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Advancements in Electrification and Decarbonization Technologies for High-Temperature Process Heating in Steel Manufacturing: The Role of Coolbrook's Rotodynamic Technology

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This paper presents Rotodynamic heating technology, which enables the decarbonization and electrification of the steel industry for high-temperature process heating, in line with its transition towards a fossil-free future. The steel industry is undergoing significant changes in its pursuit of carbon neutrality, demanding innovative solutions.

The paper compares various decarbonization methods, including CCS (Carbon Capture and Storage), green hydrogen production, hydrogen utilization as an energy source, and biofuels, alongside the Rotodynamic technology to provide an analytical view on the most cost-effective pathway for decarbonization of high-temperature process heating. To date, electrification has faced challenges in achieving high temperatures with large volumes and substantial power requirements using electric heaters.

Coolbrook's Rotodynamic technology represents a new direct electrification method capable of achieving high temperatures and handling large volumes efficiently. Identified applications in steel production span across multiple process stages and all manufacturing routes, including blast furnace, DRI, hydrogen reduction, and scrap-based steelmaking. Economic comparisons have been utilized to demonstrate the technology's viability. The need for electric heating is expected to increase, particularly in new hydrogen-based solutions that generate fewer process gases. This paper focuses on a selected concrete application of a significant steel manufacturing use case and concept, with an analysis showing that it is an effective decarbonization method that reduces both OPEX and CAPEX.

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