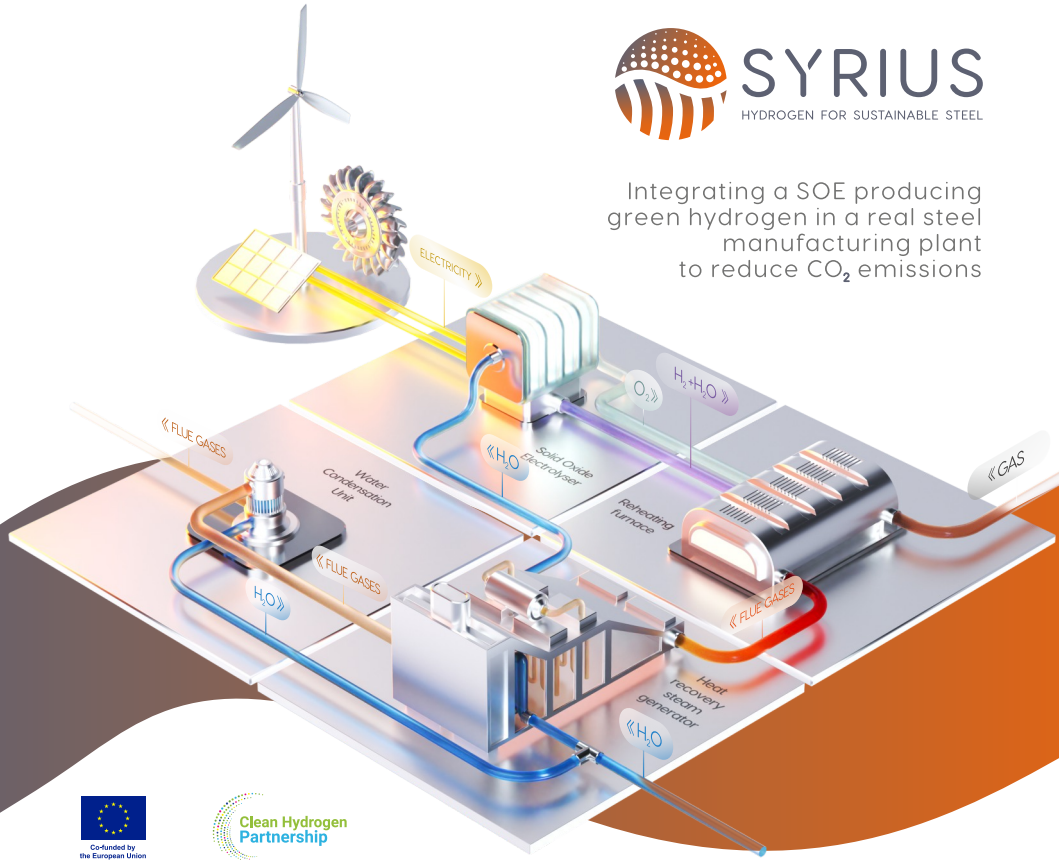
SYRIUS

HYDROGEN FOR SUSTAINABLE STEEL

Integrating a SOE producing green hydrogen in a real steel manufacturing plant to reduce CO_2 emissions



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Clean Hydrogen Partnership

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Context

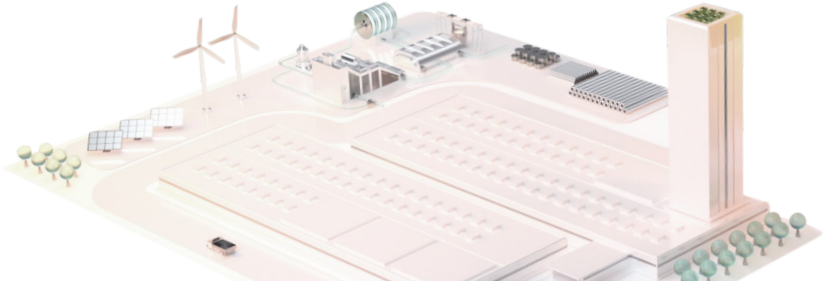
In light of the pressing challenges posed by climate change and the necessity of a transition towards more sustainable and efficient energy systems, the industrial sector is urged to achieve significant reductions of CO_2 emissions. The steel industry stands at the forefront of this challenge.

SYRIUS aims to address such challenges by integrating a SOEC system producing green hydrogen in a reheating furnace, integrating heat and water recovery and steam generation.

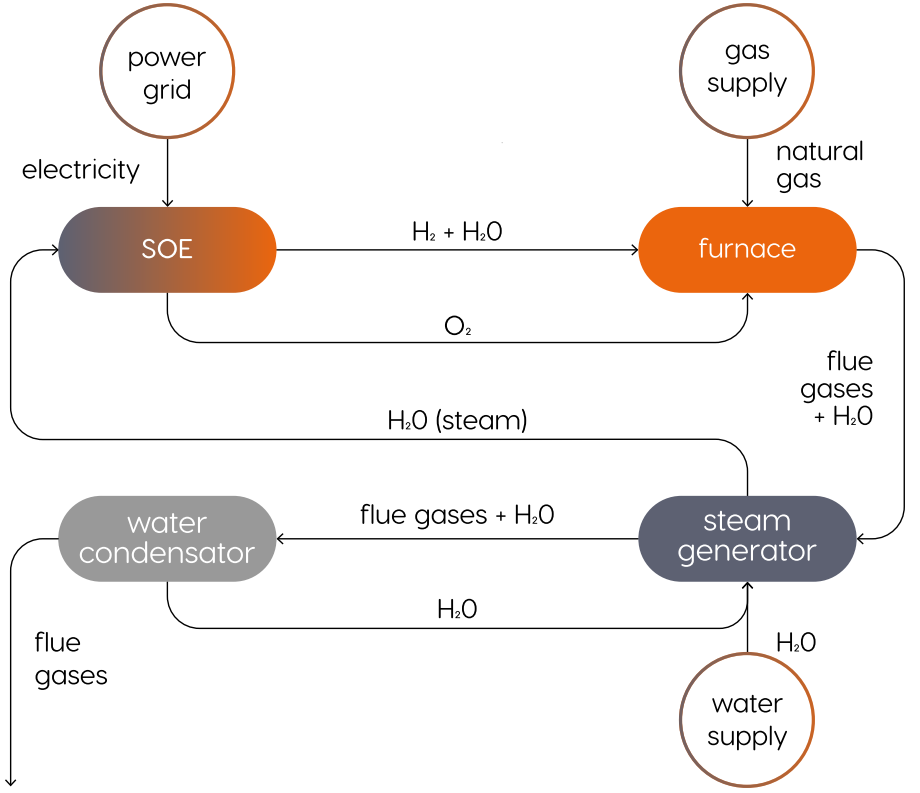
Scan the QR Code and check the SYRIUS website

Objectives

- To manufacture a SOE of 4.2 MW with heat recovery from industry's process waste heat to be integrated in an operational steel plant, to allow a full-scale demonstration of the technology;
- To test the integrated system at TRL7 and certify the renewable character of the produced hydrogen ensuring 5,000 cumulative working hours of testing;
- To demonstrate that the integrated system made by the electrolysers, renewable energy sources, storage systems, and the industrial process can be managed efficiently and safely with an advanced Energy Management System while using only renewable electricity;
- To demonstrate the SYRIUS circularity and sustainability via a comprehensive Life Cycle Assessment and Social-LCA and through Techno-Economic Analysis and Cost-Benefit Analysis;
- To ensure that hydrogen will be handled safely in the industrial process, following a "safety by design" approach;
- To develop a business plan to steer the uptake of the SYRIUS technology;
- To demonstrate test protocols contributing to the Clean Hydrogen JU's strategic objectives.



How does SYRIUS work?



SYRIUS sub-systems

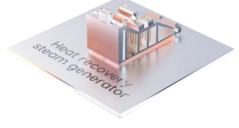
Solid Oxide Electrolyser

Solid Oxide Electrolysis Cell (SOEC) system has great potential as an innovative high efficiency technology for renewable hydrogen production. The favourable thermodynamics at high operating temperatures gives a high electric efficiency.
The overall energy efficiency can be further increased by heat recovery.

Reheating furnace

The innovative features of the SYRIUS plant integration concept include the provision of hydrogen for a new reheating furnace. The furnace is equipped with fuel-flexible burners which are able to operate with 0-100% hydrogen mixing with natural gas, allowing to reduce the CO_2 emissions of the process. Additionally, the furnace can work with air enriched with oxygen from the electrolyser.

Heat recovery steam generator



Heat recovery steam generator (HRSG) is a fully commercial and well-known technology for installation both in the power generation field and in industrial applications, such as the case of steel production processes. SYRIUS will use the steam generatedby the HRSG as heat source for the electrolyser.

Water condensation unit

SYRIUS will analyse the options for the addition of water condensation from the flue gases. Depending on the type of impurities that will be identified during real operations, SYRIUS will evaluate the use of a water condensation unit in the SOEC system.

Impact

Scientific and economic

Reduction of reliance on fossil fuels

Reducing overall reliance on fossil fuels, and reducing fuel consumption.

Energy efficiency

Energy efficiency improvement through the recovery of 25 TWh/y of useful heat.

Promoting circularity

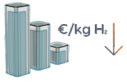
Improving energy efficiency and promoting circularity. In its strategic vision, the share of hydrogen in Europe's energy mix is projected by the European Commission from the current less 2% to 13-14% by 2050.

Developing the EU hydrogen market

Further developing an EU hydrogen market thanks to the features of its ground-breaking hydrogen production and process integration technology.

Reducing CO_2 emissions

Annual CO_2 savings higher than 10.9 Mt.



Lowering the cost of hydrogen

SYRIUS aims to strongly enhance market opportunities in the short to medium term by driving industrial green hydrogen costs below 2.2 €/kg, surpassing the SRIA targets for 2030.

Social

Development of skills and creation/conversion of jobs

Social and economic development through the creation of new skills.

Contributing to European hydrogen policies

SYRIUS will significantly contribute to policies and initiatives of the European Commission in consideration of the role that hydrogen is expected to play in filling the gap between electrification and hard-to-abate sectors, supporting the 2050 climate neutrality goal.

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Project name: SOEC hydrogen integration and circular use in steelmaking process

Project acronym: SYRIUS

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Coordinator: EU CORE Consulting Srl

Project coordinator:
Martina Fantini - EU CORE Consulting Srl
fantini@eucore.eu

Scientific coordinator:
Stefano Campanari - Politecnico di Milano
stefano.campanari@polimi.it

Partners

EU CORE
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