December 2023

GreenHeatEAF newsletter

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 indispensability of steel in society and the need to protect the environment are at the basis of the steelmaking industry's decarbonisation.

Clean steelmaking transition finds in electric arc furnaces (EAF) a key technology: it is at the basis of scrap-based steelmaking, a circular economy process, and of the new DRI-EAF route that is expected to replace the BF-BOF route. In this context, the EU-funded GreenHeatEAF project aims at further increasing the importance of EAF.

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GreenHeatEAF in brief

The GreenHeatEAF project aims at demonstrating 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.

The project focuses also on improvement of heat recovery solutions from off-gases and slag considering the changes of their features with the introduction of H_2 and/or biomass and considering different charge materials and modes. Technologies and processes for heat recovery are tested and control approaches are developed.

Transferability of GreenHeatEAF solutions is ensured by different business cases belonging to the several industrial partners SSAB, CELSA, Sidenor, Linde, Hoganas and Deutsche Edelstahlwerke DEW (associated). Currently, pilot plant trials on Hydrogen Enhanced Combustion with standard burners and demo trials with hydrogen as energy source in EAF are being prepared and scenarios analyses are ongoing concerning the use of biomass/biochar in EAF, both complemented by simulation studies

GreenHeatEAF is carried out over 42 months from January 2023 to June 2026. With a consortium of 11 partners, the project combines trials in demonstration scale, e.g. in combustion- and EAF-demo plants, with validations in industrial scale and digital optimisation with high synergy. Thus, it completely follows the Horizon Twin Transition and Clean Steel Partnership objectives and the target to progress decarbonisation technologies from TRL 5 to 7. This synergic concept of GreenHeatEAF supports implementation and digitalisation to speed up the transition of the European steel industry to highly competitive energy-efficient decarbonised steel production.

"By demonstrating the potential of a thorough integration of non-fossil gases and materials, of cutting-edge heat recovery solutions and of flexible and distributed advanced control of heating capacities in the electric steelmaking route, GreenHeatEAF supports the decarbonisation of the EU steel sector".

GreenHeatEAF

Consortium

The GreenHeatEAF consortium includes 11 specialised partners (4 steel producers and their affiliate companies, 3 research institutes, 1 gas supplier, 1 cement producer, 1 manufacturer and 1 technology platform) from 6 different European countries.

The GreenHeatEAF project is coordinated by SSSA.

Partners

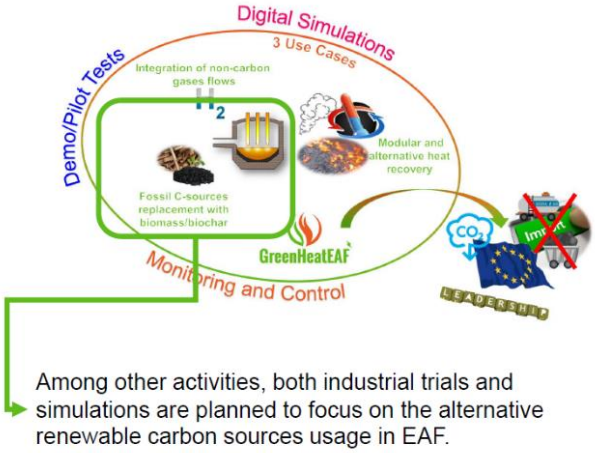
- Scuola Superiore di Studi Universitari e di Perfezionamento Sant'Anna (SSSA)
- Celsa Group
- VDEh-Betriebsforschungsinstitut GmbH (BFI)
- Linde
- Cementa
- SSAB
- Höganas
- Sidenor
- European Steel Technology Platform (ESTEP)
- Swerim
- Deutsche Edelstahlwerke

GreenHeatEAF objective

GreenHeatEAF will adapt, develop and demonstrate technologies for integrating non-C gases and renewable C-materials and for obtaining a wide control range of the whole heat capacities in EAF processes considering EAF role in both scrap- and iron-based route.

It will consider 3 use cases:
- Integration of non-C gases flows;
- Fossil C-sources replacement with biomass/biochar
- Modular and alternative heat recovery

It will include parallel and complementary application of demonstration and pilot tests, digital simulation and monitoring, and control strategies.



Expected outcomes

The GreenHeatEAF project demonstrates the potential of modular regenerator and ceramic heat exchanger to recover heat from EAF off-gases. Methodologies are developed to recover latent heat from EAF slags for their valorisation. These solutions, together with cutting-edge sensors and advanced distributed control systems allow extending the current control range of heating capacity in EAF-based steelmaking, by reducing some of the most common energy losses and achieving more flexible management of available heat sources. The use of electricity from renewable sources is also promoted for hydrogen production and, whenever possible, also directly for EAF that can be itself considered a process where hybrid heating is involved. GreenHeatEAF is expected to contribute to recover roughly 20% of wasted energy input at electric steelworks, with consequent reduction of CO_2 emissions and costs.

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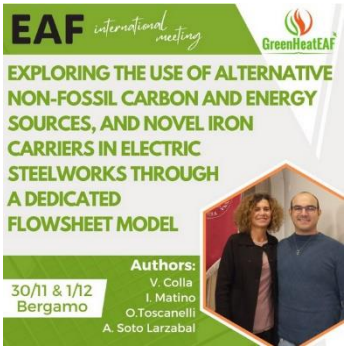
Moreover, GreenHeatEAF contributes to gradual replacement of fossil fuels and fossil carbon materials with non-fossil gases and renewable C-sources. Standard burner technologies are being adapted and their suitability for injecting enriched NG will be demonstrated together with innovative burners. Suitable operating conditions and process adaptations for increased use of hydrogen as fuel and biomass/biochar as C-sources and in case of different charges (i.e. different iron carriers) and EAF charge configuration are investigated. A stepwise roadmap will be developed to gradually integrate these gases and material workflows and to guide towards C-lean steelmaking industry. Therefore, GreenHeatEAF contributes to lowering NG, anthracite and coal exploitation, by decreasing GHG emissions through the use of sustainable gases (i.e., green H_2, preferably internally produced) and materials (zero-impacting biomass).

Events & meetings

In order to raise awareness of the project and to engage relevant stakeholders, also beyond the steel industry, the GreenHeatEAF project took already part to various events.

The project was presented at:

- ESTEP Spring Dissemination Event, March 2023, Pisa (Italy)
- ESTEP Annual Event 2023: A circular economy driven by European steel, October 2023, Barcelona (Spain)
- 10th edition of the PROMETIA Scientific Seminar, November 2023, Lisbon (Portugal)
- EAF international meeting, November 2023, Bergamo (Italy)



Next to a pre-kick-off meeting in January, the project consortium had already three General Assembly meetings in 2023. It has its third General Assembly meeting on 23-24 October 2023 in Pisa at SSSA and also had its first Advisory Board meeting online on 8 December 2023.

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