December 2023

GreenHeatEAF newsletter #2

Gradual integration of renewable non-fossil energy sources and modular heating technologies in EAF for progressive CO_2 decrease

The project falls under the funding programme of Horizon Europe – Clean Steel Partnership.

The call topic is related to modular and hybrid heating technologies in steel production.

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The year 2023 has come to its end and it is time to celebrate the arrival of the New Year!

This year was very intense for the GreenHeatEAF consortium starting its exciting adventure targeting the demonstration of the integration of non-fossil fuels and renewable C-sources in Electric Arc Furnace (EAF) processes to decrease CO_2 emissions and dependence from fossil energy and C-sources markets by combining pilot, on field and simulation investigations.

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One year of work

Many different activities have been carried out during 2023 and a very short overview is here provided.

An existing burner for natural gas and oxygen applied in the EAF at Deutsche Edelstahlwerke (DEW) has been scaled down and the construction is on-going for pilot tests at Betriebsforschungsinstitut (BFI) with hydrogen enhanced oxy-fuel-combustion. The pilot test results are basis data to investigate Hydrogen Enhanced Combustion (HEC) for EAF heating in Computational Fluid Dynamics (CFD) simulations. Off-gas temperature measurements are being prepared in an EAF off-gas duct to achieve necessary data for these simulations.

Moreover, a testbed planning for heat recovery from EAF-off-gas via a ceramic recuperator is ongoing.

Swerim completed the basic engineering of the gas supply system and will perform a Hazard and Operability Study (HAZOP) and Linde started to construct the CoJet-burner. Work is underway on the test plan for trials at Swerim's EAF including demonstration of hydrogen use, bio-carbon injection and slag heat recovery tests.

Under the leadership of SIDENOR different types of renewable C-sources to be used in the EAF were analysed by the industrial partners of the project (see some examples in Figure 1), and a selection of appropriate candidates to be used in the Pilot and Demo trials was made.

"GreenHeatEAF contributes to gradual replacement of fossil fuels and fossil carbon materials with non-fossil gases and renewable C-sources. Therefore, GreenHeatEAF contributes to lowering NG, anthracite and coal exploitation, by decreasing GHG emissions through the use of sustainable gases (i.e., green Hydrogen, preferably internally produced) and materials (zero-impacting biomass)."

Figure 1: a), b) and c) shows different types of biochar, d) shows plastic grains; e) shows a material derived from tires.

An existing model of the EAF, that was developed in Aspen Plus by Scuola Superiore Sant'Anna (SSSA), was adapted by SSSA with the support of SIDENOR to consider injection of these materials.

All the considered renewable C-sources have been modelled and the possibility to use them in EAF process has been implemented. This adaptation was done in a more complex simulation model for the whole EAF route that has been used to carry out some scenarios analyses investigating the effects of the injection of different materials and related ratios e.g., on steel and by-product composition, energy consumption, electric energy efficiency, CO_2 emissions. Some preliminary results of such scenario analyses have been presented at the last edition of the EAF international meeting, which took place in Bergamo from November 30 until December 1 2023 (see Figure 2).

Dr.s V. Colla and I. Matino presenting some preliminary results of the simulations carried out within GreenHeatEAF.

Stakeholder engagement

The GreenHeatEAF Consortium is committed to gathering primary data and information, collecting feedback, increasing ownership of results, and ensuring industrial interest and commitment towards the project results throughout the whole European steel community.

As an initial step in this direction, a first survey was launched in November 2023 to collect the stakeholders' feedback on some of the expected outcomes of the project correlated to modelling and simulation tools. Moreover, the Consortium organized a meeting and a series of interviews with the members of its Advisory Board, which was focused on foreseen barriers for transferability of the foreseen Key Exploitable Results of the project that were identified at the proposal stage.

The outcomes of the survey and of the interviews provided elements to prepare the first version of the Guidelines for Transferability, a public deliverable which summarized the analyses on intensifiers and barriers and the recommendations gathered to ensure transferability of the project outcomes.