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Techno-Economical Modelling of Biogas and Electricity Cogeneration System from Sludge with and without Bioaugmentation

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Bioaugmentation provides enhanced capability of the anaerobic microbial community in an anaerobic sludge digester at a wastewater treatment plant to produce increased methane quantity. The addition of microbial strains that are targeted to improve the degradation of certain materials via the anaerobic sludge digestion process. Yet, the economic side of it is still in question.

The aim of this work is to develop a techno-economical modeling of biogas and electricity cogeneration system from sludge with and without bioaugmentation. This, in order to provide a tool for decision makers and planners in deciding on building of conventional or bioaugmented sludge treatment and cogeneration facilities, considering investment and operation and maintenance costs.

The development of the model includes identification of significant process parameters, which need to be considered when designing a sludge treatment and cogeneration facility and affect its costs. These parameters include biogas flow rates, biogas flow system, electricity generator maximum output, digesters number and volume, etc. Data on biogas generation in conventional facilities before and after bioaugmentation will be presented and used to validate the model.

The model uses a conventional sludge treatment facility as a baseline and quantifies (1) a bioaugmented conventional sludge treatment facility and (2) a sludge treatment facility designed to use bioaugmentation to it. The work demonstrates that a comparison among the three shows the advantage of using bioaugmentation, which enhancs the output of conventional facilities by 30%; and, that implementing the model quantifies the relative value of using of bioaugmentation in the design phase.

Keywords: Bioaugmentation; sludge; electricity; methane, biogas