

City of Bethlehem Digester and Waste Activated Sludge Thickening Improvements Project – Green Project Reserve Narrative

The City of Bethlehem's Digester and WAS Thickening Improvements Project contributes to their ongoing efforts to reduce their carbon footprint. There are both short term and long term improvements that will be realized by implementation of this project.

The short term benefit is realized with a reduction in the power needed to mix each digester. This reduction is achieved by replacing the existing three inefficient mixing technologies with one efficient mixing system. The existing system uses a 15 horsepower (HP) gas mixer, a 10 HP mechanical mixer, and a 7.5 HP pumped circulation system. This is a total of 32.5 HP operating on a continuous basis. This system has been shown to be ineffective at mixing the digester. The new Cannon-type mixing system has nominal power requirement of 18 HP. This corresponds to a 44% power reduction **or 190,000 kW-hr/year as compared to the existing digesters (\$16,000/yr @ 8 cents/kWh)**. Improved mixing has the added benefit of highly efficient mixing which will increase the gas production (see the next item). The WAS thickening system will also realize a power reduction by replacement of old motors and drives with new premium efficiency drives. The improvements are difficult to accurately quantify because the condition of the existing motors/drives is not known. **Green Component Cost - \$1.47M**

The digester mixing improvements mentioned above improve the anaerobic digestion process. In addition, the sludge pumping improvements and sludge feed valve reconfigurations will improve digester performance. These improvements will increase the digester gas (biogas) production. Utilization of this gas was subject of a separate study that Bethlehem performed. This study concluded that the increased gas production offers the opportunity to implement a combined heat and power (CHP) project to convert the biogas to electricity and heat. Without this project, there is not enough biogas to justify the capital cost of the CHP project. After this project is implemented, the gas production will be measured and a CHP system will be sized and implemented based on the gas production data. Implementation of a CHP project offers a long term reduction in the City's carbon footprint by reducing the demand for utility power.

The increased gas production provides additional gas for use in the existing boiler. Currently, the boilers use the biogas, but they will occasionally need to revert to using fuel oil because of shortages in biogas production. This is generally caused by mechanical failure or limited wintertime gas production. **Historically, the digesters have averaged 120,000 cubic-ft of gas production per day (estimated based on digester solids destruction). Lower production rates occurred in the winter when the boilers need the gas the most. Once the digesters are properly mixed, the current plant loading is estimated to produce 210,000 cubic -ft/day. Since this will remain relatively constant through the winter months, this will**

provide the full demand of the boilers. Moreover, this project will improve the reliability of the digester gas supply. By increasing the production and increasing the reliability, the need for some 7000 gallons of fuel oil to be used in the boilers annually will be eliminated. **Green Component Cost - \$1.92 million.**

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