

NOM DEL PROYECTO: Modelling and sustainability assessment of cooling systems in the chemical industry

VACANT: Yes

RESUM: The economic and environmental performance of chemical processes is heavily influenced by the consumption of energy utilities for both heating and cooling. Heat requirements can be met through the combustion of fossil fuels, requiring a tight control on the associated emissions, or through process electrification, which offers a cleaner alternative. However, cooling technologies present a more complex challenge, constrained by technical and environmental factors such as ambient air temperature and humidity, particularly in the case of wet water-cooling towers. These constraints critically affect the overall performance and sustainability of cooling systems and therefore of chemical processes.

Despite extensive research on the energy integration of chemical processes, there is a notable gap in the literature regarding the impact of these limiting factors on the performance and sustainability of cooling technologies. This gap underscores the need for a comprehensive analysis to inform better decision-making in the selection and optimization of cooling systems in the chemical industry.

The goal of this thesis is to define, simulate, and optimize cooling processes within the chemical industry, focusing on a comparative analysis of dry and wet cooling technologies. The objective is to identify the most resilient and efficient cooling alternatives under varying operational conditions. This analysis will consider the influence of variable weather conditions and the electricity mix employed by the cooling technologies, evaluating their impacts on both their economic and environmental performance.

To achieve these objectives, the project will utilize state-of-the-art simulation software, including Aspen HYSYS and Aspen Plus, to model the cooling processes accurately.

Optimization algorithms will be applied using MATLAB and Python focusing on economic and sustainability objectives. Additionally, the environmental aspects of the cooling processes will be calculated by a Life Cycle Assessment (LCA) approach using the Ecoinvent database and the SimaPro software.

This research aims to provide a robust framework for the selection and optimization of cooling technologies in the chemical industry, contributing to enhanced sustainability and efficiency in industrial operations.

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