Denmark has the ambitious plan of being independent from fossil fuels by 2050 and to run the entire energy system based on renewable energy sources. One of the most likely scenarios is a bigger deployment of wind farms and a massive electrification of the industry and transportation sectors. In 2016, the industry sector accounted for 20% of the final energy use, which was by more than 50% covered directly with fossil fuels. Electrification is a promising way for decarbonizing this sector but it will require significant economic investments and changes of the infrastructures. In this work, several strategies for electrifying industrial processes, based on the integration of heat pumps and electric heaters are presented.

They were compared using energy, exergy, economic and environmental performance indicators. The production of milk powder was taken as a case study, as current factories are energy-intensive and require high-temperature heat generated by natural gas combustion. The highest energy efficiency and lowest exergy destruction was found for a system using a central heat pump system, with energy savings of 65%. The implementation of decentralised heat pumps that exchange heat between process streams and electric heaters, results in smaller reductions of only 56%. These two systems are likely profitable based on the energy price forecasts from 2020, but the decentral system allows for a gradual implementation of the most cost-effective measures.