HyInHeat project introduction

The project in brief

Title:	Hydrogen technologies for decarbonization of industrial heating processes
Acronym:	HyInHeat
GAP No.:	101091456
Call:	HORIZON-CL4-2022-TWIN-TRANSITION-01-17
Start/End:	01/01/2023 to 31/12/2026 (48 months)
Total budget:	23.96 Mio. €
EU contribution:	17,71 Mio. €
Coordinator:	RWTH Aachen University

Overall goals

1. Significant reduction of CO_2 emissions of the industrial processes with H_2 heating
2. NO_x levels of the processes at least not higher than the equivalent fossil fuel based solutions
3. Improved energy efficiency of the industrial processes
4. Significant reduction of H_2 fuel consumption of the developed process with regards to the current fossil fuel demand
5. Competitive costs of the developed technologies

The team

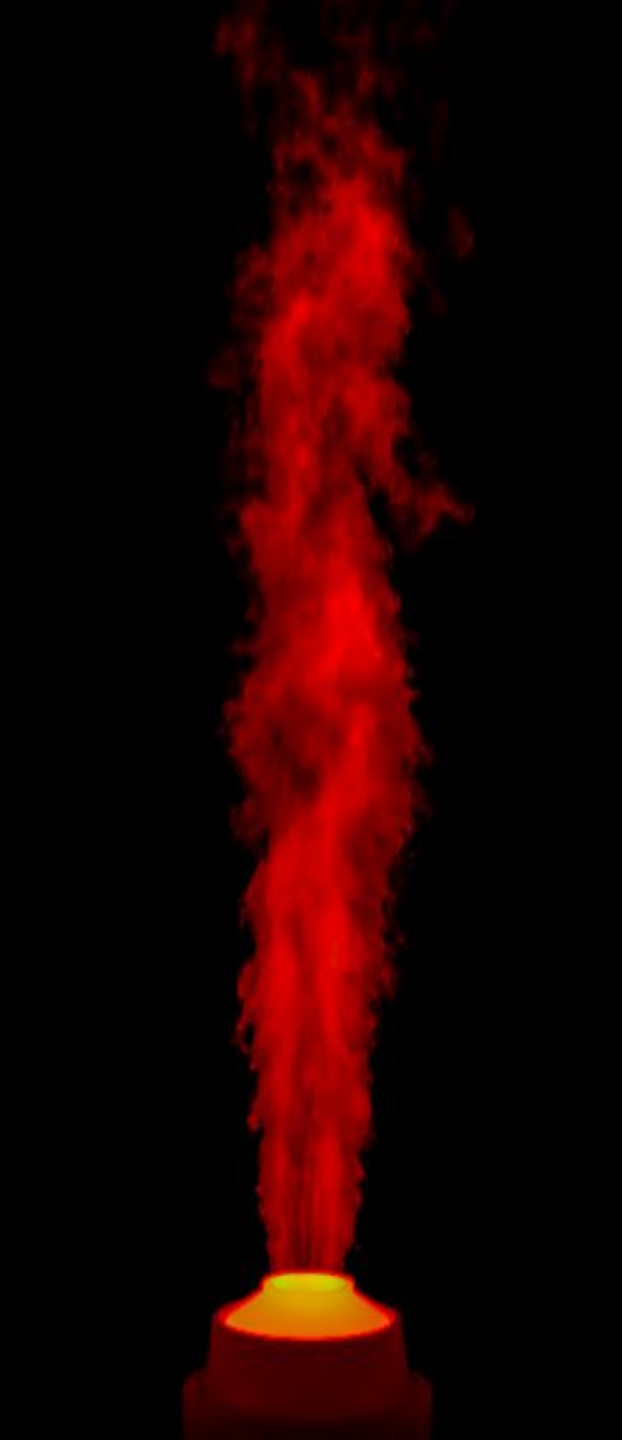
- 3 Steel and 5 Aluminium producers
- 9 Technology suppliers
- 4 Research and Technology organisations
- 4 Universities
- 2 European associations
- 1 Green Innovation Consultant & Marketing expert
- In total: 28 partners from 12 countries

The partners

The challenges

Gas-solid or gas-liquid interactions between furnace atmosphere and product | impact on refractory products and furnace materials | condensation of off-gas | heat transfer and temperature homogeinity | high-temperature chemistry for H_2/O_2 combustion | feed-forward and feed-back combustion control | higher combustion temperatures | higher NO_x formation rates | NO_x emission limit definition | emission measurement technology | safety and risk assessment | flame detection and monitoring

''HyInHeat uses a cross-sectorial approach addressing all the crucial tasks for an energy- and ressource efficient integration of H_2 in two large European sectors, Steel and Aluminium, to be an integral part of the heating solutions throughout the processes of the value chains of the two sectors''



The objectives

Redesign heating processes for H_2 as fuel

8 demonstrators for H_2 heating | 1 full off-gas system redesign | 1 greenfield reheating furnace design study | 2 retrofit design studies

Modify heating equipment and infrastructure for use of H_2

4 burner modifications and optimizations | measurement instrumentation development for fuel supply and combustion control | H_2 compatible fuel supply implementation | refractory investigation and optimization

Develop O_2 combustion processes to improve efficiency

6 demonstrators with pure O_2 as oxidizer | 1 demonstrator with oxygen-enhanced combustion

Integrate instrumentation to characterize fuel composition & flow

2 measurement technologies for fuel quality | combustion control instrumentation development | NOx emission measurement technology development | predictive emission monitoring

Prove economic viability compared to heating alternatives

Demonstrators as baseline | comparison on basis of KPIs | individual business case evaluation

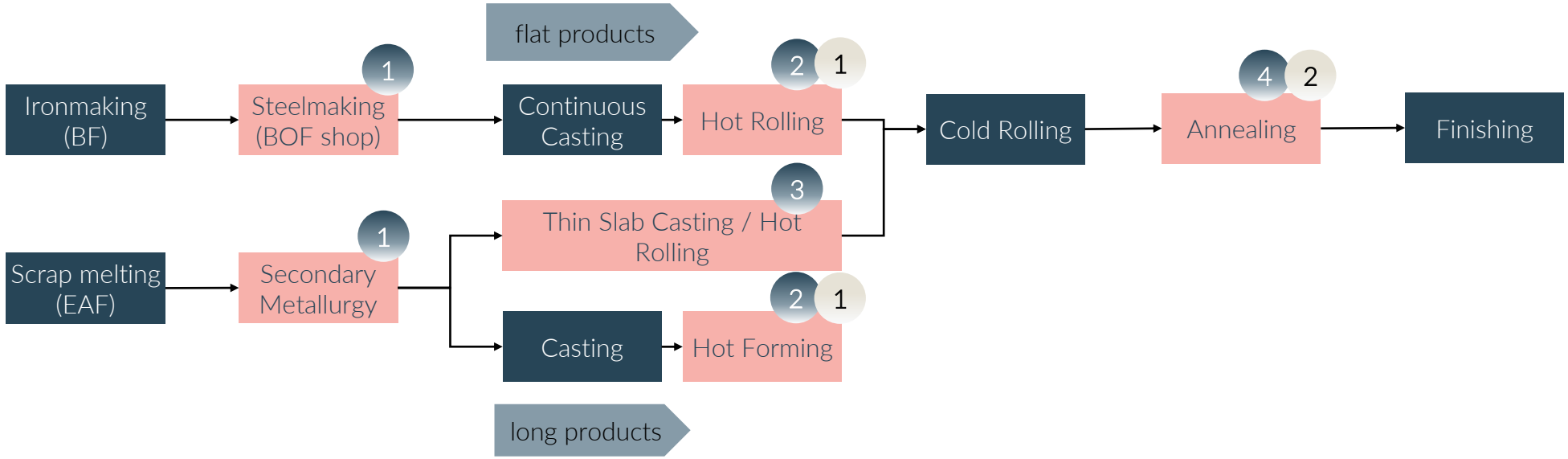
Value chain

Production processes Steel sector

HYINHEAT pilot/full-scale demonstra : HYINHEAT full-scale design studies:

1) ladle preheating
2) reheating
3) heating
4) annealing or galvanizing
5) liquid metal transfer
6) remelting / holding
7) refining
8) annealing

1) reheating
2) annealing or galvanizing
3) remelting / holding
4) homogenizing and reheating



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Value chain

Production processes Aluminium sector

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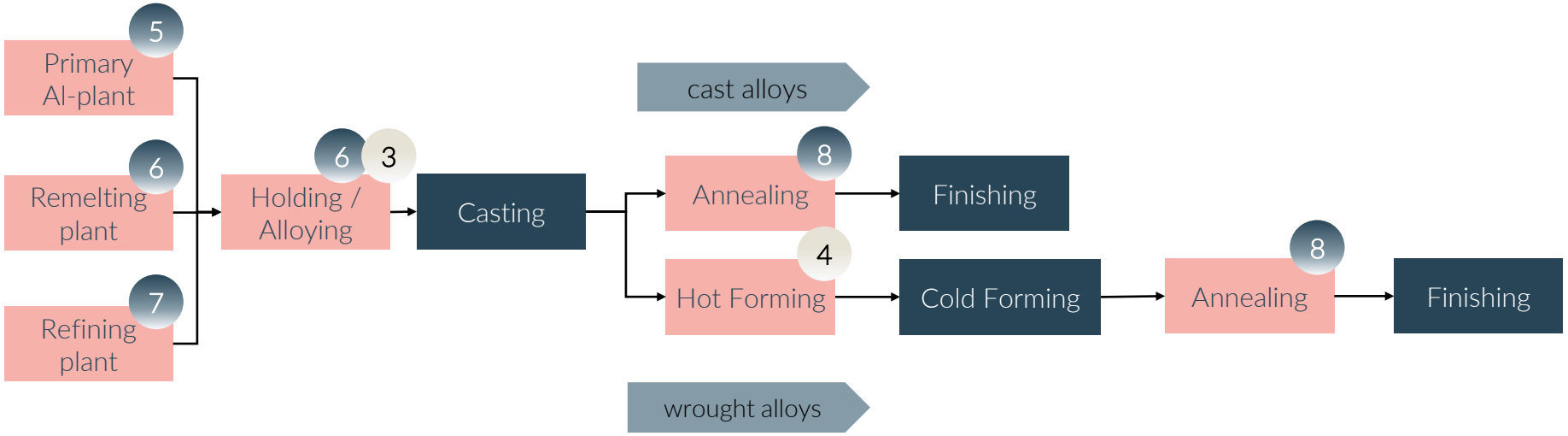


The demonstrators – part 1

Industrial size reverberatory melting furnace

Al

C-Tec, Voreppe, France | aluminium scrap remelting | retrofit from NG/O_2 to H_2/O_2 burner technology | 6.2 kt CO_2 saving for 50 kt/a remelting capacity

Pilot rotary melting furnace

Al

Befesa, Valladolid, Spain | aluminium scrap refining furnace | retrofit from NG/air to H_2/O_2 burner technology | 2.7 kt CO_2 savings for 40.5 kt/a refining capacity

Pilot radiant tube furnace

Fe Al

ArcelorMittal, Gijón, Spain | heat treatment for steel/aluminium | retrofit from NG/air to H_2/air burner technology | 31.0 kt CO_2 savings for 550 kt/a hot dip galvanizing line

Pilot walking beam furnace

Fe

SWERIM, Lulea, Sweden | steel reheating for hot rolling | retrofit from light oil/air to H_2/air/O_2 burner technology | 386 kt/a CO_2 savings for 3100 kt/a reheating frunace

The demonstrators – part 2

Industrial liquid metal transfer heater

Al

Mytilineos, Agios Nikolaos, Greece | liquid aluminium transfer | retrofit from NG/air to H_2/O_2 burner technology | 0.3 kt/a CO_2 savings

Industrial ladle preheating station

Fe

Celsa Nordic, Mo i Rana, Norway | steel ladle preheating | retrofit from NG/air to H_2/O_2 burner technology | 5.7 kt CO_2 savings for 350 kt/a steel plant

Industrial tunnel heating furnace

Fe

ArcelorMittal, Sestao, Spain | steel thin slab heating | retrofit from NG/air to H_2/air burner technology | 90.0 kt CO_2 savings for 1600 kt/a steel coil

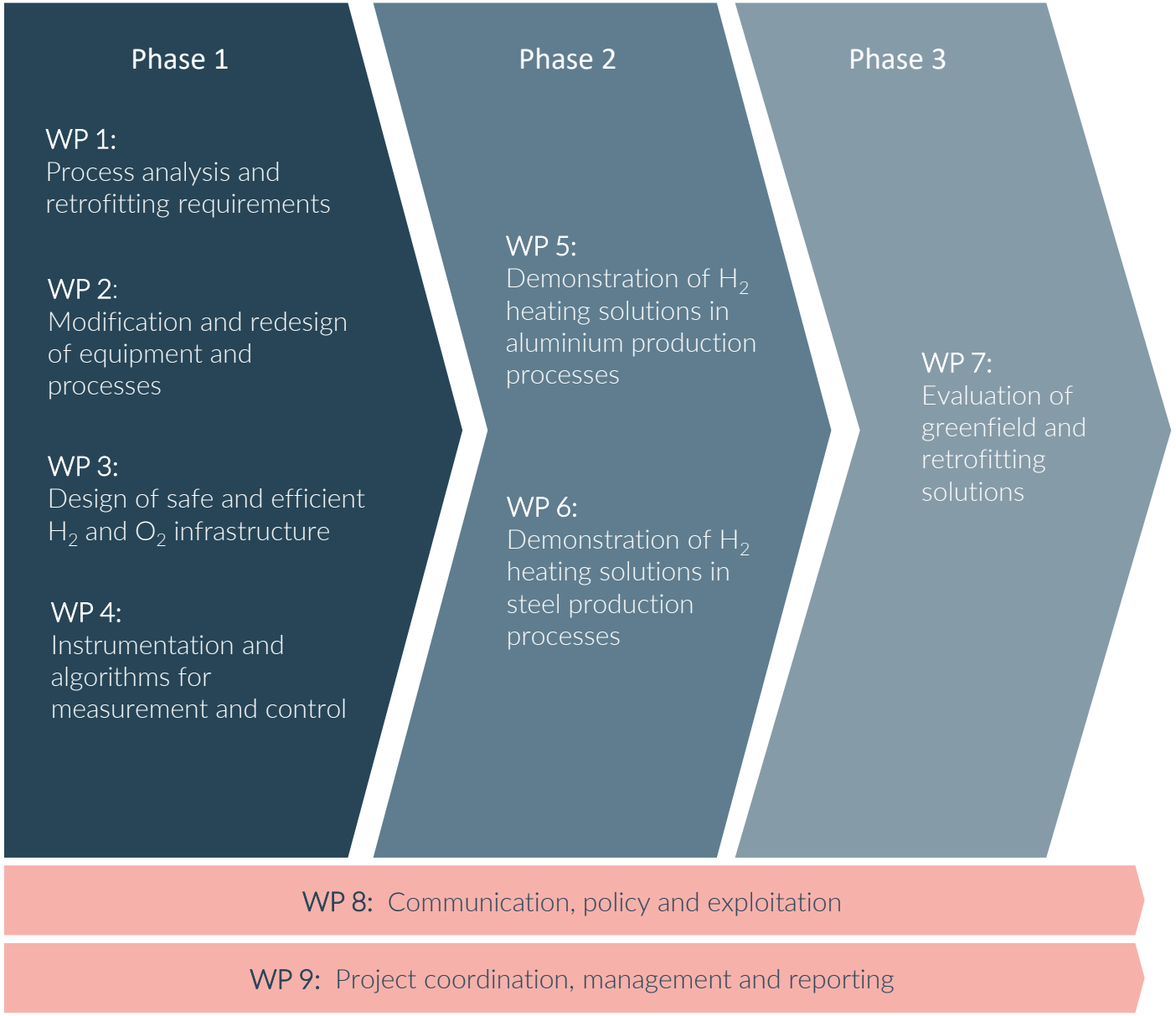
Industrial annealing furnace

Al

Toyota, Walbrzych, Poland | aluminium part heat treatment | retrofit from NG/air to H_2/O_2 burner technology | 0.1 kt/a CO_2 savings

The Workplan

- 9 work packages
- Phase 1: Technology development and adaption
- Phase 2: Implementation and validation
- Phase 3: Evaluation and analysis
- Accompanying dissemination and exploitation
- Consistent project and risk management



The timing

WP No.	Work Package	Lead	2023				2024				2025				2026			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Process analysis and retrofitting requirements	TECNALIA	■	■	■													
2	Modification and redesign of equipment and processes	LINDE		■	■	■	■	■	■	■								
3	Design of safe and efficient H_2 and O_2 infrastructure	POLIMI		■	■	■	■	■										
4	Instrumentation and algorithms for measurement and control	SICK		■	■	■	■	■	■	■								
5	Demonstration of H_2 heating solutions in aluminium production processes	GHI							■	■	■	■	■	■				
6	Demonstration of H_2 heating solutions in steel production processes	CELSA						■	■	■	■	■	■	■				
7	Evaluation of greenfield and retrofitting solutions	NTNU											■	■	■	■	■	
8	Communication, policy and exploitation	EGEN	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
9	Project coordination, management and reporting	RWTH	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■