Lucerne University of
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FH Zentralschweiz

Bachelor's thesis in Energy Systems Engineering

Integration of a Gas Turbine in an Industrial Process

Abstract

The latest version of the engineering software PinCH now allows the user to select a gas turbine as an energy conversion unit using gas turbine exhaust as hot utility. This work provides a case study for the proper integration of a gas turbine into an industrial process and makes recommendations to the software's development.

The case study follows the well-known pinch method to analyse thermal demands of a wastewater treatment plant that uses a thermal hydrolysis process for sludge treatment with biogas production from anaerobic digestion. Biogas from digesters - high in methane content and otherwise requiring to be flared - is considered a carbon-neutral energy carrier.

A techno-economic analysis was made comparing the current reciprocating engine-based combined heat and power system to one based on a gas turbine. Also known as cogeneration, this form of distributed generation provides multiple benefits to the energy system as a whole by displacing multiples of centrally generated power and reducing necessity for transmission and distribution build-out.

As part of the economic analysis, market research into gas turbine capital costs was made with parameters now available for use in the software.

The pinch analysis found that the current reciprocating engine-based CHP is not as appropriately placed for the plant's thermal demands as that of gas turbine. The gas turbine-based system could be more appropriately placed with reductions in imported natural gas and electricity. Despite savings, such a system may only be considered in a greenfield site or at the current system's end of life.

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