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Modelling of Recovery and Application of Low-Grade Thermal Resources in the Mining and Mineral Processing Industry

Authors : S. McLean, J. A. Scott

Abstract : The research topic is focusing on improving sustainable operation through recovery and reuse of waste heat in process water streams, an area in the mining industry that is often overlooked. There are significant advantages to the application of this topic, including economic and environmental benefits. The smelting process in the mining industry presents an opportunity to recover waste heat and apply it to alternative uses, thereby enhancing the overall process. This applied research has been conducted at the Sudbury Integrated Nickel Operations smelter site, in particular on the water cooling towers. The aim was to determine and optimize methods for appropriate recovery and subsequent upgrading of thermally low-grade heat lost from the water cooling towers in a manner that makes it useful for repurposing in applications, such as within an acid plant. This would be valuable to mining companies as it would be an opportunity to reduce the cost of the process, as well as decrease environmental impact and primary fuel usage. The waste heat from the cooling towers needs to be upgraded before it can be beneficially applied, as lower temperatures result in a decrease of the number of potential applications. Temperature and flow rate data were collected from the water cooling towers at an acid plant over two years. The research includes process control strategies and the development of a model capable of determining if the proposed heat recovery technique is economically viable, as well as assessing any environmental impact with the reduction in net energy consumption by the process. Therefore, comprehensive cost and impact analyses are carried out to determine the best area of application for the recovered waste heat. This method will allow engineers to easily identify the value of thermal resources available to them and determine if a full feasibility study should be carried out. The rapid scoping model developed will be applicable to any site that generates large amounts of waste heat. Results show that heat pumps are an economically viable solution for this application, allowing for reduced cost and CO_2 emissions.

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