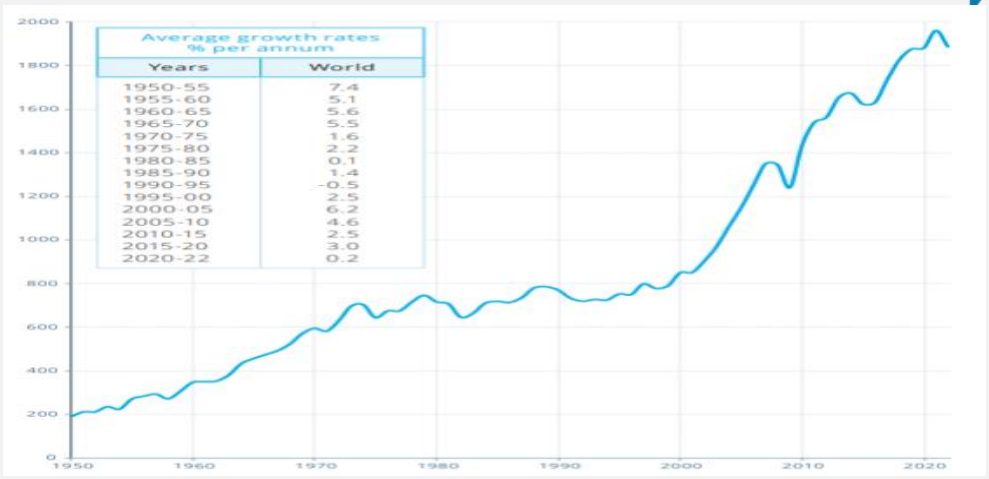
Electrification of steel industry

Edoardo D'Amanzo

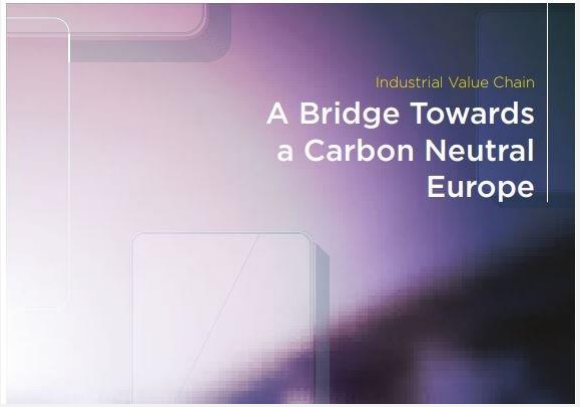
22nd September - Rome

Introduction

Steel is responsible **for 5% of entire CO_2** emissions in Europe (*IEA. (2020). Iron and Steel Technology Roadmap),* and considering the production trend, **decarbonization of steel sector is crucial** for achieving carbon neutrality in 2050.



World Steel Production by year in Millions of tons [source World Steel Association]



Application Areas for CO_2 emissions reduction in EIIs

- Process Integration
- Electrification of heating
- Electrification of process
- Hydrogen

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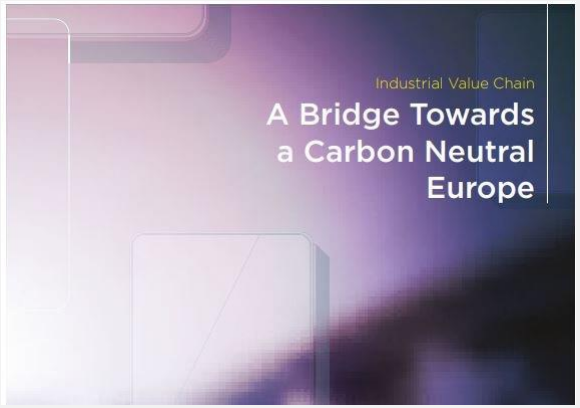

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Natural gas → heating → CO_2

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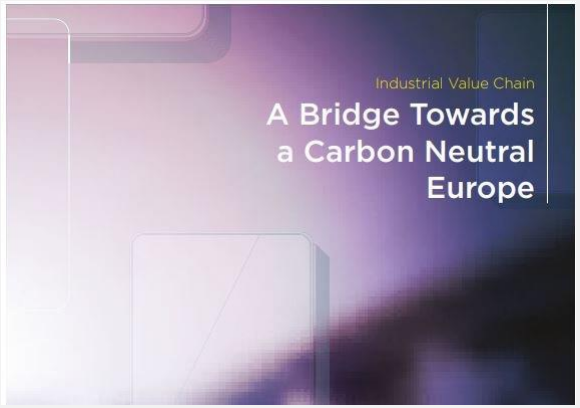

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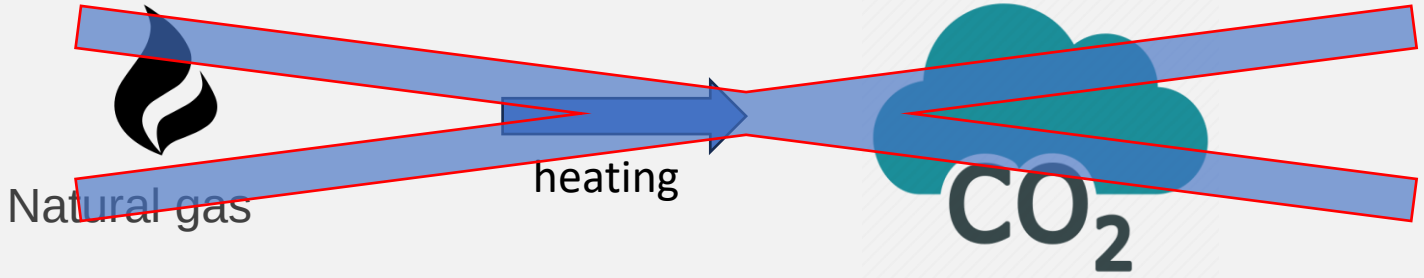
Electrification of heating = substitution of fossil fuels with electrical heating



ModHEATech project

ModHEATech: MOdular HEAting TECHnology through renewable resources for steel production

HORIZON-CL4-2022-TWIN-TRANSITION-01 –

Modular and hybrid heating technologies in steel production (Clean Steel Partnership)

Funded by the European Union

ModHEATech

Start March 2023

End March 2026

6 Partners

2 Research Centres

4 industrials

RINA

Tekniker
MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

FERALPI SIDERURGICA

ORI MARTIN

FERALPI STAHL

sidenor

ModHEATech general

The project **ModHEAtech** proposes to **decarbonize the ROLLING MILL PLANT**, keeping high quality standard without negative impact on productivity and economic needs.

How

- **Induction Heating** for **Long Product** at **industrial scale** in combination with gas burning
- **Study of an Alternative Heating Technology** for **Long Product** at **Pilot Scale**
- Impact **on Material Selection and Maintenance Strategy** for application of **Induction Furnace** and **Hydrogen: Feasibility Study**

ModHEATech – WorkPlan and activities

Route 1 –
- ❑ **Induction Furnace**
- ❑ **Long Product**
- ❑ **Industrial Scale**

Location: ORI MARTIN plant

Design
- Selection of induction technology *(ORI MARTIN)*
- Study of metallurgical impact of induction *(RINA CSM)*
- Process Integration with green energy production (Rina CSM)

Installation and Trials
- Induction system on Reheating Furnace – partialization of heating (*ORI MARTIN)*
- Industrial Tests (*ORI MARTIN)*
- KPIs Monitoring (microstructure, productivity, etc) *(Rina CSM)*

Techno-Economic Assessment

ModHEATech – WorkPlan and activities

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Techno-Economic Assessment

Route 2 –
- ❑ **Alternative Heating**
- ❑ **Long Product**
- ❑ **Pilot Scale**

Location: Feralpi plant

Design
- Selection of alternative heating technology (Feralpi)
- Setting of DoE (steelgrades, shapes, heating profile, clamps and motion, etc) (*Rina CSM*)

Pilot Trials
- Impact on different charge input, so different steel grades and different shapes (*Feralpi*)
- KpIs monitoring : microstructures, steel quality, homogeneity of heating, consumptions (*RINA CSM*)

Techno-Economic Assessment

ModHEATech – WorkPlan and activities

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Techno-Economic Assessment

Route 3 –
- ❑ **Feasibility Study on Induction Furnace & Hydrogen**
- ❑ **Long Product**

Location: SIDENOR plant

Preliminary LCA
For definition of the current state of rolling mills (Tekniker, SIDENOR)

Feasibility Study *(Tekniker)*:
- H2 Burner
- Induction Heating
- Maintenance (FMCA)
- Materials
- Green Energy Production

Final LCA. LCC and S-LCA analysis
(Tekniker, SIDENOR)

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Expected Outcomes at the end of the project

1. Induction Heating for billets: **-20% of CO_2** with 2MW of inductor installed
2. **Achieve a 50%** of energy supplied to inductor from renewable energy self-produced
3. Increasing productivity **(+10%)** by applying high heating rate
4. Proving the feasibility of **alternative heating technology** in billets heating for **special steel heating**
5. **Roadmap on how decarbonize** rolling mills plant, until a sustainability of 100% sector. Integration of **Induction Heating and Hydrogen Burners.**
6. **Less dependence from fossil fuels,** with protection from harmful market event

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Thanks for the Attention

For any questions
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Photo from https://climate.ec.europa.eu/eu-action/climate-strategies-targets_it