced operations and maintenance costs
   - Contribute to local economic development
   - Reliable heating and cooling services
   - Improved energy efficiency
   - Reduced greenhouse gas emissions
   - Increase renewable energy use
   - Increase energy independence
   - Reduced use of potable water for energy needs
   - Reduced use of toxic chemicals

3) **Potential Market:** Existing and planned thermal energy loads are a key component to the cost-effectiveness of NE projects. A survey of the potential markets and estimates for the project will be performed.

   3.1) Potential Users.

   - All existing EWEB Steam customers
   - Former customers of EWEB Steam
   - Future development of the EWEB property
   - Old Agri-Pac property redevelopment
   - Federal Courthouse
   - Property owners along or adjacent to the proposed operating pattern.

3.2) Estimated Heating and Cooling Loads: Heating and air conditioning utilization of existing buildings will be determined based on operating data, and installed equipment, where available. Where data is not available estimates will be based on climate data for Eugene and estimated loads for the new developments, proposed operating pattern, etc.

4) System Design: Based on the information and evaluation of potential NE utilization, location of users, temperature demands, and distances to preferred Neighborhood Energy sites, N2e and its affiliates will develop a preliminary conceptual design of NE systems for downtown Eugene. An engineering analysis of the required physical sizing of the key components for the NE systems will be performed.

4.1) Smart Grid Power Heat Source. A thorough analysis will be performed of the communication, control, power delivery (e.g., substation upgrades), and system components needed to use time-varying electric power and heat energy storage as the primary energy source. We will also Identify and analyze at least three promising configurations including varying amounts of storage, nameplate capacity, and/or back up energy sources. N2e and its affiliates will also perform a survey of commercially available storage media and recommend optimal medium for each level of storage analyzed. Estimated costs of the most promising configuration compared with alternatives are identified below.

4.1.1) Heating Technology using electricity. Ecofys US will investigate the optimal electric heating technology and evaluate resistive heating and heat pumps, respectively.

4.1.2) Electrical Analysis of Energy Storage Possibilities. N2e and its affiliates will investigate different energy storage possibilities for the most feasible heat storage. The focus is to determine the most viable and feasible option with an electrical/thermal focus. Furthermore, the study will determine the optimal size of the heat storage unit.

4.1.3) Electrical Infrastructure Analysis. The excess electric energy, generated at BPA facilities, has to be delivered to the Eugene location. Since the power level is large (ca. 25MW), constraints between the generation and consumption side have to be determined. This investigation will include an analysis of transmission lines, transformers, etc. for the needed capacities.

4.1.4) Electrical Load Flow Analysis. Once the general electrical infrastructure is investigated, Ecofys US will analyze the power flow between the generation and consumption side. Depending on the project participants, different power flows may be necessary. Ecofys US will investigate two cases, one in which the power is delivered over EWEB's electrical system and one in which it is not. To analyze various power flow scenarios, Ecofys US will perform the study with the simulation tool PowerWorld. It is our understanding that BPA's electrical system is modeled in PowerWorld and the BPA regularly uses this tool for load flow studies.

4.1.5) Generation Scheduling. Ecofys US will also investigate different generation scheduling schemes and determine which leads to the greatest optimization in terms of economical/technical feasibility for the project as well as for BPA and EWEB.

4.2) Heating and Cooling Station/Pump Station. A heating and cooling station will contain heat pumps, boilers, chillers, water pumps, heat exchangers, district heating and cooling distribution pumps, system controls, and auxiliary power supply for the systems. Possible locations for the "station" will be evaluated.

4.3) Heating and Cooling Distribution Systems. Routing and pipe material and size will be evaluated and recommended.

4.4) Building Connection Installations. The building's internal hot water systems are connected to the NE hot water distribution system through a heat exchanger separating the systems. The building's chilled water circulation system is typically connected directly.

4.5) Evaluating renewable backup sources for the District Heating System. We will also investigate various renewable energy sources, which could provide backup energy for the NE system. This will include but is not limited to a quick scan of geothermal sources in the Eugene area, and the possibility of using solar thermal or biomass for the heat production**.**

5) Financial Analysis. N2e and its affiliates will evaluate the economic differences between the hydronic NE systems and conventional heating and air conditioning for the potential users. Based on information gathered and evaluated regarding the on-site heating and air conditioning costs, N2e and its affiliates will provide a side-by-side economic comparison between the hydronic NE system and the avoided costs of the conventional heating and air conditioning system. A comparison of the financial projections over a 20-year operation of the hydronic NE system and conventional heating and air conditioning systems will also be provided. The comparison will include several fuel scenarios, including electric powered NE systems. The electric system analysis will assume power costs at a forward price projection of light load hour wholesale electric prices less capacity benefits ranging from $5-15/kW-month.

5.1) Avoided Cost for Conventional Heating and Air Conditioning Systems. N2e and its affiliates will evaluate and present the following costs for the conventional heating and air conditioning systems:

- Electricity and natural gas costs
- Operation and maintenance costs
- Equipment and capital costs

5.2) Neighborhood Heating and Cooling Costs to Customer. N2e and its affiliates will present a break-down of the operating and capital costs for the hydronic NE systems that will include:

- NH/NC operating costs: Fuel costs, Operation and Maintenance costs
- NH/NC capital costs: Heating and Cooling station, Distribution systems, Building connection installations.

5.3) Financial Projections. Possible project financing alternatives will be evaluated and a 20-year operation projection for the hydronic NE system compared to conventional heating and air conditioning systems will be provided.

6) Environmental Considerations

6.1) Potential Reductions of Greenhouse Gases. Potential reductions of "green house gases" compared to conventional heating and cooling systems will be calculated.

6.2) Other Environmental Benefits and Issues. Construction and operating activities for the NE system must abide by the policies and regulations that exist in Eugene to control the effects on the environment. When developing NE systems, N2e and its affiliates are fully committed to minimizing the effect that NE systems will have on the environment. The section will evaluate potential environmental, cultural, and societal impacts of the NE system and possible measures to minimize or avoid those impacts.

7) **Stakeholders.** Apart from the main stakeholders, there are several other stakeholders that will have an effect on the realization of the systems. This section will describe and discuss a policy for communication with other main stakeholders, such as:

- Government
- Private sector
- Community groups
- Environmental groups

8) **Risks and Mitigations.** The section will discuss risks and mitigations of the NE project, such as:

- Construction costs
- Obtaining necessary environmental and construction permitting
- Environmental effects of earthquakes, etc.

9) **Conclusions and recommendations.** The section will summarize the findings and conclusions of the study, and in the event of positive findings, will present recommendations on implementing the Neighborhood Energy system for downtown Eugene.

Budget, Resumes, Advisors to follow.