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U. S. Department of Energy
National Energy Technology Laboratory
P.O. Box 10940
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Seattle Steam Company CHP Final Technical Report

Grant Number: DE-EE0002737 awarded to Seattle Steam LP

Project Title: CHP at Post Street in Downtown Seattle

Principle Investigator: Stan Gent

Project Overview:

The primary objective of this project was to deploy a combined heat and power (CHP) plant in Downtown Seattle that would be integrated into the existing electrical and thermal energy distribution networks. This project was intended to significantly increase total efficiency by making productive use of the waste heat created during electric power production. It is also intended to increase the capacity and reliability of the electrical grid in the downtown core, particularly in light of growing energy demand. Furthermore, it will displace less efficient and higher emissions peaking boilers in the Post Street thermal energy plant.

Project Status Summary:

During this period the project submitted a final proposal to Puget Sound Energy for the purchase of the electricity (PPA) component of this project. PSE declined the offer. On March 12th, 2012 Seattle Steam notified DOE if its intention to Terminate the Grant.

The following provides a summary of project development efforts and progress prior to termination of Grant:

Throughout 2010 and early 2011 Seattle Steam and the development team of Hannon Armstrong and Burns & McDonnell, negotiated with Puget Sound Energy (PSE) for the purchase of the power from the proposed combined heat and power (CHP) plant. Each time an offer was made to and reviewed by PSE, using their system load planning model; their parameters changed reflecting the changing nature of the regional electric system. With each proposal and review came the need to reconfigure the CHP plant to try to find



once again a point where economics made sense. In spring of 2011, PSE issued their required biannual Integrated Resource Plan (IRP) where it was evident to the development team that the only generation required by PSE for the foreseeable future was for simple cycle capacity, a solution that would not support CHP generation.

This IRP made it abundantly clear that another solution would be required and Seattle Steam and Hannon Armstrong agreed to invite Recycled Energy Development (RED) to join the development team. Submittal of the Corrective Action Plan redefined the scope and capability of the CHP plant to make it more cost effective. This plan was approved by DOE on 01/10/12 and is reflected in Amendment #4 to the Assistance Agreement.

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Project General Description:

The Post Street project had four (4), 7.960 MW, Solar Taurus-70-10801S natural gas combustion turbines. Each turbine equipped with a 40,000 lb/hr heat recovery steam generator (HRSG). The dual-fuel HRSGs was capable of generating steam using gas turbine exhaust heat or surplus electric power. The generation capacity was nominally rated at 29.2 MW. The project as proposed had a fuel rate chargeable to power of 4,900 - 5,880 Btu/kWh dependent on time of year.

The CHP plant, when operating at 29.2 MW, can recycle turbine exhaust into supply 145 kpph of steam to SSC per hour. The actual SSC steam loads will vary based on weather, building occupation, plus additions / reductions of customer load served. SSC produces up to 80 kpph of steam from a biomass boiler, which is currently base loaded all year.

Virtual Storage of Wind/Hydro Generation

There are significant periods of time in spring and early summer when area hydroelectric and wind generation exceeds the sum of area demand and transmission capacity, causing power prices at the Mid-Columbia hub to drop to zero and sometimes go negative. To help utilize this power and balance the grid load, the project will add electric boilers to its heat recovery steam generators capable of producing steam with electricity, adding up to 30 MW of electric load in excess wind and hydro generation periods. The initial design was for 30 MW of electric boilers.

Up and Down Spinning Reserve

The project can provide electric spinning up reserves.

Tunable VAR Support

The CHP project also offers local area power factor support by allowing PSE grid managers to automatically control and fine tune the leading or lagging power factor of



Project's generation and thus precisely balance the induction and capacitance on the grid. We believe this precise control of VARs will significantly reduce the average line losses of transmitting power to the Seattle area, and will, by controlling voltage, allow the transmission lines to be thermally loaded, thus increasing transmission capacity. The adjustments would be made automatically during all periods of generation.

Environmental and Regulatory Compliance

The NEPA Environmental Assessment (EA) report has been published; public comment period closed in Q4FY10.

Reports and Briefings

Seattle Steam has submitted all required ARRA and DOE periodic progress and financial status reports in accordance with the reporting requirements listed in agreement number DE-EE0002737.

Principle Investigator

A handwritten signature in blue ink, appearing to read "Stanley Gent", is written over a blue horizontal line.

Stanley Gent
President and CEO