GreenHeatEAF

Gradual integration of REnewable non-fossil ENergy sources and modular HEATing technologies in EAF for progressive CO2 decrease

Report on DC activities-V2

Deliverable D5.6

Valentina Colla, Ismael Matino, Orlando Toscanelli (SSSA)
Delphine Snaet (ESTEP)

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1. Introduction

1.1 Purpose and scope of the present document

The GreenHeatEAF Consortium is keen to communicate and disseminate project results across the European steel sector and beyond as a way to maximise the impact of the project by raising the interest of the European steel industry.

This deliverable is the second of a set of 4 deliverables that are planned for M12 (already approved), M24, M36 and M42, respectively. Each of these 4 deliverables will describe the dissemination and communication activities implemented by the GreenHeatEAF Consortium during a period of 12 months, apart from the last one which will refer to the last 6 months of the project and will provide a final overview. All these 4 deliverables will also assess the status of achievement of the different dissemination and communication targets established in the Dissemination and Communication Plan (Deliverable D5.1) and will identify possible revisions of the identified Dissemination and Communication strategy, wherever applicable.

This document summarises the dissemination and communication activities carried out by the GreenHeatEAF partners in the second year of the project. It includes the activities carried out in its social media channels (such as LinkedIn or Twitter) as well as the events targeted by the consortium for dissemination purposes.

During the second year of activity, the project started showcasing interesting results, especially as far as modelling and simulations are concerned, and as a consequence of the completion of some industrial tests, therefore full presentations of the project results were given. Moreover, three journal papers were published, which are derived from presentations that were discussed in 2023.

The Consortium was always active in spreading news on relevant outcomes and in raising awareness, curiosity, and interest towards the project in the European steel sector by means of the social network and the project website. Moreover, some networking activities were started with other relevant EU-funded project in the field of heating technologies. Several presentations were provided by some of the partners in relevant international events.

All the developed activities followed the Dissemination and Communication Plan (Deliverable D5.1), which proved to be well aligned with the aims and scope of the project. The overall strategy established in that document proved to be effective and presently does not need revision.

1.2 Structure of the document

This rest of document is divided into 4 main sections:

- Section 2 focuses on the activities that were carried out to disseminate the first relevant project outcomes.
- Section 3 describes the developed communication activities.
- Section 4 overviews the future events that are targeted by the Consortium to disseminate and communicate the project outcomes.
- Section 5 provides some concluding remarks and considerations for a fine tuning of the established Dissemination and Communication strategy to amplify the project impact and meet the ambitious targets that were identified at the beginning of the project in the Dissemination and Communication Plan (Deliverable D5.1).

2. Dissemination Activities

Dissemination is focused on the **public disclosure of the project results to specific target groups,** and has the following main Dissemination Objectives (DOs):

DO1. to raise awareness and interest of potential users on the project results;
DO2. to foster interaction with stakeholders and potential users (the ecosystem) to obtain key feedback and enhance exploitation opportunities;
DO3. to transfer knowledge of the developed solutions to the scientific community and exchange experiences which can support improvements and refining of the research activities;
DO4. to foster the acceptance of GreenHeatEAF outcomes and tools in the EU steel industry;
DO5. to ensure a broad applicability of the project results also beyond the steel sector.

During the second year of the project, the following papers, which derived or were requested by the publishers based on contributions provided in conferences attended during the first year of the project, were published in Open Access mode.

- Matino, V. Colla, O. Toscanelli, A. Soto, A. Zubero: "Esplorare l'uso di fonti alternative e non fossili di carbonio nelle acciaierie elettriche attraverso un modello flowsheet dedicato," *La Metallurgia Italiana*, 115 (39), 2024, pp. 24-33. https://www.aimnet.it/la_metallurgia_italiana/2024/marzo/02.pdf
- Matino, V. Colla, A. Petrucciani, A. Zaccara, O. Toscanelli, A. Soto Larzabal, A. Zubero Lombardia: "An advanced simulation tool to support adoption of alternative non-fossil Carbon sources in electric steelworks," Vol. 115, No. 5, Art. 504, *Materiaux et Techniques*, 2024. https://www.mattech-journal.org/articles/mattech/pdf/2024/05/mt20240027.pdf
- L. Kieush, J. Rieger, R. Attrotto, A. Sorino, W. van der Stricht, H. Oterdoom, E.P. Heikkinen, G. Dall'Osto, Carlo Mapelli, D. Mombelli, L. Di Sante, F. Cirilli, V. Colla, T.A. Branca, I. Matino, A. Petrucciani, A. Zaccara, C. Brondi, E. Mousa, E. Nylund, E. Sandberg, M. Guzzon, E. Malfa, A. Schröder, I. Bellemans: "Roadmap for Recycling Practices and Resource Utilization in the Iron and Steelmaking Industry: A Case Studies," *Materiaux et Techniques*, Vol. 115, No. 5, Art. 503, 2024. https://www.mattech-journal.org/articles/mattech/pdf/2024/05/mt20240007.pdf

Moreover, 7 presentations fully focused on the project were provided within 5 international Conferences, which are summarized in **Table 1**.

The abstracts of the four full presentations are provided in the following subsections, while the D&C reports related to all the events where GreenHeatEAF was presented, prepared according to the template available in the Dissemination and Communication Plan, are reported (in chronological order) in **Appendix I** of the present document.

Table 1. List of events where detailed presentations concerning GreenHeatEAF were discussed.

Authors	Partners	Title of the presentation	Date	Conference
V. Colla, I. Matino, A. Zaccara, O. Toscanelli, A. Soto Larzabal A. Zubero Lombardia	SSSA SIDENOR	Reducing the dependence from non-fossil carbon materials and the related impacts: effect of the use of alternative C-bearing materials on material and energy flows of electric steelworks	14.05.2024	18th Society and Materials Conference (SAM18)
B. Kleimt; V. Peiss; I. Matino; V. Colla, O. Toscanelli, J. Orre A. Soto Larzabal G. Solheim	BFI SSSA SWERIM SIDENOR CELSA	Complementary modelling approaches to assess and optimise the EAF process behaviour for C-lean operation	04.06.2024	13th European Electric Steelmaking Conference EEC 2024
V. Colla, I. Matino, A. Zaccara, O. Toscanelli, A. Soto Larzabal A. Zubero Lombardia	SSSA SIDENOR	Use of alternative non-fossil carbon sources in electric steelworks: Results of flowsheet model-based simulations	05.06.2024	
V. Colla, I. Matino, O. Toscanelli,	SSSA	Modelling of processes for upgrading biomass before its use in the steel industry	18.10.2024	9th European Coke and Ironmaking Congress ECIC 2024
O. Hatzfeld M. Magnelov, J. Orre, P. Kwaschny, I. Matino, O. Toscanelli, V. Colla	BFI SWERIM LINDE SSSA	Demonstration and Digital tools to investigate hydrogen exploitation in EAF burners	31.10.2024	ESTEP Annual Event 2024
V. Colla, I. Matino, O. Toscanelli,	SSSA	Scenario analyses to evaluate the effects of hydrogen exploitation in EAF burners	31.10.2024	
I. Matino, V. Colla, O. Toscanelli, A. Zaccara, A. Soto Larzabal A. Zubero Lombardia Jon Hermosa	SSSA SIDENOR	Exploring the effects of the use of alternative carbon-bearing materials in EAF through dedicated simulations	29.11.2024	ESTEP Workshop SecCarb4Steel

2.1 Reducing the dependence from non-fossil carbon materials and the related impacts: effect of the use of alternative C-bearing materials on material and energy flows of electric steelworks

V. Colla[1], I. Matino[1], A. Zaccara[1], O. Toscanelli[1], A. Soto Larzabal[2], A. Zubero Lombardia[3]

[1]Scuola Superiore Sant'Anna, TeCIP Institute, Pisa (Italy)
[2]Sidenor I+D Bizkaia (Spain)
[3]Sidenor Aceros Especiales Bizkaia (Spain)

In the context of the European Green Deal, European Steelmaking sector is facing a challenging period characterized by deep transformations finalized to the achievement of carbon neutrality by

2050. Therefore, several efforts are spent for transforming existing steelmaking routes to C-lean ones or for exploiting less-impacting energy or carbon sources in existing processes. This last aspect is fundamental both from the environmental point of view and thus for reducing fossil CO_2 emissions and from the societal point of view for decreasing the dependence from geopolitical unstable countries for the purchasing of fossil raw materials. However, uncertainties exist on the effects and on the impact that the introduction of these materials could have on the process. For this reason, one of the activities performed in the EU-funded project entitled *"Gradual Integration of REnewable carbon and alternative non-carbon Energy sources and modular HEATIing technologies in EAF for progressive CO_2 decrease – GreenHeatEAF*" concerns the investigations of the effects of the use of alternative C-bearing sources on material and energy flows. Scenario analyses have been carried out through simulation performed by using an electric steelmaking route model. Different alternative C-materials have been tested with the model and the effects on some key components of tapped metal and on process parameters such as electric energy consumption are monitored and compared. Furthermore, in the upcoming future complementary industrial tests will be carried out.

2.2 Complementary modelling approaches to assess and optimise the EAF process behaviour for C-lean operation

B. Kleimt[1], V. Peiss[1]; I. Matino[2], V. Colla[2], O. Toscanelli[2], J. Orre[3], A. Soto Larzabal[4], G. Solheim[5]

[1]VDEH-BetriebsforschungsInstitut, (Germany)
[2]Scuola Superiore Sant'Anna, TeCIP Institute, Pisa (Italy)
[3]SWERIM AB, Lulea (Sweden)
[4]Sidenor I+D Bizkaia (Spain)
[5]Celsa Armeringsstal AS (Norway)

The importance of the Electric Arc Furnace (EAF) is strongly increasing within the transformation towards a Green Steel production. However, still various measures have to be taken and investigations to be done to allow a fully carbon-neutral steelmaking process in the EAF. In the EU-funded project entitled "*Gradual Integration of Renewable carbon and alternative non-carbon Energy sources and modular Heating technologies in EAF for progressive CO_2 decrease – GreenHeatEAF*", several of these measures are investigated, developed and tested in pilot and industrial scale. These developments are accompanied by application of different kinds of process models which are newly developed, adapted and extended for simulation and optimisation of these measures and for analysing the effects and behaviour of processes at different EAF plants in case of C-lean oriented process changes.

Within the project, three different kinds of EAF models are applied: a stationary flowsheet model for EAF production route scenario analysis, a stationary mass and heat balance model based on HSC Chemistry, and an analytical dynamic EAF process model for offline simulations as well as online monitoring and control application. In the paper, the three modelling approaches and their validation with industrial process data from different kinds of EAF operations (scrap-based, DRI usage, batch process, ConSteel process) are described and their potentialities are explained.

2.3 Use of alternative non-fossil carbon sources in electric steelworks: Results of flowsheet model-based simulations

I. Matino[1], V. Colla[1], O. Toscanelli[1], A. Soto Larzabal[2] A. Zubero Lombardia[3]

[1]Scuola Superiore Sant'Anna, TeCIP Institute, Pisa (Italy)
[2]Sidenor I+D, Bizkaia (Spain)
[3]Sidenor Aceros Especiales, Bizkaia (Spain)

The last and upcoming years have been and will be characterized by significant changes in the European steelmaking sector. Steelworks are indeed committed to achieve important goals from the point of view of sustainability improvement and emissions reduction. In this context, electric steelworks are considered fundamental, as they already play an important role being aligned to the circular economy concept. Nonetheless, in order to increase the competitiveness of electric steelmaking, several research activities are ongoing that aim at improving energy efficiency and sustainability and reduce dependency on fossil carbon. These achievements can be obtained, for instance, by replacing fossil carbon with hydrogen and/or alternative renewable carbon sources. These aspects are among the topics investigated in the EU-funded project entitled "*Gradual Integration of REnewable carbon and alternative non-carbon Energy sources and modular HEATIing technologies in EAF for progressive CO_2 decrease – GreenHeatEAF*". The project investigates the use of renewable C-bearing materials exploiting both field and simulation tests. In particular, as far as simulations are concerned, a standard EAF route model was adapted to investigate the effects of the use of different alternative C-sources on the production of different steel families and how their composition affects for instance the EAF electric energy, the CO_2 emissions from EAF, the C and S content in tapped metal, the metallic efficiency. Models' adaptations and main results of simulations will be shown.

2.4 Modelling of processes for upgrading biomass before its use in the steel industry

I. Matino, V. Colla, O. Toscanelli,

Scuola Superiore Sant'Anna, TeCIP Institute, Pisa (Italy)

In the context of Green Deal ambitions of making EU sustainable and climate neutral, renawables can play a fundamental role in steel industry. Among them, biomass is an alternative and renewable carbon source and it fits with the circular economy concept.

However, these materials should meet specific requirements to be used. In order to investigate biomass upgrading and to compare processes and products to be used in steel production two models have been developed during the EU-funded project entitled "*Gradual Integration of REnewable carbon and alternative non-carbon Energy sources and modular HEATIing technologies in EAF for progressive CO_2 decrease – GreenHeatEAF"*. The models refer to biomass pyrolysis and torrefaction processes. Stationary flowsheet models have been developed using the Aspen Plus V11 software. Concerning the pyrolysis model, the main considered units and section are a dryer to dry partially the biomass, a pyrolysis reactor to simulate pyrolysis at a temperature of 550°C and condensation section for separating biooil from non-condensable gases. The torrefaction model considers a dryer and the torrefaction reactor, respectively, to dry biomass and to simulate the torrefaction process in a range between 225°C and 275°C. Both models have been validated with literature data and relative error values concerning monitored parameters (e.g. produced biochar, related high heating value) are lower than 10%. The models are, therefore, suitable for use within scenario analyses on biomass upgrading before its usage in steel industry. In addition, in order to evaluate of the integration of biomass upgrading process in existing

steelmaking routes, the models can be also combined with other flowsheet models developed to reproduce the steel production routes.

2.5 Demonstration and Digital tools to investigate hydrogen exploitation in EAF burners

O. Hatzfeld[1], M. Magnelöv[2], J. Orre[2], P. Kwaschny[3], I. Matino[4], O. Toscanelli[4], V. Colla[4]

[1]VDEh –Betriebsforschungsinstitut GmbH, Duesseldorf, Germany
[2]Swerim AB, Lulea, (Sweden)
[3]LindeTechnology, (Sweden)
[4]Scuola Superiore Sant'Anna, TeCIP Institute, ICT-COISP, Pisa (Italy)

Electric Arc Furnace (EAF) are increasingly relevant for the transformation towards a Green Steel production. Various measures like hydrogen exploitation have to be taken and investigations need to be done to allow a fully carbon-neutral steelmaking process in the EAF. In the EU-funded Horizon Europe project "*Gradual Integration of Renewable carbon and alternative non-carbon Energy sources and modular Heating technologies in EAF for progressive CO_2 decrease –GreenHeatEAF*", several of these measures are investigated, developed and tested in pilot and industrial scale. These experimental developments are accompanied by application of different kinds of process models which are newly developed for simulation and optimization.

Within this project the H2exploitation is experimentally investigated in hydrogen oxyfuel combustion for EAF heating and theoretically investigated in EAF heating with Hydrogen Enhanced Combustion (HEC). The impact of H2 exploitation is additionally investigated regarding the impact on the EAF process itself and the impact on avoiding fossil carbon in the steelmaking process.

Experimental investigations focus on EAF heating with EAF-burners from Linde for 100% hydrogen and pure oxygen combustion at demonstration level. The investigations focus on the demonstration of hydrogen enhanced oxyfuel combustion with an existing EAF burner. The results are the basis for the CFD-simulation of EAF heating with HEC in combination with electric heating for the melting process. Results are needed as well to analyse the technical, economical, and ecological impact of hydrogen combustion in the EAF process. In this contribution the status of tests and test bed development in the project are presented.

2.6 Scenario analyses to evaluate the effects of hydrogen exploitation in EAF burners

Ismael Matino, Valentina Colla, Orlando Toscanelli

Scuola Superiore Sant'Anna – TeCIP - ICT-COISP, Pisa, Italy

Steelmaking sector is strongly committed to reach the European Green Deal objectives of achieving the climate neutrality by 2050. Several solutions are under investigations, such as transition from BF-BOF to DRI-EAF route, substitution of fossil sources and fuels with renewables and alternative fuels, improvement of resource and energy efficiencies. In this context, the EAF-based steelmaking route is acquiring a higher role compared to the past, and efforts are spent to improve the sustainability of processes that already intrinsically fit the concept of circular economy. Among the different analysed possibilities, the replacement of natural gas used in EAF burners to provide part of the chemical energy required in EAF with green hydrogen has increasingly been considered. However, effects on the process and product have to be investigated to avoid unexpected issues. The project entitled "*Gradual Integration of Renewable non-fossil energy sources and modular*

heating technologies in EAF for progressive CO_2 decrease – GreenHeatEAF," which is funded by the EU through the Horizon Europe programme based on a Clean Steel Partnership call, develops trials with conventional and innovative burners as well as with pilot EAF, and these trials are complemented by scenario analyses carried out with ad-hoc simulation studies. To this aim, a flowsheet model was adopted, which has been updated through the years within different research initiatives [1-3] and represents the whole EAF production route until the beginning of the continuous casting. In the context of the GreenHeatEAF project, new streams, reactions and design specifications units were added to the model. Then, EAF production heats were simulated by substituting each time 10% of the energy provided through natural gas with hydrogen, and different parameters were monitored such as EAF electric energy, CO_2, CO and H2O content in EAF off-gases, EAF off-gases temperature, H_2 content in melted steel. As expected, more H_2O and less CO_2 can be found in EAF off-gases. Interestingly, the decrease of CO_2 is more evident until a blend of 20% of natural gas and 80% of H_2. In addition, hydrogen in tapped steel significantly increases it becomes more than two times of the starting case (only NG in burners) with a full hydrogen use, while further negligible changes are observed in tapped steel and in slag. Further simulations are ongoing to provide as much as possible information for supporting and paving the way to the introduction of the use of hydrogen instead of natural gas in electric arc furnaces.

References

[1] Matino, I. et al. (2016). Process modelling and simulation of electric arc furnace steelmaking to allow prognostic evaluations of process environmental and energy impacts. *Matériaux & Techniques*, 104(1), 104.
[2] Petrucciani, A. et al. (2022). Flowsheet Model and simulation of produced slag in electric steelmaking to improve resource management and circular production. *Chemical Engineering Transactions*, 96, 121-126.
[3] Matino, I. et al. (2024). Esplorare l'uso di fonti alternative e non fossili di carbonio nelle acciaierie elettriche attraverso un modello flowsheet dedicato. *La Metallurgia Italiana*, 24.

2.7 Exploring the effects of the use of alternative carbon-bearing materials in EAF through dedicated simulations

I. Matino[1], V. Colla[1], O. Toscanelli[1], A. Zaccara[1], A. Soto Larzabal[2,3], A. Zubero Lombardia[3], J. Hermosa[3]

[1] Scuola Superiore Sant'Anna, TeCIP Institute, Pisa (Italy).
[2] Sidenor I+D, Bizkaia, (Spain).
[3] Sidenor Aceros Especiales, Bizkaia, (Spain).

In the context of the decarbonization of the electric steelmaking route to contribute to the achievement of the Green Deal objectives, the replacement of fossil C-bearing materials is envisaged as one of the promising solutions. It is expected, indeed, that using alternative non-fossil materials significant amount of CO_2 emissions can be avoided [1]. However, although some first researches of the use of renewable (e.g. biomass/biochar) and alternative (e.g. tires) C-bearing materials can be found in literature already in the first years of 2000 [2,3], there are still unknown aspects that require dedicated investigations. Therefore, this topic is one of the aspect addressed in the project entitled "*Gradual integration of REnewable non-fossil ENergy sources and modular HEATing technologies in EAF for progressive CO_2 decrease*" (Ref. GreenHeatEAF – G.A. No 101092328), funded by the Horizon Europe framework. Both industrial, pilot and simulation tests are envisaged in the project.

Simulation is considered a powerful tool for exploring a vast area of scenarios to investigate the effects of the use of these materials in the Electric Arc Furnace (EAF). For this reason, a previously developed model simulating the whole EAF scrap-based production route [4,5] was firstly enhanced

to manage the use of alternative C-bearing materials in EAF, and afterwards used for different kind of scenario simulations and sensitivity analyses. In addition, knowing that biomass features are often unsuitable for direct use in metallurgical processes, some upgrading processes were modelled. The aim of this modelling work is to explore the possibility of integrating these processes in electric steelworks to both recover available heat and decrease steelworks dependence on an emerging market (i.e. biochar market) which is expected to increase (with consequent costs increase) in the future. An overview of the models and the simulation results will be provided. The main result is that the use of biochar seems to have no critical effect on the liquid steel quality and no significant deviations were observed on energy consumptions. Other effects of the use of the considered alternative C-bearing materials are still unclear and under investigation.

References

[4] European Steel Technology Platform, Improve the EAF scrap route for a sustainable value chain in the EU Circular Economy scenario, 2021, last access May 23, 2024. https://www.estep.eu/assets/Publications/Improve-the-EAF-scrap-route-Roadmap-Final-V2-3.pdf
[5] L. Wibberley et al., Large scale use of forest biomass for iron and steelmaking. NSW Government Sustainable Energy Research Development Fund (SERDF) Report by BHP Minerals Technology and NSW State Forests. (2001).
[6] J.P. Gorez et al., Recycling used tires in the electric arc furnace. *Metallurgical Research & Technology*, 100(1), 17-23 (2003).
[7] I. Matino et al., Process modelling and simulation of electric arc furnace steelmaking to allow prognostic evaluations of process environmental and energy impacts, *Matériaux & Techniques*, 104 (1), 104 (2016).
[8] A. Petrucciani et al., Flowsheet Model and simulation of produced slag in electric steelmaking to improve resource management and circular production, *Chemical Engineering Transactions*, 96, 121-126 (2022).

2.8 Collaboration and synergies with other EU-funded projects

During the ESTEP annual event that was held on October 29-31 in Linz (Austria) contacts and discussions were established with the following EU-funded research projects

- *"Hydrogen technologies for decarbonization of industrial heating processes" (HyInHeat)*, Horizon Europe - G.A. No 101091456 (contacts with this project were started in 2023).
- *"Clean Hydrogen and Digital tools for REheating And heat treatMent for Steel" (HyDreams)*, Research Fund for Coal and Steel (RFCS) G.A. 101098480.
- *"Advancing Hydrogen Combustion for Sustainable Aluminium Industries" (H2AL)*, Horizon Europe – G.A. No. 10137610
- *"Decarbonising the glass industry with hydrogen technologies" (H2GLASS)*, Horizon Europe - G.A. No 101091456
- *"HYbrid TEChnologies for sustainable steel reheating" (HyTecHeat)*, Horizon Europe - G.A. No 101092087
- *"Digital TWINs for Green Hydrogen transition in steel industry" (TWINGHY)*, Research Fund for Coal and Steel (RFCS) G.A. 101099158.
- "The highly efficient and sustainable decarbonisation of bright annealing process by recovery and reuse of H2" (H2Reuse) LIFE Grant Agreement No. 101156487

Moreover, in October 2024 interactions started with a new project funded by the EU through the Research Fund for Coal and Steel and entitled *"Fostering Industrial Symbiosis solutions for the steel sector by results monitoring and dissemination from national and EU funded projects coupled to definition of cross-sectorial synergy scenarios" (Symbio-Steel)* (Grant Agreement No. 101156509). This is an Accompanying Measure related to the implementation of Industrial Symbiosis practices and solutions and can be useful to spread the results related to the use of non-

fossil Carbon sources in the steel sector. The GreenHeatEAF consortium plans to attend future events organised in the context of the Symbio-Steel project to spread the outcomes of the experimental and simulation investigations related to the use of biomass/biochar in the EAF.

Finally several members of the Consortium are very active in the EU-funded research and are working to favour synergies with other EU-funded projects.

2.9 Achievement status of the established dissemination targets

Relevant progresses are observed on the achievement of the dissemination targets established for the project within the Dissemination and Communication plan (Deliverable D5.1) thanks to the intense dissemination actions that were put in place by the consortium in the second year. Results are summarised in **Table 2**.

To sum up, at the present status of the project, the dissemination strategy appears appropriate and does not need revision.

Table 2. Comparison between target and actual values of the established KPIs for the dissemination activities.

Communication activity	KPI Communication	Target	Actual value	% vs target.	Status
Scientific and technical papers	• No. of articles in well reputed scientific journals in Open Access mode	15	3	20%	
	• No. of downloads for the published papers overall	9000	~800*	9%	
Presentations, lectures, posters in conferences, congresses and workshops	• No. of papers published in proceedings of international conferences and workshops	12	2	17%	
	• No. of presentations/posters discussed in international scientific events	18	9	50%	
	• No. of persons in the general audience reached in the attended scientific events)	10000	~1680	17%	
Internal seminars and dissemination events	• No. of internal partners' events	8	0	0%	
	• No. of pilot training sessions related to the outcomes of the project and some of the developed tools	4	0	0%	
Webinars and seminars on GreenHeatEAF outcomes	• No. of webinars and seminars	3	0	0%	
	• No. of persons overall attending the held webinars and seminars	150	0	0%	
Attendance to exhibitions/trade fairs	• No. of exhibitions or trade fairs attended	3	0	0%	
	• overall number of the audience of the attended exhibitions and trade fairs	3500	0	0%	
Presentations in events promoted by EU initiatives, platforms, and associations	• No. of presentations	4	4	100%	✓
	• Total number of experts and industrial representatives reached in the presentation events	200	320	160%	✓
Collaboration and synergies with other CSP and HEU projects	• No. of projects contacted for potential synergies in terms of knowledge exchange and future project scale-up	10	9	90%	
	• No. of joint activities put in place with some of the previously identified and contacted projects	5	1	20%	
GreenHeatEAF final Workshop	• No. of presentations held during the Workshop both by GreenHeatEAF beneficiaries and by external experts	8	0	0%	
	• No. of attendees	100	0	0%	

* This figure is computed by summing data from ResearchGate and data from the Publishers of the papers.

3. Communication activities

Communication activities mostly aim at **promoting the project itself and its impacts among the identified groups**. The following main Communication Objectives (CO) have been defined:

- CO1. to raise awareness in the steel community of the benefits of the GreenHeatEAF technologies and solutions in terms of socio-economic and environmental sustainability of the steel production cycle;
- CO2. to raise awareness and favour opportunities for transferability of concepts;
- CO3. to raise awareness among European Commission (EC), Public Authorities and policymakers to foster cooperation in spreading the benefits of the GreenHeatEAF outcomes and solutions;
- CO4. to involve workers and young talents in further development and deployment of the GreenHeatEAF tools and solutions and create among them awareness on their impact by also promoting connected career opportunities;
- CO5. to promote gender equality and integrate gender dimension in research and innovation activities.

Based on the strategy elaborated at the very beginning of the project, the communication activities implemented by the GreenHeatEAF Consortium during the second year were aimed at both raising awareness of the project objectives and potential benefits in the steel community and providing information on the first results that were achieved.

The Consortium made the choice to keep a “technically focused” profile in Communication activities, i.e. implementing communication actions which mostly refer to technical objectives, activities, and outcomes of the project. Consequently, communication activities mostly concerned the first results that were achieved and the implemented dissemination actions, namely the participation to events and presentations held by partners and the publications that were issued (see also **Section 2**).

The communication strategy mostly exploited the project website, the social media (LinkedIn) and some presentations made by single partners on more general topics connected to GreenHeatEAF. One newsletter was issued summarizing the work developed in the second year of the project. Two further newsletters are under preparation.

3.1 Project website

The GreenHeatEAF website is online since spring 2023 and was finalised by the end of the first semester of 2023 (see Deliverable D5.2), according to the project schedule. The website is hosted on the ESTEP website and can be found under the list of projects of the Clean Steel Partnership (https://www.estep.eu/clean-steel-partnership/greenheateaf).

By the end of the year, the GreenHeatEAF website was visited by a total of 1316 views **Figure 1** shows the time trend of the number of visitors on the project website and pages, and highlights some peaks in correspondence to the dissemination events participated by the project partners.

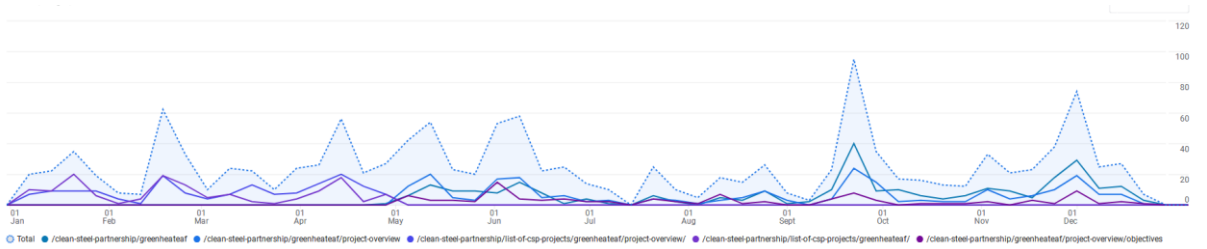

Figure 1. Time trend of the number of visitors of the project website starting from 01.01.2024.

At the end of 2024 a revamping of the project website was started to make it more attractive and to facilitate retrieval of information and documents.

3.2 LinkedIn Account

A LinkedIn account was created for the project at the end of March 2023 (see also Deliverable D5.1) and presently holds 820 followers. Since the account creation, 22 posts were published and 1 post from SWERIM was reposted, which gathered a total of about 18000 views and about 1200 visitors. The time trend of the visitors who accessed the GreenHeatEAF page on LinkedIn (based on the LinkedIn analytics) is shown in **Figure 2**, while the distribution of their profiles is shown in **Figure 3**.

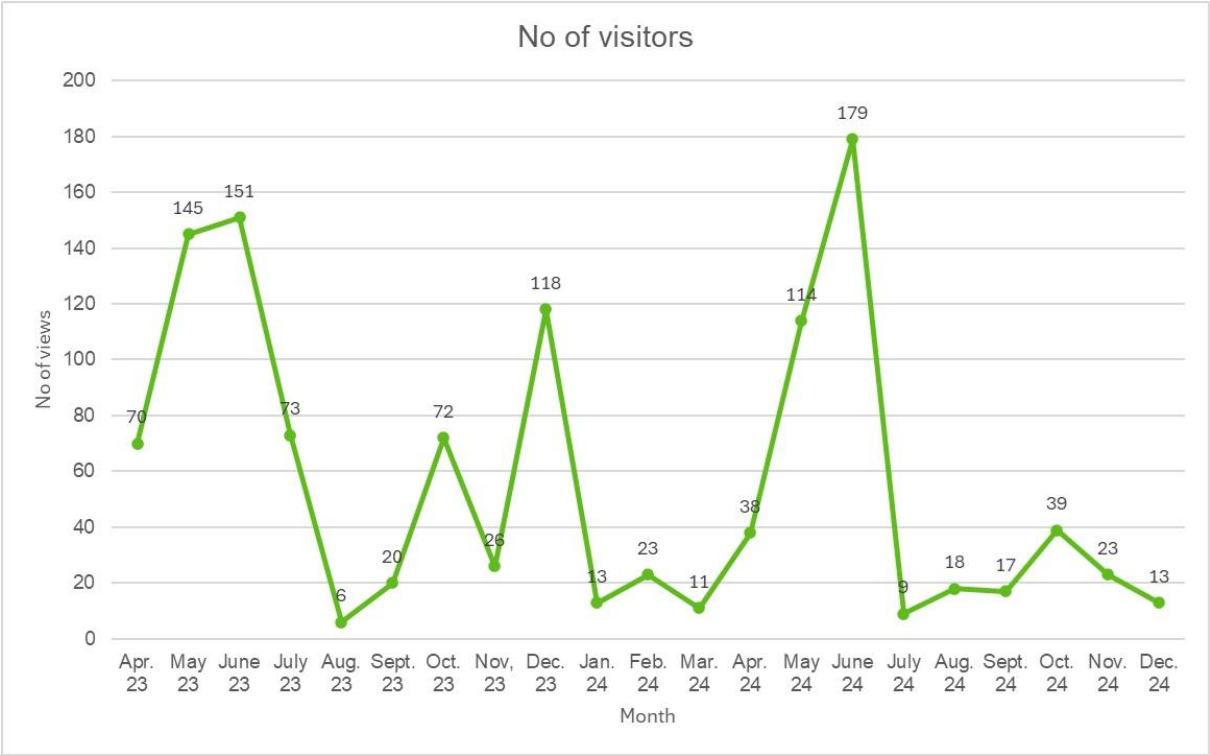

Figure 2. Time trend of the visitors of the LinkedIn page of the project.

Figure 3. Distribution of the profiles of the visitors of the LinkedIn page of GreenHeatEAF.

3.3 Newsletter and press releases

One newsletter was released summarizing the research activities that were carried out in 2024 and overviewing the dissemination events attended by the Consortium. This newsletter was spread through the project website and the project Linkedin page. The publication of the newsletter was still not regular, as the research activities are ongoing, but the Consortium is committed to release more numerous newsletters in the incoming months and on a more regular basis.

No press release was produced on 2024, but the consortium is committed to produce some press releases when the experimental activities at the plants or the pilot trials will achieve more mature and substantial results.

3.4 Achievement status of the established communication targets

Table 3 presents the current value of the established KPIs for communication activities and compares them with the target values established in the Dissemination and Communication Plan (Deliverable D5.1). Such values are very ambitious, and their trend cannot be “linear” throughout the project duration, as communication initiatives are expected to be more numerous and effective as soon as concrete results will be available. However, especially the activity on social media (LinkedIn) proved to be effective, with the target number of followers expected for the whole project duration largely overcome.

Table 3. Comparison between target and actual values of the established KPIs for the communication activities.

Communication activity	KPI Communication	Target	Actual value	% vs target.	Status
Project website with dedicated contents. Link to partners' website. Sharing public deliverables, reports, and training material	• No. of views by M40	10000	3116	31%	
	• No. of documents downloads	1000	n.a.	n.a.	
	• Total audience (No of persons) reached	70000	n.a.	n.a.	
Newsletters and bulletins	• No. of press releases	4	1	25%	
	• Online newsletters with news, events, and information of interest	4	3	75%	
	• No. of readers (total over the project duration)	5000	12400*	248%	✓
Press releases to newspapers and social media.	• No. of social media followers	500	825	165%	✓
	• Reached audience (no of people)	5000	13500#	270%	✓
Presentations in events organized by or relevant to EU, platforms, and associations. Publications on EC communication channels	• No. of clustering events at EU level	1	1	100%	✓
	• No. of publications on EC communication mean	1	0	0%	
Communications and seminars dedicated to students and young minds	• Overall audience of students reached	300	0	0%	
Communications and seminars dedicated to gender equality	• No. of presentations on gender equality in project event	1	0	0%	
	• No. of sessions on career opportunities	1	0	0%	

* This value is estimated assuming that 5% of the readers of "Il Tirreno" read the article mentioning the project and 20% of the viewers of the LinkedIn posts of the newsletters read them.
# This value is the sum of the estimated number of readers of the press releases on newspapers and the number visitors of the LinkedIn page of the project.

In the future, newsletters should be published on a more regular basis and, with respect to the initial communication strategy, it was decided that they should not necessarily overview all the activities carried out on a certain period. In other words, also "thematic" newsletters could be published additionally to the more "comprehensive" ones, which focus on one specific WP or research topic.

No press releases were delivered in 2024. Even if, from a merely formal point of view, the objective concerning the target audience was already reached in 2023, the GreenHeatEAF Consortium is aware that this is not enough and is committed to enforce its strategy on this side and all the partners are planning to mobilise local press in the future.

The Consortium took part to one clustering event at EU organised during the ESTEP annual dissemination event in Linz, by thus reaching the target, but it is committed to participate to further clustering events in the future.

The presentations in events organized by or relevant to EU, platforms, and associations. Publications in EC's communication channels and the communications and seminars dedicated to students and young minds as well as to gender equality are foreseen mostly for the incoming months of the project.

4. Future targeted events

During regular meetings (Steering Committee meetings and 6-monthly General Assemblies) and, more in general, during the project execution, the GreenHeatEAF consortium periodically analyses the events being planned and update the list of potential targets for GreenHeatEAF. The target events include conferences, workshops, exhibitions and other dissemination and communication opportunities, where the consortium can make presentations to share the results of the work carried out in GreenHeatEAF, as well as trade fairs, exhibitions and dissemination and communication initiatives organised by the EU.

In the Dissemination and Communication Plan established at the beginning of the project (Deliverable D5.1) as well as in the First D&C Report (Deliverable D5.5) an initial list of events was provided. In such lists 3 out of the 4 events initially identified for 2023 and 3 out of the 6 events initially identified for 2024 were attended. Two additional events (ECIC 2024 and the SecCarb4Steel Workshop) were identified after January 2024 and attended by a representative of SSSA.

As far as relevant events for the year 2025 are concerned, in 2024 the following two abstracts concerning part of the work developed within the project were submitted and accepted for presentation:

- V. Colla, I. Matino, A. Zaccara, O. Toscanelli: “Simulation of hydrogen usage in electric arc furnace for its decarbonization,” *AISTech 2025 — The Iron & Steel Technology Conference and Exposition*, Nashville, Tennesee (USA), May 5-8, 2025.
- I. Matino, V. Colla, O. Toscanelli, A. Zaccara, A. Soto Larzabal, A. Zubero Lombardia, J. Hermosa: “Reducing use of fossil carbon and fuels to decarbonize the electric steelmaking route: evaluation of the effects of biomass and hydrogen exploitation in the Electric Arc Furnace,” *7th Conference on Clean Technologies in the Steel Industry CTSI 2025*, Wien (Austria), May 20-22, 2025.

The related papers are under preparation and will be submitted in the first months of 2025.

Moreover, the Consortium is planning to submit some abstracts to the European Steel and Application Days (ESTAD) 2025, a major Conference for the European steel sector, which will be held in Italy in Autumn 2025. The deadline for Abstract submission is 15.02.2025.

This list of potentially relevant events has been revised at the end of the second year to reflect future opportunities for disseminating and communicating the project outcomes, and **Table 4** provides the list of future events identified by the Consortium at the date of delivery of the present document.

Table 4. list of relevant events (question marks are included when the exact dates or locations are still not defined).

Event	Date	Location	Description
AISTech 2025 — The Iron & Steel Technology Conference and Exposition	05-08.05.2025	Nashville (USA)	Main outcomes related to WPs 2-3
7th Conference on Clean Technologies in the Steel Industry CTSI 2025	20-22.05.2025	Wien (Austria)	Main outcomes related to WPs 2-3
IFRF Conference 2025: Sustainable and safe industrial combustion	17-19.06.2025	Sheffield (Great Britain)	Main outcomes related to WP 1
METEC & ESTAD 2025	06-09.10.2025	Verona (IT)	Main outcomes related to WPs 1-3
DIGIMET 2025 - International Workshop Carlo Longaretti on Digital Tools for the Metallurgical Industry	27-28.11.2025	Bergamo (IT)	Main outcomes related to WP3
ESTEP Annual Event 2025	??.10.2025	??	Main outcomes related to WPs 1-3
ESTEP Annual Event 2026	??.??.2026	??	Final outcomes of the project, with reference to aspects related to control approaches
21st IFAC Workshop on Control, Optimization and Automation in Mining, Mineral and Metal Processing MMM2026	??.??.2026	??	Final outcomes of the project, with reference to aspects related to control approaches

5. Conclusions

In the second year of the project the GreenHeatEAF consortium developed a quite intense Dissemination and Communication activity supported by the achievement of some preliminary results. The elaborated Dissemination and Communication strategy proved to be effective and, in general, all the partners showed a positive and collaborative attitude in spreading research objectives, ambitions, concepts and preliminary outcomes. This enabled a good progress on the achievement of the established target values of most the identified KPIs for Dissemination and Communication.

3 publications on international Journals have been issued, and there are concrete plans and opportunities to make further publications in the incoming months.

The Consortium was active in establishing connections and identifying opportunities for synergies with other EU-funded research initiatives.

The consortium also identified some margins for improvements to be stressed for communication activities, also based on the expected development of activities and availability of partial results, especially as regard to:

- development of press releases, also with a national and international visibility;
- more numerous and more “regular” publication of newsletters, also focused on specific topics.

6. List of Figures

7. List of Tables

8. List of acronyms and abbreviations

Acronym	Full Name
AB	Advisory Board
BFI	VDEh-Betriebsforschungsinstitut GmbH
CFD	Computational Fluid Dynamics
DRI	Direct Reduced Iron
EAF	Electric Arc Furnace
EC	European Community
EU	European Union
HEC	Hydrogen Enhanced Combustion
KER	Key Exploitable Result
KPI	Key performance Indicator
SSSA	Scuola Superiore Sant'Anna

Appendix I. Reports on dissemination and communication activities pursued in the second year of the project

I.1 18th Society and Material Conference SAM18

Event information	
Event name (and acronym)	18th Society and Materials International Conference SAM18
Type of event	Conference
Date	May 14-15, 2024
Location	Jönköping (Sweden)
Geographic coverage	European
Type of audience	RTOs, Academia, Steel Companies, Associations, researchers on material science, sustainability and socio-economic issues
Approximate size of audience	40
Short description	The SAM conference deals with the nexus between materials and society and, is calling for papers from the Science, Technology, Engineering, and Mathematics (STEM) and the Social Sciences and Humanities (SSH) communities. SAM is an international forum for exchanging on new methodologies, new concepts and new issues that connect materials and society from different perspectives, ranging from social to engineering sciences. Some special disciplines like Material Flow Analysis or Life Cycle Assessment, have been an important part of the meetings, as long as they were focusing on new directions and on innovative methodologies. More scientific approaches, driven by social science, economics or materials science have also been presented. The focus was always on pluri-disciplinarity and inter-disciplinarity
Information about dissemination activity	
Presentation title	Reducing the dependence from non-fossil carbon materials and the related impacts: effect of the use of alternative C-bearing materials on material and energy flows of electric steelworks
Presenter	Antonella Zaccara (SSSA)
Other partners involved	Sidenor
Hashtag(s) for Social Media	#GreenHeatEAF #steel #circulareconomy #sustainability #EAF #biomass #biochar #EU #research #project #HorizonEurope
Attachments (e.g. agenda, invitation)	Detailed program of the event

18th Society and Materials (SAM) International Conference

Jönköping University, Sweden
May 14 - 15, 2024

Venue

School of Education and Communication (Google maps), Jonkoping University

Access

- **Jönköping Airport** is located 9 km from the city center. To get to and from the airport there is a regular bus service (route 27) to Jönköping city centre.
- From **Copenhagen (Kastrup Airport)**, Denmark you can easily travel to Jönköping by train. The train station in Copenhagen airport is inside the airport and no transfer is required.

Hotel Recommendation

- Quality Hotel Match
- ProfilHotels | Savoy
- Clarion Collection Hotel Victoria

Please note that we don't have any partnership with the hotels, and we recommend the nearest hotels to the university.

SAM Organizing Committee

Jönköping University
Anders Jarfors

KTH
Rutger Gyllenram

ArcelorMittal
Anne-Laure Hettinger, Ayoung Jo, Julio L. Rivera

IF Steelman
Jean-Pierre Birat

IRT-M2P
Gaël Fick, Angela Sanchez

ITAS – KIT
Marcel Weil

Knowledge & Innovation
Andrea Declich

NTNU
Leiv Kolbeinsen

Contact

SAM Organizing Committee
Email: sam.conference@arcelormittal.com

Ayoung Jo
Email: ayoung.jo@arcelormittal.com

GreenHeatEAF

Day 1	
08:40	Registrations & Coffee
09:00	**Opening**
09:05	**Welcoming by host – Jönköping University**
09:10	**Keynote - The value of information - What LCA, MFA and direct measurements do for decarbonisation of the steel industry** *Rutger Gyllenram, KTH, Sweden*

Session 1 Case studies in Sustainability	
09:55	**AI-based modelling techniques for input materials optimization in the EAF route** *Laura Laid, Antonella Zaccara, S. Dettori, Scuola Superiore Sant'Anna, TeCIP, ICT-COISP, Pisa, Italy*
10:20	**Reducing the dependence from non-fossil carbon materials and the related impacts: effect of the use of alternative C-bearing materials on material and energy flows of electric steelworks** *Antonella Zaccara, Valentina Colla, Scuola Superiore Sant'Anna, TeCIP, Pisa, Italy*
10:45	**Efficient Scrap management to improve efficiency and circularity in steel industry** *Alice Petrucciani, Jonas Peterson, Scuola Superiore Sant'Anna, TeCIP, Pisa, Italy*
11:10	**Development of Decision Support System for slag management and valorization in the steel industry** *A. Petrucciani, Scuola Superiore Sant'Anna, TeCIP, Pisa, Italy*
11:35	**Functionally integrated castings for Body in White applications; Consequences for materials use and mix in automotive manufacturing** *Anders E. W. Jarfors, Jönköping University, Sweden*
12:00	**The LISA project: low impact of sustainable aluminum** *Lucia Lattanzi, Jönköping University, Sweden*
12:25	**GROUP PHOTO & LUNCH (1h)**

13:30	**Keynote - Metals demand 2050 – steel, copper, nickel** *Magnus Ericsson, Anton Löf, Olof Löf, RMG Consulting, Stockholm, Sweden*
Session 2 New developments in Foresight (based in particular on LCA and MFA)	
14:15(v)	**Carbon capture, bioenergy and electrification as options to decarbonize the global cement sector (Video)** *Kimon Keramidas, Université de Grenoble-Alpes, Grenoble, France*
14:40(v)	**Sustainable management of metals: the journey from resource-depletion methods to the contribution-to-resource-inaccessibility method (Video)** *Jo Dewulf, BRGM, Orléans, France, & Ghent University, Ghent, Belgium*
15:05	**Feedback loops in the Material-Energy-Transport nexus and the case for low-demand transition scenarios** *Romain Guillaume Billy, Norwegian University of Science and Technology, Norway*
15:30	**Prioritization of strategies by integrating SWOT method with Hesitant fuzzy linguistic MCDM method for developing a sustainable energy storage system: a case study of India** *Sayan Das, Marcel Weil, ITAS, Karlsruhe, Germany*
15:55	**COFFEE BREAK (40m)**

Session 3 LCA to optimize Sustainable Technologies	
16:40	**Quantifying the Environmental Impacts of Foam Injection Molding for Lightweight Components - A Life Cycle Assessment Study** *Lars Bippus, University of Stuttgart, Stuttgart, Germany*
17:05	**Evaluating the Global Warming Potential and Cumulative Energy Demand of Graphene as an Electrode Material for Supercapacitors** *Fatemeh Bahmei, KIT, Karlsruhe, Germany*
17:30	**Environmental sustainability of ceramic matrix composites (CMC) production technologies** *Nicoletta Narres, Acoustics and Building Physics, University of Stuttgart, Life Cycle Engineering GaBi, Stuttgart, Germany*
	Closing
18:00	**END OF DAY 1**

Networking Dinner (barbecue) at 19h

Day 2	
08:40	Registrations & Coffee

09:00	**Keynote - Energy** *Leiv Kolbeinsen, NTNU, Trondheim, Norway*
Session 4 Sustainability and SSH	
09:45	**Keynote - Inviting ANT to help redefining LCA, as a way to prepare it for a Net-Zero world** *Jean-Pierre Birat, IF Steelman, France*
10:30	**Material Sorting. New methodology to improve the interdisciplinary experience of material libraries** *Chiara Del Gesso, Carmen Rotondi, Sapienza University of Rome, Rome, Italy*
10:55	**Renewable Energy Acceptance and responsible agents: Unravelling the Influence of Government and Corporate Trust** *Patrick Stuhm, KIT, Karlsruhe, Germany*
11:20	**Science and art materials to improve knowledge of climate change impacts** *Arnaud Delebarre, Mines Paris, PSL University, Paris, France*
11:45(v)	**Kinetic materials experience in morphing artifacts for environmental sustainability (Video)** *Yi Sui, Politecnico di Milano, Milan, Italy*
12:10(v)	**Industry 5.0 as a Multidimensional Innovation Ecosystem (Video)** *Ralf Kopp, Technical University Dortmund, Dortmund, Germany*
12:35	**Lunch (1h)**
13:40	**Competence supply for the future sustainable metallic components: CIRCUMET, a case study** *Ehsan Ghassemali, Madelene Zetterlind, Jönköping University, Jönköping, Sweden*
14:05	**LCA, Distributive Justice and SDGs – an exploration** *Korbinian Czirwitzky, University of Stuttgart, Stuttgart, Germany*
14:30	**Prospective environmental systems analysis tools for decision support in emergent socio-technical solutions for circularity – A review** *Danna Persson, Linköping University, Linköping, Sweden*
14:55	**Social Life Cycle Assessment of Sodium Ion Battery Raw Materials** *Bismark Razak Haruna, KIT, Karlsruhe, Germany*
15:20	**(Steel and Aluminum)** *(ArcelorMittal)*
15:45	**Break (15m)**

Closing	
16:00	**Jean-Sebastien Thomas (JST) Award Ceremony**
16:10	**Conclusion**
	END OF DAY 2

I.2 13th European Electric Steelmaking Conference EEC 2024

Event information	
Event name (and acronym)	13th European Electric Steelmaking Conference EEC 2024
Type of event	Conference
Date	June 3-7, 2024
Location	Essen (Germany)
Geographic coverage	European
Type of audience	RTOs, Academia, Steel Companies, OEMs, Associations
Approximate size of audience	350
Short description	The conference provided an extensive program with over 90 presentations on topics such as electric arc furnace technologies, DRI/HBI melting, energy efficiency and strategies for environmentally friendly steelmaking. In addition to the technical dialogue, the evening event and the plant visits offered many opportunities to network. The accompanying trade exhibition also presented the latest products and services relating to electric steelmaking and provided plenty of opportunities for discussions and networking.
Information about dissemination activity	
Presentation title	Use of alternative non-fossil carbon sources in electric steelworks: Results of flowsheet model-based simulations
Presenter	Valentina Colla (SSSA)
Other partners involved	Sidenor
Hashtag(s) for Social Media	#GreenHeatEAF #steel #circulareconomy #sustainability #EAF #biomass #biochar #EU #research #project #HorizonEurope
Attachments (e.g. agenda, invitation)	Detailed program of the event

Program 2024

Overview

June 3
5:00 PM Early congress registration
6:00 PM Get together

June 4
10:00 AM Opening
11:00 AM Technical sessions

June 5
9:00 AM Technical sessions
6:00 PM Evening event

June 6
9:00 AM Technical sessions
2:15 PM Farewell

June 7
7:00 AM Plant visits

04.06.2024 | 05.06.2024 | 06.06.2024

Room 1

Opening sessions:

10:00

Prof. Dr.-Ing. Klaus Krüger, Conference Chair

Silke Krebs, State Secretary for Economic Affairs, Industry, Climate Action and Energy in the state government of North Rhine-Westphalia

Dr. Henrik Adam, Chairman of Steel Institute VDEh, Vice President European Corporate Affairs, Tata Steel Ltd, The Netherlands

Keynote sessions:

10:30 SALCOS® EAF - Centerpiece of a hydrogen-based transformation for a CO2-neutral steel industry
Johannes Markus Höffgen, Salzgitter Flachstahl GmbH

11:00 The first step in thyssenkrupp's transformation - technology and boundary conditions
Dr. Matthias Weinberg, Competence Center Metallurgy, thyssenkrupp Steel Europe

11:30 Green steel strategy and circular economy activities inside Swiss Steel Group
Bernhard A. Rischka, Senior Manager Corporate Technology, Swiss Steel Holding AG

12:00 Lunch Break

Auxiliary systems:

- **13:00** Robots for the hot gunning repair of EAF, LF and RH
  Christian Wolf - Velco GmbH
- **13:25** Safe Electric Melting: How robotics is transforming the EAF steel production
  Dr. Ion Rusu - POLYTEC spa
- **13:50** Application of technology to improve safety at the EAF, by eliminating human operation – Zero man around
  Giovanni Londero - MORE
- **14:15** Improvement of refractory maintenance and safety at the EAF with the help of 3D laser scanning and fully automated gunning robot system
  Rolf Lamm - Minteq International GmbH-Ferrotron Division
- **14:40 Coffee Break**
- **15:10** SwingDoor, hybrid burner and real time off gas analysis – a full technological package to immediate reduce CO2 emissions in EAF operation
  Patrick Marterer - INTECO PTI
- **15:35** Hydrogen-ready energy-efficient technologies for EAF steelmaking
  Hamzah Alshawarghi - Linde GmbH
- **16:00** Development on advanced oxygen-fuel burner in Electric Arc Furnace
  Kyuntae Kim - HYUNDAI STEEL
- **16:25** Decarbonization at nucor using Tallman supersonic carbon injection system
  Aaron Strelbisky - Tallman Technologies Inc.
- **16:50** Developing new type of side-wall burner box of Electric Arc Furnace from waste cobalt based metal parts of reheating furnace
  Koray Gencoglan - Tosyali Holding
- **17:15** Elevating EAF sustainability: Pneumatic injection drives efficiency and reduced CO2 emissions
  Leomar Marcon - Lhoist Germany

Room 2

EAF/LF metallurgy:

- **13:00** Modeling the kinetic behavior of Nitrogen Pickup in an Electric Arc Furnace
  Siddharth Nachankar - IOB RWTH Aachen
- **13:25** Controlling nitrogen in steel during CONARC steelmaking process
  Prakash Gupta - Tata Steel Limited
- **13:50** Removal of tramp elements from molten steel by evaporation: role of temperature, pressure, C, and S
  Youn-Bae Kang - Pohang University of Science and Technology
- **14:15** Development of high efficiency smelting of high quality steel in Ladle Furnace process
  Dr. Rensheng Chu - Shougang Group Co., LTD. Research Institute of Technology
- **14:40 Coffee Break**
- **15:10** Tramp and residual element distribution in EAF – Trials in a 6 tonnes pilot furnace
  Dimitra Papamantellou - Tata Steel Netherlands
- **15:35** ***CANCELLED*** - Analysis of saturated MgO foam slag and energy consumption of Electric Arc Furnace
  Bo Cui - University of Science and Technology Beijing, State Key Laboratory of Advanced Metallurgy
- **16:00** Value in use of lime in EAF steelmaking process
  Jelena Brankov - Carmeuse Europe

Process modelling:

- **16:25** Research on Hybrid Modeling of LF Refining Process
  Zicheng Xin - University of Science & Technology Beijing
- **16:50** CFD modelling and validation of industry-scale Electric Arc Furnaces
  Chenn Zhou - Purdue University Northwest

Room 3

Process modelling:

- **13:00** Complementary modelling approaches to assess and optimise the EAF process behaviour for C-lean operation
  Bernd Kleimt - VDEh-Betriebsforschungsinstitut GmbH
- **13:25** Keeping an EAF in top-shape: Prevent standstills, extend operational life and one day … even process optimization?
  Yves Van Ingelgem - Zensor
- **13:50** Digital modeling at the forefront: A case study of ArcelorMittal Belval's production enhancement
  Alexander König - FESIOS GmbH
- **14:15** Numerical modeling of energy efficient solutions for "flat bath" process in the EAF
  Dr. Sergii Timoshenko - Donetsk National Technical University
- **14:40 Coffee Break**
- **15:10** Establishment and evaluation of dynamic model for Electric Arc Furnace steelmaking
  Dr. Zhaoping Chen - Baoshan Iron & Steel Co., Ltd.
- **15:35** Online temperature estimation in the electric arc furnace (EAF) on the industrial edge
  Goran Andonovski - University of Ljubljana, Faculty of electrical engineering
- **16:00** Investigation of electromagnetic and gas stirring in EAF by numerical flow simulations
  Monika Zielinska - ABB Sp. z o. o./AGH University of Krakow
- **16:25** Tornado flow inside Electric Arc Furnace driven by external magnetic field
  Mohamad Al Nasser - Montanuniversität Leoben
- **16:50** Continuous development of prediction models for EAF and steelmaking for improved process control
  Dr. Piero Frittella - Feralpi Group

04.06.2024 | 05.06.2024 | 06.06.2024

Room 1

Furnace technology:

- **09:00** Allcharge: The SMS solution for the green steel of today
  Massimiliano Daita - SMS group SpA
- **09:25** EAF quantum – Performance and next generation outlook
  Dr. Hans-Jörg Krassnig - Primetals Technologies Germany
- **09:50** High quality low carbon flat grades based on EAF-LF-VD process route
  Bojan Vucinic - Danieli & C. Officine Meccaniche S.p.A
- **10:15** Efficiency, flexibility and safety - The future of electric steelmaking needs to achieve all three key targets
  Hannes Beile - tripleS GmbH & CoKG
- **10:40** **Coffee Break**
- **11:10** Innovations in small Electric Arc Furnaces: Projects, designs, challenges, and performance insights
  Christian Redl - INTECO melting and casting technologies GmbH
- **11:35** SAVEDRY® water leakage monitoring on electric arc furnaces in real-time
  Steven Reumschüssel - Saveway GmbH & Co. KG

DRI melting furnace:

- **12:00** SAF and OSBF modelling - State of the art and open research questions
  Moritz Eickhoff - Department for Industrial Furnaces and Heat Engineering of the RWTH Aachen University
- **12:25** **Lunch Break**
- **13:25** Melting and processing of DRI – EAF or smelter?
  Gerald Wimmer - Primetals Technologies Austria GmbH
- **13:50** Tenova's iBlue open slag bath furnace design – fundamental design decisions for a DRI melter
  Dr. Markus Dorndorf - LOI Thermprocess GmbH
- **14:15** Post-Taphole Ladle Refining of CRISP+ Electric Smelting Furnace Hot Metal to Produce High Quality Green Metallics
  Rainer Hüsken - Hatch
- **14:40** **Coffee Break**
- **15:10** On the way to a sustainable DRI-Smelter – Lessons learned from ferroalloy production
  Marcus Sommerfeld - thyssenkrupp Steel Europe AG
- **15:35** Green transition of the direct reduction route
  Gerald Wimmer - Primetals Technologies Austria GmbH
- **16:00** Electric smelting furnace technology benefits & readiness
  Kyle Chomyn - Hatch Ltd
- **16:25** Refractory challenges and solutions for DRI-based EAF steelmaking
  Uxia Dieguez Salgado - RHI Magnesita GmbH

Room 2

Slag characteristics and treatment:

- **09:00** Digital solutions for enhancing the decision-making for electric steelworks slag valorization
  Dr. Ismael Matino - Scuola Superiore Sant'Anna
- **09:25** The physical parameters of slags, their evaluation and their significance for the design and process of electric furnaces
  Dr. Roland König - Bluemetals GmbH
- **09:50** Metallurgical treatment of EAF slag to improve the environmental properties
  Marek Kassenbrock - Georgsmarienhütte GmbH
- **10:15** Development of high-efficiency smelting technology for slag recycling in Electric Arc Furnace with hot metal charging
  Yu-Lun Huang - China Steel Corporation
- **10:40** **Coffee Break**

Avoiding fossil energy/ carbon:

- **11:10** Effects of replacing fossil charge coal with bio-coal briquettes in electric arc furnace
  Joel Orre - Swerim AB
- **11:35** From screening trail to use - Foaming coal replacement in the EAF process
  Michel Wurlitzer - ArcelorMittal Hamburg GmbH
- **12:00** Use of alternative non-fossil carbon sources in electric steelworks: Results of flowsheet model-based simulations
  Dr. Valentina Colla - Scuola Superiore Sant'Anna
- **12:25** **Lunch Break**
- **13:25** Chemical package solutions for carbon footprint reduction in EAF steelmaking
  Stefano Morsut - MORE
- **13:50** An Experimental Setup and Investigation on Biochar Blends for Slag Foaming Applications
  Christopher DiGiovanni - CanmetMATERIALS, Natural Resources Canada
- **14:15** Technical and material-based solutions for the reduction of CO^2-eq. emissions in EAF steelmaking
  Dr. Dennis Fischer - D.A.R. Metall AG
- **14:40** **Coffee Break**
- **15:10** Transformation pathway to a green lime offer
  Tobias Dickmann - Lhoist Europe
- **15:35** Biocarbon use in Electric Arc Furnace (EAF) steelmaking is now realistic – some techno-economic considerations are now considered to be solved
  Dr. Pasi Rönkkö - Carbon Balance Finland Oy

Room 3

Process control:

- **09:00** Optimizing scrap mix and melt-down operation in the EAF – the MultiSensEAF project
  Dr. Thomas Echterhof - RWTH Aachen University, Department for Industrial Furnaces and Heat Engineering
- **09:25** Tenova's iEAF® solution, a key component in the EAF technological roadmap transformation towards the goal of green steel
  Armando Vazquez Arredondo - Tenova Goodfellow Inc.
- **09:50** SmartFurnace Advanced EAF optimization control and tools by AMI
  Mariana Viale - AMI Automation
- **10:15** Leveraging Optical Emission Spectroscopy (OES) for enhanced process control in Electric Arc Furnace (EAF) steelmaking
  Mehrdad Mirzaei - Luxmet Oy
- **10:40** **Coffee Break**
- **11:10** The effect of arc stability on EAF performance
  Paul Stafford - GrafTech International Inc.
- **11:35** Temperature control in steelmaking reduces energy consumption and stabilizes the process
  Dr. Otmar Jannasch - Smart Steel Technologies
- **12:00** **Lunch Break**

Merging technologies:

- **13:25** How the sample preparation free LIBS-technology opens new possibilities for increasing efficiency in steel making and steel refining
  Martin Sprunk - Secopta Analytics GmbH
- **13:50** Transformative insights: The impact of rapid slag analysis on carbon-neutral steel production
  Andreas Kunz - QuantoLux Innovation GmbH
- **14:15** Towards sustainability: Exploring hydrogen arc utilization in Electric Arc Furnaces
  Prof. Abdellah Kharicha - Montanuniversität Leoben
- **14:40** **Coffee Break**
- **15:10** H_2 plasma smelting of iron ore or DRI - an industrial perspective
  Harmen Oterdoom - Butter Bridge
- **15:35** Fossil fuel substitution by Coolbrook's RotoDynamic Heater technology
  Timo Paananen - Coolbrook
- **16:00** Secondary electrothermal alloying and refining (SETAR) as a new method of out-of-furnace steel processing
  Dr. Oleksandr Kharchenko - Zaporizhzhia National University, Engineering Institute
- **16:25** Reduction behavior of molten iron oxide using mill-scale and solid carbonaceous residues after pyrosis of waste polymer
  Sun-joong Kim - Chosun university

04.06.2024 | 05.06.2024 | 06.06.2024

Room 1

Power supply solutions:

- **09:00** Danieli Q-One technology for innovative power transfer to the arc furnace
  Antonello Mordeglia - Danieli Automation S.p.A.
- **09:25** New multilevel converter system solutions for EAF power supplies
  Dr. Christof Sihler – GE Vernova Power Conversion
- **09:50** Medium voltage power supply for Electric Arc Furnaces
  Daniel Dinkel - Primetals Germany
- **10:15** Next generation power supply options for Electric Arc Furnaces and Electric Smelting Furnaces
  Yan Elksnis - Hatch Ltd.
- **10:40 Coffee Break**

Auxiliary systems:

- **11:10** Slag Transport Systems (STS): A new solution to a Century old problem
  Riccardo Bianchi - Paling Transporter Ltd.
- **11:35** Mobile fluxes injection system: Optimizing EAF processes for sustainable steel production trials
  Camille Douce - Lhoist
- **12:00** High performance EAF off-gas treatment solutions for hybrid steel plants
  Thomas Steinparzer - Primetals Technologies Austria GmbH
- **12:25 Lunch Break**
- **13:25** Fume treatment plant for a steelmaking facility overview
  Matteo Tomba - PERT SRL
- **13:50** Zero impact for water resources for a steel industry complex
  Matteo Tomba - PERT SRL

Room 2

Process optimisation:

- **09:00** Reduction of electrode unit consumption in ladle-refining furnace
  Yoshiyuki Mizutani - Godo Steel, Ltd.
- **09:25** Case of energy-saving activities for ancillary equipment (at Godo-steel, Ltd.)
  Tetsuya Onodera - Godo Steel, Ltd.
- **09:50**

Overall process management:

- **10:15** Energy management and scheduling of melt shops with multiple dynamic operation modes
  Marco Lauricella - ABB Corporate Research Center German
- **10:40 Coffee Break**
- **11:10** Efficient heat scheduling combined with energy management in a hybrid steel plant
  Dr. Martin Schlautmann - PSI Metals GmbH
- **11:35** Optimized EAF operation by Primetals' heat cloning
  Manuel Sattler - Primetals Technologies Austria GmbH
- **12:00** AI in electric steelmaking: Next generation raw material optimisation
  Ansgar Jüchter - ArcelorMittal Hamburg
- **12:25 Lunch Break**
- **13:25** AI-Driven decision support system for scrap-based steelmaking in the Electric Arc Furnace
  Bernd Kleimt - VDEh-Betriebsforschungsinstitut GmbH
- **13:50** Impact of furnace retrofitting solutions in electric steelmaking on environmental evaluation
  Felix Kaiser - RWTH Aachen University - IOB

Room 3

Melting of DRI:

- **09:00** Iron ore quality and its impact on Electric Smelting Furnace (ESF)-based steelmaking
  Dr. Ge Sa - Hatch Ltd.
- **09:25** Revolutionizing steel production: Utilizing H_2-reduced iron oxide pellets for sustainable, Low-CO^2 emission steelmaking
  Dario Pauluzzi - Danieli & C Officine Meccaniche S.p.A
- **09:50** H_2-reduced DRI melting in a lab-scale EAF – Preliminary assessment of melting behaviour with optical emission spectroscopy and video recording
  Dr. Henri Pauna - University of Oulu, Finland
- **10:15** Thermochemical understanding the melting behavior of HBI and phosphorus transfer in EAF conditions: In-situ observation and computational simulations
  Prof. Joohyun Park - Hanyang University
- **10:40 Coffee Break**

Process optimisation:

- **11:10** Result for EAF operation when HBI up to 60% in bucket
  Jaemin Lee - HSC
- **11:35** Optimization of the melting process of an electric arc furnace (EAF) by digital off gas measurement
  Hannes Beile - tripleS GmbH & CoKG
- **12:00** Metallurgical benefits of inert gas stirring in Electric Arc Furnaces for several raw materials strategies on the way to green steelmaking
  Marcus Kirschen - RHI Magnesita
- **12:25 Lunch Break**

I.3 9th European Coke and Ironmaking Congress ECIC 2024

Event information	
Event name (and acronym)	9th European Coke and Ironmaking Congress ECIC 2024
Type of event	Conference
Date	October 16-18, 2024
Location	Bardolino (Italy)
Geographic coverage	European
Type of audience	RTOs, Academia, Steel Companies, Associations, researchers on ironmaking and steelmaking
Approximate size of audience	240
Short description	ECIC 2024 focused on the newest technologies in coke making, sintering, pelletizing, pyrolyzing the biomasses and ironmaking (blast furnaces, direct reduction and carbon–based smelting processes). The 2050 goal of carbon neutrality and the related intensive efforts of the steel industry will significantly affect the technologies for iron ore reduction. In this perspective, the shortage of iron ores matching the requirement for direct reduction by gas and for melting in electric arc furnace makes important proposal of new technologies and devices that can ensure the carbon neutrality even for the coal-based routes. ECIC focused on technologies that can achieve such a goal improving the efficiency of the existing process, applying the devices that avoid a net emission of greenhouse gases and to point out new routes based on exploitation of biomasses whose net emission is intrinsically neutral.
Information about dissemination activity	
Presentation title	Modelling of processes for upgrading biomass before its use in the steel industry
Presenter	Valentina Colla (SSSA)
Other partners involved	NONE
Hashtag(s) for Social Media	#research #modelling #simulation #GreenHeatEAF #Cokemaking #Steelmaking #Congress #ECIC2024 #steel #metallurgy #biomass #HorizonEurope #CleanSteelPartnership #sustainability
Attachments (e.g. agenda, invitation)	Detailed program of the event

TIMETABLE

	Wednesday 16 October 2024	
08:00	Registration	
	GARDENIA ROOM	IRIS+LILIUM ROOM
09:00	OPENING SESSION	
10:50	Coffee break	
11:15	**H2 and Syngas exploitation I**	**Sintering and Pelletizing I**
13:00	Lunch	
14:00	**H2 and Syngas exploitation II**	**Sintering and Pelletizing II**
15:20	Coffee break	
15:45	**CO2 mitigation including CCUS**	**Cokemaking I**
19:00	Welcome reception	
	Thursday 17 October 2024	
08:30	**Direct reduction and smelting reduction I**	**Sintering and Pelletizing III**
10:30	Coffee break	
10:55	**Direct reduction and smelting reduction II**	**Blast furnace ironmaking - equipment I**
13:00	Lunch	
14:00	**Direct reduction and smelting reduction III**	**Cokemaking II**
14:40		**Blast furnace ironmaking - operations I**
15:40	Coffee break	
16:00	**Direct reduction and smelting reduction IV**	**Blast furnace ironmaking - operations II**
19:30	Conference dinner	
	Friday 18 October 2024	
08:30	**Blast furnace ironmaking - operations III**	**Measuring Technologies and Industry 4.0 I**
10:10	Coffee break	
10:35	**Biocoal | biochar**	**Measuring Technologies and Industry 4.0 II**
11:20		**Blast furnace ironmaking - equipment II**
13:20	**Closing remarks**	

SCOPE and BACKGROUND

AIM is glad to announce the 9th European Coke and Ironmaking Congress (ECIC) to be held in Bardolino, Italy, on 16–18 October 2024.

ECIC 2024 will focus on the newest technologies in coke making, sintering, pelletizing, pyrolyzing the biomasses and ironmaking (blast furnaces, direct reduction and carbon–based smelting processes).

The 2050 goal of carbon neutrality and the related intensive efforts of the steel industry will significantly affect the technologies for iron ore reduction. In this perspective, the shortage of iron ores matching the requirement for direct reduction by gas and for melting in electric arc furnace makes important proposal of new technologies and devices that can ensure the carbon neutrality even for the coal based routes.

This Congress will focus on technologies that can achieve such a goal improving the efficiency of the existing process, applying the devices that avoid a net emission of green house gases and to point out new routes based on exploitation of biomasses whose net emission is intrinsically neutral.

BACKGROUND

The Coke and Ironmaking events started separately as the European Ironmaking Congress (EIC) in 1986 in Aachen, Germany, and in 1991 in Glasgow, Scotland, and as the International Cokemaking Congress (ICMC) in 1987 in Essen, Germany, and in 1992 in London, England.

The merger of these two events took place in 1996 as the European Coke and Ironmaking Congress (ECIC) in Gent, Belgium.

1st EIC – Aachen, 1986
1st ICMC – Essen, 1987
2nd EIC – Glasgow, 1991
2nd ICMC – London, 1992
3rd ECIC – Gent, 1996
4th ECIC – Paris, 2000
5th ECIC – Stockholm, 2005
6th ECIC – Düsseldorf, 2011
7th ECIC – Linz, 2016
8th ECIC – Bremen, 2022

COMMITTEES

CONGRESS CHAIRPERSONS

Prof. Carlo Mapelli – Politecnico di Milano, Italy
Prof. Johannes Schenk – Montanuniversität Leoben, Austria

SCIENTIFIC AND STEERING COMMITTEE

Christian Boehm – Primetals Technologies Austria, Austria
Martin Gantenberg – Paul Wurth, Luxembourg
Peter Liszio – thyssenkrupp Steel, Germany
Hans Bodo Lüngen – Lüngen Consulting, Germany
Luca Orefici – Pipex Energy, Italy
Franz Reufer – Paul Wurth Deutschland, Germany
Lena Sundqvist – Luleå University of Technology , Sweden
Jan van der Stel – Tata Steel Nederland Research & Development, Netherlands
Reinoud van Laar – Danieli Corus, Netherlands
Olena Volkova – Institute for Iron and Steel Technology, TU Bergakademie Freiberg, Germany

ORGANISING COMMITTEE

Federica Bassani – Associazione Italiana di Metallurgia, Italy
Sabrina De Donato – Associazione Italiana di Metallurgia, Italy
Carlo Mapelli – Politecnico di Milano, Italy
Silvano Panza – Associazione Italiana di Metallurgia, Italy

ORGANISING SECRETARIAT

AIM – Associazione Italiana di Metallurgia
Via Filippo Turati 8 – 20121 Milano
Italy
Tel. +39 0276021132 or 0276397770
E-mail: aim@aimnet.it

Wednesday 16 October 2024
Gardenia room

8:00 Registration of attendees

9:00 **OPENING SESSION**
Welcome addresses by
Silvano Panza – AIM President
Johannes Schenk, Carlo Mapelli – Conference Chairpersons

9:20 [ecic_097] **The way the European steel industry wants to become carbon neutral**
H. B. Lüngen – Germany
P. Schmöle – Germany

9:50 [ecic_114] **Iron ore for direct reduction: future challenges and solutions**
C. Barrington – International Iron Metallics Association, United Kingdom

10:20 [ecic_115] **Hydrogen perspectives in iron and steelmaking**
C. Mapelli – Politecnico di Milano, Italy

10:50 **Coffee break**

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Wednesday 16 October 2024
Gardenia room

Session H2 AND SYNGAS EXPLOITATION I
CHAIRPERSONS: ANDRÉ OUDHUIS – MICHAEL ZARL

11:15 Keynote [ecic_094] **Hydrogen ironmaking to decarbonise the steel industry. Fundamentals and current progress**
F. Patisson, O. Mirgaux – University of Lorraine, France

11:40 [ecic_081] **Influence of hydrogen injection on basic iron ore sinter reduction at blast furnace center conditions**
A. Abdelrahim, A. Koskela, M. Iljana, T. Fabritius – University of Oulu, Finland
C. van der Kroon, V. Pridhivi – Tata Steel Europe, Netherlands

12:00 [ecic_090] **Circular ironmaking: transforming byproducts into DRI with hydrogen reduction**
M. Leuchtenmüller – Montanuniversität Leoben, Austria

12:20 [ecic_104] **On the influence hydrogen-bearing injected fuels in the ironmaking blast furnace**
S. Nielson, T. Okosun, O. Ugarte, C. Q. Zhou – Purdue University Northwest, USA
K. Leontaras, J. Entwistle – US Steel, USA

12:40 [ecic_116] **Hydrogen production technology from solid-oxide electrolysis using waste heat from the ironmaking process**
Y. Yang, H. Kim, J. S. Ahn – POSCO N.EX.T Hub, Korea

13:00 **Lunch**

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Wednesday 16 October 2024
Iris+Lilium room

Session SINTERING AND PELLETIZING I
CHAIRPERSONS: MAGNO RIBEIRO – YAOZU WANG

11:15 Keynote [ecic_058] **Influence of metallic iron structure and molten slag formation on softening behavior of pre-reduced pellets under high temperature loading condition in inert atmosphere**
K-i. Ohno, T. Kon – Kyushu University, Japan
T. Orimoto, N. Yasuda – Nippon Steel Corporation, Japan

11:40 [ecic_016] **T Atomic-scale structural analysis of calcium ferrite in sintered ore by scanning transmission electron microscopy**
K. Takehara, K. Ikeda, T. Kawano, T. Higuchi – JFE Steel, Japan

12:00 [ecic_002] **Effects of gradual substitution of coke breeze with charcoal on the sinter process**
J. Eisbacher-Lubensky, F. Kittinger, S. Pichler, C. Weiß – Montanuniversität Leoben, Austria
H. Stocker, S. Wegschelder – voestalpine Stahl Donawitz, Austria

12:20 [ecic_079] **Revealing the softening and melting behavior of sinters and lump ores under a real blast furnace working line by analyzing the quenched burdens**
W-c. Tsai, Y-n. Chiu, K-c. Chang, K-c. Hsieh, S-k. Lin – National Cheng Kung University, Taiwan
P-c. Cheng – National Cheng Kung University, Taiwan and China Steel Corporation, Taiwan
J-S. Shiau – China Steel Corporation, Taiwan
H-l. Chen – National Pingtung University of Science and Technology, Taiwan

12:40 [ecic_069] **Investigate effects of sintering condition on the agglomeration behavior of iron ore sinter with high SiO_2 content**
P-c. Cheng – National Cheng Kung University, Taiwan and China Steel Corporation, Taiwan
K-c. Chang, S-x. Liu, K-c. Hsieh, S-k. Lin – National Cheng Kung University, Taiwan
J-s. Shiau – China Steel Corporation, Taiwan

13:00 **Lunch**

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Wednesday 16 October 2024
Gardenia room

Session H2 AND SYNGAS EXPLOITATION II
CHAIRPERSONS: HAMZAH ALSHAWARGHI – REINOUD VAN LAAR

14:00 [ecic_026] **Production of hot hydrogen-rich syngas in integrated plants for efficient injection in the blast furnace and CO2 mitigation (ProSynteg)**
E. L. Faraci, M. Gili, D. Ressegotti – Rina-Centro Sviluppo Materiali, Italy
D. Garot – CRM asbl, Belgium
A. Oblanca Gutiérrez – ArcelorMittal, Spain
C. Morelli, L. Micheletti – Paul Wurth Italia, Italy

14:20 [ecic_110] **CO_2-free hydrogen production technology from ammonia/methane using direct reduced iron**
S. Joo, G. Kwon, C. H. Rhee, B-S. Kim, Y. Yang, H. W. Park – POSCO N.EX.T Hub, Korea

14:40 [ecic_077] **Influence of a higher hydrogen based reduction share from coke oven gas injection on the blast furnace process**
H. Bartusch, T. Hauck – VDEh-Betriebsforschungsinstitut, Germany
F. Demirci, A. Janz – Hüttenwerke Krupp Mannesmann, Germany

15:00 [ecic_100] **The pyrolysis of natural gas as a source of hydrogen and carbon**
G. Dall'Osto, C. Mapelli, D. Mombelli, S. Bazri – Politecnico di Milano, Italy
M.M.S. Tommasini, A. Lucotti – Università di Perugia, Italy

15:20 **Coffee break**

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Wednesday 16 October 2024
Iris+Lilium room

Session SINTERING AND PELLETIZING II
CHAIRPERSONS: KO-ICHIRO OHNO - JAN EISBACHER-LUBENSKY

14:00 [ecic_083] **Comparative analysis of different sinter strand modeling techniques in flowsheeting: insights for steelmaking optimization**
A. Walk – Technische Universität Wien, Austria and K1-MET, Austria
B. Weiss – Primetals Technologies Austria, Austria
W. Wukovits – Technische Universität Wien, Austria

14:20 [ecic_084] **Investigating the oxidation behaviour of magnetite ore: impact of particle size fraction and mineralogical composition**
A. Laarich, C. Andersson, H. Ahmed – Luleå University of Technology, Sweden
T.K Sandeep Kumar, D. Marjavaara, K. Wiegel – LKAB, Sweden
S. Richter – Outotec & Co., Germany
J-O. Wikström – Kaunis Iron, Sweden

14:40 [ecic_054] **Development of convergence engineering simulation technique based on the image data obtained by X-ray computed tomography for ironmaking packed bed deformation**
S. Natsui, R. Honda, H. Nogami – Tohoku University, Japan

15:00 [ecic_121] **Reduction of NO and SO2 from the sintering process through the use of new hearth layer materials**
L. Tomas Da Rocha, S. Cho, B-J. Chung, S-M. Jung – POSTECH, Korea

15:20 **Coffee break**

Wednesday 16 October 2024
Gardenia room

Session CO2 MITIGATION INCLUDING CCUS
CHAIRPERSONS: YASUSHI SASAKI – JAN VAN DER STEL

15:45 **Keynote** [ecic_109] **How ironmaking holds the key to the green steel evolution**
T. Hansmann – SMS group, Germany

16:10 [ecic_012] **Options for reducing CO2 emissions for iron and steel plants and energy efficiency considerations**
S. Kumar, Y. Gordon, P. Krawchuk – Hatch, Canada
R. Mala – Hatch, Canada

16:30 [ecic_057] **Integration of carbon capture and utilization process in a steel mill during the transition phase towards net zero emissions**
C. Mühlegger, O. Maier, A. Sasiain Conde – K1-MET, Austria
A. Spanlang, T. Keplinger – voestalpine Stahl, Austria
A. Werner – TU Wien, Austria

16:50 [ecic_067] **Technologies and status of hydrogen, syngas, and carbon capture use in ironmaking**
H. Alshawarghi, J. von Schéele, P. Mathur – Linde, Germany

17:10 [ecic_061] **New ways to harness the CO_2 footprint in sintering**
E. Fehringer, M. Böberl – Primetals Technologies Austria, Austria

17:30 [ecic_085] **Transforming blast furnace into environmentally friendly EASyMelt™ through the utilization of ammonia and carbon capture for achieving net-zero emissions**
F. Mauret, M. Baniasadi, J. Ji, P. Kinzel – Paul Wurth, Luxembourg
H. Saxén – Åbo Akademi University, Finland

17:50 [ecic_127] **Combining processes and technology in an example of a waste processing and steel & cement production facility**
H. Oterdoom – Butterbridge, Netherlands

19:00 **Welcome reception at *La Loggia e la Barchessa Rambaldi***

Wednesday 16 October 2024
Iris+Lilium room

Session COKEMAKING I
CHAIRPERSONS: ANDREA FABBRI – HANNAH LOMAS

15:50 [ecic_060] **Effect of coal blending and pretreatment on coke quality and its reactivity**
W-J. Lee, D-M. Jang, J-O. Park, G-H. La – POSLAB, Korea

16:10 [ecic_063] **Measurement and analysis of semi-coke contraction**
S. Khoshk Rish, D. R. Jenkins, A. Tahmasebi – NIER University of Newcastle, Australia

16:30 [ecic_050] **Development of coke structure under stamp charged coking condition**
S. Khoshk Rish, A. Wang, M. Mahoney, A. Tahmasebi – CIMR/NIER University of Newcastle, Australia

16:50 [ecic_055] **Measurement of coke quality**
B. Pearson, D. E. Pearson – Pearson Coal Petrography, Canada

17:10 [ecic_064] **Biocoke under blast furnace atmosphere with increased amounts of hydrogen**
A. Heikkilä, J. Haapakangas, A. Koskela, T. Fabritius – University of Oulu, Finland

17:30 [ecic_082] **High temperature shrinkage measurement development as a tool to extend lifetime of coke ovens**
A. Oudhuis, B. Gols, J. van der Plas, L.J. Pille, P. Put, B. van Vliet – Tata Steel, Netherlands
A. Tahmasebi, S. Khoshk Rish, D. Jenkins - The University of Newcastle (NIER), Australia

17:50 [ecic_111] **Demonstration of CO_2 utilization in ironmaking industries: CO_2 reaction with unused hot carbon in coking chamber**
H. W. Park, S. Joo, B-S. Kim, G. Kwon, C. H. Rhee – POSCO N.EX.T Hub, Korea

18:10 [ecic_036] **Mineral effects on coke performance at high temperatures: reactivity and dissolution**
R. J. Longbottom, B. J. Monaghan – University of Wollongong, Australia

Thursday 17 October 2024
Gardenia room

Session DIRECT REDUCTION AND SMELTING REDUCTION I
CHAIRPERSONS: CHRISTIAN BOEHM – HANGGOO KIM

8:30 [ecic_045] **The role of Australian iron ores for the green transition**
G. Wimmer, R. Millner, B. Hiebl, Ch. Boehm – Primetals Technologies Austria, Austria

8:50 [ecic_070] **HIsarna for processing almost all waste materials an option for iron making**
J.L.T. Hage, H.K.A. Meijer, J.E.B. Fradet, C. Zeilstra, J.W.K Van Boggelen, J. Van Der Stel – Tata Steel, Netherlands

9:10 [ecic_011] **Green steel and vanadium production in Uzbekistan**
Z. Adilov, T. Kodirov, D. Atakhanov – Enter Engineering, Uzbekistan
M. Bodley, M. Sidawi, S. Thakurdin, Y. Gordon, G. Dressel, S. Kumar – Hatch, Canada

9:30 [ecic_003] **Hy³ (Hy-CUBE): Hyundai Steel's initiative for carbon avoidance steelmaking**
H. Kim, M. Sun – Hyundai Steel, Korea

9:50 [ecic_024] **Refractory lining challenges in transitioning from established to hydrogen-ready operations in DRI shaft furnace technologies**
D. Gavagnin, E. Kyrilis – RHI Magnesita, Austria
E. J. Estrada Ospino – RHI Canada, Canada
M. Spreij – RHI Magnesita Trading, Netherlands
S. Postrach – RHI Magnesita Sales Germany, Germany

10:10 [ecic_117] **Fe_3C as an alternative iron source to DRI**
Y. Sasaki – Tohoku University, Japan
K. Ikeda, H. Kubo – Fukuoka Institute of Technology, Japan

10:30 **Coffee break**

Thursday 17 October 2024
Iris+Lilium room

Session SINTERING AND PELLETIZING III
CHAIRPERSONS: SUNG-MO JUNG – ISMAEL MATINO

8:30 **[ecic_098] Mechanism for iron burden reduction of blast furnace process-a laboratory scale simulation**
Y-j. Kuo, Y-n. Chiu, K-c. Chang, Y-j. Hu, W-c. Tsai, P-c. Cheng, K-c. Hsieh – National Cheng Kung University, Taiwan
J-S. Shiau – China Steel Corporation (CSC), Taiwan
H-L. Chen – National Pingtung University of Science and Technology, Taiwan
S-k. Lin – National Cheng Kung University, Taiwan and China Steel Corporation (CSC), Taiwan

8:50 **[ecic_096] Minimizing environmental impact of pelletizing and direct reduction plants**
T. Steinparzer, T. Plattner, P. Trunner – Primetals Technologies Austria, Austria

9:10 **[ecic_033] Reduction disintegration behavior of self-fluxing pellet at 600°C and 700°C under high hydrogen blast furnace condition**
K. Momma, T. Murakami – Tohoku University, Japan

9:30 **[ecic_053] Mineral phase and structural evaluation of the influence of iron ore concentrate on melting and assimilation phenomena in the sintering process**
S. Yamazaki, T. Adachi, H. Taguchi, K. Koga, K. Miyagawa – Kobe Steel, Japan

9:50 **[ecic_052] The effect of gangue phase existing state on gangue removal behavior in the iron ore upgrading process by reduction-crushing-separation**
T. Adachi – Kobe Steel, Japan

10:10 **[ecic_041] Utilization of biocarbon in iron-ore sintering for CO_2 reduction**
J. Song, Y. Lee, J. Lee – Hyundai Steel, Korea
J. Yoo – Korea Institute of Energy Research, Korea
D. Kim – Wonjin Worldwide, Korea

10:30 **Coffee break**

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Thursday 17 October 2024
Gardenia room

Session DIRECT REDUCTION AND SMELTING REDUCTION II
CHAIRPERSONS: CHRIS BARRINGTON – CHRISTIAN BOEHM

11:00 **[ecic_072] High resolution characterization of DC arc parameters in a Hydrogen Plasma Smelting Reduction furnace**
C. R. Quick, E. Reichel – K1-MET, Austria

11:20 **[ecic_013] The behavior of trace elements in the smelter**
A. Pfeiffer, B. Voraberger, G. Wimmer – Primetals Technologies Austria, Austria

11:40 **[ecic_006] Electric smelting furnace technology and implementation readiness**
K. Chomyn, S. Ge, T. Koehler, C. Walker, D. Rudge – Hatch, Canada

12:00 **[ecic_004] Estimating heat and material balances in direct reduction plants under various operating conditions**
M. Sun, H. Kim – Hyundai Steel, Korea

12:20 **[ecic_037] Smelter – A new Pathway for green iron making**
G. Wimmer, A. Pfeiffer, B. Voraberger – Primetals Technologies Austria, Austria

12:40 **[ecic_025] Quantitative study for COG-based production of DRI of a high carbon content in a fluidized-bed reactor**
J. O. Jo, J. R. Lee – Hyundai Steel, Korea
H. Kim – Pukyong National University, Korea
K. Yoo – Korea Maritime & Ocean University, Korea

13:00 **Lunch**

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Thursday 17 October 2024
Iris+Lilium room

Session BLAST FURNACE IRONMAKING – EQUIPMENT I
CHAIRPERSONS: IAKOV GORDON – DAVID ANDREW OSBORNE

10:55 **Keynote [ecic_095] The grand quest for green steel – It's all about survival**
G. Wimmer – Primetals Technologies, Austria

11:20 **[ecic_087] Material tracking**
C. Dengler, X. Rooss – Paul Wurth, Luxembourg
D. I. Durneata, L. Wu – Rogesa, Germany

11:40 **[ecic_074] 37 year campaign of IJmuiden blast furnace 6**
J.R.H. Stuurwold, B. Nugteren, G.J. Tijhuis, F. Kerkhoven – Tata Steel, Netherlands
R. van Laar – Danieli Corus, Netherlands

12:00 **[ecic_015] Method evaluation for understanding the reduction behaviour of cold-agglomerated pellets**
M. Bennett, R. Joyce, P. Warren – Binding Solutions, United Kingdom

12:20 **[ecic_059] Gasification reactivity of coke microtextural constituents to CO_2**
H. Lomas, S. Khoshk Rish, A. Jayasekara, A. Tahmasebi – University of Newcastle, Australia
T. Congo, K. Steel – University of Queensland, Australia

12:40 **[ecic_075] Latest generation dry blast furnace gas cleaning technology: improved energy efficiency and carbon footprint**
P. Klut, J. de Weerdt, G. Bakker – Danieli Corus, Netherlands

13:00 **Lunch**

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Thursday 17 October 2024
Gardenia room

Session DIRECT REDUCTION AND SMELTING REDUCTION III
CHAIRPERSONS: LENA SUNDQVIST-ÖQVIST – JOHANNES SCHENK

14:00 **[ecic_038] Applicability of a laboratory counter-current BORIS reactor to study non-isothermal reduction of iron oxides with hydrogen**
Y. Graz, Y. Maurice, A. Husson, R. Santos Ferreira, O. Nechyporuk, J. Barros Lorenzo – ArcelorMittal Maizieres Research, France

14:20 **[ecic_103] Exploring the effects of lateral hydrogen injection in the hydrogen plasma smelting reduction process**
D. Ernst – Montanuniversitaet Leoben, Austria
M. Farkas, M. Zarl – K1-MET, Austria

14:40 **[ecic_092] Investigation of the behaviour of phosphorus, sulfur and copper during the hydrogen plasma smelting reduction process**
B. Adami – K1-MET, Austria
D. Ernst, J. Schenk – University of Leoben, Austria

15:00 **[ecic_113] Carbon-free electrodes in hydrogen plasma smelting reduction: an innovative approach for low emission steelmaking**
M. Zarl, M. Farkas – K1-MET, Austria
B. Geier • voestalpine Stahl Donawitz, Austria
D. Ernst – Montanuniversitaet Leoben, Austria

15:20 **[ecic_021] Hydrogen based reduction behavior of MgO rich magnetite pellets**
P. Garg, H. Ahmed, C. Andersson – Luleå University of Technology, Sweden
C. Samuelsson – Future Eco North, Sweden
J-O. Wikström – Kaunis Iron, Sweden

15:40 **Coffee break**

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Thursday 17 October 2024
Iris+Lilium room

Session COKEMAKING II
CHAIRPERSONS: THORSTEN HAUCK - FRANZ REUFER

14:00 [ecic_086] **The role of the coke dry quenching technology in the frame of the transition to the green steel**
A. Fabbri, F. Strobino, R. Calcagno, A. Ferraris – Paul Wurth Italia, Italy

14:20 [ecic_028] **Optimizing coal blending in coke production: A logistic approach**
J. Kim – POSCO Holdings N.EX.T Hub, Korea
D. Jang, H. Jeong, S. Lee – POSCO, Korea

Session BLAST FURNACE IRONMAKING – OPERATIONS I
CHAIRPERSONS: THORSTEN HAUCK - FRANZ REUFER

14:40 [ecic_031] **Innovative ultra low carbon ironmaking technology with massive HBI charging in blast furnace**
M. Yakeya, A. Kasai, M. Sakamoto, T. Tagawa, K. Miyata – Kobe Steel, Japan

15:00 [ecic_088] **Techno-economic assessment of ammonia and HBI as flexible green energy carrier for BF-BOF steel making**
J. Ji, E. Taktak, P. Kinzel, M. Baniasadi, F. Mauret – Paul Wurth, Luxembourg

15:20 [ecic_122] **Coke behavior with H_2O in a hydrogen-enriched blast furnace: A review**
K. Li, F. Zhou – University of Science and Technology Beijing, China
J. Zhang – University of Science and Technology Beijing, China and University of Queensland, Australia

15:40 **Coffee break**

Thursday 17 October 2024
Gardenia room

Session DIRECT REDUCTION AND SMELTING REDUCTION IV
CHAIRPERSONS: VALENTINA COLLA – FABRICE PATISSON

16:00 [ecic_009] **The Extended Discrete Element Method (XDEM) as a common simulation framework for traditional and green steelmaking**
B. Peters, X. Besseron – University of Luxembourg, Luxembourg

16:20 [ecic_022] **Blast furnace transition towards DRP, CO2 reduction and hydrogen usage in ENERGIRON® plants**
M. Lapasin, D. Paduzzi, M. Mahmoud – Danieli & C. Officine Meccaniche, Italy

16:40 [ecic_019] **Coolbrook's RotoDynamic Heater™ - electrifying high-temperature process heat and reducing fossil fuel emissions in the steel industry**
T. Paananen – Coolbrook, Finland

17:00 [ecic_044] **Reduction of sinter in hydrogen containing atmosphere**
A. Szemalikowska, M. Niesler, J. Stecko, J. Marcisz, W. Szulc – Łukasiewicz - Górnośląski Instytut Technologiczny, Poland

Thursday 17 October 2024
Iris+Lilium room

Session BLAST FURNACE IRONMAKING – OPERATIONS II
CHAIRPERSONS: RAYMOND JAMES LONGBOTTOM - HANS BODO LÜNGEN

16:00 [ecic_046] **The green transformation in the Chinese ironmaking industry**
J. Zhang – University of Science and Technology Beijing, China and University of Queensland, Australia
K. Li, Z. Liu, T. Yang – University of Science and Technology Beijing, China

16:20 [ecic_051] **Evaluation of the conversion behavior of Alternative Reducing Agents in a test rig under raceway conditions**
T. Nanz, M. Bösenhofer – K1-Met, Austria and TU Wien, Austria
J. Rieger – K1-Met, Austria
H. Stocker – voestalpine Stahl Donawitz, Austria
C. Feilmayr – voestalpine Stahl, Austria
M. Harasek – TU Wien, Austria

16:40 [ecic_005] **Softening and melting behaviour of ferrous burden under simulated blast furnace process conditions**
Y. Xiao, A. Craamer, M. Martinez Pacheco, T. Peters – Tata Steel, Netherlands

17:00 [ecic_023] **CFD investigation of blast furnace raceway: Effect of the co-injection of coke-oven gas (COG) and the injection method in the tuyere level**
A. Islas, M. Baniasadi, P. Goedert, P. Bermes – SMS group (Paul Wurth), Luxembourg
A. Feiterna, D. Durneata – AG der Dillinger Hüttenwerke, Germany
A. Janz, F. Demirci – Hüttenwerke Krupp Mannesmann (HKM), Germany

Thursday 17 October 2024
Gardenia room

Session DIRECT REDUCTION AND SMELTING REDUCTION IV
CHAIRPERSONS: VALENTINA COLLA – FABRICE PATISSON

17:20 [ecic_034] **First steps in the endeavour to determine particle properties in the direct reduction process of iron ore pellets**
S. La Manna, S. Z. Ajabshir, D. Barletta, M. Poletto – Università di Salerno, Italy
K. Qyteti, V. Scherer – Ruhr-University Bochum, Germany

17:40 [ecic_071] **Influence of some operating parameters on the direct reduction of iron ore by hydrogen in a shaft furnace**
A. Marsigny, O. Mirgaux, T. Quatravaux, F. Patisson – Institut Jean Lamour, France

18:00 [ecic_078] **Simulation of Direct Reduction Processes to be included in a process chain multipurpose simulation toolkit**
J. Matino, V. Colla, A. Vignali – Scuola Superiore Sant'Anna, TeCIP, Italy

18:20 [ecic_042] **Iron ore sintering tests for direct reduction in H_2-containing atmosphere**
A. Szemalikowska, M. Niesler, J. Stecko, J. Marcisz, W. Szulc – Łukasiewicz - Górnośląski Instytut Technologiczny, Poland

19:00 Transfer service departure
19:30 **Conference dinner at *Cantina Monteci***

Thursday 17 October 2024
Iris+Lilium room

Session BLAST FURNACE IRONMAKING – OPERATIONS II
CHAIRPERSONS: RAYMOND JAMES LONGBOTTOM – HANS BODO LÜNGEN

17:20 [ecic_039] **Influence of blast furnace technology and design features on heat losses in the cooling system and coke consumption for compensation of them**
O. Chaika, B. Kornilov, A. Moskalyna – National Academy of Sciences of Ukraine (ISI NASU), Ukraine
M. Alter – ALTER Blast Furnace Consulting, USA
V. Naboka, S. Safonov – PJSC "Zaporozhstal" Iron & Steel Works, Ukraine

17:40 [ecic_076] **BF-BOF steelmaking CO_2 emissions reduction options**
R. van Laar, D. Verma, J. de Weerdt – Daniell Corus, Netherlands

18:00 [ecic_119] **Recovery of a blast furnace to normal operation after a "chilled hearth" event**
M. Alter – ALTER Blast Furnace Consulting, USA
O. Chaika – Iron & Steel Institute of National Academy of Sciences, Ukraine

19:00 Transfer service departure
19:30 **Conference dinner at *Cantina Monteci***

Friday 18 October 2024
Gardenia room

Session BLAST FURNACE IRONMAKING – OPERATIONS III
CHAIRPERSONS: GEBER BERNHARD – MATTEO GILI

8:30 [ecic_062] **CO_2 reduction technology through COG injection and low-reduced iron charging to the blast furnace**
J-O. Park, W-J. Lee, G-H. La, Y-S. Lee, S-H. Yi – POSLAB, Korea

8:50 [ecic_029] **Start-up and usage of coke oven gas at HKM on our mission to green steel and CO_2 reduction**
F. Perret, F. Demirci, A. Janz, R. Peter – Hüttenwerke Krupp Mannesmann, Germany
T. Semleit, S. Schulte – thyssenkrupp Steel Europe, Germany

9:10 [ecic_068] **Insights into the segregation in the blast furnace charging system: from the stockhouse to top hoppers**
A. Hadi, Y. Pang, D. Schott – Delft University of Technology, Netherlands
A. Adema, J. van der Stel – Tata Steel Europe, Netherlands

9:30 [ecic_027] **Spotlight on Na2O and K2O behaviour in blast furnace operation**
P. Warren – Binding Solutions, United Kingdom
M. Geerdes – Geerdes Advies, Netherlands

9:50 [ecic_014] **Application of slag model to minimize the end-to-end cost of hot metal production**
Y. Gordon – Hatch, Canada
N. Iziumskiy, G. Matveenko, P. Zhabrovets – Association of Pig Iron Producers, Ukraine

10:10 **Coffee break**

Friday 18 October 2024
Iris+Lilium room

Session MEASURING TECHNOLOGIES AND INDUSTRY 4.0 I
CHAIRPERSON: HAUKE BARTUSCH

8:30 [ecic_010] **EMF-timeseries analysis implemented as predictive tool in BF-tapping control**
S. Moll, J. Eisbacher-Lubensky, C. Weiß – Montanuniversität Leoben, Austria
J. Felser – voestalpine Metal Engineering, Austria
G. Lengauer – voestalpine Stahl, Austria

8:50 [ecic_102] **Transparent AI - key element for successful ironmaking process optimization**
D. Bettinger, H. Fritschek, A. Klinger, P. Krahwinkler, M. Schaler, C. Tauber – Primetals Technologies Austria, Austria
C. Feilmayr, C. Staudinger – voestalpine, Austria
M. Schatzl – K1-Met, Austria
R. P. Goldberg – Midrex Technologies, USA

9:10 [ecic_007] **Campaign life extension of COREX furnaces**
W.L. Ying, A. Sadri, Y. Gordon – Hatch, Canada

9:30 [ecic_032] **A soft measurement model construction method based on machine learning and CFD**
Y. Wang, S. Li, J. Zhang, Z. Liu – University of Science and Technology Beijing, China

9:50 [ecic_017] **Integrated steel plants challenges during transition to green steel - a holistic quantitative evaluation of CO2 reduction potentials using digital twins in m.simtop**
B. Weiss, R. Miltner, H. Völkl, B. Hiebl – Primetals Technologies Austria, Austria

10:10 **Coffee break**

Friday 18 October 2024
Gardenia room

Session BIOCOAL | BIOCHAR
CHAIRPERSONS: ANNE HEIKKILÄ – LUCA OREFICI

10:35 **Keynote** [ecic_093] **Production of high-quality biocarbon and utilization in the metallurgical industry**
K. Rigas, M. Gemvik, T. Brink – Envigas, Sweden

11:00 [ecic_056] **BioCoDe: biomass for cokemaking decarbonization**
V. Pepe – RINA Consulting-Centro Sviluppo Materiali, Italy
A. Sorino, R. Attrotto, A. Vecchio, G. Fiorenza – Acciaierie d'Italia, Italy

11:20 [ecic_106] **Bio-coke for manganese ferroalloys production - results of the BioCoke4FA| R&D project implementation**
M. Rejdak, A. Sobolewski, M. Wojtaszek-Kalaitzidi, B. Mertas – Institute of Energy and Fuel Processing Technology, Poland
M. Książek – SINTEF, Norway
S. Y. Larsen – Eramet, Norway
P. Szecówka – Koksownia Częstochowa Nowa, Poland

11:40 [ecic_065] **Assessing biochar functionality for EAF use**
G. Seenivasan, A. Andersson, H. Ahmed, L. Sundqvist-Öqvist – Luleå University of Technology, Sweden

12:00 [ecic_080] **Modelling of processes for upgrading biomass before its use in steel industry**
I. Matino, V. Colla, O. Toscanelli – Scuola Superiore Sant'Anna, TeCIP, Italy

12:20 [ecic_040] **Research on the potential role of biocarbon in future ironmaking process**
G. Kim, H. Oh, J. Lee, Y. Lee, Y. Bae, J. cho, J. Kwon, J. Park, J. Lee – Hyundai Steel, Korea

Friday 18 October 2024
Iris+Lilium room

Session MEASURING TECHNOLOGIES AND INDUSTRY 4.0 II
CHAIRPERSON: CARLO MAPELLI

10:40 **[ecic_048] Advanced thermal camera technology for tuyere raceway temperature measurement**
P. Warren – Binding Solutions, United Kingdom
I. Scott, S. Ibrahim – Pyroptik, United Kingdom
T. Stoakes – British Steel, United Kingdom

11:00 **[ecic_008] Monitoring strategies for blast furnaces and electric arc furnaces**
W.L. Ying, Y. Gordon, S. Kumar, A. Sadri – Hatch, Canada

Session BLAST FURNACE IRONMAKING – EQUIPMENT II
CHAIRPERSON: CARLO MAPELLI

11:20 **[ecic_047] How are ironmakers investing in existing blast furnace assets?**
D. Osborne, R. Horwood, G. Jemison – Primetals Technologies, United Kingdom

11:40 **[ecic_091] Innovative two-stage blast furnace gas cleaning technology implemented at Blast Furnace no 2 in ArcelorMittal Poland Dąbrowa Górnicza plant**
M. Czaplicka – Polish Academy of Sciences, Poland
M Niesler – Upper Silesian Institute of Technology, Poland
A. Ryfa – Silesian University of Technology, Poland
M. Kocot – ArcelorMittal, Poland

12:00 **[ecic_073] Danieli Top Charging Unit: simple and flexible design, easy maintenance**
A. Glazer, E. Tesselaar, E. Engel – Danieli Corus, Netherlands

12:20 **[ecic_123] Introduction of POSCO's NO.4 Blast furnace relining and sinter facilities construction**
J.y. Jo, B.s. Yoo, T.h. Park, W.h. Byun – POSCO Steel Company, Korea

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Friday 18 October 2024
Gardenia room

Session BIOCOAL | BIOCHAR
CHAIRPERSONS: ANNE HEIKKILÄ – LUCA OREFICI

12:40 **[ecic_049] Bio-reductants in smelting of direct reduced iron**
A. Phiri, K. Vallo, J. Hamuyuni, T. Rönnberg, T. Haimi – Metso Metals, Finland

13:00 **[ecic_125] Reduction of a basic manganese ore using biochar Kernel palm shells**
G. I. Kayombo, MK Wa Kalenga - University of Johannesburg, South Africa

13:20 **Closing remarks**
Johannes Schenk, Carlo Mapelli – Conference chairpersons

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POSTER SESSION

[ecic_030] Molecular and supramolecular structure of individual fractions of low-metamorphised coal
A. Starovoit, Y. Sorokin, Y. Malyi – USUST, Ukraine
Y. Zingerman – Independent cokemaking expert, Ukraine

[ecic_043] Characterization of sinters after reduction in hydrogen containing atmosphere
R. Rozmus, A. Janik, K. Radwański, M. Niesler, J. Stecko, A. Szemalikowska – Łukasiewicz - Górnośląski Instytut Technologiczny, Poland

[ecic_126] Use of artificial neural network to predict energy consumption in the reduction zone during high carbon ferromanganese production
MK Wa Kalenga, DK Nyembwe - University of Johannesburg, South Africa
FI Masengo - University of South Africa

NOTE OF THE PROGRAMME *POSSIBLE CHANGES IN THE PROGRAMME WILL BE COMMUNICATED DURING THE CONFERENCE.*
updated on October 1, 2024

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I.4 ESTEP Annual Event 2024

Event information	
Event name (and acronym)	ESTEP 2024 Annual Event: H2forGreenSteel meets a Circular Economy driven by the European Steel
Type of event	Conference
Date	October 29-31, 2024
Location	Linz (Austria)
Geographic coverage	European
Type of audience	Steel Companies, other Energy-Intensive Industries, RTOs, Academia, researchers and technicians operating in the Steel Sector
Approximate size of audience	150
Short description	ESTEP 2024 Event aimed at bringing together the European steel community to discuss two pillars of the Clean Steel Partnership towards C-lean processes: the hydrogen exploitation and the circular economy application. Achievements, challenges and future expectations were analysed thanks to contributions from different European steelmaking actors and to the presentations of current CSP projects. The event allowed the steel sector to meet other industrial sectors involved in the European Green Deal which are active actors in industrial symbiosis (e.g. cement, water and aluminium).
Information about dissemination activity	
Presentation title	Demonstration and Digital tools to investigate hydrogen exploitation in EAF burners - Contribution to the Clustering special session gathering EU projects addressing hydrogen in heating technologies with a clear focus on demonstrators and NOx emissions, digital tools and KPIs topics.
Presenter	Marianne Magnelov (SWERIM), Oliver Hatzfeld (BFI)
Other partners involved	SSAB
Hashtag(s) for Social Media	#GreenHeatEAF #Dissemination #Event #ESTEP #Linz #Research #EU #HorizonEurope #heating #hydrogen #FutureLowEmissionsIndustry
Presentation title	Scenario analyses to evaluate the effects of hydrogen exploitation in EAF burners
Presenter	Ismael Matino (SSSA)
Other partners involved	NONE
Hashtag(s) for Social Media	#modelling #simulation #GreenHeatEAF #Dissemination #Event #ESTEP #Linz #steel #metallurgy #research #HorizonEurope #CleanSteel #hydrogen #FutureLowEmissionsIndustry
Attachments (e.g. agenda, invitation)	Detailed program of the event


H2 FOR GREEN STEEL
3rd INTERNATIONAL CONFERENCE
Meets
A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL
OCTOBER 29 30 31
voestalpine Stahl, Linz, Austria
ESTEP
2024 Annual Event
Sponsored by:
voestalpine
ONE STEP AHEAD.
PRIMETALS TECHNOLOGIES

H2 FOR GREEN STEEL 3rd INTERNATIONAL CONFERENCE Meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL

ESTEP 2024 Annual Event

PROGRAMME TUESDAY 29 OCTOBER

Visit to voestalpine facilities (optional)

09:00 *Welcome at voestalpine*

09:30 **Visit 1st group**
Blast Furnace & automotive components

10:00 **Visit 2nd group**
Automotive components & H2 electrolyzer

Waiting visit in-between : Zeitgeschischtemuseum

12:00 *Lunch*

Technical conference

13:00 *Registration*

13:30 **Introduction to the Conference**
Ismael Matino, Scuola Superiore Sant' Anna (Conference chairman)

13:40 **Welcome and Opening of the 1st Day**
Klaus Peters, Secretary General, ESTEP

13:55 **Opening Lecture** (online video)
Maria-Cristina Russo, DG RTD, European Commission

14:05 **The Clean Steel Partnership: working together to achieve a clean and sustainable future for competitive steelmaking**
Alessandra Colli, DG RTD, European Commission

14:25 **Session 1 - Green Steel production by hydrogen**
Thomas Bürgler, voestalpine (Session chairman)

14:30 **Hy4smelt - Hydrogen-based direct reduction and smelting of ultra-fine iron ores to green hot metal**
Hanspeter Ofner, Primetals

14:50 **Simulation, modelling, and monitoring of plasma and arc-based processes for green metal production**
Hamideh Hassanpour, K1-MET

15:10 **Model-based control of electric arc plasma in the HPSR process for zero-emission iron ore reduction**
Erwin Reichel, K1-MET

15:30 **Mechanism of iron ore pellets direct reduction: new insights of factors affecting the kinetic of the process with low quality materials**
Filippo Cirilli, RINA-CSM

15:50 **Decarbonization solutions for the steel industry: an update**
Gorkem Oztarlik, AirLiquide

16:10 **Growing with Green Steel, how regional funding can play an important role in the development of decarbonisation know-how**
Hans van der Weijde, Tata Steel

16:30 *Coffee Break*

ESTEP voestalpine ONE STEP AHEAD PRIMETALS TECHNOLOGIES DAY 1

H2 FOR GREEN STEEL 3rd INTERNATIONAL CONFERENCE Meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL — ESTEP 2024 Annual Event

PROGRAMME TUESDAY 29 OCTOBER

16:55 **Session 2 - Smart, efficient and circular resource management paving the way to decarbonization**
Ismael Matino, Scuola Superiore Sant' Anna (Session chairman)

17:00 **Gas processing for syngas makeup and carbon monoxide valorization at integrated steelwork**
Balan Ramani, Tata Steel

17:20 **Methodologies and tools for designing a decision support system for energy management**
Valentina Colla, Scuola Superiore Sant' Anna

17:40 **Simulation and analysis of energy networks in the transition to sustainable steelmaking**
Christa Mühlegger, K1-MET

18:00 **Exploring and optimizing process off-gas management in steelworks during their transitions towards C-lean processes**
Lorenzo Vannini, Scuola Superiore Sant' Anna

18:00 **Digital transformation and sustainable innovation in steel manufacturing: the AID4GREENEST project**
Ilchat Sabirov, IMDEA Materials

18:40 ***Closure of first conference day***

19:00 ***ESTEP Celebration 20° Anniversary***
voestalpine Stahl Linz, first floor
(voestalpine-Straße 3 4020 Linz, Austria)

ESTEP voestalpine ONE STEP AHEAD. PRIMETALS TECHNOLOGIES DAY 1

H2 FOR GREEN STEEL Meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL — ESTEP 2024 Annual Event

PROGRAMME WEDNESDAY 30 OCTOBER

08:00 *Registration*

08:45 **Welcome and Opening of the Second Day**
Herbert Eibensteiner, CEO, voestalpine

09:15 **High Level Panel Discussion**
Moderated by Matthew Moggridge, Steel Times International
Axel Eggert, Director General, EUROFER
Kurt Satzinger, Head of R&D, voestalpine
Jürgen Schneider, Director of the Directorate General VI Climate action & Energy, Austrian Ministry Representative
Alexander Fleischanderl, CTO, Primetals
Christian Weinberger, Hydrogen Europe

10:15 *Coffee Break*

10:35 **Session 3 - Resource efficiency and industrial symbiosis**
Agnieszka Morillon, FEhS (session chairwoman)

10:40 **TransZeroWaste – Upgrading of low-quality iron ores and mill scale with low carbon technologies**
Martin Hubrich, BFI

11:00 **Decarbonization through industrial symbiosis : The use of recycled carbon raw materials in the steelmaking**
Elia Gosparini, I.Blu

11:20 **Utilization of recovered refractory material as slag additive and experimental determination of liquid slag properties**
Irmtraud Marschall, K1-MET

11:20 **EUROSLAG – Core activities and challenges for the slag value chain**
Thomas Reiche, FEhS

12:00 **Valorisation of zinc containing residues : Zincval project**
Damiano Capobianco, Esin Iplik, Marianne Magnelöv & Yanping Xiao, RINA-CSM, Linde, Swerim & Tata Steel

12:40 **Decarbonization in the steel industry and future production routes (e.g., SuSteel) and future utilization paths for the by-products generated (e.g., slags and dusts)**
Christoph Thaler & Wolfgang Reiter, voestalpine & K1-MET

13:00 *Lunch*

ESTEP voestalpine ONE STEP AHEAD. PRIMETALS TECHNOLOGIES DAY 2

H2 FOR GREEN STEEL Meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL — ESTEP 2024 Annual Event

PROGRAMME WEDNESDAY 30 OCTOBER

14:00 **Session 4 - Circularity in the European steel sector**
Valentina Colla, Scuola Superiore Sant' Anna (Session chairwoman)

14:05 **Challenges and solution for steelmaking dust valorization in the green steel transition**
Bernhard Voraberger, Primetals

14:25 **Development of a pyrometallurgical approach for iron and zinc recovery: design and modeling of a plasma reactor within the ReMFRa project**
Loredana Di Sante, RINA-CSM

14:45 **Improved analysis of post-consumer scrap to further push a circular steel industry**
Johannes Rieger, K1-MET

15:05 **Valorization and characterization of hydrochar for coke replacement in steelmaking: a circular economy approach**
Filippo Cirilli, RINA-CSM

15:25 **Green solutions for by-product utilization from process gas cleaning plants**
Paul Trunner, Primetals

15:45 *Coffee Break*

16:10 **DRASTIC: Demonstrating real & affordable sustainable building solutions with top-level whole life cycle performance and improved circularity**
Barbara Fernandez, CELSA

16:30 **COACH - Cold-bonded agglomerates for blast furnace ironmaking with chemically engineered binders**
Frederic Van Loo, CRM Group

16:50 **Gaining value with Ecolbriq : Two possible applications of Ecolbriq®: Reducing CO2 emissions and/or recycling of byproducts minimizing landfill**
Nella Janakova, Progress Ekotech

17:10 **Steel: from main to co-product in a circular economy?**
Harmen Oterdoom, Butterbridge

17:30 *Closure of the second conference day*

19:00 **Sightseeing tour of Linz**
Meeting point: in front of the Old Town Hall Linz (Altes Rathaus)
Address : Hauptplatz 1

20:00 *Conference Dinner at Herberstein*
Restaurant address : Altstadt 10, 4020 Linz, Austria

ESTEP voestalpine ONE STEP AHEAD PRIMETALS TECHNOLOGIES DAY 2

H2 FOR GREEN STEEL 3rd INTERNATIONAL CONFERENCE Meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL

ESTEP 2024 Annual Event

PROGRAMME THURSDAY 31 OCTOBER

08:00 **Registration**

08:10 **Session 5 - Clustering special session on Hydrogen in heating technologies**

The morning part of the special session aims at jointly presenting EU projects addressing hydrogen in heating technologies (steel downstream and other sectors) with a clear focus on demonstrators and NOx emissions, digital tools and KPIs topics.

The following projects contribute:

HyInHeat, Thomas Echterhof & Nico Schmitz, RWTH Aachen
HyDreams, Martin Demuth, Messer Austria
H2AL, Marco Lubrano Lavadera, The Université libre de Bruxelles
H2GLASS, Antonio Tuzio, Stam Tech
HyTecHeat, Filippo Cirilli, RINA-CSM
TWINGHY, Hassan Mohanna, CELSA
GreenHeatEAF, Oliver Hatzfeld & Marianne Magnelöv, BFI & SWERIM
H2Reuse, Salvatore Nardi, Tenova

08:10 **Welcome and Introduction to the special session and presentation of involved speakers for each included project**
Thomas Echterhof, RWTH Aachen University (session chairman)

08:20 **Demonstrators subsession - introducing the demonstrators of the included projects**

10:05 ***Coffee Break***

10:20 **Panel Discussion on NOx emissions and emission limits, Digital Tools, and KPIs of the included projects**

11:50 **Concluding remarks**
Thomas Echterhof, RWTH Aachen University

12:00 ***Lunch***

13:00 **Development and testing of low-NOx roof burner SMS-RADFlame HY2 for the steel industry**
Tommaso Bortolussi & Irene Luzzo, SMS Group & RINA-CSM

13:20 **Results from the experimental campaign with H2 oxyfuel burner for electric arc furnaces (EAF)**
Irene Luzzo, RINA-CSM

13:40 **CFD modelling of flameless combustion: from natural gas to hydrogen**
Mattia Bissoli, TENOVA

14:00 **Scenario analyses to evaluate the effects of hydrogen exploitation in EAF burners**
Ismael Matino, Scuola Superiore Sant'Anna

14:20 **Fuel flexible self-recuperative burners for radiant tube heating systems**
Christian Wupperman, RWTH Aachen

14:40 **Greetings and next steps**
Ismael Matino , Scuola Superiore Sant'Anna (Conference chairman)

14:45 ***Closure of the ESTEP Annual Event***
Klaus Peters, Secretary General, ESTEP

ESTEP voestalpine ONE STEP AHEAD. PRIMETALS TECHNOLOGIES DAY 3

H2 FOR GREEN STEEL 3rd INTERNATIONAL CONFERENCE Meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL

ESTEP 2024 Annual Event

PROGRAMME THURSDAY 31 OCTOBER

08:00 **Registration**

08:20 **Session 6 - Renewable energy and hydrogen availability in Europe**

Hans van der Weijde, Tata Steel (Session chairman)

08:25 **Hydrogen production by methane pyrolysis**
Robert Obenaus-Emler, University of Leoben

08:45 **RecHycle - Recycling hydrogen for climate neutrality**
Joke Bauwens, ArcelorMittal

09:05 **Hydrogen online training (steelHub)**
Antonius Schröder, TU Dortmund

09:25 **Towards a skills intelligence framework. Mapping of hydrogen skills initiatives in Germany and Austria**
Karina Maldonado - Mariscal, TU Dortmund

10:05 ***Coffee Break***

Poster session

Getting ready for EAFs – Data-driven modelling of mechanical properties of steel sheets from chemical analysis and process parameters
Peter Raninger, Materials Center Leoben

Physics-based modelling of tramp element effects on microstructure evolution during downstream processing
Peter Raninger, Materials Center Leoben

ZincVal - Valorisation of zinc containing residues
Damiano Capobianco, Esin Iplik, Marianne Magnelöv & Yanping Xiao, RINA-CSM, Linde, Swerim & Tata Steel

Converting an Existing Integrated Steel Plant to Electric Steel Production with 80% CO2 Emission Reduction
Gabor Szabo, University of Miskolc

Abstract booklet

The abstracts are compiled in the form of a digital booket to be found on the event webpage

ESTEP voestalpine ONE STEP AHEAD. PRIMETALS TECHNOLOGIES DAY 3

I.5 ESTEP online Workshop SecCarb4Steel

Event information	
Event name (and acronym)	ESTEP Workshop “Preparation and use of biogenic and non-biogenic secondary carbon carriers (SCC) in processes for iron and steelmaking” (SecCarb4Steel)
Type of event	Workshop
Date	November 15, 22, 29, 2024
Location	Online
Geographic coverage	European
Type of audience	Steel Companies, other Energy-Intensive Industries, RTOs, Academia, researchers and technicians operating in the Steel Sector
Approximate size of audience	77
Short description	The workshop aimed at providing the ESTEP community with an update about recently finished and ongoing R&D&I initiatives by sharing experiences, needs, best practices, innovative solutions for use and valorisation of Secondary Carbon Carriers (SCC) in iron and steelmaking. The web-conference acts as a platform to showcase developments, promote collaboration, and share knowledge to achieve CO_2-lean iron and steelmaking by utilizing biogenic and non-biogenic SCC. This includes enhancing the efficiency of these SCC and making required transformational changes. During the event also sector coupling possibilities were presented allowing a deeper understanding of industrial symbiosis. This contributes to the decarbonisation pathway of “Smart Carbon Usage - Process Integration” within the frame of the Clean Steel Partnership (CSP) as stated in the Strategic Research and Innovation Agenda (SRIA). All outcomes of the workshop contributed to the overall goals defined in the Circular Economy Action Plan and the Green Deal of the European Union.
Information about dissemination activity	
Presentation title	Exploring the effects of the use of alternative carbon-bearing materials in EAF through dedicated simulations
Presenter	Valentina Colla (SSSA)
Other partners involved	Sidenor
Hashtag(s) for Social Media	#GreenHeatEAF #secondary #carbon #carriers #iron #steelmaking #ESTEP #simulations #field #trials #steel #metallurgy #sustainability #biomass #biochar #CleanSteel #emissionsreduction
Attachments (e.g. agenda, invitation)	Detailed program of the event

Facing green steel production by utilisation of secondary carbon carriers

Progressing the iron and steelmaking industry towards a CO_2-lean goal is closely linked to the lowered use of fossil fuels and reducing agents. Biogenic and non-biogenic secondary carbon carriers can significantly contribute by being applied in various metallurgical processes including cokemaking, iron ore sintering, blast furnaces, direct reduction of iron ore, and electric arc furnaces. Moreover, it is essential to fully account for circular economy principles, as well as social, economic, and environmental aspects.

The ESTEP community will get an update about recently finished and ongoing R&D&I initiatives by sharing experiences, needs, best practices, innovative solutions for use and valorisation of SCC in iron and steelmaking.

During the event also sector coupling possibilities are presented allowing a deeper understanding of industrial symbiosis. This contributes to the decarbonisation pathway of "Smart Carbon Usage - Process Integration" within the frame of the Clean Steel Partnership (CSP) as stated in the Strategic Research and Innovation Agenda (SRIA).

Participation fee

» Free for speaker in the related session
» 50 € per person per session
» 100 € per person for all sessions

Student fee (all sessions)

» 60 € (additional seats offered based on availability)

Company flat rate fees (all sessions)

» 300 € (max. 25 persons)

Fee is used by ESTEP for workshop organization as well as generation and provision of the proceedings and related publications. Members of ESTEP interested in sponsoring the event (1000 €) are invited to contact the ESTEP secretariat via e-mail: D.Snaet@estep.eu

Scientific committee

J. Wiencke (ArcelorMittal), G. Landra (Beltrame Group), L. Kieush, S. Lesiak, (K1-MET), C. Prietl, B. Voraberger (Primetals Technologies), F. Cirilli (RINA-CSM), T. Echterhof (RWTH), V. Colla (Scuola Superiore Sant'Anna), E. Malfa (Tenova)

Organisational committee

K. Peters, D. Snaet, A. Swarnakar (ESTEP), J. Rieger (K1-MET)

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Keynote lectures

15 November 2024

Biochar production plants: Status quo by Next Generation Elements (NGE)

NGE produces customised facilities for recycling of biogenic residues utilising pyrolysis. Carbon capture and storage by pyrolysis (PyCCS) has recently been acknowledged by the EU as a reasonable approach.

22 November 2024

Decarbonization through recycling and industrial symbiosis: The use of recycled carbon raw materials in steelmaking by I.BLU

Decarbonisation in steelmaking thanks to the use of recycled carbon contained in recycled polymers allows for the replacement of virgin coal and maintenance of carbon "in the ground" thanks to industrial symbiosis.

29 November 2024

Ecological evaluation of the utilization of secondary carbon sources in the steel industry through a Life Cycle Assessment approach by RWTH Aachen

The implementation of Life Cycle Assessment (LCA) helps to identify and address shifts in environmental burdens using SCC across different stages or processes, promoting more sustainable technology development and eco-friendly design.

Workshop programme

15 | 11 - Utilization of biogenic SCC in iron and steelmaking - *Chair E. Malfa (Tenova)*

09:00 Opening words – *ESTEP*
09:10 Biochar production plants: Status quo – *Next Generation Elements*
09:40 Towards low-carbon cokemaking: Insights on the influence of alternative materials on the coke quality and process performance – *ArcelorMittal*
10:00 Hydrochar as a secondary carbon carrier: A circular approach for low-carbon steel production – *RINA-CSM*
10:20 Application of hydrochar for a sustainable electric arc furnace process – *KTH Royal Institute of Technology*
10:40 Lignin-based products as biogenic secondary carbon carriers for the manufacture of furnace electrodes and refractories in iron metallurgy and steelmaking – *KTH Royal Institute of Technology*
11:00 Plenary discussion with authors and closure of the session

22 | 11 - Non-biogenic SCC for iron and steelmaking - *Chair V. Colla (Scuola Superiore Sant'Anna)*

09:00 Decarbonisation through recycling and industrial symbiosis: The use of recycled carbon raw materials in steelmaking – *I.BLU*
09:30 A techno-economic and environmental assessment of coke-making with non-recyclable waste plastics in Europe: Evaluation of current and future market conditions – *University of Ghent*
09:50 The SMART project: Recycling of plastics and waste materials in TORERO to substitute more coal injection in the blast furnace – *CRM Group*
10:10 Practice of recycled plastics injection into a blast furnace at voestalpine Stahl – *K1-MET*
10:30 Polymer injection in EAF as a secondary carbon carrier scaled at industrial level: Process KPIs and decarbonization performance assessment – *Beltrame Group*
10:50 Analysing the green hydrogen to green steel transition through the sustainability triple helix lens: Reflections upon HYDRA (IT06) IPCEI – *RINA-CSM*
11:10 Plenary discussion with authors and closure of the session

29 | 11 - Recent project activities on European level following SCC usage - *Chair G. Landra (Beltrame Group)*

09:00 Ecological evaluation of the utilization of secondary carbon sources in the steel industry through a Life Cycle Assessment approach – *RWTH Aachen*
09:30 TACOS: Towards a zero CO_2 sintering – *CRM Group*
09:45 OnlyPlastic: EAF working with polymers derived from plastic residue in substitution of fossil fuel – *Tenova*
10:00 Creation of new value chain relations through novel approaches facilitating long-term industrial symbiosis – *COBALIS – RINA-CSM*
10:15 Exploring the effects of the use of alternative carbon-bearing materials in EAF through dedicated simulations – *Scuola Superiore Sant'Anna*
10:30 BioCoDe: Biomass for cokemaking decarbonization. Objectives and first project results – *Acciaierie d'Italia*
10:45 Hard-to-abate? Our solution for the EAF route within the BioRECAST project – *Politecnico di Torino*
11:00 Valorisation of biomass residues for sustainable steel production – EU RFCS project of BioReSteel – *SWERIM*
11:15 Plenary discussion with authors and closure of the session

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