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## **Transforming Steelmaking: Advanced Automation Solutions Powering the Twin Transition**

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The steel industry is undergoing a twin transition, where digitalization and sustainability work in tandem to drive efficiency, reduce environmental impact, and enhance productivity. As steelmaking is an energy-intensive process with significant  $CO_2$  emissions, the integration of advanced automation solutions is essential to meet the industry's growing demands for decarbonization and resource efficiency. By implementing intelligent automation across key steelmaking aggregates, steel producers can achieve realtime process optimization, reduce energy consumption, and ensure consistent product quality.

In the Basic Oxygen Furnace (BOF), automation enables optimized process control with precise endpoint detection. Machine Learning approaches are introduced for further refinement of models, enhancing precalculation accuracy of essential process parameters. Additionally, expert systems automate operator tasks, such as converter tapping.

The Argon Oxygen Decarburization (AOD) process, benefits from new functionalities enabling dynamic adjustment of gas ratios and active temperature control, leading to cost and environmental benefits.

For Electric Arc Furnace (EAF), a new online emissions monitoring module, provides continuous reporting of emissions produced. Integrated valuation algorithms make emissions of the furnace transparent and provide information as a basis for emission reduction. Additionally, AI-driven analytics support better decision-making, reducing variability in the melting process.

In Secondary Metallurgy (SecMet), calculating desulfurization, aluminum fading, and homogenization is challenging due to the dynamic nature of molten steel/slag movement. Traditional models calculate these parts separately, requiring extensive parameter adjustments. New Process optimization functions use a kinetic model to predict circulation movement, resulting in more precise predictions of sulfur and aluminum values. By integrating digital technologies such as machine learning, AI-driven analytics, and real-time monitoring, steel producers can align industrial performance with sustainability goals, reducing carbon footprints while maintaining high productivity. This comprehensive approach to automation across BOF, AOD, EAF, and SecMet supports the twin transition, ensuring a smarter, cleaner, and more competitive steel industry for the future.

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