



The EU's contribution to decarbonise the steel sector

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Andrea GENTILI

**Clean Planet Partnerships Manager and
Deputy Head of Unit**

European Commission – DG RTD
Unit C3 'Low Emission Future Industries'
Email: Andrea.GENTILI@ec.europa.eu



Content

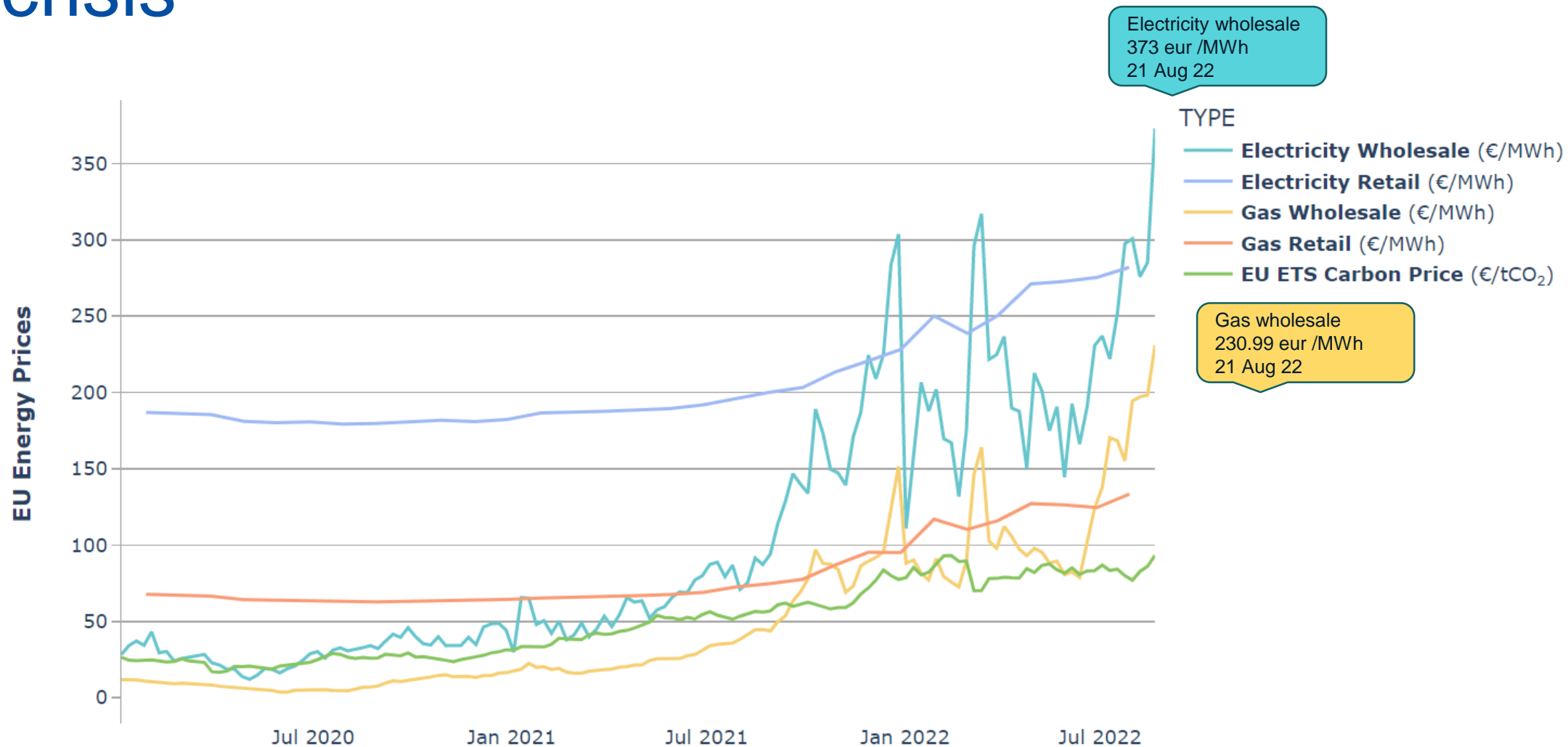
- 1. Recent European policy evolution for steel**
- 2. The HE Clean Steel Partnership and its role**
- 3. From policy to action: paving the road for EU Reserach & Innovation**

Steel: a key building block of the green & digital transition



A strategic material for Europe.. BUT its competitiveness is at risk

Steel industry highly impacted by energy prices crisis



Momentum Shift towards the decarbonisation of steel sector

Clear trend in Europe towards **decarbonisation** and **hydrogen-based** steel making.

Company	Country	Current primary steel capacity in EU (Mt)	Announced strategy
ArcelorMittal	Several	47	2030: Hydrogen + CCUS 2050: Hydrogen DRI
Thyssenkrupp	Germany	12	2030: CCUS + DRI 2050: Hydrogen DRI
Voestalpine	Austria	8	Hydrogen DRI
Tata Steel	Netherlands	8	Hydrogen DRI
SSAB	Sweden Finland	7	Hydrogen DRI
Salzgitter	Germany	5	Hydrogen DRI

Source: JRC, 127468



1. Recent European policy evolution for steel R&I in the EU

Steel: Key in the European Industrial Strategy

EU Green Deal

The Commission will support clean steel breakthrough technologies leading to a zero-carbon steel making process by 2050.



RePowerEU

The Commission expects that around 30% of EU primary steel production will be decarbonized with renewable hydrogen by 2030.

But more is needed..



Thierry Breton  @ThierryBreton · Nov 21

A “Made in ” [#industry](#) is more relevant than ever.

Given notably the energy situation and the challenges the US Inflation Reduction Act pose, we urgently need to [#accelerate](#) our joint efforts with EU industrial actors.

Constructive exchange at the 2022 ERT plenary meeting.



Crise de l'énergie : il faut une réponse européenne commune et solidaire https://www.lesechos.fr/idees-debats/cercle/crise-de-lenergie-il-faut-une-reponse-europeenne-commune-et-solidaire-1865743#utm_source=le%3AlecOf&utm_medium=clic&utm_campaign=share-links_twitter



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Crise de l'énergie : il faut une réponse européenne commune et soli...
Les commissaires européens Thierry Breton et Paolo Gentiloni s'alarment du plan de 200 milliards d'euros annoncé par l'Allemagn...

The New RFCS Legal Base

- During the period 2016 - 2021, the research funding of the RFCS was lowered to less than 1/3 of the amount that was usually dedicated to the call. In fact, from the EUR 40 million/year usually available until 2016, there was a constant drop down of EU funding, due to the reduction of the bank interests. The EU funding of the RFCS Annual call 2021 reached only EUR 11.3 million.
- In July 2020, the EC adopted therefore a proposal for a revision of the RFCS legal base.
- In July 2021, the Council adopted the new RFCS legal base, composed by three Council Decisions **(EU) 2021/1094**, **(EU) 2021/1207** and **(EU) 2021/1207**.
- In February 2022, the new RFCS legal base allowed to launch the first Big Tickets calls for steel and coal for total EU funding of **EUR 104 million (for steel)** and EUR 36 million (for coal).

The major novelties of the new RFCS legal base



- To contribute to achieve climate neutrality by 2050, in full **alignment with the European Green Deal**.
- To **pool resources (2021-2027) to respond to new research needs** in steel (i.e. supporting R&I for clean steel breakthrough technologies) and coal (i.e. contributing to Just Transition) via dedicated calls.
- To ensure a financial annual allocation to manage RFCS **(annual + dedicated)** Calls up to EUR 111 millions.

New Research Objectives of the RFCS Programme

New art. 8, 9 and 10 and 10b for STEEL

~~8) New and improved steelmaking and finishing techniques~~

8) New, sustainable and low-carbon steel making and finishing products

~~9) RTD and the utilisation of steel~~

9) Advanced steel grades and applications

~~10) Conservation of resources and improvement of working conditions~~

10) Conservation of resources, protection of the environment and circular economy

10b) Management of work force and working conditions.



2. The HE Clean Steel Partnership and its role

The Horizon Europe Clean Steel Partnership (CSP)

- European **Public-private co-programmed partnership** under Horizon Europe.
 - European Partnerships bring the European Commission and private and/or public partners together to address some of Europe's most pressing challenges through concerted research and innovation initiatives (https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/european-partnerships-horizon-europe_en).
- Objectives, commitments and governance of the CSP are specified in the **Memorandum of Understanding** signed by the public side (Commissioners Gabriel and Breton) and by the private side (by ESTEP) on August 9, 2021.
- The CSP work started with Work Programme 2021-2022 under Horizon Europe.
- The implementation of the CSP is still ongoing.
- The Clean Steel Partnership is developed in the context of the EU goals and policies to achieve climate neutrality by 2050 - the European Green Deal, the Fit for 55 package, the Clean Planet for All strategy and the Paris Agreement.

European Clean Steel Partnership: Key Elements

Lead DG:	EC.R&I.C3	Co-lead DG:	GROW.I.1
Predecessor:	none (but some coverage by SPIRE cPPP)		
Roadmap:	from Feb 2021		
Launch:	2021 (calls in WP 2021/22)		
Budget:	1 700 M€ in total (350 M€ HE + 350 RFCS + 1 000 M€ Private side)		

Partners: Private side represented by the European Steel Technology Platform (ESTEP). Members include major steel producers (e.g. ThyssenKrupp Steel Europe, Voestalpine, ArcelorMittal, SIDENOR), machine steel providers (e.g. Tenova, Krupp, Danieli), steel research centers (e.g. CSM, BFI, CRM, IMZ, AM Maizières Research), and NGOs representing trade unions and environmental interests.

Particularities:

- Mentioned in the European Green Deal.
- 2 complementary 'legs':
 - RFCS (bottom up approach + high TRLs demonstrators).
 - Horizon Europe (top down approach + mid-TRLs projects).

Challenges:

EU steel industry is responsible for 20-25% of industrial CO2 emissions.

Need for major technological breakthroughs in order to cut these on a sufficient scale.



Main Objectives and the CSP Strategic Research Innovation Agenda

The **general objective** of the CSP Partnership is to develop technologies at TRL8 to **reduce CO2 emissions** stemming from EU steel production by 80-95% compared to 1990 levels by 2050, ultimately leading to climate neutrality.

This objective is to be achieved while **preserving the competitiveness and viability** of the EU steel industry.

Specific objective 1: Enabling steel production through carbon direct avoidance (CDA) technologies at a demonstration scale.

Specific objective 2: Fostering smart carbon usage (SCU – Carbon capture) technologies in steelmaking routes at a demonstration scale, thus cutting CO2 emissions from burning fossil fuels (e.g. coal) in the existing steel production routes.

Specific objective 3: Developing deployable technologies to improve energy and resource efficiency (SCU - Process Integration).

Specific objective 4: Increasing the recycling of steel scrap and residues, thus improving smart resources usage and further supporting a circular economy model in the EU.

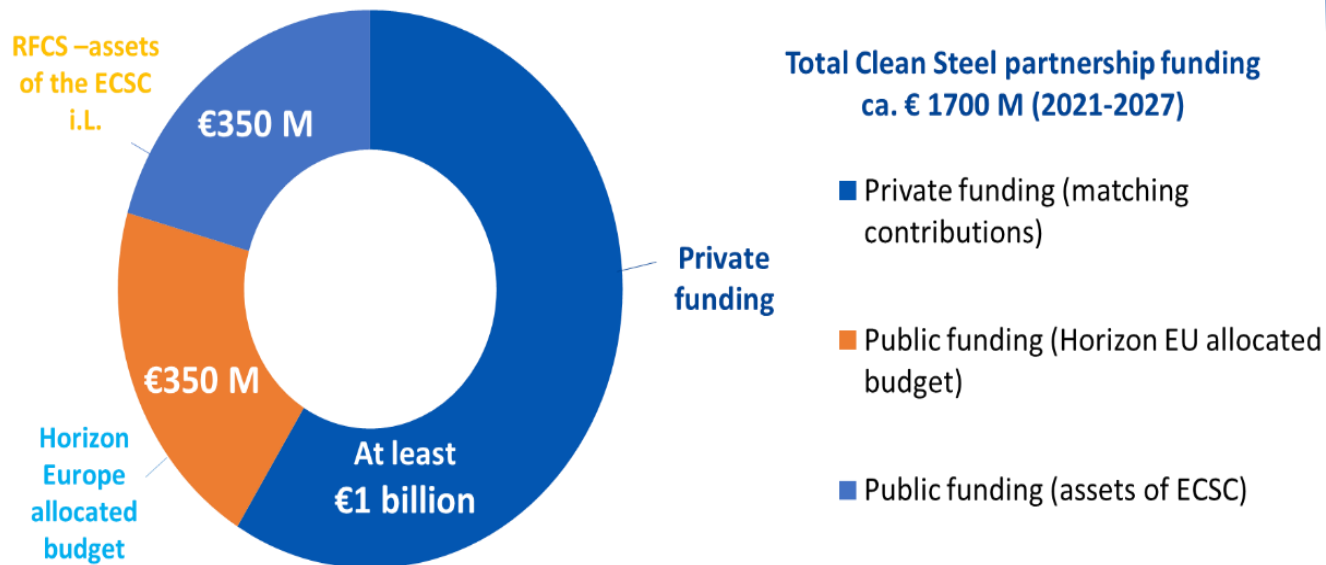
Specific objective 5: Demonstrating clean steel breakthrough technologies contributing to climate-neutral steelmaking.

Specific objective 6: Strengthening the global competitiveness of the EU steel industry in line with the EU industrial strategy for steel.

EU R&I for steel within the CSP: two sources of funding

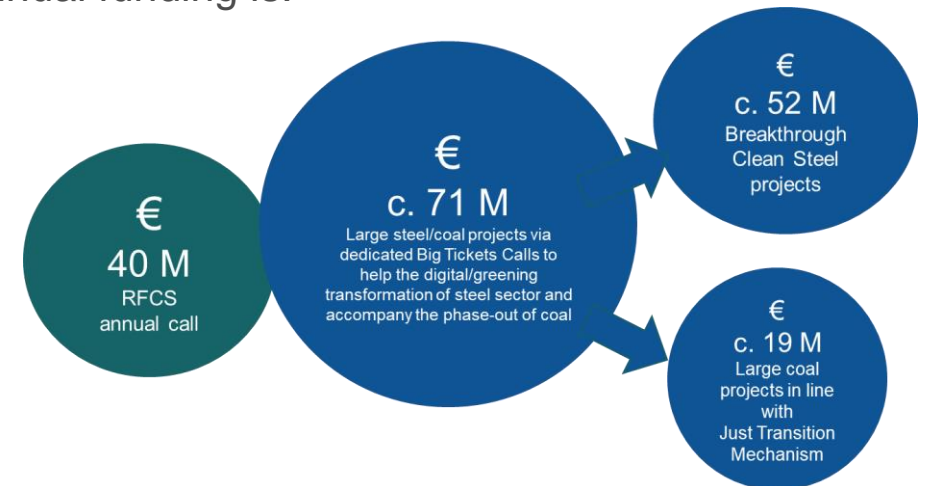
Horizon Europe 2021-2027

- 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.



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.



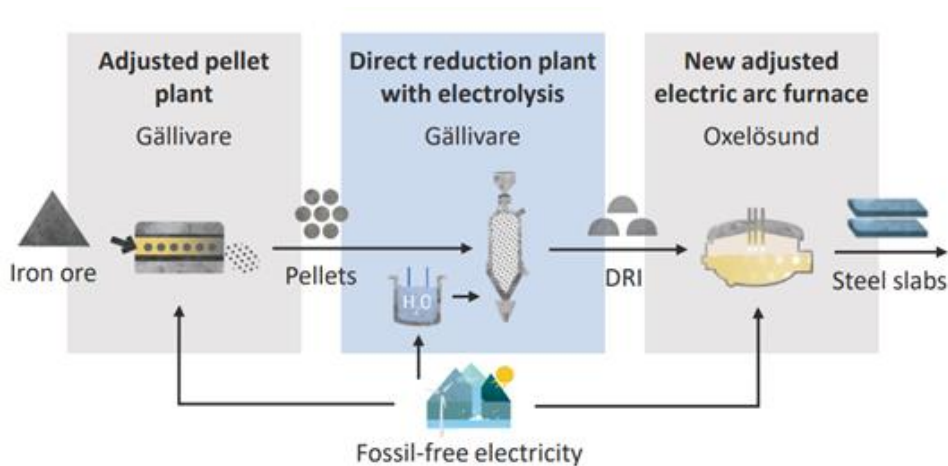
3. From policy to action: paving the road for EU Research & Innovation

Funding and Programmes opportunities for Clean Steel

- **Horizon Europe/RFCS Big Tickets calls supporting the Clean Steel technologies** – R&I innovation projects for clean steel production: calls 2023 are open (for an overall EU funding of around EUR 160 million)
- **EU ETS Innovation Fund** – for demonstration of innovative low-carbon technologies
- **State Aid** – aid to support low-emission production processes; key frameworks for steel decarbonisation projects (e.g. IPCEI)
- **Recovery & Resilience Facility** – EU response to the COVID pandemic to support reform and investments by Member States

HYBRIT

- **Coordinator:** Hybrit Development AB
- **Other participants:** SSAB EMEA AB, Luossavaara-Kiirunavaara Aktiebolag Associated
- **Partner:** Vattenfall AB
- **Funding from Innovation Fund:** € 143.000.000
- **GHG avoidance:** 14.3 Mt CO₂eq (first 10 years of operation)



Update April 2022

European Commission

INNOVATION FUND

Driving clean innovative technologies towards the market

HYBRIT Demonstration: Swedish large-scale steel value chain demonstration of Hydrogen Breakthrough Iron-making Technology

The Innovation Fund is 100% funded by the EU Emissions Trading System

© HYBRIT

- HYBRIT will replace coal-based blast furnaces with direct hydrogen-based reduction technology.
- HYBRIT will demonstrate a complete industrial value chain for hydrogen-based iron and steelmaking.
- The project will produce approximately 1.2 Mt crude steel annually (25% of Sweden's production).

Important Projects of Common European Interest (IPCEI)

Second wave - “IPCEI Hy2Use”

- 35 projects from 29 companies in 13 Member States, and 2 projects from Norway.
- € 5.2 billion aid approved.
- Triggering € 7 billion in private investments.
- Hy2Use will support:
 - The construction of hydrogen-related infrastructure, notably large-scale electrolysers and transport infrastructure, for the production, storage and transport of renewable and low-carbon hydrogen.
 - The development of innovative and more sustainable technologies for the integration of hydrogen into the industrial processes of multiple sectors, especially those that are more challenging to decarbonise, such as **steel**, cement and glass.



Recap: European steel industry

Policy actions to support the business case

Key measures on demand side

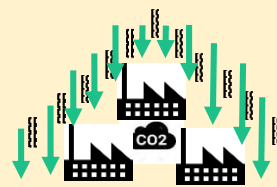
- **Carbon contracts for difference**
- **Eco-design for Sustainable Products**
- (carbon accounting through the life-cycle) → e.g. *clean car*
- **Green public procurement**
- → to mainstream green steel purchasing by public buyers
- **Standardisation**
- (e.g. clean steel)

Inputs

- **Technology and digitalisation**
- Industrial Technology Roadmaps; Digital for Green Alliance 
- **Raw materials**
- European Raw Materials Alliance 
- **Clean & affordable energy**
- (electricity and hydrogen) 
- **Skills**
- Pact for skills (ESSA), Social Dialogue 

Input challenges:

- Technologies not yet ready;
- Cost & availability of clean energy (net zero steel requires 3-5x more electricity);
- Lack of skills



-80-95% CO₂ emissions by 2050
(Eurofer roadmap)

The European steel sector:

- €170 bn gross value added to the EU economy
- 1.3% of EU GDP
- 500 production sites in 23 MS
- 330.000 direct jobs
- 2.6 million indirect jobs
- 200 mill t/CO₂ emissions (ca. 5% of EU emissions)

Investment challenge:

High investment needs and long payback periods

Competitiveness challenge:

Potential loss of safeguards & threat of dumping due to overcapacities

Covering investment needs

- **RRF**
- **MFF** (ETS innovation fund, Horizon Europe/Clean Steel Partnership, InvestEU)
- **Private markets** (Sustainable Finance Taxonomy)
- **EIB**
- **National budgets**

Actions at international level

- **Trade defence**
- (prolongation of steel safeguards, anti-subsidy cases)
- **International cooperation** on decarbonisation of industry
- **Carbon Border Adjustment Mechanism**

Collaborative policy-making

- **Governance** through ecosystems 
- **High-Level Group** energy-intensive industries
- **Industrial Alliances**
- **CEEAG and IPCEIs** (hydrogen, low-carbon industry)



Thank you

The EARTO (European Association of Research&Technology organisations)



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Overview of Awarded Projects in 2021 and in 2022: HE Cluster 4 for Clean Steel and RFCS

To date, a total of **20 projects** are awarded/selected-for-award during 2021 and 2022.

HE Cluster 4 – Clean Steel

- 2021:

Topic	Project Acronym
18	MaxH2DR
19	HIYIELD
19	ReMFra
19	CAESAR
22	RecHycle

- 2022:

Topic	Project Acronym
13	PURESCRAP
13	TransZeroWaste
16	GreenHeatEAF
16	ModHEATech
16	HyTecHeat

RFCS

- 2021 Annual Call:

Objective	Project Acronym
Accompanying measure	DissHEAT
RPJ-TGA3: Conception of steel products	HELIX
PDP-TGA2: Downstream steel processing	SmartCool
RPJ-TGA1: Iron- and steelmaking	H2transBF2030
PDP-TGA1: Iron- and steelmaking	ProSynteg
RPJ-TGA4: Steel applications and solutions for existing and new markets	CONSTRUCTADD

- 2022 Big Tickets:

Objective	Project Acronym
CSP-2	MODIPLANT
CSP-2	FULLH2REHEAT
CSP-2	HYDREAMS
CSP-2	TWINGHY

Horizon Europe Cluster 4: Digital, Industry and Space: H2-Focused Projects from Call 2021

- **RecHycle** - Recycling renewable hydrogen for climate neutrality

- **Coordinator:** ARCELORMITTAL BELGIUM NV
- **Funding from Horizon Europe Cluster 4, call 2021, topic 22:** € 6.226.743 (over a total project budget of € 28.419.718)
- **Type:** IA, reaching TRL 8

The project will demonstrate a cost-efficient solution to decrease carbon emissions by initiating a new industrial symbiosis between and within the steel industry, chemical industry and renewable energy sources (e.g. wind or solar to obtain green electricity or hydrogen).

- **MaxH2DR** - Maximise H2 Enrichment in Direct Reduction Shaft Furnaces

- **Coordinator:** VDEH-BETRIEBSFORSCHUNGSINSTITUT GMBH
- **Funding from Horizon Europe Cluster 4, call 2021, topic 18:** € 4.161.836 (over a total project budget of € 4.476.583)
- **Type:** IA, reaching TRL 8

A world-first test rig determines pellet properties at conditions of industrial H2 enriched DR furnaces and a physical demonstrator shows the linked solid and gas flow in shaft furnaces.

Upcoming calls for EU R&I proposals in Horizon Europe Cluster 4 and RFCS programmes



Horizon Europe WP2023-2024

Clean Steel Topics – Main Aspects



- Under Horizon Europe Cluster 4: Digital, Industry and Space. This cluster is about boosting the EU's strategic autonomy with a strong focus on the green transition.
- A total of 4 topics are presented, with 6 areas of technological interest.
- Good balance is achieved between RIA and IA topics – 2 RIA and 2 IA.
- Topic yearly allocation follows established policy priorities, as well as new ones (e.g. REPowerEU), for example:
 - Topic on digital transformation is placed in 2024.
 - Topic on smart carbon usage and improved efficiency via process integration is placed in 2023.
- 1 topic set up for lump sum approach.
- Overall budget for Clean Steel is EUR 65 million.
- The WP2023-2024 has been published in December 2022 and the first deadlines for calls of proposals are in April 2023.

Horizon Europe WP2023-2024: Clean Steel Topics 2023



- **HORIZON-CL4-2023-TWIN-TRANSITION-01-43:** Low carbon-dioxide emission technologies for melting iron-bearing feed materials
OR
Smart carbon usage and improved energy & resource efficiency via process integration (Clean Steel Partnership) (IA)
 - IA / TRL 5 to 6-7 / 4-6M€ per project
- **HORIZON-CL4-2023-TWIN-TRANSITION-01-45:** Circular economy solutions for the valorisation of low-quality scrap streams, materials recirculation with high recycling rate, and residue valorisation for long term goal towards zero waste (Clean Steel Partnership) (RIA)
 - RIA / TRL 4 to 5-6 / 3-6M€ per project

Horizon Europe WP2023-2024: Clean Steel Topics 2024



- **HORIZON-CL4-2024-TWIN-TRANSITION-01-44:** Digital transformation and ensuring a better use of industrial data, which can optimise steel supply chains (Clean Steel Partnership) (IA)
 - IA / TRL 5 to 6-7 / 3-5M€ per project / lump sums
- **HORIZON-CL4-2024-TWIN-TRANSITION-01-46:** CO₂-neutral steel production with hydrogen, secondary carbon carriers and electricity
OR
Innovative steel applications for low CO₂ emissions (Clean Steel Partnership) (RIA)
 - RIA / TRL 4 to 5-6 / 3-5M€ per project

RFCS Big Tickets Call 2023: Steel



- The RFCS Big Ticket call 2023 in steel (published on 2nd February 2023) is the biggest call dedicated to steel since the beginning of the RFCS program: EUR 130 million
- Focus on big Pilot/Demonstration projects (up to 18 m€ of EU funding and high TRLs e.g. 8) for breakthrough R&I for accelerating the twin (greening and digital) transformation of the EU steel industry via breakthrough clean steel making technologies
- Call objectives:
 - (1) CO₂ neutral iron ore reduction (Increasing the use of pre-reduced iron carriers).
 - (2) Developing technologies to reduce the specific energy required to produce steel
 - (3) Circular economy and sector coupling solutions to meet the zero-waste goal for steelmaking
 - (4) Preparation of steel CO/CO₂ gases for Carbon Capture Use and Storage (CCUS)
 - (5) Process Integration (PI) in steel plants to reduce the use of fossil carbon and associated CO₂ emissions.
- Deadline: 4th May 2023 (tbc)