

# APPENDIX D – Assessment of Distributed Generation Opportunities

Seattle City Light worked with consulting firm Ecos Climate Solutions to assess the distributed generation opportunities and corresponding financial and environmental benefits for selected customer in its service territory. The technologies included combined heat and power, waste heat recovery, steam let down turbines and renewable generation options, including solar.

Nine customers participated. For each participating customer, on-site audits were completed to develop a detailed understanding of facility operations and processes. The consultant collected fuel and electricity consumption data from each customer, and modeled customer facilities' energy loads for at least one year to develop an energy baseline. An assessment was made of potential financial and environmental benefits from the use of new technologies.

Altogether, 20 independent projects were analyzed, 10 of which represent high quality opportunities for Seattle City Light and the customers based on customer payback and Seattle City Light incentives. The 10 projects have the potential to generate 45 million kWh per year and reduce greenhouse gas (GHG) emissions by 11,150 metric tons of CO<sub>2</sub> equivalents (MTCO<sub>2e</sub>) per year.

## Distributed Generation Technology Types

### *Cogeneration*

Cogeneration technology generates electricity at the point of consumption while recovering the waste heat for process heating loads or to replace existing steam production. Aggregate efficiencies typically range from 75 percent to 90 percent. Facilities and operations with year-round base heating loads demonstrate the highest potential. While natural gas is often the most practical fuel to use in urban settings, there is the issue of greenhouse gas emissions. However, according to the EPA's Emissions & Generation Resource Integrated Database, running cogeneration on natural gas has a lower

environmental impact than using grid power in the Northwest region, due to efficiencies the system captures. Cogeneration technology is difficult to justify economically in regions, such as the Northwest, with low electricity rates.

### *Steam Letdown*

Distributed steam systems supply steam at the pressure needed by the demand load. Central boilers that produce this steam can only do so at a single pressure at any given time, and must put enough energy from the burning of fuel into every pound of steam in the system until the entire capacity reaches the desired pressure. Steam users who do not need steam at the pressure delivered typically reduce the pressure, or "let it down" to the lower pressure they require by using pressure reducing valves (PRVs). Reducing the pressure through a PRV releases some of the energy content of the higher-pressure steam into the environment. The difference in pressure is converted from potential energy in the form of pressure to kinetic energy in the form of velocity, turning into noise and vibration in the PRV and increasing the volume and speed of the steam.

An alternative to the utilization of a PRV is the installation of a small steam turbine connected to an electric generator. The amount of energy available to run the turbine is determined by the amount of steam on a pounds-per-hour basis, and the size of the pressure reduction. Package steam letdown turbine generator systems are commercially available from multiple manufacturers.

### *Condensate Waste Heat Recovery*

Historically, the only viable use for low grade heat has been space heating or domestic hot water. If neither of these demands is available, the low-grade heat is "wasted" or unrecoverable. A technology that holds promise to capture this heat is in the early commercialization phase with few completed projects beyond small-scale test prototypes.

## Photovoltaics

Photovoltaics (PV) generate solar power by converting sunlight directly into electricity through the use of solar cells packaged in photovoltaic modules. There is good potential for solar power generation in the Northwest region according to published findings by the Department of Energy. The major challenge for PV technology in the Northwest is grid electricity's relative low-cost compared with solar generation, which renders the projects uneconomic.

Average PV installation costs are approximately \$8 per square foot. Solar carports, or SolarPorts, are another opportunity for PV installations. Roof structures can be installed in paved parking lots, and the PV equipment can be installed on the top surface. SolarPorts can be installed for an additional \$1 per watt, about a 12.5 percent increase over average PV installation costs.

## Wind

Analysis shows that the average wind speeds found in the Seattle region are not sufficient to justify investment in this technology. According to the U.S. Department of Energy's information on wind technologies, Seattle falls into "Wind Power Class 1," which is unsuitable for wind energy development.

## Modeling Methodology and Assumptions

The overall objective of the model is to provide a high-level assessment of economic and environmental opportunities for renewable energy generation and waste heat recovery investments. A detailed feasibility study on each project would provide more detail and more precise cost estimates.

State and federal incentives are available for efficiency and renewable projects. This model assumes that the federal Business Energy Tax Credit and accelerated depreciation

allowances will be used for renewable projects. In the case of government or not-for-profit customers, these credits have been discounted under the assumption that third-party tax equity investors will offer funding for these value streams. State incentives have been bundled using the Renewable Energy Credit (REC) price assumption in the model. Based on I-937 legislation, which credits utilities twice for onsite renewable generation, the model assumes that the utility will purchase credits for 6 cents per kWh.

The assumptions for electricity and natural gas price escalation have been set at a conservative annual increase of 3 percent. If natural gas prices increase at a greater rate than electricity, over time the economics for cogeneration will be inversely affected, because gas is a key cost component for this investment. In addition, the model currently assumes no standby charge for on-site generation; Seattle City Light can add these into the model as needed. A standard financial structure has been used for each assessment based on current commercial lending terms.

## Evaluated Projects

Listed below are the four types of opportunities that are recommended by the consultant for further investigation.

- Seven promising steam letdown opportunities.
- A large-scale district cogeneration project
- An in-depth demonstration efficiency project
- A heat recovery project with a strong potential for large-scale electrical generation from existing high-quality process waste heat.

Projects were ranked first by the estimated customer payback and then adjusted by perceived technology and implementation risk. Financial results were based on high-level assessments of each of the opportunities.