Energy Analysis in Wastewater Treatment

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Abstract

With the increase of global population and energy demand, we need to pay higher attention to energy savings, including in wastewater treatment plants. In the United States, the energy cost for wastewater treatment accounts for about 3-4% of domestic electricity (EPA., 2006). The typical energy consumption of wastewater treatment is 20-35 $kWh_e \cdot PE^{-1} \cdot y^{-1}$, among which 30-60 % of energy is used by aeration to remove organic carbon and nitrogen (McCarty et al., 2011). Understanding the energy balance of wastewater treatment plants play an important role for us to further improve the energy situation of the treatment plants. My research explored the energy input and output of the wastewater treatment plant at University Park in State College, PA. The research creates an energy model for the wastewater treatment plant. Based on this model, we discovered that if processes had higher efficiency and that if the anaerobic digestion was more efficient the plant could be energy positive. With this information, we can later work on achieving this efficiency and incorporating it into the plant.

References

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Background

- Wastewater comes from all the utilities in buildings like toilets, washing machines, showers, and sinks but also all the water from storm drains and runoff.
- The main pollutants are nitrates and phosphorus. Bacteria is used to help discard these, Aeration is needed to provide dissolved oxygen for the bacteria. The breakdown of the sludge creates a biogas that can be used to create energy in anaerobic digestion.
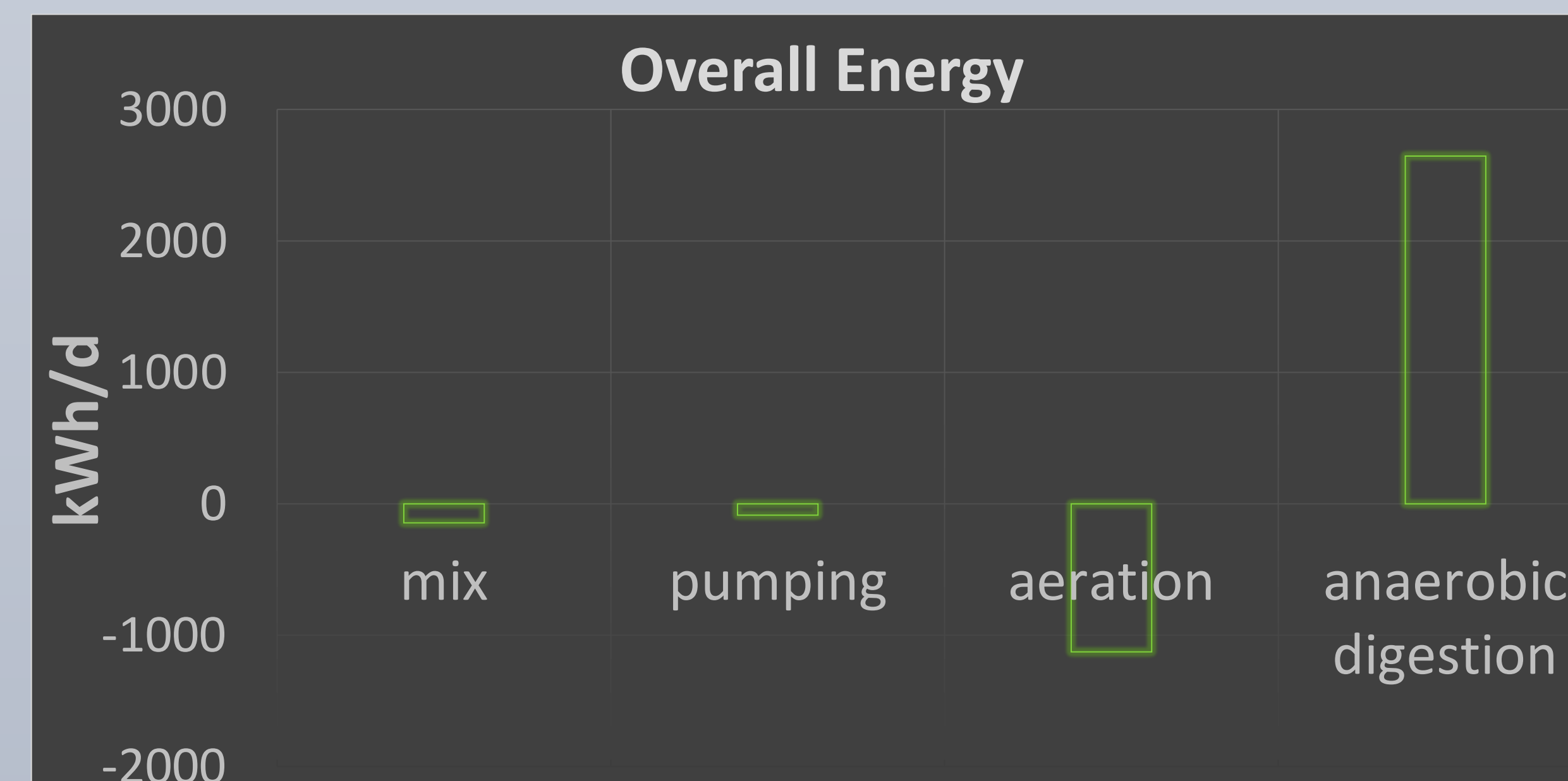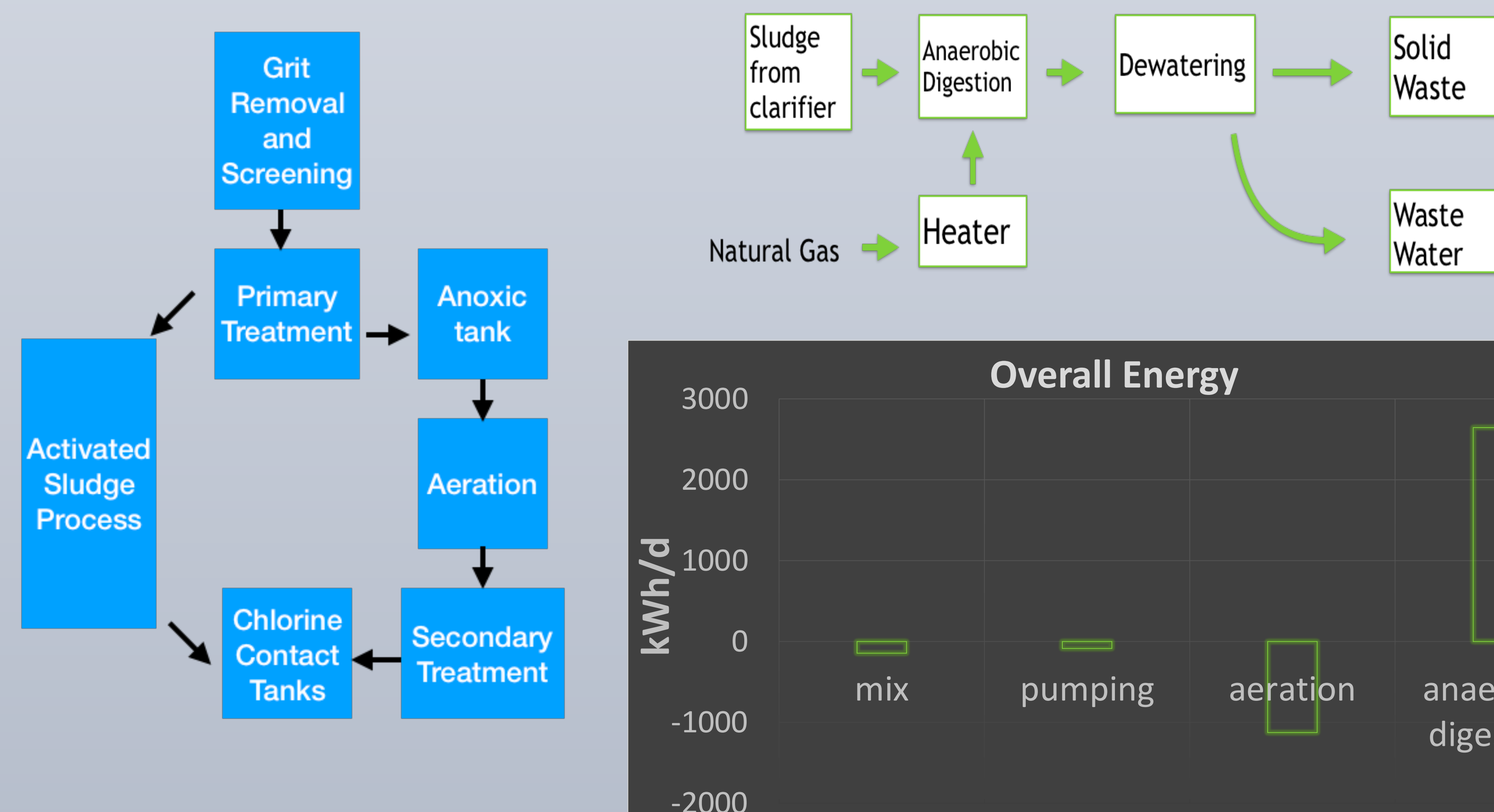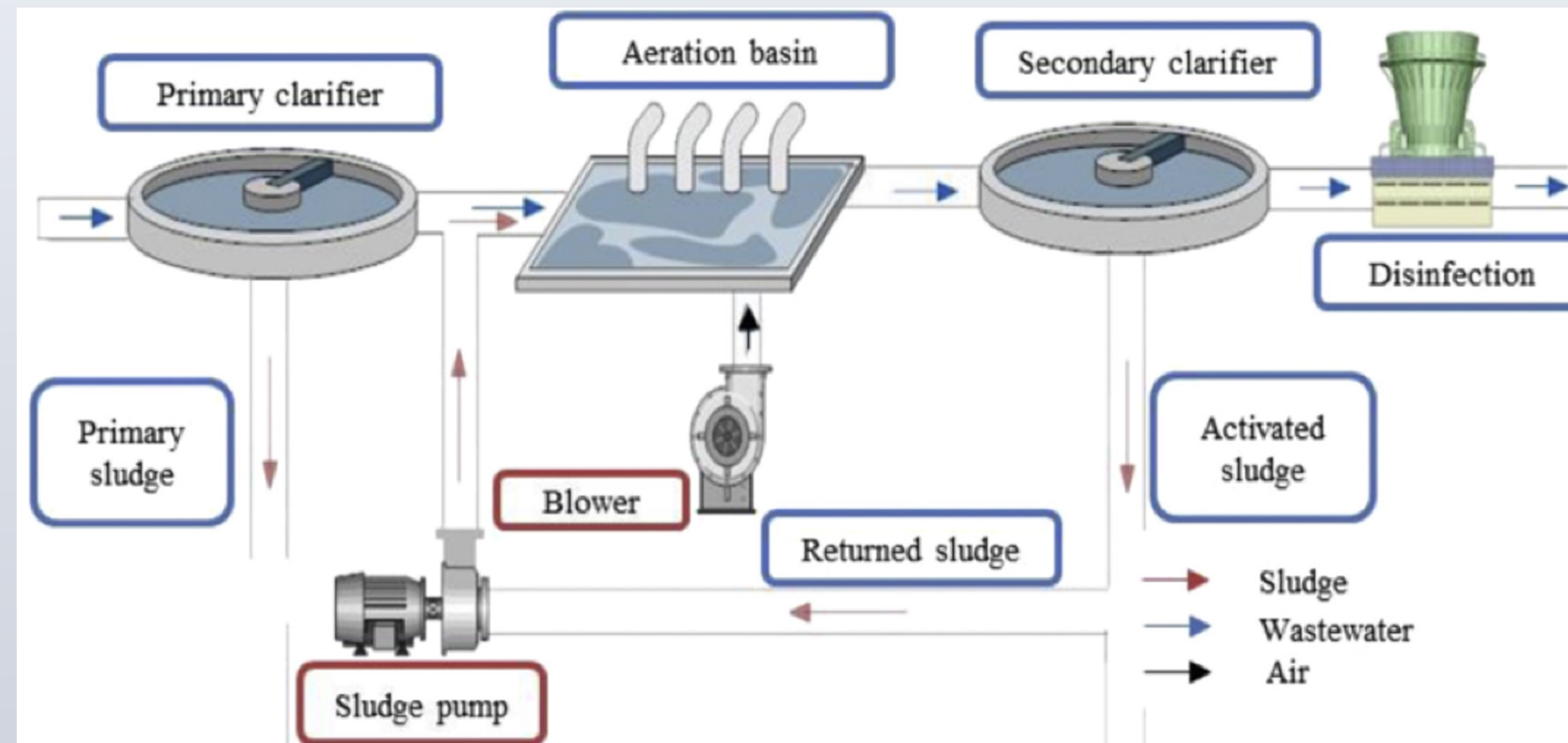
Results

- Minimizing the energy use of WWTPs by just 10% could lead to an annual savings of $400 million in the United States (Asadi et al., 2017)

- After gathering data from the wastewater treatment plant at University Park approximately 80% of the energy used for treating water is for aeration.

- With further research we can make aeration and anaerobic digestion more efficient to make the wastewater treatment plant energy positive. Research will also be done to decrease the environmental impact.