Steel Works Energy-Saving Strategies Through Artificial Intelligence Techniques

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ABSTRACT

One of the main challenges in liquid steel production through the Electric Arc Furnace (EAF) route is optimizing energy consumption while maintaining high production and reducing CO₂ emissions. In this paper, ECON Tech presents some strategies which apply Artificial Intelligence in the Steel Industry as parts of Smart Metrix Solutions: the material flow predisposition in the EAF, the temperature prediction in the EAF, the additions optimization in the Ladle Furnace, as well as the dispatch temperature prediction to the Continuous Casting Machine to optimize superheating. Furthermore, appropriate learning algorithms allow for optimizing processing times, increasing energy efficiency, and decreasing emissions.

Keywords: Energy savings, Artificial Intelligence (AI), Machine Learning, Temperature and Quality prediction, Emissions, Additions, Mass balances

INTRODUCTION

Energy efficiency is a crucial aspect of steel production that provides a range of benefits, including cost savings, environmental sustainability, improved competitiveness, and increased productivity:

1. Cost savings: Energy is one of the highest costs in the steel production process, and reducing energy consumption can lead to significant cost savings. By implementing energy-efficient practices and technologies, steel producers can reduce their energy costs and increase their profitability.

2. Environmental sustainability: Steel production is a highly energy-intensive process contributes to greenhouse gas emissions and air pollution. By reducing energy consumption, steel producers can decrease their carbon footprint and minimize their environmental impact.

3. Improved competitiveness: The steel industry is highly competitive, and energy efficiency is becoming an increasingly important factor in the competitiveness of steel producers. Companies that can produce steel in an energy-efficient manner will be better positioned to compete in the market and attract customers looking for environmentally responsible products.

4. Increased productivity: Implementing energy-efficient technologies and practices can also lead to improved production processes and increased productivity. For example, reducing energy consumption in the electric arc furnace can increase the capacity of the furnace, enabling the production of more steel with the same amount of energy.

By investing in energy-efficient technologies and practices, steel producers can enhance their operations and position themselves for long-term success in this rapidly changing industry. Considered by process, steel production in the United States based on the Electric Arc Furnace (EAF), the “Electric route,“ has been the primary process (more than 60% of total production) since 2010. Worldwide it has been steadily increasing in the last ten years (28.9% of total world production by process³). The Electric route is considered one of the low-carbon technologies in steel production². Paper² shows that promoting low-carbon technologies, including EAFs, has a potential for energy savings of about 4.2% in China (321.35 Million ton coal equivalent) of increasing energy needs from 2015 to 2030. But changing the technologies is not easy³: From 30 respondents (seven, 7/30, were Electric-arc furnace producers) in a survey¹ carried out from April to June 2015, they found that 90% said they had an energy management system to track and optimize energy use; 79% integrated an energy efficiency goal into their core business strategies; and 93% had some form of benchmarking process based on an external reference, cost control, and better