STEEL 24 MASTER

XXVI Edizione

RINA

**1ª Settimana**
RINA
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6 - 10 Maggio 2024

**2ª Settimana**
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Cremona
10 - 14 Giugno 2024

# RFCS ProSynteg project dissemination
# Paul Wurth presentation: background and role of Paul Wurth

May 6, 2024

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# RFCS ProSynteg project

Production of hot hydrogen-rich syngas in integrated plants for efficient injection in the blast furnace and $CO_2$ mitigation

**Decarbonization of the iron and steel industry**

ProSynteg

**Background and role of Paul Wurth**

Co-funded by the European Union

PAUL WURTH SMS group

SMS group

RINA

# RFCS ProSynteg project

## Production of hot hydrogen-rich syngas in integrated plants for efficient injection in the blast furnace and $CO_2$ mitigation

**Project number**: 101057965

**Project name**: *Production of hot hydrogen-rich syngas in integrated plants for efficient injection in the blast furnace and $CO_2$ mitigation*

**Project acronym**: *ProSynteg*

**Call**: RFCS-2021

**Topic**: RFCS-02-2021-PDP

**Type of action**: RFCS Project Grants

**Granting authority**: European Commission-EU

**Project starting date**: 1 July 2022

**Project end date**: 31 December 2025

**Project duration**: 42 months

Research & Innovation
Research Fund for Coal and Steel

This project has received funding from the European Union's Research Fund for Coal and Steel under grant agreement N. 101057965

Co-funded by the European Union

# SMS group at a glance

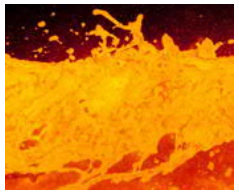
Paul Wurth S.A. and Paul Wurth Italia SpA are companies of SMS group; in 2021 SMS became the sole owner of Paul Wurth's plant engineering business

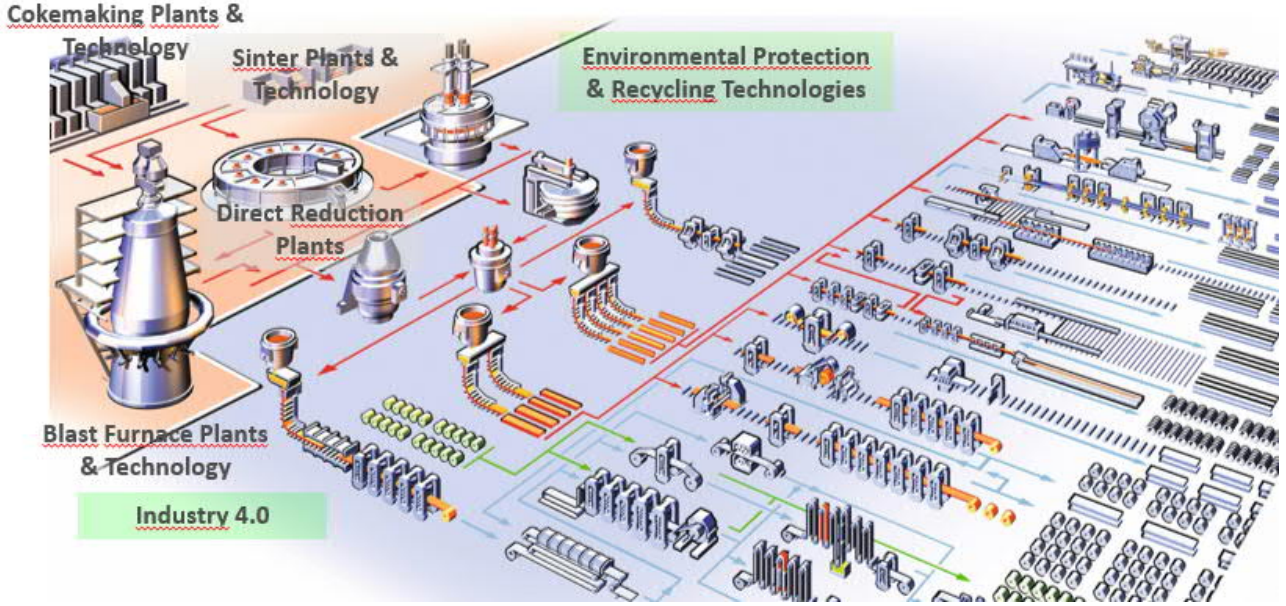
- ✓ Worldwide presence
- ✓ SMS group > about 13.200 employees
- ✓ 95 workshops and sites globally

# SMS group at a glance

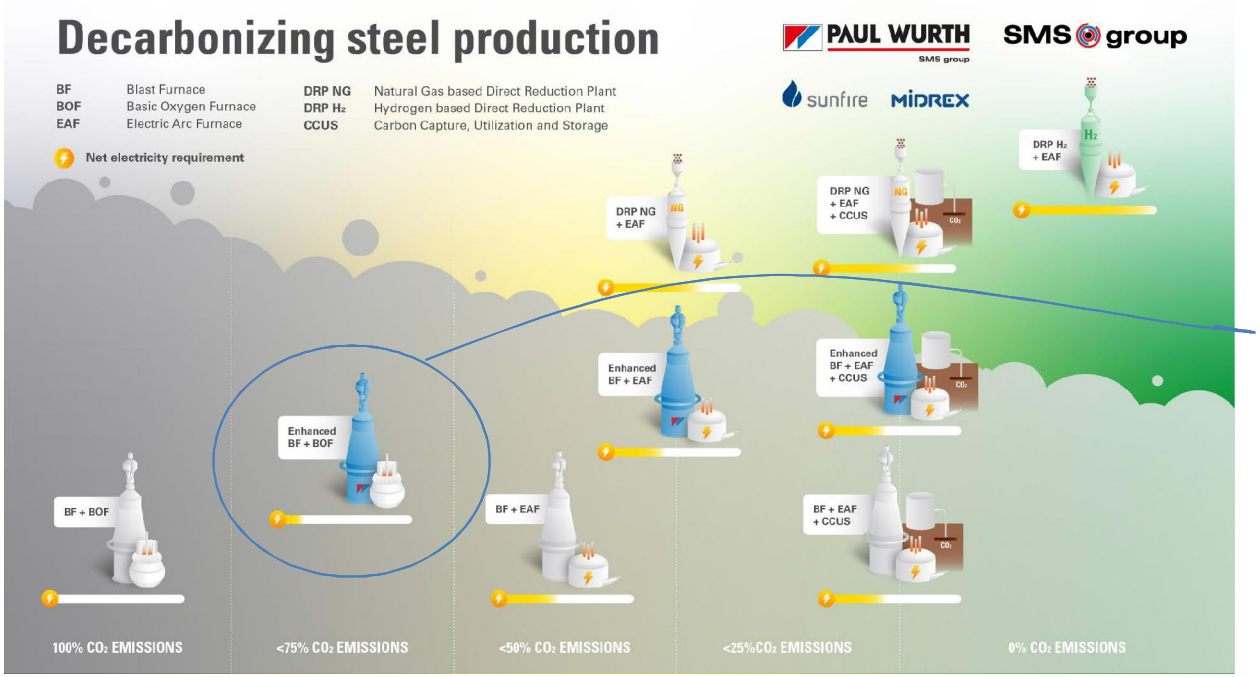
As companies of SMS group, Paul Wurth Italia and Paul Wurth SA are leading market players for the design and construction of complete plants for the coke- and iron-making industry.
Our mission is to turn metals green and to advance climate-neutral and sustainable metals production.

# SMS group at a glance






# SMS group for green steel




**Stepwise reduction of $CO_2$ footprint**

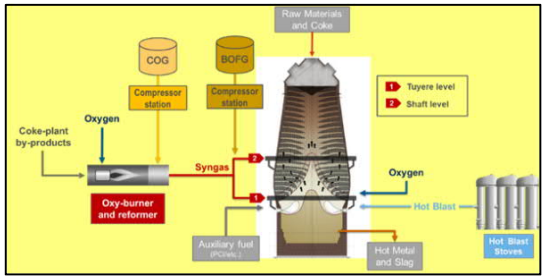
- Syngas injection in the blast furnace shaft
- Reduction of CO2 emissions

PAUL WURTH SMS group

SMS group

# SMS group for CO2 stepwise reduction

**New technology by PW for the production of hot syngas, to be injected to the blast furnace**

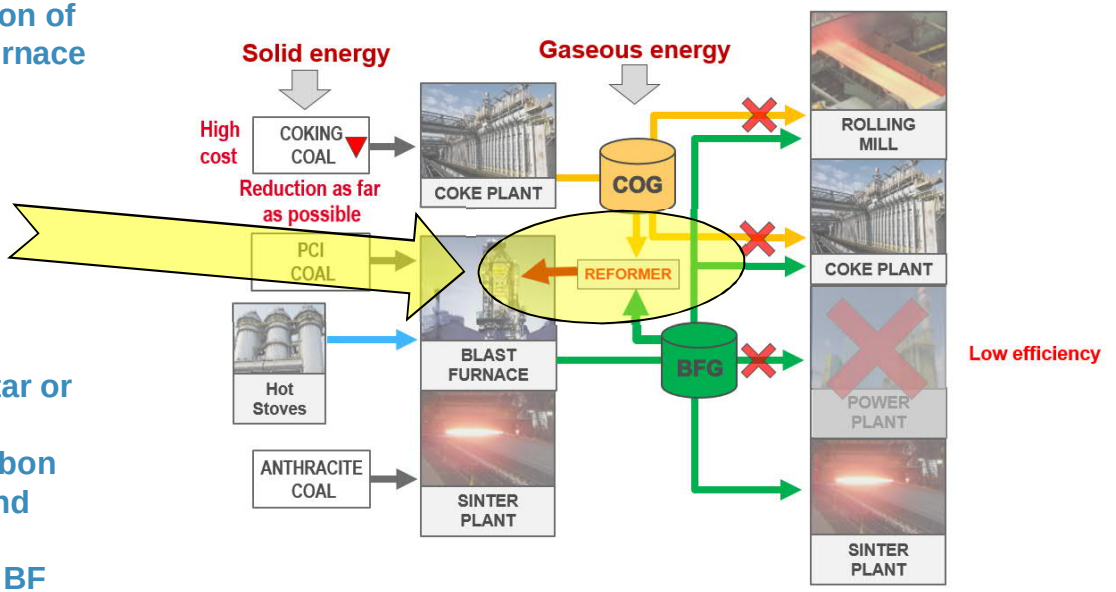



**Syngas produced as reformed COG via tar or coke breeze combustion ➔**

- **circular C = CO2 neutral source of carbon**
- **internal re-use of process off-gases and coke oven plants by-products**
- **reduction of coke consumption in the BF**

**➔ reduction of CO2 emissions**

**Integrated cycle steel plant: Coke Ovens Batteries + Blast Furnace**



# Paul Wurth background for ProSynteg

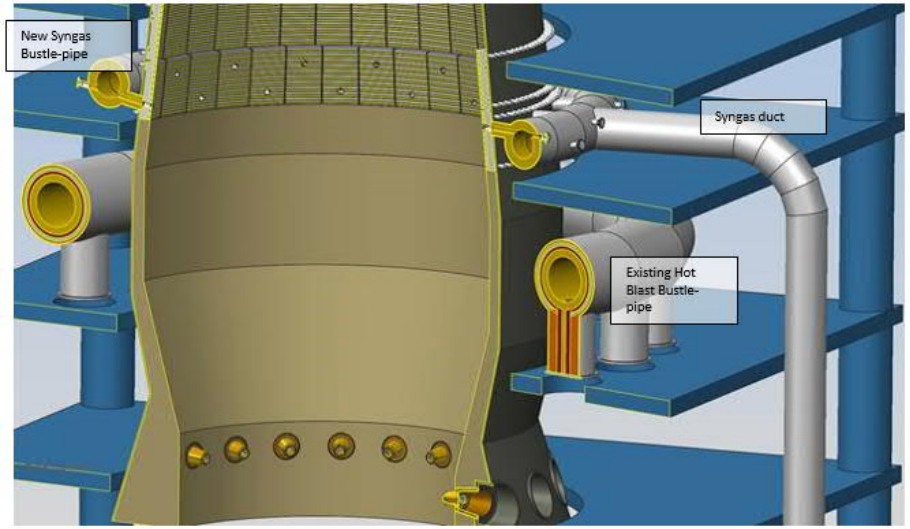
**From oxy-tar pilot plant**

**to oxy-cokebreeze**

- Paul Wurth developed an innovative process to generate CO2 neutral hot syngas from coke plant by-products by dry reforming.
- The subsequent utilisation of syngas (a mixture of carbon monoxide and hydrogen) in the blast furnace allows reduction of CO2 emissions
- Agreement Italiana Coke and Paul Wurth signed in 2021 for installation of an oxy-tar pilot plant at Italiana Coke's production site in Cairo Montenotte (SV)
- Oxy-tar pilot plant designed, developed, installed and put in operation by PW
- Test campaigns on-going

**existing oxy-tar pilot plant by PW**

# Paul Wurth background for ProSynteg




**Expected benefits:**

1. Reduced OPEX due to Coke rate decrease, which largely overcomes the decreased revenues from power production, corresponding to the used amount of gas
2. Productivity increase due to reduced coke rate (decreased gas generation at bosh level)
3. Possibility to operate with higher slag rates since part of reducing gas not passing through cohesive zone
4. Add on technology not impacting tuyere area → PCI injection not affected
5. Enabler for higher top gas temperature which represents a solution to boost productivity in case of the constraint for lower top gas temperature

# RFCS ProSynteg project idea

**From oxy-tar pilot plant**

**to oxy-cokebreeze**

- Submission of RFCS ProSynteg proposal in Sept.2021
- Approved begin of 2022
- Grant Agreement signed in June 2022
- Official start of ProSynteg project: July 1st, 2022

- **ProSynteg is based on the adaptation of the existing oxy-tar pilot plant to oxy-coke breeze setup and on the execution of relevant test campaigns**

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# ProSynteg: Paul Wurth role and activities

Research & Innovation
Research Fund for Coal and Steel

**Paul Wurth S.A. (Luxembourg)**

**Paul Wurth Italia SpA (Italy)**

- WP1 Coordination and Reporting
- WP2 Laboratory experiments
- WP3 Reforming model
- **WP4 Adaptation of the pilot plant**
- **WP5 Pilot test campaigns**
- WP6 Evaluation of industrial application potential
- WP7 Detailed CO2 and economic calculations

**core tasks by PW**

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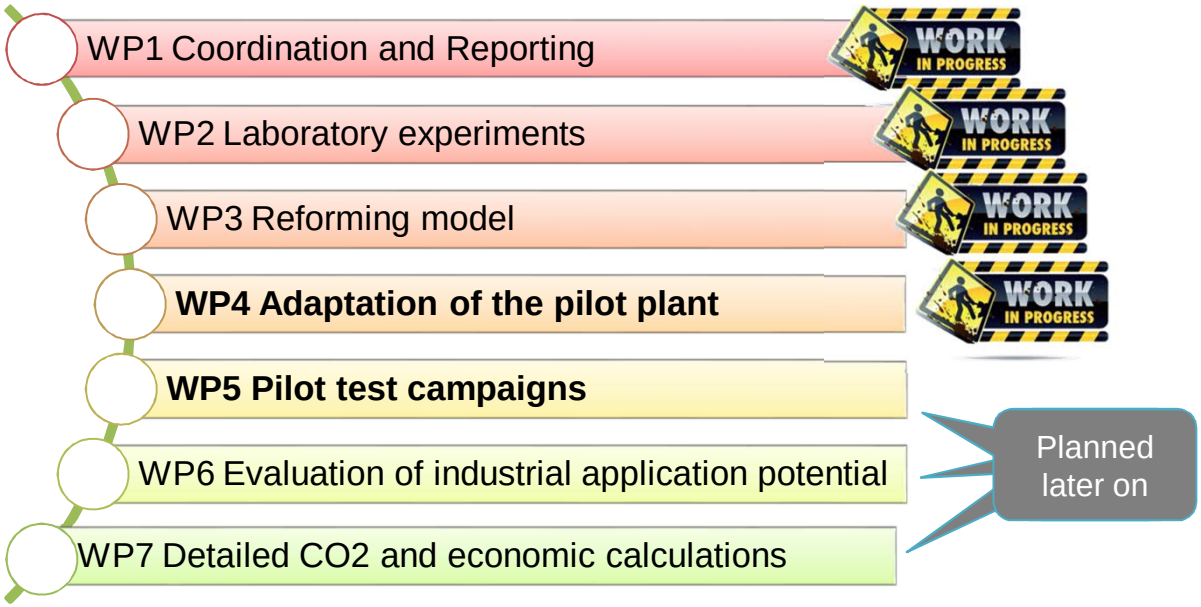
# ProSynteg: Paul Wurth role and activities

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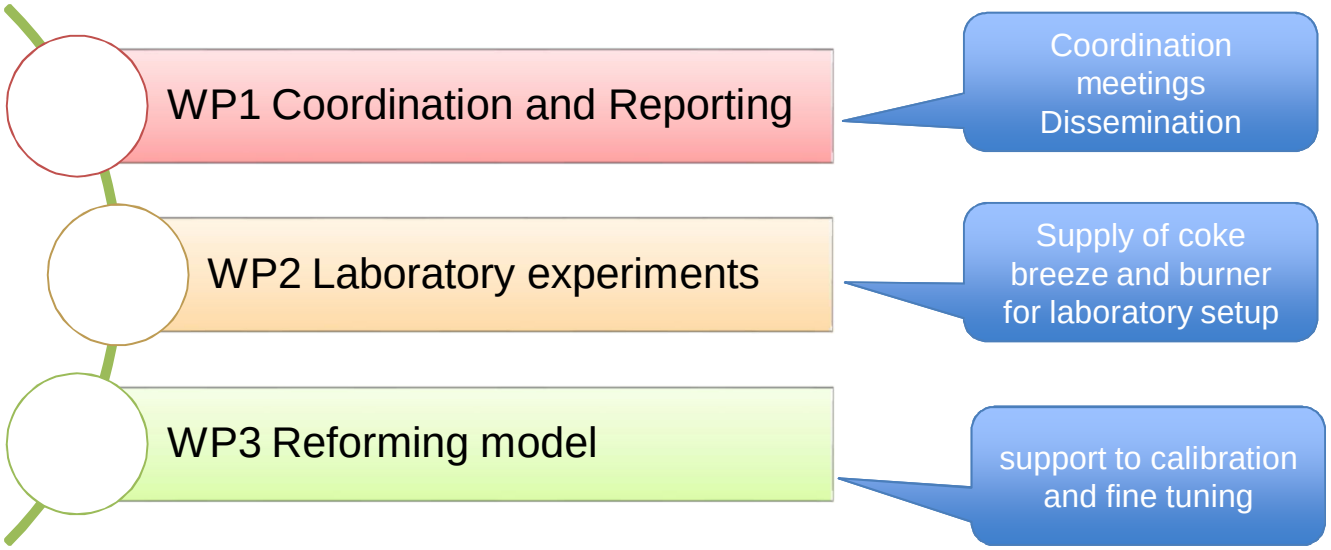
# ProSynteg: Paul Wurth role and activities

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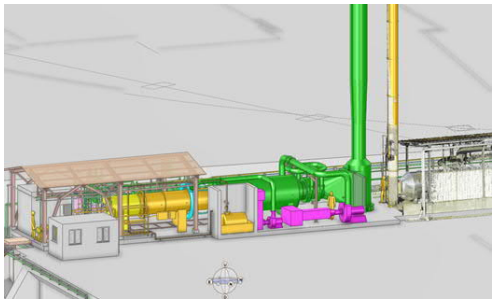
# ProSynteg: Paul Wurth role and activities

ProSynteg

## WP4 Adaptation of the pilot plant

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PAUL WURTH
SMS group

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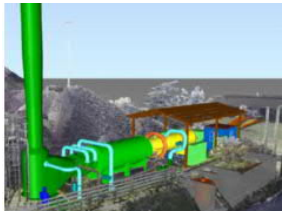
# ProSynteg: Paul Wurth role and activities

## WP4 Adaptation of the pilot plant



- ✓ **Task 4.1 Detailed Engineering**
- ✓ **Task 4.2 Adaptation of the existing plant**
- ✓ **Task 4.3 Commissioning**

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# ProSynteg: Paul Wurth role and activities

**Main equipment:**

- ✓ combustion chamber and reforming reactor
- ✓ oxy-coke-breeze burner
- ✓ coke breeze storage, transportation and injection system
- ✓ interconnection with plant COG line
- ✓ oxygen feeding line
- ✓ other utilities
- ✓ EIC

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# ProSynteg: Paul Wurth role and activities

## WP4 Adaptation of the pilot plant

**Split of activities between PW Lux. and PW Italia**

| Description | Engineering | Supply | Erection and commissioning |
|---|---|---|---|
| Oxy-coke breeze burner | PWIT | PWIT | PWIT |
| Coke grinding and feeding system with relevant auxiliaries | PW S.A. + PWIT | PWIT | PWIT |
| Oxygen system | PWIT | PWIT | PWIT |
| Other utilities (power, natural gas, nitrogen, water, etc) | PWIT | PWIT | PWIT |
| Reformer | PWIT | PWIT | PWIT |
| Instrumentation and control | PWIT | PWIT | PWIT |

**Paul Wurth S.A. (Luxembourg)**

**Paul Wurth Italia SpA (Italy)**

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# ProSynteg: Paul Wurth role and activities

- Analysis of requirements for adaptation from oxy-tar setup to oxy-coke-breeze setup and definition of layout and general arrangement of the equipment
- Development of technical specifications for the main equipment
- Overall engineering review
- Procurement activities
- Clarifications and preparation of documentation for local authorities permits
- Development of 3D model
- Analysis of requirements about automation and data processing
- Preparation of deliverable D4.1

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# ProSynteg: Paul Wurth role and activities

**WP5 Pilot test campaigns**

Later on

- ✓ **Task 5.1 Realisation of pilot campaigns**
- ✓ **Task 5.2 Analysis of the results**

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# ProSynteg: Paul Wurth role and activities

## WP6 Evaluation of industrial application potential

Later on

**PW support and contribution:**

- ✓ Task 6.1 Flexibility of the process regarding raw materials
- ✓ Task 6.3 Detailed calculation of the value in-use of the syngas at the BF and comparison with direct injection of COG in tuyeres
- ✓ Task 6.4 Safety issues at the BF linked to the new process, to gas injection and to the increase H2 content of the BF top gas
- ✓ Task 6.5 Alternative options for using the hot syngas in reheating furnaces or other combustion applications

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# ProSynteg: Paul Wurth role and activities

**WP7 Detailed CO2 and economic calculations**

Later on

**PW support and contribution:**

✓ Task 7.2 Economic calculations

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