

Abstract

A technical and economic assessment of a small scale cogeneration system in an urban academic building is conducted. The methodology and mathematical simulation developed critically assesses Cooper Union's 250 kW cogeneration plant at 41 Cooper Square. First, the existing cogeneration plant and its interaction with the building systems are described. Next, utility cost savings are calculated based on estimates of seasonal cogeneration electrical and thermal output. While the cogeneration system yields positive economic returns by shifting utility consumption from electricity to inherently cheaper natural gas, the study reveals four specific system limitations that prevent the system from reaching its full savings potential. A mathematical model of the cogeneration system at part-load and electrical and thermal demand profiles specific to 41 Cooper Square are developed to perform a more detailed economic analysis. Simulations reveal that the cogeneration system in its current configuration reduces annual utility expenses by \$101,000. A series of four modest retrofits, each with favorable economic returns, are proposed to address the limitations of the cogeneration system. The four retrofits are: replace an undersized heat exchanger on the heat recovery system, upgrade the electrical connectivity of the cogeneration system, install a control mechanism on the natural gas supply, and commission a gas meter directly on cogeneration to lower the natural gas utility rate. Implementation of these retrofits would double the savings. The methodology presented in this study can be applied to other cogeneration systems to assess technical capabilities and potential savings.