



Development of new methodologies **S** for In**D**ustrial  
CO2-fre**E** steel p**R**oduction by electro**WIN**ning

# Partners

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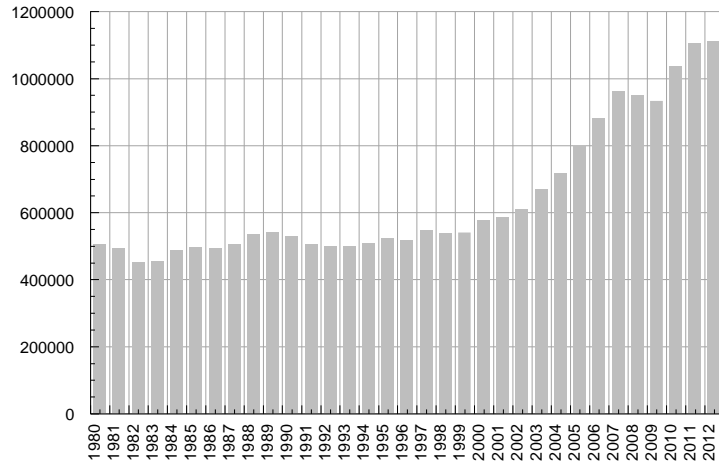




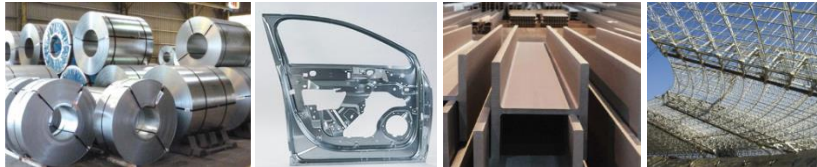
# General presentation of SIDERWIN project

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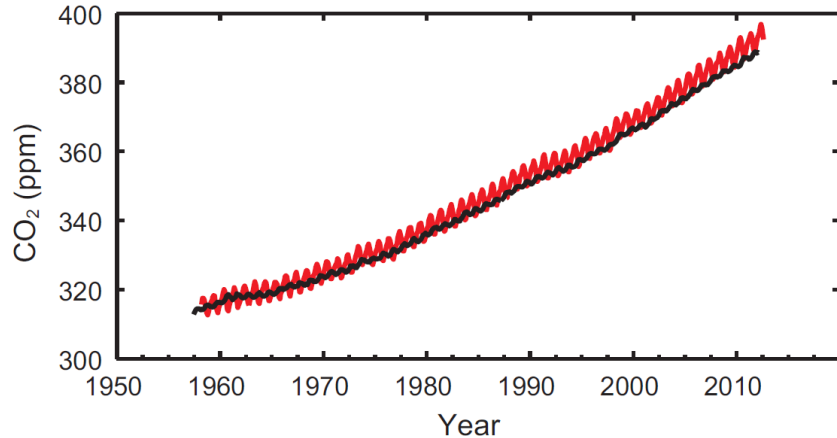


- Worldwide primary iron is produced at a rate of 1 billion tons per year.
- Steel and aluminium are among the material basis of our societies.

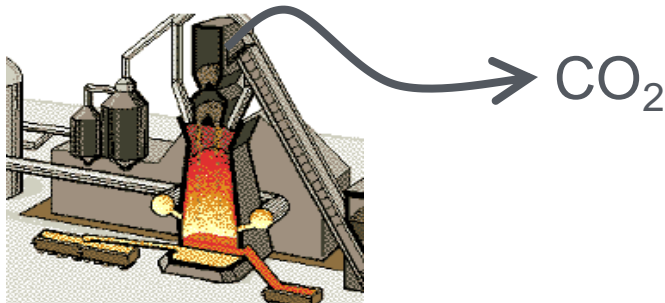


# General presentation of SIDERWIN project

Atmospheric CO<sub>2</sub>

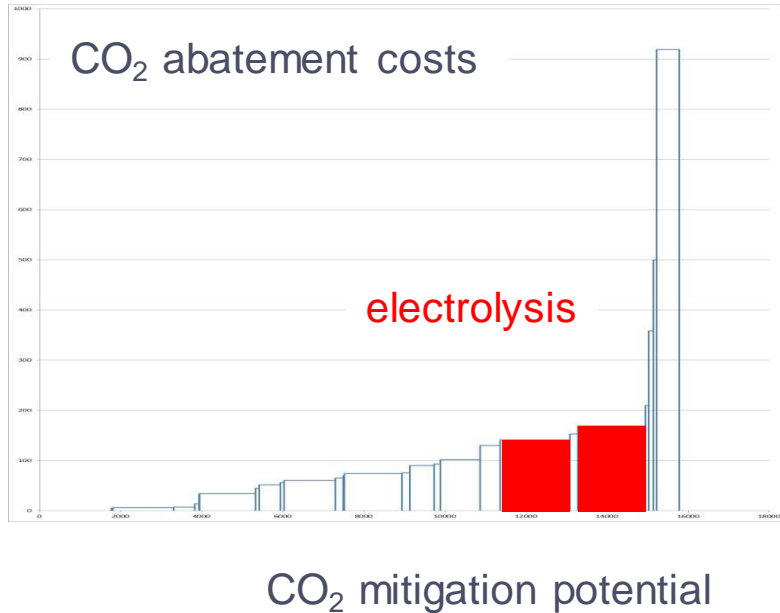


- The atmospheric concentrations of carbon dioxide has increased to levels unprecedented in at least the last 800,000 years.
- Steel production represents 4% of Europe(27) CO<sub>2</sub> emissions.



# General presentation of SIDERWIN project

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- A breakthrough is needed.
- Electrification of steel production is a good candidate to achieve a radical reduction of CO<sub>2</sub> emissions.

# General presentation of SIDERWIN project

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Develop a breakthrough innovation compared to the conventional steel production route by electrowinning iron from its naturally occurring oxides at low temperature in an aqueous based electrolyte.

The electrolysis process using renewable energies will transform any iron oxide, including those inside the by-products from other metallurgies, into steel plate with a significant reduction of energy use.



Total budget/funding

6 824 336€

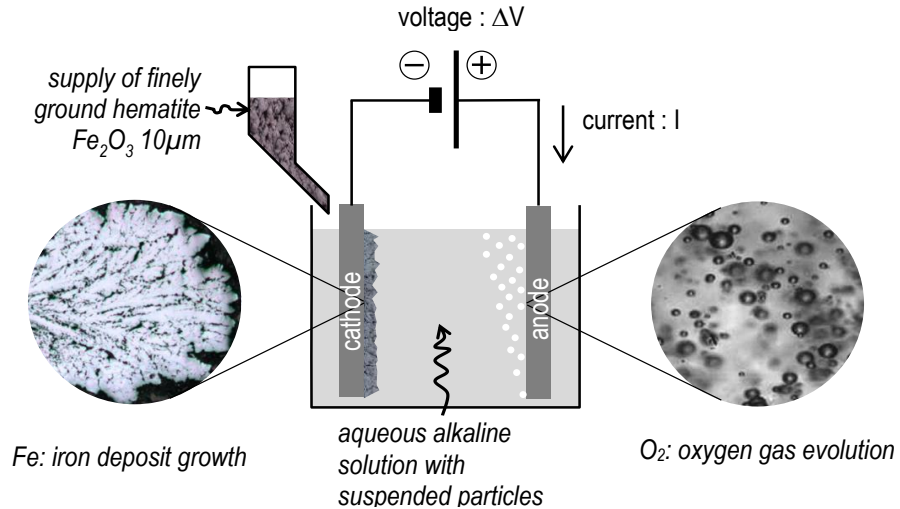
# SIDERWIN project's objectives





# SIDERWIN project's objectives

## Objective 1



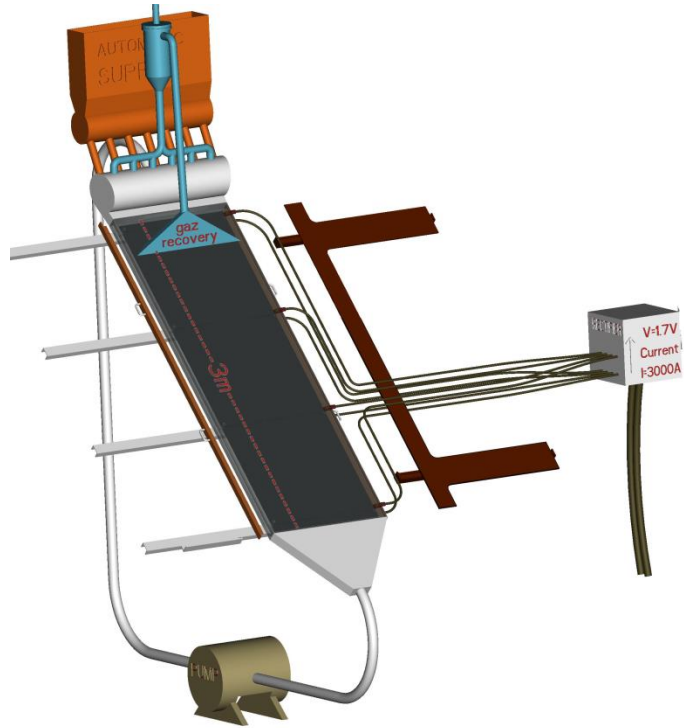
Develop, build and demonstrate the production of iron metal from its oxide without direct involvement of carbon or fossil fuels, and according to the simplest stoichiometry of the reaction of iron oxide decomposition.



# SIDERWIN project's objectives

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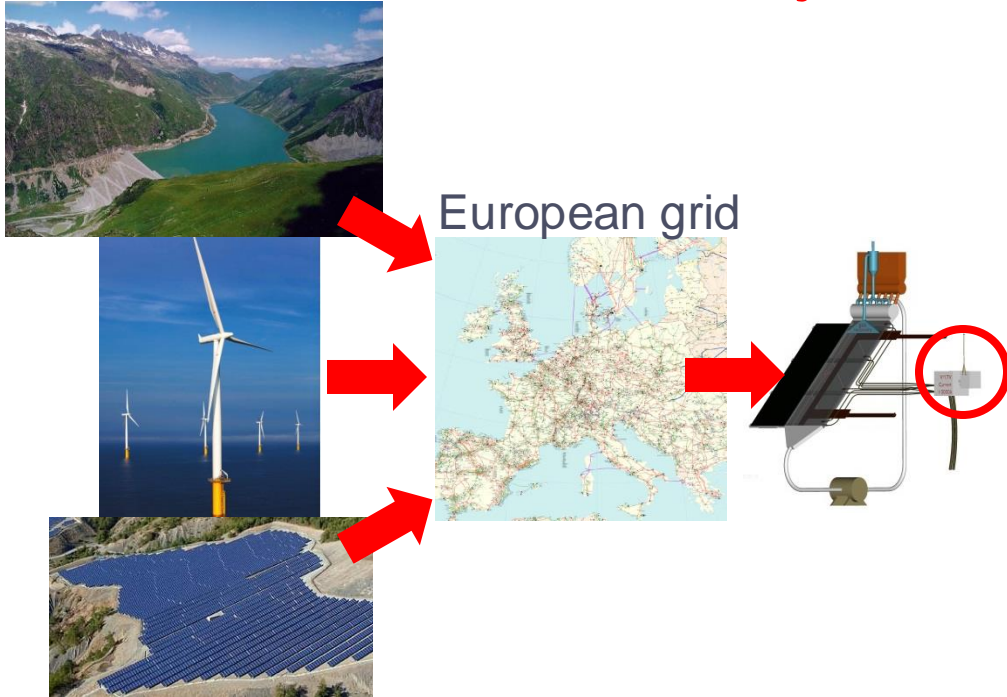
## Objective 2



Produce iron by electrowinning with a prototype cell equipped with the key components of the final version.

# SIDERWIN project's objectives

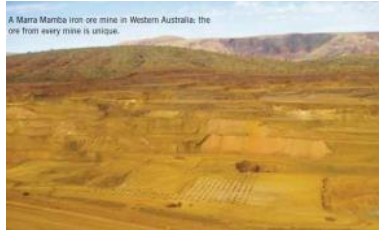
## Objective 3



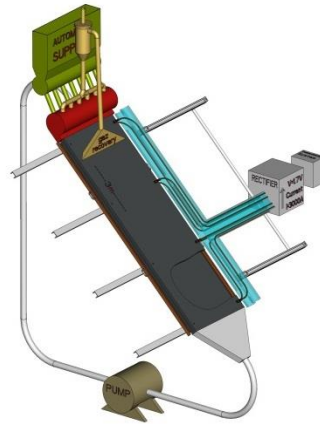
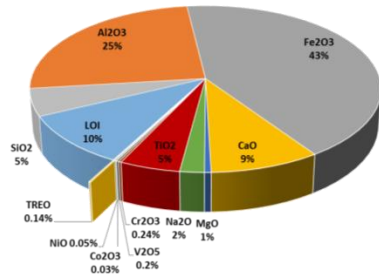
Interface the electrowinning prototype with a communication system to operate it according to electric grid priorities in real time.

# SIDERWIN project's objectives

## Objective 4



RED MUD chemical analysis



Produce iron metal from oxide coming from low-grade iron ore incompatible with the conventional process and from residues of non-ferrous metallurgies.

# SIDERWIN project's objectives

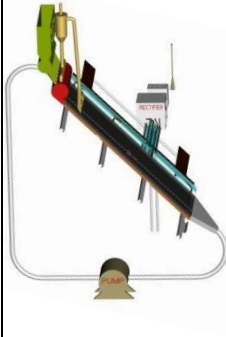
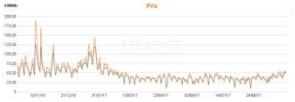
## Objective 5

### Inputs

*raw material markets*



*electricity markets*



### Outputs

*primary steel*



*intermediate products*



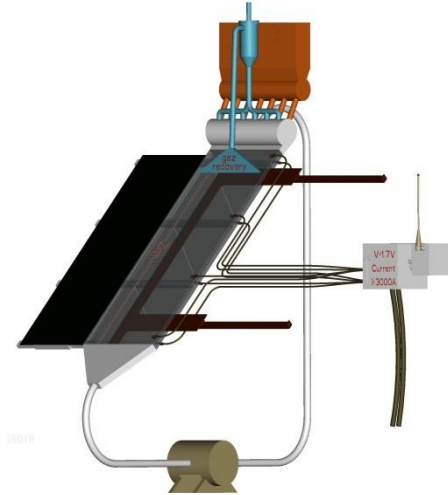
*oxygen gas*

$O_2$

Propose a profitable model that should facilitate the financial support of the next development steps of the ULCOWIN process.

# SIDERWIN project's objectives

- Manufacturing of an experimental pilot scale electrowinning cell build according to a unique processing route developed during past projects.



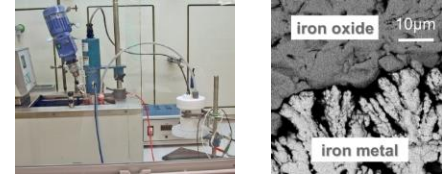
<b>Cathode area</b>	3 x 1 m
<b>Current intensity</b>	3 kA
<b>Electric power</b>	6kW
<b>Metal production rate</b>	50kg.d <sup>-1</sup>
<b>Electrolyte volume</b>	300L

These characteristics will evolve and be re-defined during specifications stage

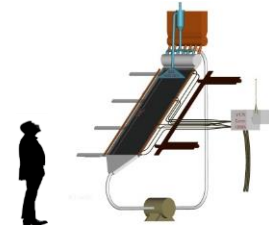
# Innovations expected from the SIDERWIN project

1. New knowledge on iron electrochemistry
2. Development of a breakthrough technological route for steel production
3. Draw a route for deployment to address steel production
4. Turn steel production into an environmentally efficient industrial activity
5. Development of a cost competitive steel production process

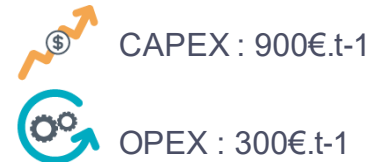
## Laboratory study



## Design and operation of a pilot at TRL 6



## Economical objectives



# SIDERWIN project's expected impacts



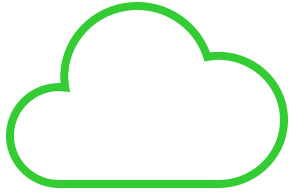
Reduction by 31% of the direct energy consumption

1



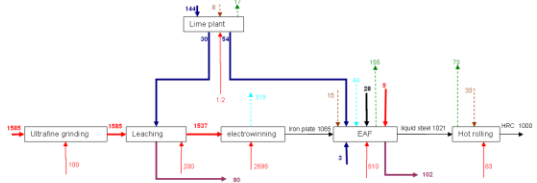
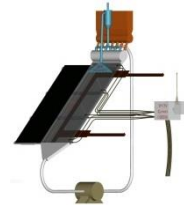
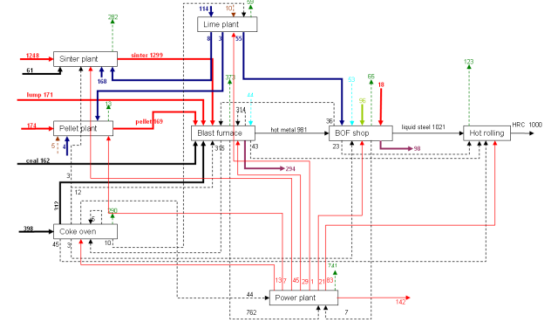
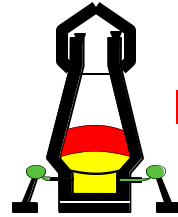


# SIDERWIN project's expected impacts



Reduction of the direct GHG emissions by 87%

2



# SIDERWIN project's expected impacts



Strengthening the global position  
of European process industry

3



# SIDERWIN project's expected impacts



**Network integration of steel production in European single market for economic growth**

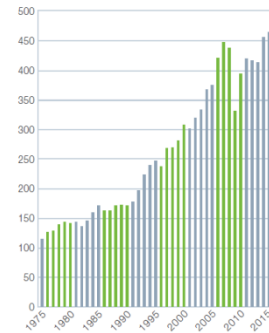
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## European electricity market



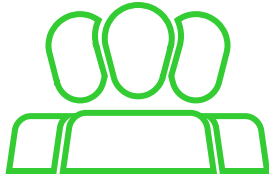
## World steel trade in products

million tonnes



# SIDERWIN project's expected impacts

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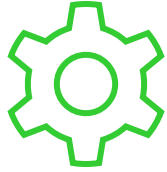
**Creation of jobs from  
new businesses**

5

New services, to name a few:

1. Contribution to quality of electricity by improving its reliability,
2. Contribution to security of supply,
3. Improvement of quality by voltage and frequency control,
4. Substitution of peaking power plants,
5. Participation to the tertiary reserve market,
6. Contribution to the integration of RES,
7. Share benefits of deferral of investments.

# SIDERWIN project's expected impacts



Cross sectorial strengthening  
of global leaders

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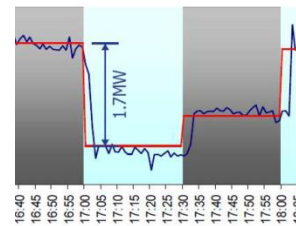
minerals  
electricity



process



products  
services

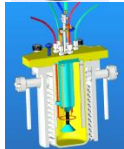
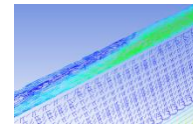
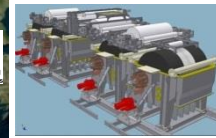
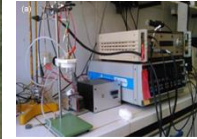
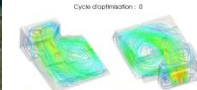


# SIDERWIN project's expected impacts



Improving innovation capacity  
and the integration of new  
knowledge

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# Thanks for your interest

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<https://www.siderwin-spire.eu>



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