Highly efficient technologies for increased yields in steelmaking processes and reduced environmental impact

Project details

Project Call	EU Horizon Europe – Cluster 4 Climate neutral, Circular and Digitized Production – Twin Green and Digital Transition Improvement of the yield of the iron and steel making (Clean Steel Partnership) (Innovation Action)		
Project Acronym	HIYIELD		
Grant Agreement No.	101058694	Duration	36 months
Project Start Date	01-07-2022	Project End Date	30-06-2025
Coordinator	KTH	Webpage:	www.hiyield.proj.kth.se

The project HIYIELD aims to promote a circular economy by progressively increasing the scrap uptake in three scenarios representing the current European steelmaking routes, with the ambition to deliver relevant solutions to all steelmakers.
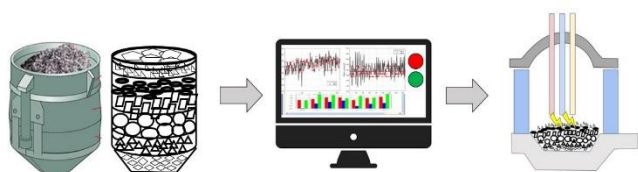
News

The project was presented at the ESTEP Spring Dissemination Event held at Brussels on March 2024, by the project coordinator Björn Glaser (ESTEP HIYIELD).

The project has developed pilot-scale technologies and infrastructure to upgrade and process high-quality post-consumer scrap metal. After laboratory-scale validation, the performance of the demonstration plant and its final products has been evaluated against specific targets. The project is now moving into industrial-scale trials to assess the applicability and performance of these technologies in operational environments. Some achievements from each demo cases are outlined below.

Demo Case 1: Upgrading and intelligent use of post-consumer scraps

The project has implemented a combination of mechanical, physical, and sensor-based sorting techniques to efficiently upgrade the low-grade scraps. Three combinations (modes) were promoted through trials, by utilizing the available equipment of the facilities.

Feed-stock material

Hammer-mill

Shredder out-put (100%)
Fe (71%), N-Fe(29%)

Targeted quality
Fe (>95%), N-Fe(<5%)

Fe shredded (76,2%)
Fe (92.4%), N-Fe(7.6%)

N-Fe shredded (23,8%)
Separation Efficiency 82%

A deep learning-based approach is applied to classify post-consumer scrap types and to correlate scrap layering with process data, enabling more efficient scrap charge operations.
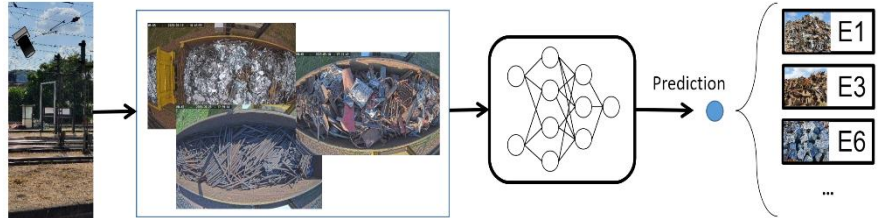
Demo Case 2: Identifying and tracking of pre-consumer scraps

Cameras were strategically placed at different locations to monitor scrap arriving by train and truck at the scrapyard, and the collected images were used to implement a DL based scrap identification system. The results from the DL model has been published in Nature journal (Article).

The initial analysis, sorting and melting were performed with shredder scrap, which was prepared with the 1500 HP shredder plant. The prepared material was simultaneously tested with the demo unit and melted in the furnace for a first analyzation using OES.

Demo Case 3: Enabling steelmaking to further increase scrap uptake and improved utilization of alloys by providing high-speed sampling and analysis

A ridged High-Speed analyser and argon stirring devices has been setup successfully at the laboratory at Minkon. The HS analyser is capable to be placed at the shop floor next to the liquid steel facilities. A combination sampler was designed and build, which allows for the high-speed sample and standard sample to be taken simultaneously in a single operation. The high-speed sampler was analysed using the HS analyser and the standard sampler was analysed using classic laboratory analysis. The results do agree within the standard deviation of a classical OES analysis. The use of the high-speed sampling technology will avoid long waiting times for steel analysis resulting in shorter processing time and increased yield, less energy consumption by less temperature losses and a closer control of the production process by additional sampling and modern data treatment.

Mid-term project meeting

The mid-term project meeting was held at FERRIERE NORD SPA in Osoppo, Italy on March 2024. The Consortium members, project officer and expert reviewer attended the meeting, where the project progress was addressed and the results were discussed.