12 partners from 7 European countries (France, Belgium, Switzerland, Greece, Norway, Portugal and Spain) covering the entire value chain to develop the ULCOWIN technology: from the raw material (iron ore) to the demonstration (production of steel) through the development of the process and pilot.

ArcelorMittal

John Cockerill

EDF

CFD numerics

Quantis

tecnalia
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

universidade de aveiro

ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ

reco

MYTILINEOS

DYNERGIE

NTNU
Norwegian University of Science and Technology

GENERAL DETAILS

Project Start Date: 1st October 2017

Project End Date: 31st March 2023

Project duration: 66 months

Grant Agreement No: *768788*

Call: H2020-SPIRE-10-2017

Web page: *www.siderwin-spire.eu*

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ArcelorMittal Maizières
Research S.A.
France

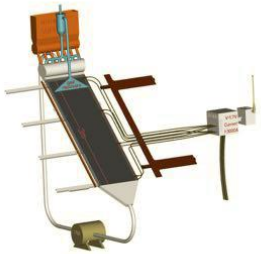
SPIRE PROJECT

Development of new methodologies for industrial CO_2-free steel production by electrowinning

Siderwin

The vision:

To develop a breakthrough innovation CO_2-free steel production process with a significant reduction of energy use by applying an electrochemical method to steelmaking.



www.siderwin-spire.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 768788.

The Objective:

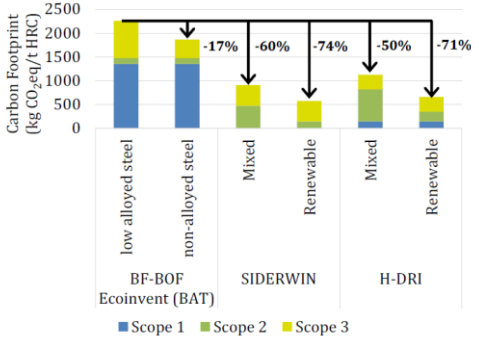
To develop a **breakthrough innovation** compared to the actual steel production process bringing together **steel making with electrochemical process**. It **transform iron oxide into steel plate** with a significant reduction of energy use.

Main Results:

- SIDERWIN **pilot plant has been built** and its able to produce iron plates.
- The **average metallic iron content** was found to be around **96% and can be up to 98.7%** under stable working conditions, the magnetite content was less than 4%.
- It is possible to reach high **faradaic yield, close to 90%,** under stable working conditions.

The benefits:

SIDERWIN and the H-DRI technology perform better in term of carbon footprint than the currently used BF-BOF. For the SIDERWIN technology with DSR, mixed, the carbon footprint amounts to 0.9 t CO_2eq which is 60% lower than the BF-BOF technology. With the renewable electricity mix, the **total carbon footprint is 0.6 t CO_2eq** which is a **reduction of 74%.** The H-DRI technology has a similar carbon footprint than SIDERWIN with 1.1 t CO_2eq with DSR, mixed and 0.7 t CO_2eq with DSR, renewable, which represent reductions of 50% and 71%, respectively.



Main Conclusions:

- SIDERWIN technology can **contribute to future carbon neutral steelmaking** with:
  - Almost no direct CO_2 emissions.
  - At least -60% carbon footprint vs traditional BF-BOF route.
  - Without compromising environmental footprint vs BF-BOF route.
  - Fully electrified primary production.
- The pilot technical performances have been validated and optimal parameters for operation have been defined, the **SIDERWIN technology has been successfully scaled up**. The main results obtained from the pilot trials are:
  - It is possible to use cathode with size up to 1.25 m².
  - Electrolysis cell energy use confirmed at pilot scale have demonstrated that the 2.7 MWh/t of Fe produced are reachable in optimized conditions.
- The SIDERWIN technology can contribute to the **balance of the power system** with its fully electrified steel primary production. The European power system can meet the additional SIDERWIN demand with carbon-free means.
- The SIDERWIN technology can contribute to **circular economy**, via the possible integration of raw materials.

The Future:

Based on the results of the project a **roadmap for the industrialization** and development of the technology has been defined. The history of the development of this technology and the future industrialization forecast is shown in the image below.