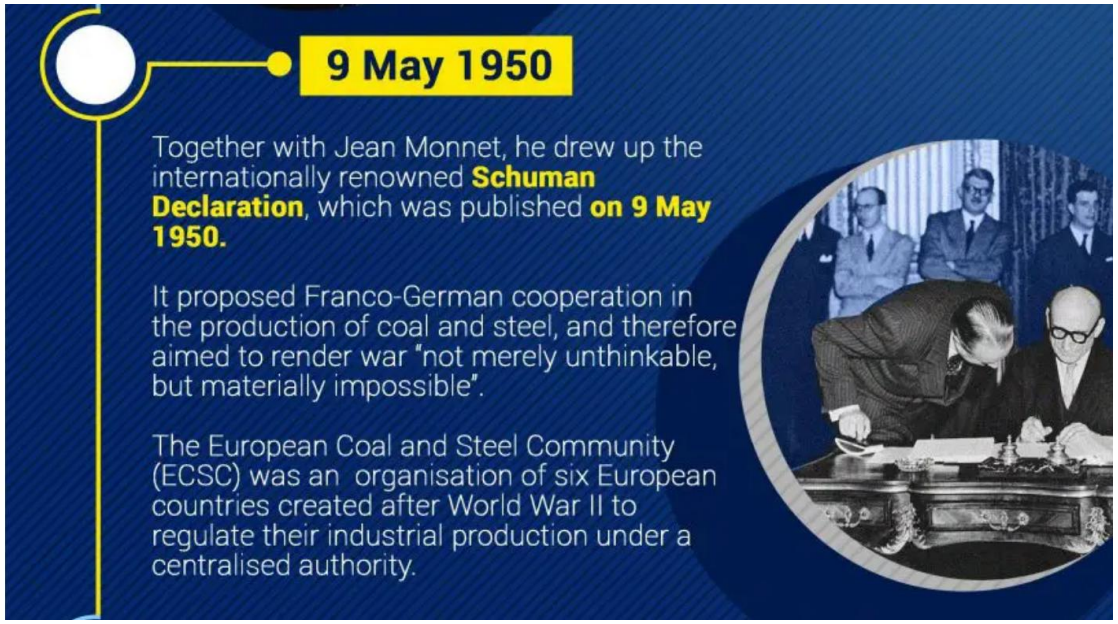
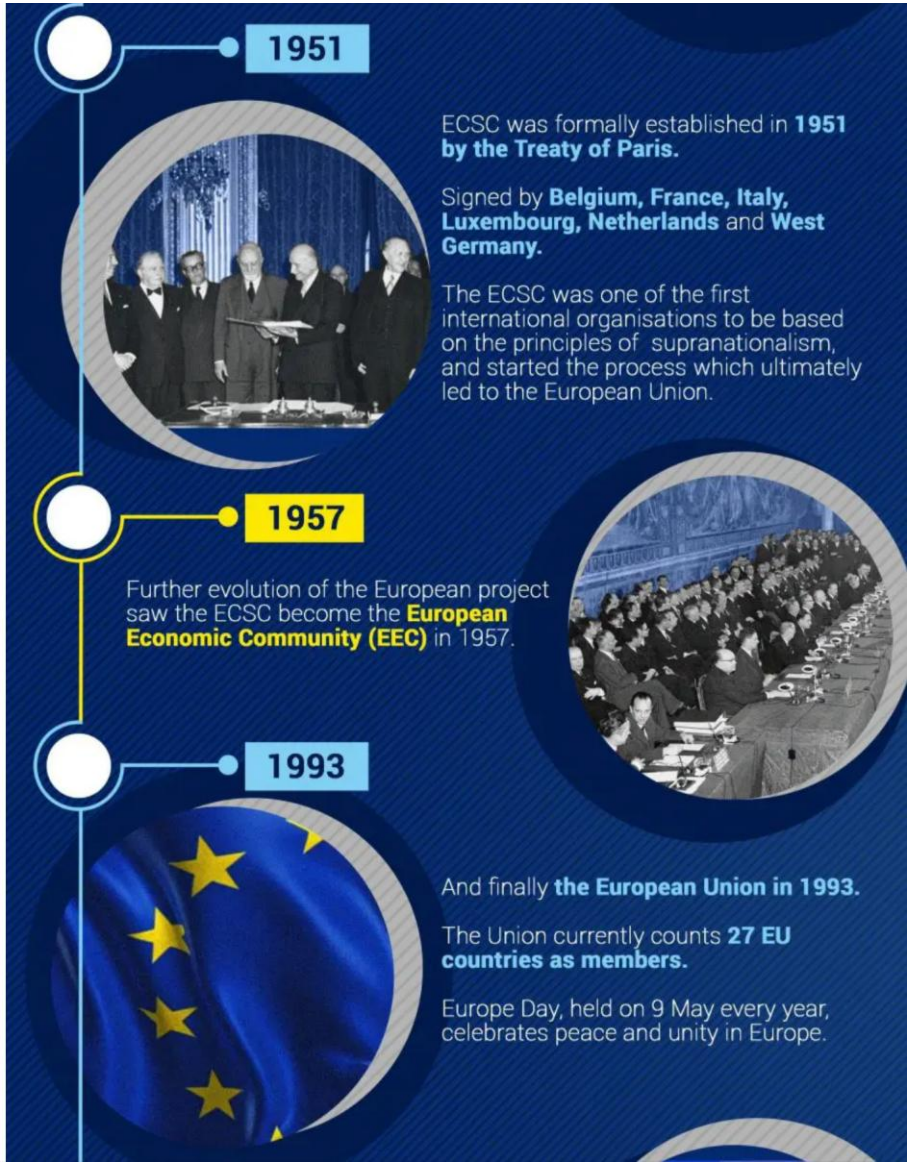
Transformation of the EU Steel Industry the role of innovation, collaboration and standardisation

Singapore, 02 December 2025

Dr. Klaus Peters
Secretary General, ESTEP

Collaboration – Steel and Coal Community showcased the way to the EU





Source: EUAM-Ukraine.eu, link

Origin of the Research Fund for Coal and Steel (RFCS) = ECSC

- In the year 1952 the first “European Union” in the form of the “European Coal and Steel Community (ECSC)” had been founded, starting with 6 member states (treaty of Paris)
- The ECSC had been financed by money from the steel producers in Europe. The money was collected as special levy on steel production.

Funding aspects

- The ECSC's **budget** was funded by **levies on coal and steel production** and by contracting **loans**. The levies were intended to cover administrative expenditure, non-repayable aid towards retraining workers, and technical and economic research (which needed to be encouraged). Money received from borrowing could only be used to grant loans.
- In the field of **investment**, in addition to granting loans, the ECSC could guarantee loans contracted by companies with third parties. The ECSC also had the power to provide guidance on investments which it did not fund.

Source: https://eur-lex.europa.eu/EN/legal-content/summary/treaty-establishing-the-european-coal-and-steel-community-ecsc-treaty.htm

- Beneath financing many economical and social topics, the common research was an important aspect of the ECSC.
- The ECSC treaty expired on 23rd July 2002 and needed a successor.

The 15 ECSC (EU) members in 2002

Date	Members	Members added
23 July 1952	6	The *Inner Six*: Belgium, France, West Germany, Italy, Luxembourg and the Netherlands
1 January 1973	9	Denmark, Ireland and the United Kingdom
1 January 1981	10	Greece
1 January 1986	12	Portugal and Spain
1 January 1995	15	Austria, Finland and Sweden

Source: https://en.wikipedia.org/wiki/European_Coal_and_Steel_Community

Backbone of EU Steel Research: RFCS

- After expiring of the ECSC treaty in 2002 it had been decided, to use the still **existing assets** (around 2 billion €) as basis for a new research programme
- RFCS = **R**esearch **F**und for **C**oal and **S**teel
  - Check and balance by inclusive approach
  - Technical groups composed of steel producers and academia steered the projects
- Use the **interest rates of these assets** of the ECSC (now ECSC in Liquidation =ECSC i.L.) to finance the new fund. Worked well for the first years until the financial crisis 2008/2009 and low interest rates.
- Deviation of budget between steel and coal: 72,8% to 27,2%
- 2021 Modernisation of RFCS
  - Using interest rates and part of the assets
  - Period of Horizon Europe (2021-2027)
  - 40 million € annual budget for coal and steel
  - 52 million € annual contribution to the EU Clean Steel partnership
  - 2025 Steel and Metal action Plan announces the reform of RFCS

Enrico Gibellieri

Presidente del Comitato consultivo CECA

27.6.2002

23.7.2002

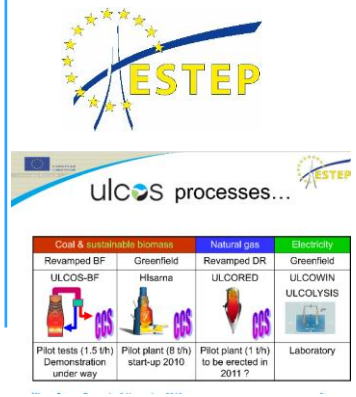
European Steel Technology Platform (ESTEP) - Timeline

Vision

ESTEP is the dissemination and communication platform for EU Steel Research Activities

2004

Establishment of ESTEP in context of ULCOS



2015

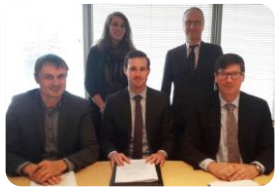
Appointment of Secretary General: Dr. Klaus Peters

2017

Strategic Research Agenda (SRA)

2018

Legal entity (AiSBL): Incorporation by 13 founders



2021

Clean Steel Partnership

2023

ESTEP Support towards standardization

2025

Cooperation + International presence

More info: https://www.estep.eu/

European Steel Technology Platform (ESTEP) – Overview

- European Technology Platform (EU 2020)
  - Created in **2004** (ULCOS) and reconfirmed by EC in 2013
  - Legal entity (AiSBL): incorporation by 13 founders in March 2018
  - Members more than 5-fold by 2025: 73 members (March 2025)
  - Open for organisations from EU + associated countries (steel producer, technology provider, university, RTO, SME, …)
- Exchange with European Commission
- ESTEP mission

  Collaborative EU actions (projects) on innovative technology to tackle EU challenges (renewable energy, climate change (CO_2), Circular Economy) in order to create a sustainable EU steel industry

- Collaborative work in 6 Focus Groups
  - Thematic conferences
  - Initiate proposal writing
  - Road mapping and publication
  - Work towards standardization
  - Position papers

- EU Clean Steel Partnership (CSP)

  ESTEP facilitates the private side

The Clean Steel Partnership

ESTEP SRA available at ESTEP.eu

Collaboration of ESTEP in 2025

April

9TH INTERNATIONAL SLAG VALORISATION SYMPOSIUM
FROM RESIDUES TO RESOURCES AND RESILIENCE
8-11 APRIL 2025 LEUVEN, BELGIUM

KU LEUVEN

Sep

5th Aachen Thermoprocess Colloquium
Home › 5th Aachen Thermoprocess Colloquium

IOB Institut für Industrieofenbau und Wärmetechnik | RWTH AACHEN UNIVERSITY

Climate Action BREAKTHROUGH TECHNOLOGY CONFERENCE worldsteel ASSOCIATION 2025

Supported by:

SEAISI South East Asia Iron and Steel Institute Company No: 993483-M

ESTEP European Steel Technology Platform

Dec

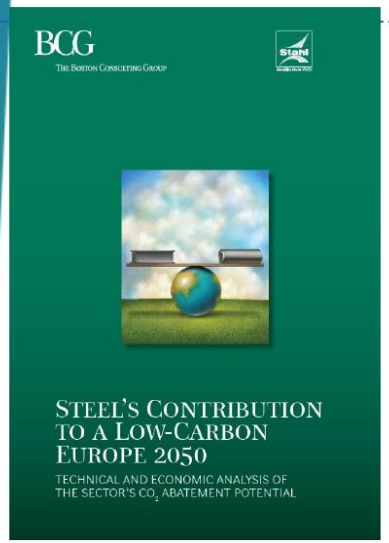
Oct

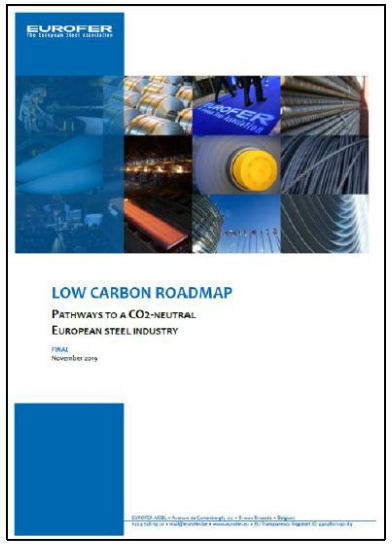
Nov

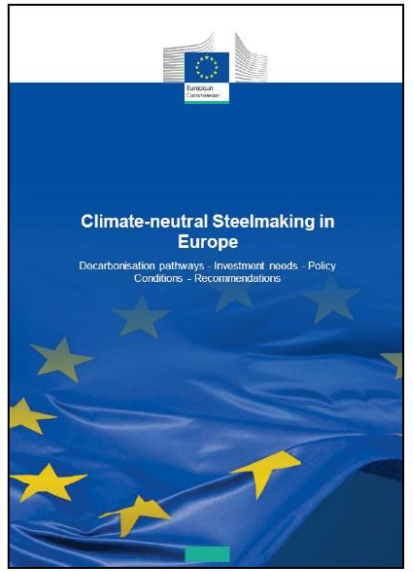
EU Steel Research focussed on Decarbonisation

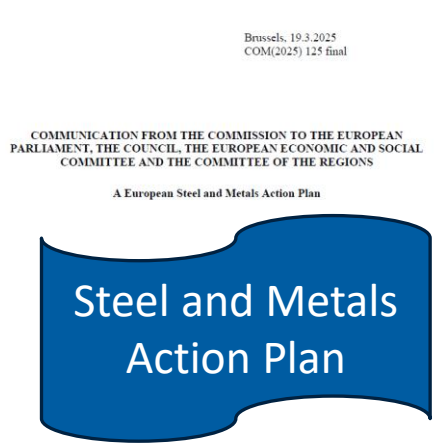
Innovation in and with EU steel:

Several roadmaps are publicly available









Steel and Metals Action Plan

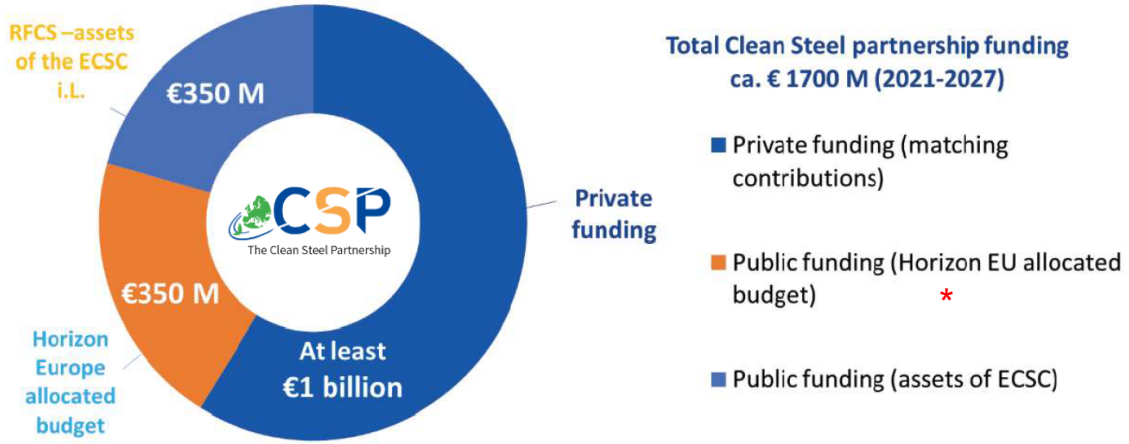
- https://www.eurofer.eu/publications/reports-or-studies/low-carbon-roadmap-pathways-to-a-co2-neutral-european-steel-industry
- https://www.estep.eu/clean-steel-partnership
- https://www.estep.eu/projects/estep-projects/green-steel-for-europe/publications

EUROFER
THE EUROPEAN STEEL ASSOCIATION

www.eurofer.eu

Horizon Europe 2021-2027

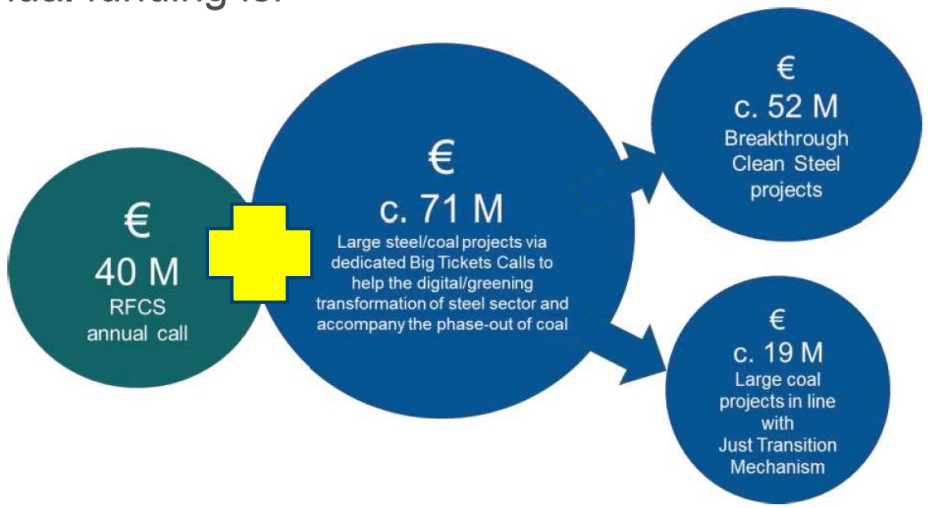
- Dedicated investment of € 350 million, with contribution of private funding.
- Clean Steel has 2 sources of funding, HE and RFCS, contributing to research & innovation with a total of € 700 million in the period 2021-2027.



* ECSC=European Coal and Steel Community (grandfather of the EU)

RFCS

- By Council decision it relies on multiannual technical guidelines.
- With the new legal base in force since 2021 the annual funding is:



The distribution of funding is set at **27.2 %** for coal-related research and **72.8 %** for steel-related research, as provided for by Article 4(2) of the implementing measures, decided by the Council in 2003.

EU Clean Steel Partnership

Accelerate towards net zero CO_2 steelmaking

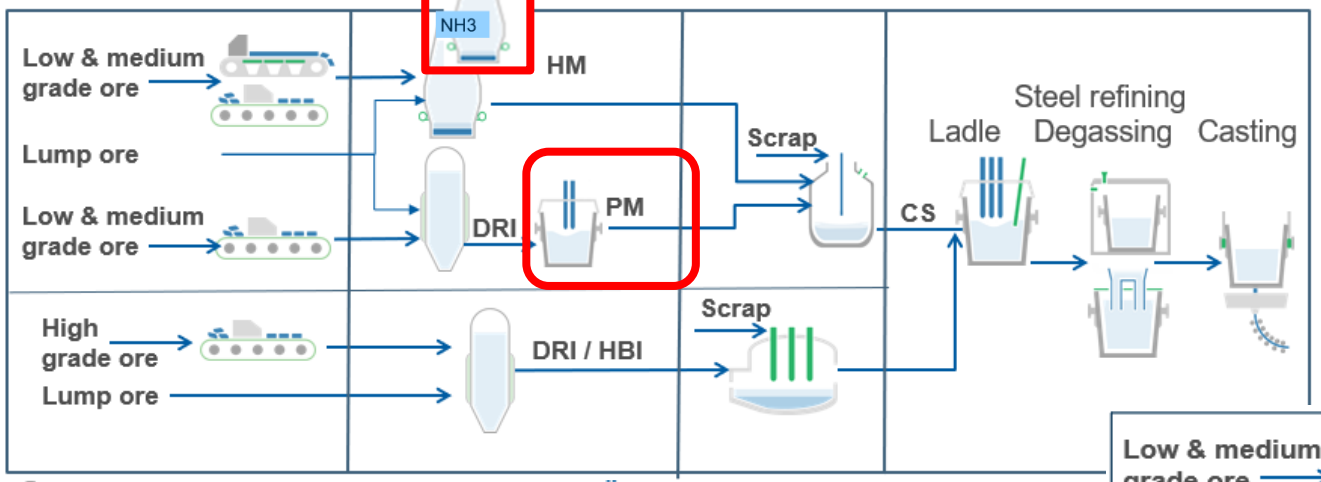
- Partnership in the frame of Horizon Europe (HEU) in 2021 to 2027/2030
  - Unique setting due to synergies of public financial pillars (HEU + **R**esearch **F**und **C**oal+**S**teel)
  - Memorandum of Understanding signed by ESTEP + European Commission (RTD+Grow)
- CSP-Budget: € 1.7 billion
  - €350 million from Horizon Europe
  - €350 million from assets of the ECSC* in Liquidation (source of RFCS funding)
  - At least matched by steel sector (expected €1.000 million)
- Projects
  - size: € 10-100 million
  - Developments starting at TRL 6 to end up with TRL 8 (Technology Readiness Level)
    exceptional start at 5 to end up with at least TRL 7
  - 2 + 2 demonstrators showing CO_2 emission reduction potential of at least 50% (80%)
- Strategic Approach by 12 Building Blocks
  - Building Blocks define collaborative research areas
  - Impact by linking the Building Blocks with company pathways
    - Carbon Direct Avoidance
    - Smart Carbon Usage (Process Integration and CCUS)
    - Circular Economy
  - Enablers: People + Digitization (2% of the total budget)

*ECSC=European Coal and Steel Community (grandfather of the EU)

Transformation of EU steel industry

Co-existence of breakthrough and traditional steelmaking processes

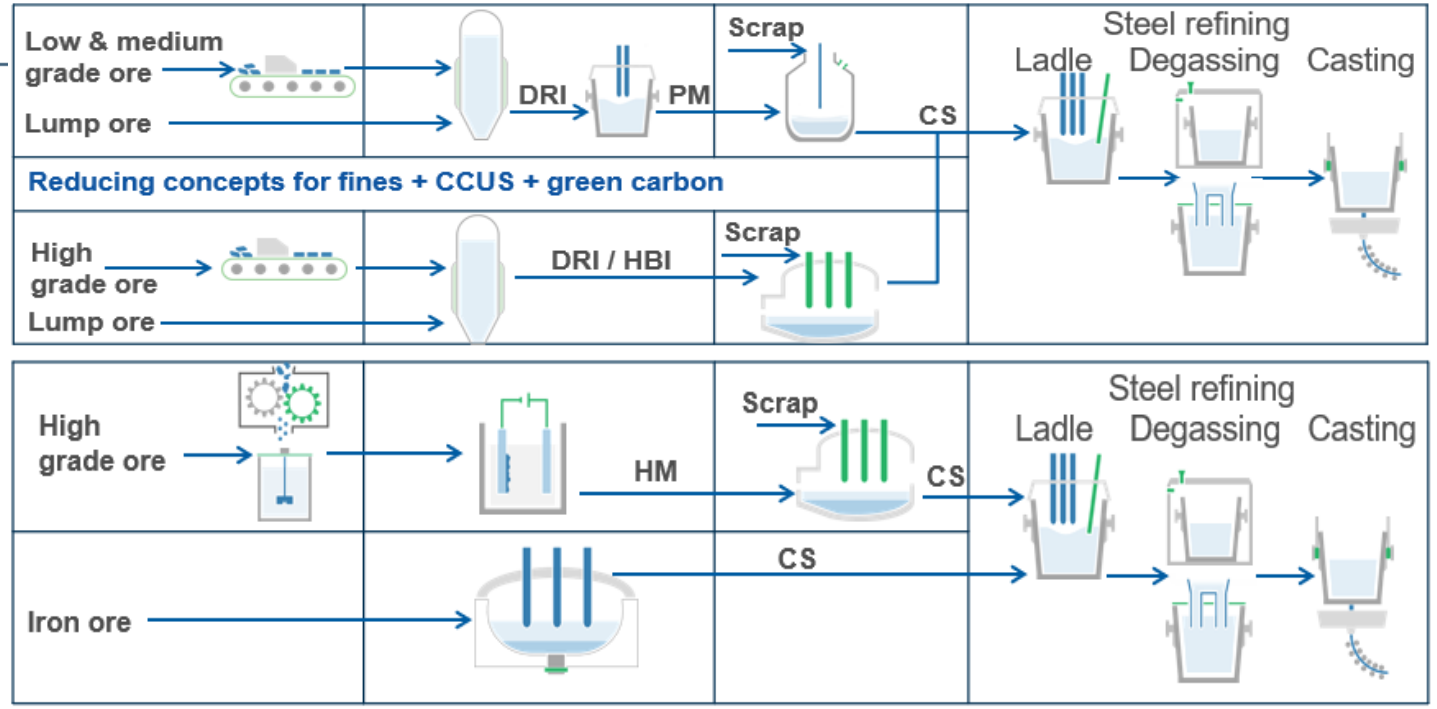
Near term (2030) | Mid term (2040) | Long term (2050)



New ideas generated since 2021

3 examples

- Primary melter
- Hydrogen BF
- Flash Reactor



Sinter plant
Pellet plant
Blast furnace (BF)
Direct reduction (DR) plant
Basic Oxygen Furnace (BOF)
Electric Arc Furnace (EAF)
Electric Smelter (Submerged Arc Furnace)
Grinding
Leaching
Iron electrolysis
Molten oxide electrolysis

HM Hot Metal
DRI Direct Reduced Iron
PM Pre Melt
CS Crude Steel
HBI Hot Briquetted Iron
CCUS Carbon, Capture, Utilization and Storage

Source: sustainability summit 2022 + ESTEP + Green Steel 4 Europe

37 Clean Steel Partnership Projects (2021 onwards)

Total Funding = 204.3 million € [Horizon Europe: 107.3 and RFCS BT: 97.0]

Horizon Europe: 107.3 million € funding (funding rate 70% to 100%)

No.	Project Acronym	Funding call	Area of Intervention	EU Funding (mln Euro €)
1	MaxH2DR	HEU 2021 #18	CDA	4.2
2	HIYIELD	HEU 2021 #19	CE	3.6
3	RemFRa	HEU 2021 #19	CE	4.8
4	CAESAR	HEU 2021 #19	CE	5.6
5	RecHycle	HEU 2021 #22	COMB	6.2
6	PURESCRAP	HEU 2022 #13	CE	5.0
7	TransZeroWaste	HEU 2022 #13	CE	5.0
8	GreenHeatEAF	HEU 2022 #16	PI	3.6
9	ModHEATech	HEU 2022 #16	PI	3.4
10	HyTecHeat	HEU 2022 #16	PI	3.4

No.	Project Acronym	Funding call	Area of Intervention	EU Funding (mln Euro €)
11	Agiflex	HEU 2023 #43	SCU	4.7
12	H2PlasmaRed	HEU 2023 #43	PI	6.0
13	Dust2Value	HEU 2023 #45	CE	4.6
14	ZHyRON	HEU 2023 #45	CE	4.5
15	MEDALS	HEU 2023 #45	CE	5.7
16	SMARTChain	HEU 2024 #44	ENA	5.0
17	DiGreeS	HEU 2024 #44	ENA	5,0
18	ProcTwin	HEU 2024 #44	ENA	4.8
19	NANO-S-MART	HEU 2024 #46	CE	3.1
20	E-ECO Downstream	HEU 2024 #46	CE	5.0
21	ZEROSTEEL	HEU 2024 #46	CE	5.0
22	MOWSES	HEU 2024 #46	CE	4.6
23	CISMA	HEU 2024 #46	CE	4.5

37 Clean Steel Partnership Projects (2021 onwards)

Total Funding = 204.3 million € [Horizon Europe: 107.3 and RFCS BT: 97.0]

Research Fund for Coal and Steel (RFCS): **97.0 million €** (funding rate 50%)

No.	Project Acronym	Funding call	Area of Intervention	EU Funding (million Euro €)
24	MODIPLANT	RFCS BT 2022	PI	8.0
25	FULL2REHEAT	RFCS BT 2022	PI	8.6
26	HYDREAMS	RFCS BT 2022	PI	4.3
27	TWINGHY	RFCS BT 2022	PI	4.5
28	SLAG2BUILD	RFCS BT 2024	CE	4.6
29	Hy4Smelt	RFCS BT 2024	CDA	18.0
30	H2Loop	RFCS BT 2024	CDA	6.2
31	CROSSCUT	RFCS BT 2024	SCU	5.0
32	PRISMA	RFCS BT 2024	ENA	5.1
33	SUPERHEAT	RFCS BT 2025	CDA	3.1
34	RIVER	RFCS BT 2025	SCU	6.9
35	SHINE	RFCS BT 2025	CDA	14.7
36	BSI	RFCS BT 2025	CE	2.4
37	GreenHeat4Rails	RFCS BT 2025	ENA	5.6

Preliminary Data (September 2025)

Examples of EU steel research projects

Scrap

Decarbonisation

Standardisation

ISO Standards

Slags etc.

Digitisation

Collaboration

Scrap Cluster Workshop @ ESTEP, April 2025

- 4 projects joined and discussed how to optimise scrap quality and usage
- Purescrap (workshop leader), CISMA, DiGreeS, CEASAR
- Hybrid workshop

4 projects on Scrap

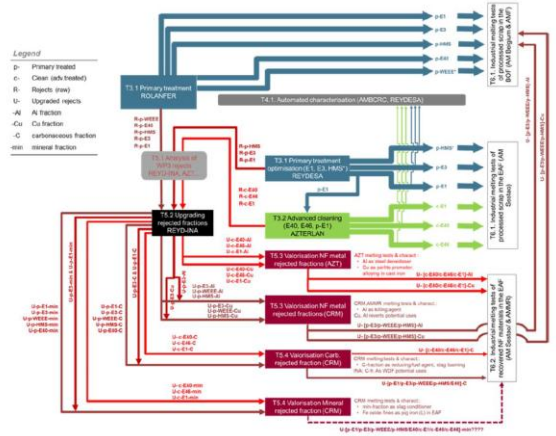
CAESAR ambition: upgrade ferrous scrap & valorise cleaning residues

Project aims

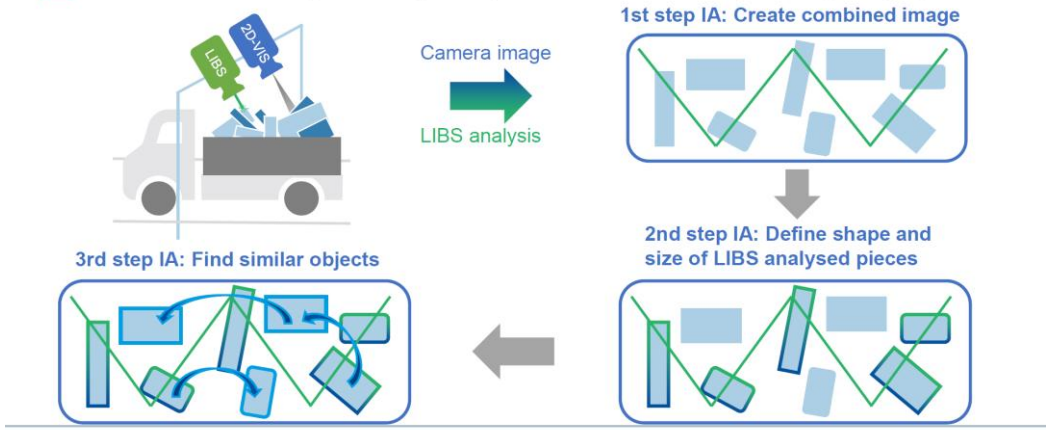
- ✓ to improve sorting of purely FE scrap
- ✓ to valorize all the treatment by-products:
  - Non-ferrous metals
  - Carbon bearer materials (plastics, wood…)
  - Mineral fraction

Work on the optimization of separation and purification steps

➢ **Sensor-based sorting**



DiGreeS Heavy melting scrap verification – Image analysis (IA)

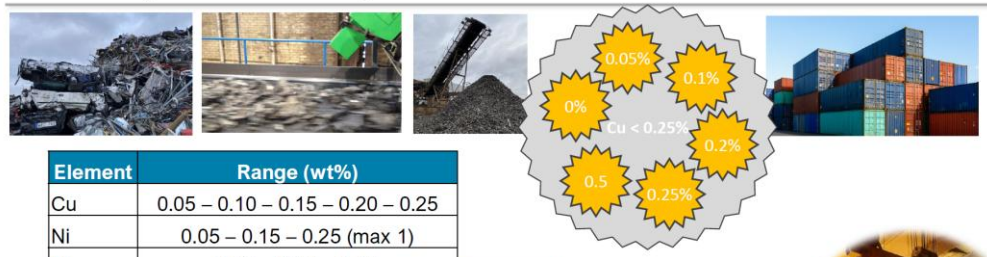


ULiège robotic sorting line

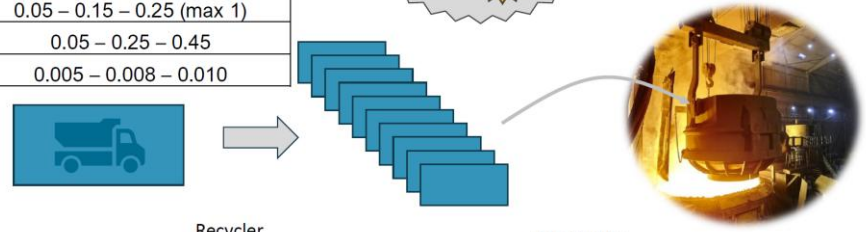
PICKIT – MULTIPICK: first industrial line sorting 10 000 t/year of Zorba @ Comet Traitements in Obourg (Belgium)

THE PURESCRAP CONCEPT

Batch analysis with chemistry and size information



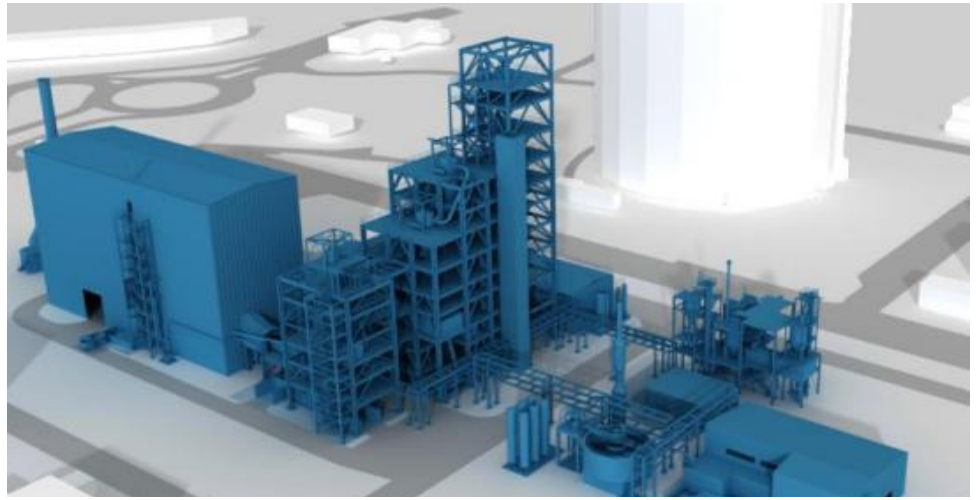
Element	Range (wt%)
Cu	0.05 – 0.10 – 0.15 – 0.20 – 0.25
Ni	0.05 – 0.15 – 0.25 (max 1)
Mo	0.05 – 0.25 – 0.45
Sn	0.005 – 0.008 – 0.010



Hy4Smelt: 50.5 mln € total budget – 18 mln € funding

Hydrogen-based fluidised bed direct reduction of ultra-fine iron ores and smelting to green hot metal

A breakthrough process of hydrogen-based, CO2-neutral reduction and melting of non-agglomerated low/medium-grade iron ore.
The industrial-scale demonstrator is first-of-its-kind worldwide in processing ultra-fine iron ores in an innovative fluidised bed direct reduction (DR) with 100 % green H2 and melting the direct reduced iron in a renewable powered electric furnace.
Duration: 54 months



Expected impact:

- Push forward decarbonisation of the steel sector/high CO2 reduction
- Substitution of 55 blast furnaces operated in the EU
- Flexible use of varying ore qualities: high raw material supply security
- Circular economy: smelter slag utilisation as secondary raw material
- Initialisation of wide market uptake of new green ironmaking process

Consortium:

- Primetals Technologies Austria GmbH (AT)
- voestalpine Stahl GmbH (AT)
- K1-MET GmbH (AT)
- ESTEP (BE)
- University of Salento (IT)
- Lösche GmbH (DE)
- University of Weimar (DE)
- Sant'Anna School of Advanced Studies (IT)
- Cemex España Gestion Y Servicios Sl. (ES)

Hy4Smelt – Groundbreaking Ceremony 23 Sep. 2024

Unique financing of the overall project:
RFCS Big Ticket Funding supports OPEX, while national funding supports CAPEX

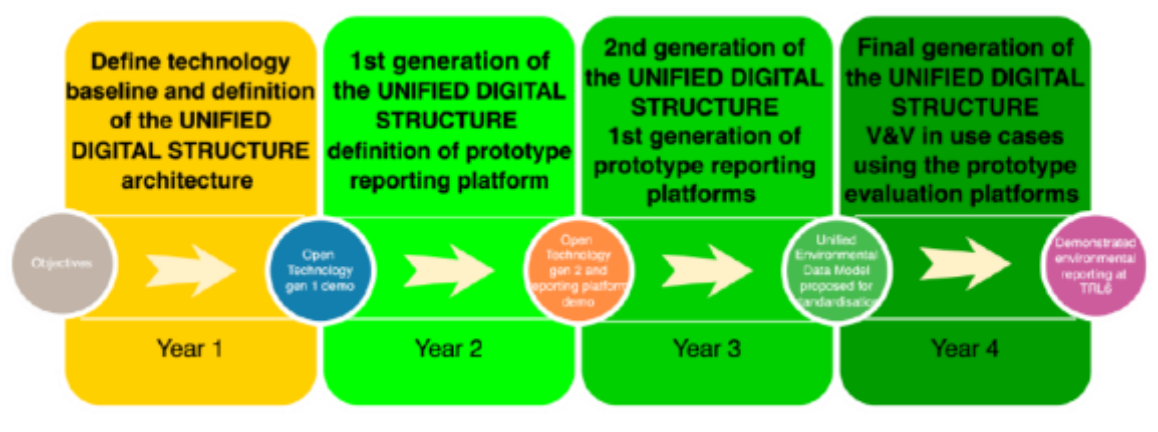
Flagship Project: The RFCS Big Ticket PRISMA Project- 1

RFCS Big Tickets calls 2024

PRISMA

PRODUCT ENVIRONMENTAL FOOTPRINT INFORMATION SYSTEM FOR STEEL MANUFACTURING

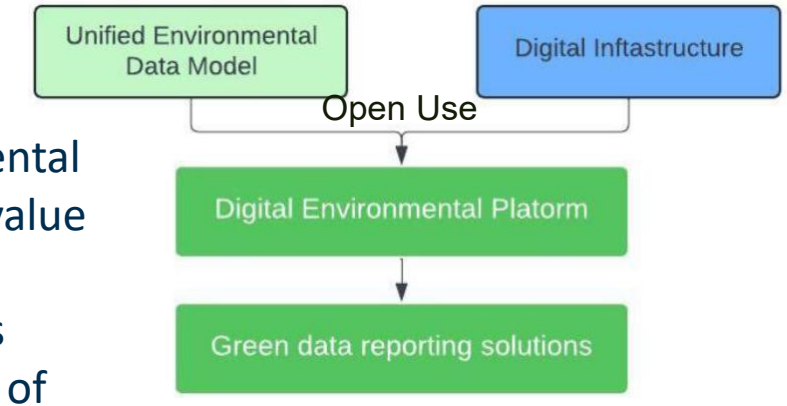
Key word: Digitalisation, Standardization, Interoperability, Open Use, Environmental footprint, LCA, Environmental, data management, Sustainability, Steel Manufacturing.



Total Costs ≈10 M€ (funding 50%)

GOALs:

- develop a Unified Environmental Data Model (UEDM), streamlining environmental reporting and analysis across the steel value chain.
- quantify and mitigate steel production's carbon footprint through the direct use of in-line information for life cycle assessments (LCAs) and digital product passports (DPPs).



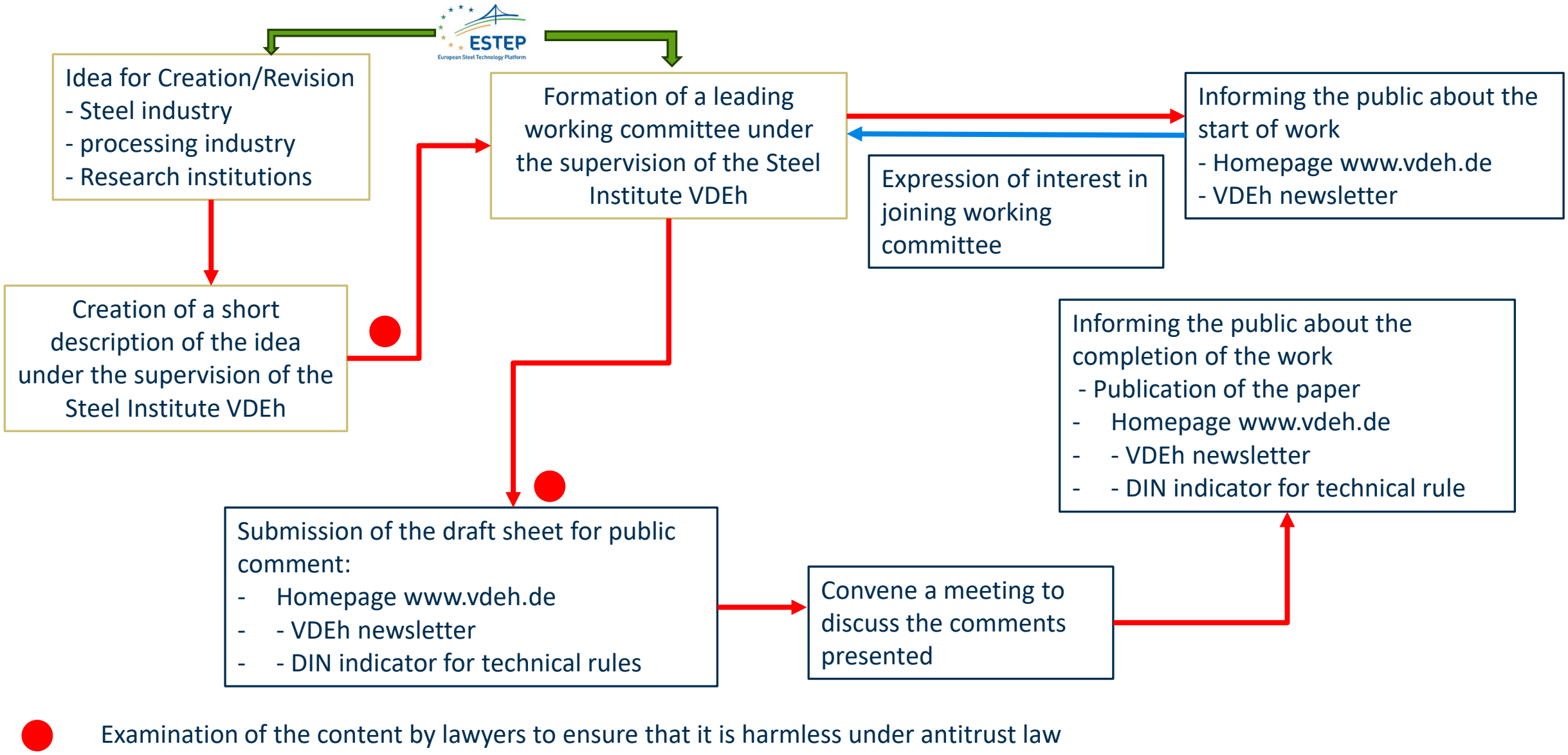
Started on 01.04

Y1 activities ongoing

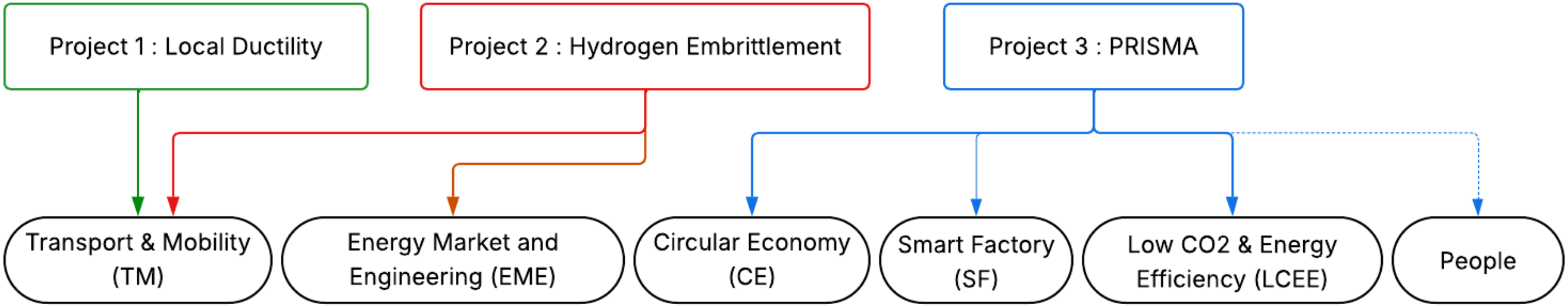
ESTEP's work towards Standardisation

- ESTEP started in 2023 to support the work towards standardization
- Bridging Industry Efforts
  - Industries pursue standardization independently
  - **ESTEP provides a shared, neutral platform** to coordinate and amplify the impact
- Driving Pre-Standardization Success
  - **Leverages member expertise** to develop critical standards
  - **Focus Groups** facilitate:
    - Technical specification development
    - Validation of methodologies
    - Formal documentation for standardization bodies (Pre-standardization document)
- Connecting Members to Authorities
  - Identifying **early pathways** for potential standardization
  - Facilitates communication and alignment with standardization bodies and regulatory authorities.

ESTEP's Role in the work towards standardisation



Linking ESTEP Standardization Topics with Focus Groups



Interdisciplinary Nature of Topics

- Standardization themes cut across multiple ESTEP Focus Groups.
- Projects support several thematic areas simultaneously, ensuring broad industrial relevance.

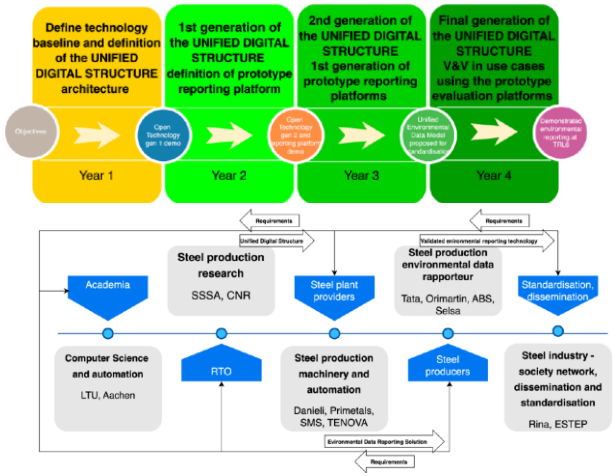
Key Message

- ESTEP's standardization projects integrate expertise from multiple Focus Groups.
- This interdisciplinary collaboration accelerates the development of strong and widely applicable standards.

Funded project examples: PRISMA + CISMA

- CSP Project: PRISMA*
  - April 2025- March 2029
  - Product environmental footprint information system for steel manufacturing (PRISMA)
  - To develop a Unified Environmental Data Model (UEDM), streamlining environmental reporting and analysis across the steel value chain.
  - *https://prisma-project.eu*

Funded by the European Union



prisma

Kickoff Meeting April 2025

- CSP Project : CISMA*
  - November 2024 – April 2028
  - High-quality sheet steel production from 100% scrap-based EAF routes, reducing CO_2 emissions compared to traditional methods. It focuses on managing residual elements like Copper, improving scrap quality and developing digital tools, with validation through pilot trials in automotive and white goods sectors.
  - *https://cisma-project.eu*

Funded by the European Union

ESTEP project examples Hydrogen measurement + Local ductility

1) ESTEP Project: Hydrogen measurement in zinc-coated cold rolled strip*

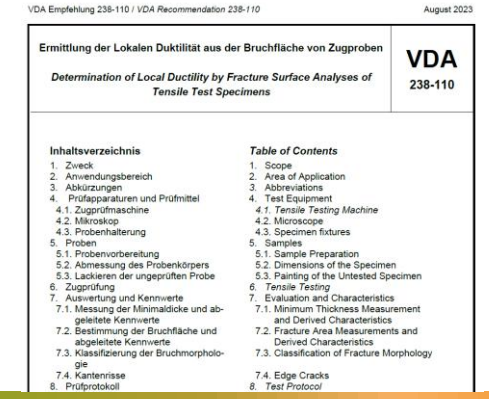
- Started from March 2022 (Ongoing)
- Increased application of lightweight design materials in the automotive industry, mostly in zinc-coated condition, therefore,
  - Higher the strength, the higher the risk of hydrogen emrittlement
- New concept for sample preparation for the hydrogen measurement (“Diffusible” or weakly trapped hydrogen).
  - New Work Item Proposal (NWIP) submitted in ISO on *Zinc-coated low alloy steel — Method for preparation of test specimens for hydrogen embrittlement testing in sheets and components*, presented to ISO/TC 17/SC 7 in March 2025 at Stockholm, Sweden.


- **“Hydrogen measurement in Zn-coated cold-rolled strip”** from ESTEP with the support of NBN (Doc. N 1218)
The proposer, Mr Akilesh Swarnakar, made a presentation on Sample preparation for hydrogen determination in zinc-coated low alloyed steel sheets and components.
The objectives are the diffusible or weakly trapped hydrogen (<400°C): the galvanized high-strenght steels used in structural components.
The challenge is the lack of detailed description of sample pretreatment and
5

ISO/TC 17/SC 7
Methods of testing (other than mechanical tests and chemical analysis)
Draft Minutes
ISO/TC 17/SC 7
26th March 2025
Date: 2025-04-11
Secretariat: AFNOR
Chair: HOLLEBECQ Louis-Jean, ilc@compalab.org
Committee Manager: Kamokoue Julie, j.kamokoue@unm.fr
measurement.
During discussions, it was pointed out that the current title is confusing. The title of this project should not imply that the proposal is about a method for determining hydrogen (whether free or total), but rather a method for sample preparation for hydrogen embrittlement tests.

2) ESTEP Project: Local Ductility – Part 2

- Feb 2024 – March 2026
- Deeper knowledge about dependencies of local ductility measurements on sample geometry and testing parameters.
- Recommendation will be given for VDA 238-118 revision.


VDA Empfehlung 238-110 / *VDA Recommendation 238-110* August 2023

Ermittlung der Lokalen Duktilität aus der Bruchfläche von Zugproben
Determination of Local Ductility by Fracture Surface Analyses of Tensile Test Specimens
VDA 238-110

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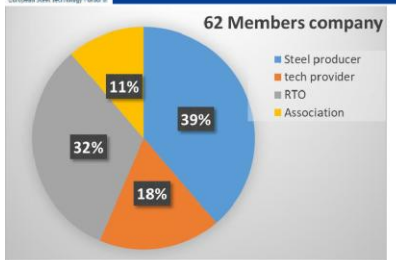
**https://www.estep.eu/publications*

Slag workshop: March 2025 in Duisburg, Germany

ESTEP Focus Group Circular Ecomony



ESTEP
European Steel Technology Platform

Circular Economy
Circular economy & sustainability

- Training → **Competence sharing**
- Design → **Implementation by projects**
- Innovation / Uptake → **Dissemination**

Contributions to CSP SRIA - CDA & SCU-PI
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.estep.eu/assets/Publications/2024-CSP-SRIA-v2.pdf

The Symbio-Steel project

Objectives

Symbio-Steel will focus on the current state, upcoming techniques, and developments of Industrial Symbiosis implementation, to reach proactive cross-sectorial cooperation and integrations.

Overall objective:

paving the way to a wider uptake of Industrial Symbiosis solutions in the steel sector, exploiting and spreading knowledge on most promising and available results, supporting synergies with other industrial sectors.

Project co-funded by the Research Fund for Coal and Steel (RFCS) G.A. 101156509

InSGeP

- Simulation of effects on slag and process of DRI or HBI charge in electric arc furnace
- Collection and laboratory development of slag samples using DRI and HBI in industrial and pilot scales
- Valorization of EAF slags from DRI melting with dry granulation process
- Market analysis and stakeholder consultation

David Algermissen

European Commission
The research leading to these results has received funding from the European Union's Research Fund for Coal and Steel research programme under grant agreement number: 101112665

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Main objectives of TransZeroWaste

- **Upgrading low-grade iron ore** by combining with iron-rich by-products
- **Development of innovative techniques to produce high quality pre-material** for decarbonised future production routes
- **Separation of disturbing components** from byproducts to replace scrap
- **Development of the technological basis and digital tools** supporting the transition towards zero waste in the European steel industry

-> Three main technical approaches

Typical material samples

Fraction from iron sieving | Coarse mill scale | Fine mill scale (oily contents up to 10 wt.-%)

Concluding Remarks

- RFCS = backbone of EU steel research
  - Modernisation in 2021
  - Reform in 2027/28
- Decarbonisation topics dominate Research Funding opportunities
- Foster collaborative research on EU level
  - Large size projects and high technology readiness level (TRL)
  - Industrial demonstrators
  - Test bed for full industrial size investments
    - Raw material and energy availability + affordability
    - Permitting
    - Risk sharing / Know the partners
    - Develop / confirm business case
  - Collaboration
- ESTEP supports the important work towards standardisation
- ESTEP – The EU platform for steel research dissemination

Thank you very much for your attention

Workshop Regional Decarbonisation Roadmaps

The Clean Steel Partnership

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