

# STEPWISE

## SEWGS Technology Platform for cost effective CO<sub>2</sub> reduction in the Iron & Steel Industry

<b>EU Funding program :</b>	HORIZON 2020, LCE-15-2014
<b>Grant agreement reference :</b>	No. 640769
<b>Project duration :</b>	1 May 2015 – 31 April 2019
<b>Estimated project total cost :</b>	20 M€
<b>EU contribution :</b>	13 M€
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<b>Project web site :</b>	<a href="http://www.stepwise.eu">www.stepwise.eu</a>

### 1. SUMMARY

In the STEPWISE project, the Sorption Enhanced Water-Gas Shift (SEWGS) CO<sub>2</sub> capture technology is brought to TRL6 by means of design, construction, operation and modelling a pilot installation in the Iron and Steel industry using Blast Furnace Gas (BFG). This advanced CO<sub>2</sub> removal technology makes use of regenerative solid adsorbents. The STEPWISE project represents the essential demonstration step within the research, development and demonstration trajectory of the SEWGS technology. This project will further reduce the risks associated with scaling up of the technology.

### 2. PROJECT SCOPE

The Iron and Steel industry is responsible for an annual output of 2.5-3.0 GtCO<sub>2</sub>/yr, with up to 10% originating from within the European Union. This represents 6% of total CO<sub>2</sub> emissions, and 16% of total industrial CO<sub>2</sub> emissions. In terms of avoiding serious long term climate change, it is essential that each industrial sector looks to improving energy efficiency and decreases CO<sub>2</sub> output, as recently reaffirmed in the COP21 negotiations in Paris.

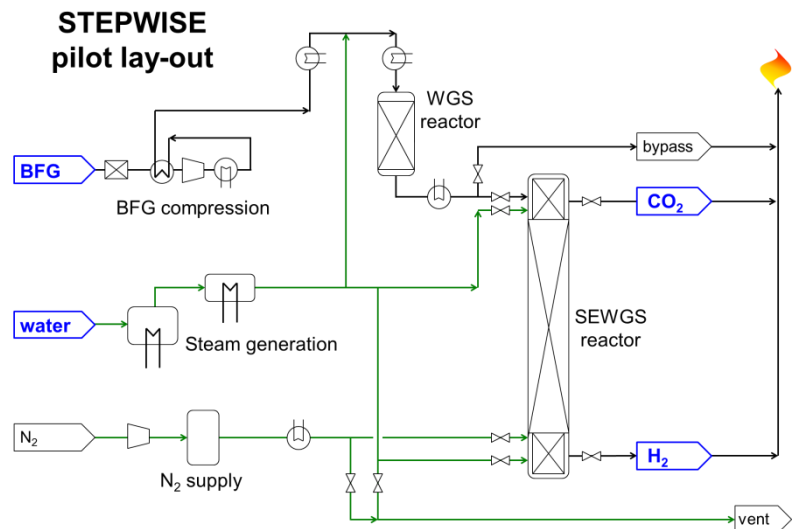
The technology developed in the STEPWISE project has the potential to decrease CO<sub>2</sub> emissions worldwide by 2.1 Gt/y based on current emission levels in the steel industry. The overall objective is to secure jobs in the highly competitive European steel industry, a sector employing 360 thousand skilled people with an annual turnover of €170 billion.



The STEPWISE project has at its heart the SEWGS technology (Sorption-Enhanced Water-Gas Shift). The SEWGS technology platform is a solid sorption technology for CO<sub>2</sub> capture from fuel gases in combination with water-gas shift and acid gas removal. The main objectives of the STEPWISE project is de-risking of the SEWGS technology by piloting.

### 3. TECHNICAL DESCRIPTION & IMPLEMENTATION

BFG is decarbonized by converting the CO into H<sub>2</sub> and CO<sub>2</sub> by reaction with steam via the water-gas shift reaction and separating the CO<sub>2</sub>-H<sub>2</sub> using the SEWGS technology. The project covers the design, construction, operation and modelling of a 14 tCO<sub>2</sub>/day capture unit, consisting of a BFG compression section, an advanced pre-shift section and a single column SEWGS unit. Novel WGS catalysts and CO<sub>2</sub> adsorbents are developed and produced at industrial scale. The pilot testing serves to refine reactor models, being used in the techno-economic and life-cycle assessments. Finally, a basic design and cost estimate of a full-scale unit will be made.



### 4. IMPACT

Large industrial sectors, such as the Cement and the Iron and Steel industry, cannot significantly reduce their carbon footprint by using renewable energy and instead rely on CCS technology to do so. In general, the isolation of CO<sub>2</sub> and its subsequent transport and storage comes with an energy penalty. The STEPWISE project brings CO<sub>2</sub> capture technology to TRL6 within the setting of the Iron and Steel industry. The project aims at reducing the costs for avoiding CO<sub>2</sub> emissions by 25%. By 2050, a potential cost saving of 750 times the research costs for this project will be realized each year every year.

### 5. CONSORTIUM REPRESENTS 9 PARTNERS FROM 5 MEMBER STATES

- Technology providers ECN and Swerea Mefos
- Sorbent and catalyst manufacturers Kisuma Chemicals and Johnson Matthey
- Design and engineering Amex Foster Wheeler, Politecnico di Milano, University Babeş Bolyai and Tata Steel Consultancy
- Industrial end user SSAB

