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A novel approach to energy management in electric steelworks

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The electric steelmaking route since its birth appeared to be a paradigmatic representation of the raising concept of circular economy, as it recycles steel components at the end-of-life products. Moreover, its importance is foreseen to increase according to the increasing demand of decarbonizing steel production to meet the ambitious goals of the European Green Deal.
However, being the EAF-based route still characterized by a limited diversification of energy supply sources, it results into the necessity of optimizing its use considering several aspects at the same time such as efficiency, cost reduction and as a consequence, the optimization of the production planning to be related to the on-time availability of energy. Such optimization Task needs the key factor of appropriate energy management to reduce production costs while ensuring satisfaction of the energy demands coming from all different processes, not limited to EAF. It implies a strict relationship between the behaviour of the Power Grid and the production plan.
Consequently, the optimization of energy consumption in the steel production chain can only be achieved by simultaneously looking at the individual processes as a network of users in which each individual process is already close to their optimal operating point. This results in a huge number of energy consumers to be managed.
In this context, the European project entitled "Energy Management in the Era of Industry 4.0" (EnerMIND), co-funded by the European Union through the Research Fund for Coal and Steel, aimed at the effective and efficient steel production which needs to run component processes of the manufacturing chain thus realizing a high utilization rate of production facilities.
To achieve this aim, the development and implementation of a novel energy management system based on innovative components and a flexible infrastructure and a software demonstrator. Such demonstrator considers the most energy intensive areas of the steelworks and exploits artificial intelligence and optimization methodologies to minimize electricity consumption and level trends through matching intelligent production planning and Power Grid offer and related energy costs.
The paper will provide an overview of the developed solution, and the set of models based on neural networks that allow forecasting with good accuracy the electricity consumption in EAF and LF as a function of the main production information. The models were trained and validated through production and process data from a real steelwork with encouraging results.

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