<u>Life Cycle Assessment (LCA) of Thermal Chemical Sludge Treatment Technologies: Redefining the Possibilities of America's Waste</u>

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Abstract

As the human population continues to surpass seven trillion people in the world; the need for decentralized wastewater treatment plants (WWTP) has never been more apparent. As parameters of cities continue to expand and their neighborhoods approach dangerous proximity to WWTPs, today WWTPs methodology of operation just does not satisfy the emission and odor concerns the future. Therefore in order to fulfill the growing waste needs of the nation; new decentralized WWTPs must engineered to be truly energy neutral, space innovative, efficient, environmentally safe and adaptable to the changing conditions of society.

Currently, Aerobic Digestion is the most popular solids treatment procedure across the United States, but it also presents a number of different obstacles for expanding neighborhoods. Fortunately, alternative Thermal Chemical Treatments possess a number of nutrient recovery and energy production possibilities that could be utilized for the benefit of society. One such procedure, Thermal Stabilizations, currently serves as the most well-known Thermal Chemical procedure today, but another emerging sludge treatment technology, Gasification; has shown potential energy positive improvements for small decentralized WWTPs systems.

In order to compare the actual environmental benefit and impacts of the two thermal chemical treatment technologies within small decentralized WWTPS, a Life Cycle Assessment (LCA) of the two methodologies was utilized to determine the total operational energy impacts and benefits of both systems. Using a combination of excel based spreadsheets, mass balance equations and the WWEST program; Thermal Stabilization was compared to Gasification and the preliminary results are shown below.

Figure 1 depicts the total operational energy requirements that Thermal Stabilization (blue) had when compared to Gasification (red). Total energy consumption and recovery is compared in the last three columns of the graph.

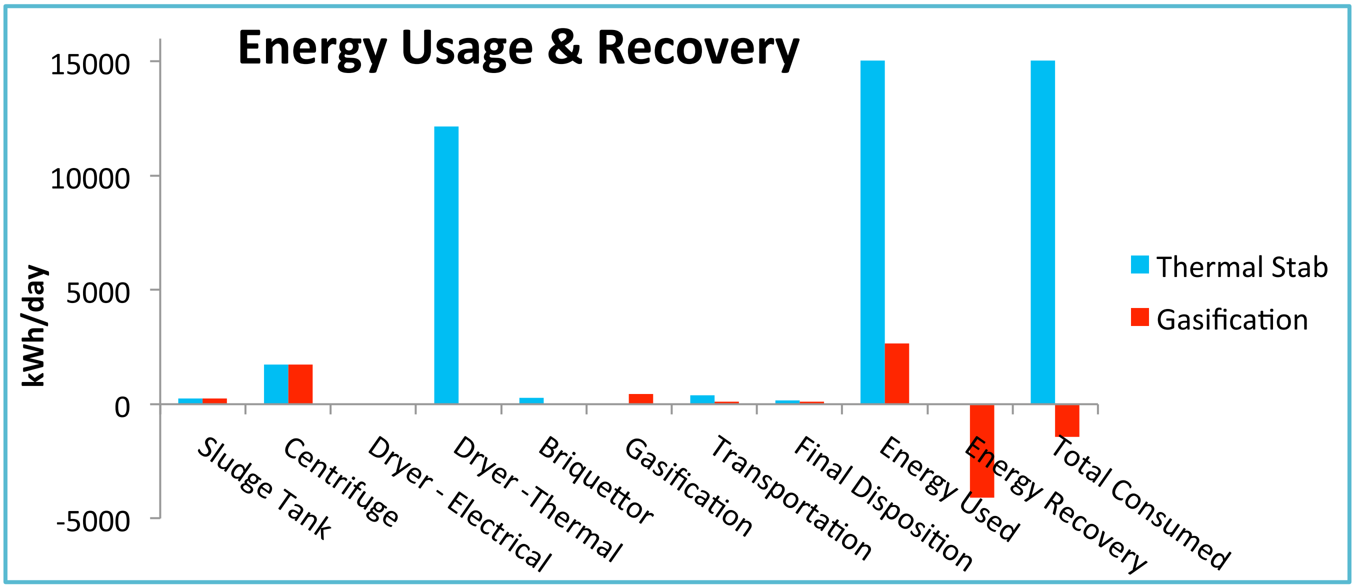

Figure 1: Gasification vs Thermal Stabilization Energy Usage & Recovery

Figure 2 depicts the individual distribution of electrical energy consumption of each of the two processes. Also, the smaller graph in the lower-right hand corner of figure 2 shows the percentage of energy recovery vs. consumption of each system.

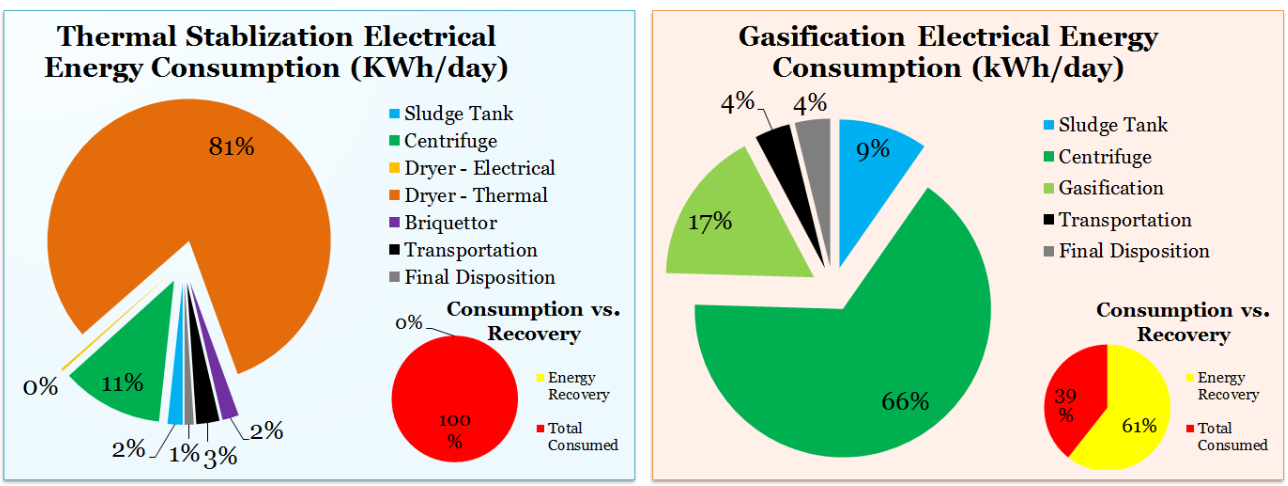

Figure 2: Energy consumption for Thermal Stabilization & Gasification

In conclusion, Gasification possessed a significant energy recovery system and also significantly reduced the overall energy requirements when compared to Thermal Stabilization. Ultimately more research is needed, but if studied further; it is hypothesized that Thermal Stabilization will have an approximate 20 to 40 % energy recovery while Gasification will still remain as the optimum sludge treatment technology with 61% energy recovery in the system.