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EVER-GREEN ENERGY™

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Executive Summary

Introduction

The City of Burlington is well positioned to enhance the sustainability, efficiency, and effectiveness of its energy future by integrating its existing energy infrastructure and leveraging underutilized energy systems to develop a Community Energy System (CES). The McNeil Generating Station (McNeil) currently operates at an efficiency of approximately 25% while generating approximately 50 megawatts (MW) net of electricity. The collaborative (Collaborative) of the Burlington Electric Department; the University of Vermont (UVM); Fletcher Allen Health Care (FAHC); and the Burlington District Energy Service committee, a citizen group, was formed for the purpose of investigating the viability of implementing a CES that integrates McNeil's generation assets with the loads located at FAHC, selected UVM facilities, and the University of Vermont Trinity campus (Trinity).

The Collaborative has engaged Ever-Green Energy to examine the potential for McNeil to provide an affordable and sustainable energy option for FAHC and UVM, along with the greater Burlington community. A CES in Burlington could capture 50% or more of its required thermal energy from the flue gas stream at McNeil, which is currently exhausted to the atmosphere from the electricity generation process. The energy recovered from the flue gas, along with energy extracted from the steam turbine, could be distributed through a hot water system to the Burlington community for space heating and domestic hot water needs. Implementation of a CES would improve the overall efficiency of McNeil by increasing the amount of energy that is captured from the electricity generation process.

Ever-Green has identified a technically feasible plan for implementation of a district energy system that would manage against the increasing risk of natural gas price volatility. Implementation of an integrated energy plan that connects McNeil with the campuses identified in this report would establish a foundation for a future comprehensive energy program that could benefit the Burlington community for generations to come.

CES Customers

Establishing a CES is a capital intensive endeavor and an initial group of anchor customers would need to be connected to the system to support the initial capital investment. Given that all of the buildings analyzed within this report are owned by two partners within the Collaborative, Burlington is well positioned to develop an integrated energy system with relatively minimal customer development efforts. Once an initial system is developed, expansion to additional customers adjacent to the energy distribution system becomes much easier to implement.

System Integration

The success of the system depends on the detailed integration of customer usage needs, energy production, fuel management, and energy distribution. Integrating McNeil with the hospital and university campuses offers an excellent opportunity to develop a CES system to meet the future energy needs of the Burlington community.

District heating customers could be served primarily with energy recovered from McNeil's flue gas and supplemented with energy extracted from the steam turbine. Hot water would be distributed to customer buildings via a series of underground pipes running from McNeil to the Trinity, FAHC, UVM and University Health Center (UHC) campuses.

To optimize the energy generation assets currently in Burlington, Ever-Green has assumed that the UVM, Trinity, and FAHC campuses would utilize their existing central plants for redundancy to the system in the event of a service disruption at McNeil. UHC's boilers are at the end of their service life and replacement is currently under consideration.

Business Structure

With a possible CES conceptually defined, Burlington could focus on developing the business structure of the CES. Although many operational models are possible, Ever-Green recommends that the CES business is structured as a private, non-profit business, utilizing a cost-based rate structure. This structure would generate many benefits, including a positive reception from customers, the key stakeholders, and the community. This structure would also allow the business to operate separately from McNeil, while providing members of the Collaborative with the ability to guide the governance of the business and establish a program that bolsters the long-term viability of McNeil and reduce greenhouse gas emissions in the Burlington community.

Environmental Benefits

Implementation of a CES in Burlington will bring the community closer to its goals of greenhouse gas emission reduction. By integrating combined heat and power at McNeil, the Burlington community would be developing a local, renewable, and reliable energy solution that reduces carbon dioxide emissions by an estimated 14,400 tons per year. This reduction would equate to the elimination of 2,700 automobiles per year[1]. The recent contract award to McNeil allowing the sale of Connecticut Class 1 RECs supports the long-term viability of generating biomass-based energy in Burlington. McNeil will be available to provide efficient cogenerated thermal energy to the Burlington CES and the CES would provide McNeil with additional revenue streams, increase plant efficiency, and establish a longterm, resilient energy program for future generations.

Financial Benefits

Development of the CES would provide long-term stability to the Burlington energy market. In general, a natural gas rate of approximately $6.90 enables the biomass-powered CES to be competitive for the majority of the prospective system customers. Given that the primary cost of the CES is related to predictable debt service payments and energy costs are buffered from the volatile natural gas market, connecting to a district energy system would provide customers

[1] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2010. Chapter 3 (Energy), Tables 3-12, 3-13, and 3-14. U.S. Environmental Protection Agency, Washington, DC. U.S. EPA #430-R-12-001

with a much more predictable energy rate. Historically, biomass rates reflect stable costs and this stability could be viewed by prospective CES customers as a competitive and operational advantage when compared with the price volatility of natural gas.

Financing Strategies

Once the business structure decision has been made, system financing strategies should be established. Partners within the Collaborative expressed hesitancy with investments into the CES; therefore Ever-Green recommends the establishment of a private district energy business to provide the most practical basis for financing the system. Financing would be secured in the private market through securing long-term energy service agreements with the customers of the system. Prospective customers would not be required to make an investment in the CES development, although grants or other subsidies would help decrease the projected energy rate. Given the recent escalation in natural gas prices, it is projected that the CES would be competitive with the input of less than $2 million toward the initial system financing. This financial input would move development forward to serve the majority of the initial anchor customer load.

The Collaborative would need to provide financing to cover costs of the next phase of development, with repayment to occur at project financing. Based upon information gathered by Ever-Green, the expected capital investment required for implementation of the CES is approximately $31 million.

Conclusion

The City of Burlington, UVM, and FAHC all have climate goals that include reducing greenhouse gas emissions and leveraging local, renewable, and reliable energy sources to meet their long-term energy needs. The development of a CES in Burlington would provide the partners of the Collaborative with a platform to achieve those goals and invest in the greater good for the Burlington community. A CES that utilizes biomass as its primary fuel source would provide customers with a more stable cost of energy when compared to natural gas. Given the recent increases in the price of natural gas, connection to the CES could be viewed as economically compelling for prospective customers. Based on these findings, the system potential, and the economic conditions, it is recommended that additional steps are taken to prepare the system for project financing.

About Ever-Green Energy

Ever-Green Energy is one of the country's foremost experts on the advancement of community energy systems, built upon decades of experience with system development, utility ownership and management, and engineering.

EGE was formed in 1998 by District Energy St. Paul to advance the national model established for Saint Paul's Community Energy System (CES). The first major project launched by EGE was the development of a biomass-fired combined heat and power (CHP) facility in St. Paul. The CHP facility was a key step in advancing Saint Paul's system, which was preceded by district heating, district cooling, and thermal storage and has been further advanced by solar thermal and hot water thermal storage. Drawing from the knowledge base of the team that has developed, operated and managed the flagship system in Saint Paul where customers pay less today for energy than they did 30 years ago (adjusted for inflation), EGE's industry-leading experience helps communities, colleges, universities, and government organizations advance the study, development, and operation of integrated energy systems. EGE operates and manages two other community energy systems in Minnesota and also provides system advisory services to District Heat Montpelier in Montpelier, Vermont.

For the past 10 years, EGE has owned and operated the biomass-fired combined heat and power facility in downtown Saint Paul, along with a biomass collection and processing business. On an annual basis, these facilities process over 250,000 tons of biomass to generate power and heat. In addition, the operation serves as a research facility for local biomass fuel producers looking to take their fuels to market. EGE's biomass knowledge is recognized internationally and sought after by many campuses and communities looking to develop similar biomass programs.