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Energy efficiency intervention in urea processes by recovering the excess pressure through hydraulic power recovery Turbines (HPRTs)

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Highlights

- Energy efficiency in urea plants through Hydraulic Power Recovery Turbines (HPRTs).
- Three HPRTs' layouts, as well as four urea capacities, have been investigated.
- A numerical model is built in ASPEN PLUS® to resemble the urea synthesis process.
- The studied energy efficiency system allows recovering a maximum of 4,000 MWh/year.
- The lowest obtainable PayBack Period (PBP) from this intervention is of 3 years.

Abstract

Different energy efficiency interventions have been developed so far by different companies to reduce the energy consumption in urea processes, but none of them are related to the pressure energy recovery from liquids. In this paper, a power recovery solution is proposed for urea plants, namely Hydraulic Power Recovery Turbines (HPRTs). The ASPEN PLUS® software is used to simulate different scenarios where one or more HPRTs can be installed. Precisely, three different layouts having one, two, and three HPRTs, as well as different urea plants capacities (approximately 1,600, 2,300, 3,000, and 3,700 t/day), have been investigated. Focusing on the use of only one HPRT, the maximum yearly power recovery of almost 4,000

MWh/year has been obtained; then, the avoided Carbon Dioxide (CO_2) has been also calculated by inspecting four different countries, achieving the highest value of 2,400 tCO_2 in Italy. Considering the highest energy recovery value previously mentioned, a net economic saving of 806 k€/year and a PayBack Period (PBP) of 3 years can be achieved, showing the potential of this kind of intervention in existing plants and how it could further boost the urea production worldwide considering the urea itself as an efficient carbon capture technique.

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Keywords

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