

Science and Engineering Research Program

Project Description

Institute:

Institute of Electrotechnology - Faculty of Electrical Engineering and Computer Science

Project title:

Enhancing Sustainability: A Systematic Approach to Evaluate Electric Substitution Concepts for Gas-Powered Industrial Furnaces

Project description:

Approximately 70% of the energy consumption in developed industrial countries like Germany or the United States is dedicated to generating process heat. This substantial figure underscores the pivotal role of heat-intensive processes within these economies. Engaging in a brief self-experiment, consider compiling a list of everyday products—ranging from food and clothing to transportation—that have not undergone some form of heat treatment during their production cycle. The challenge highlights the pervasive nature of heat-dependent processes in our daily lives.

From an economic and operational standpoint, a significant majority of thermoprocessing plants rely on burning fossil fuels, contributing significantly to the emission of vast quantities of CO₂ and other environmentally harmful gases. This reality underscores the urgent need to reevaluate our energy sources and methods. Aligning with environmental objectives, such as those outlined in the European Green Deal, requires a transition away from fossil fuel-based heat generation. Embracing alternative and sustainable approaches becomes imperative for reducing our carbon footprint and mitigating the adverse impact on the environment.

One of the most economically sustainable way of CO₂ reduction is the direct substitution of fossil burners with electrical resistive heating elements with minimal change to the furnace topology. For the implementation of electric substitution, the market offers a wide range of different heating element materials and designs, differing both in their overall performance and in the requirements for the heating process itself. The main objective of the project is to develop a tool, preferably based on Excel, that enables engineers to systematically evaluate common substitution concepts for a given process.

Required skills:

- Good communication capability
- Being proficient in Excell
- Interest in developing industrial scale, ready to use solutions for the CO₂ reduction

Contact/supervisor:

Institute of Electrotechnology
Leibniz University Hannover
Wilhelm-Busch-Straße 4
DE-30167 Hannover

Igor Niedzwiecki, M.Sc.
niedzwiecki@etp.uni-hannover.de
+49 511 762 2366