

Clean Energy, Restored lands: The Path Forward for Coal Regions

Bochum, Germany

29-30 September 2026



Organised by



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Die Landesregierung
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Organisers



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Welcome ceremony





Jörg Lukat

Mayor of Bochum



Silke Krebs

NRW State Secretary for Economic Affairs, Industry,
Climate Action and Energy



Martin Špolc

Director for Prosperity,
Directorate-General for Research and Innovation,
European Commission



Marian Zmarzły

Undersecretary of State, Polish Ministry of Energy



Prof. Alicja Krzemień

President, EURACOAL

Clean Energy, Restored Lands: The Path Forward for Coal Regions

High-Level
European coal in transition

Bochum, Germany

29–30 September 2026

EURACOAL keynote speech

Prof. Alicja Krzemień

President of EURACOAL

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EURACOAL
powering transition in Europe
European Association
for Coal and Lignite
AISBL



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High-Level

European coal in transition

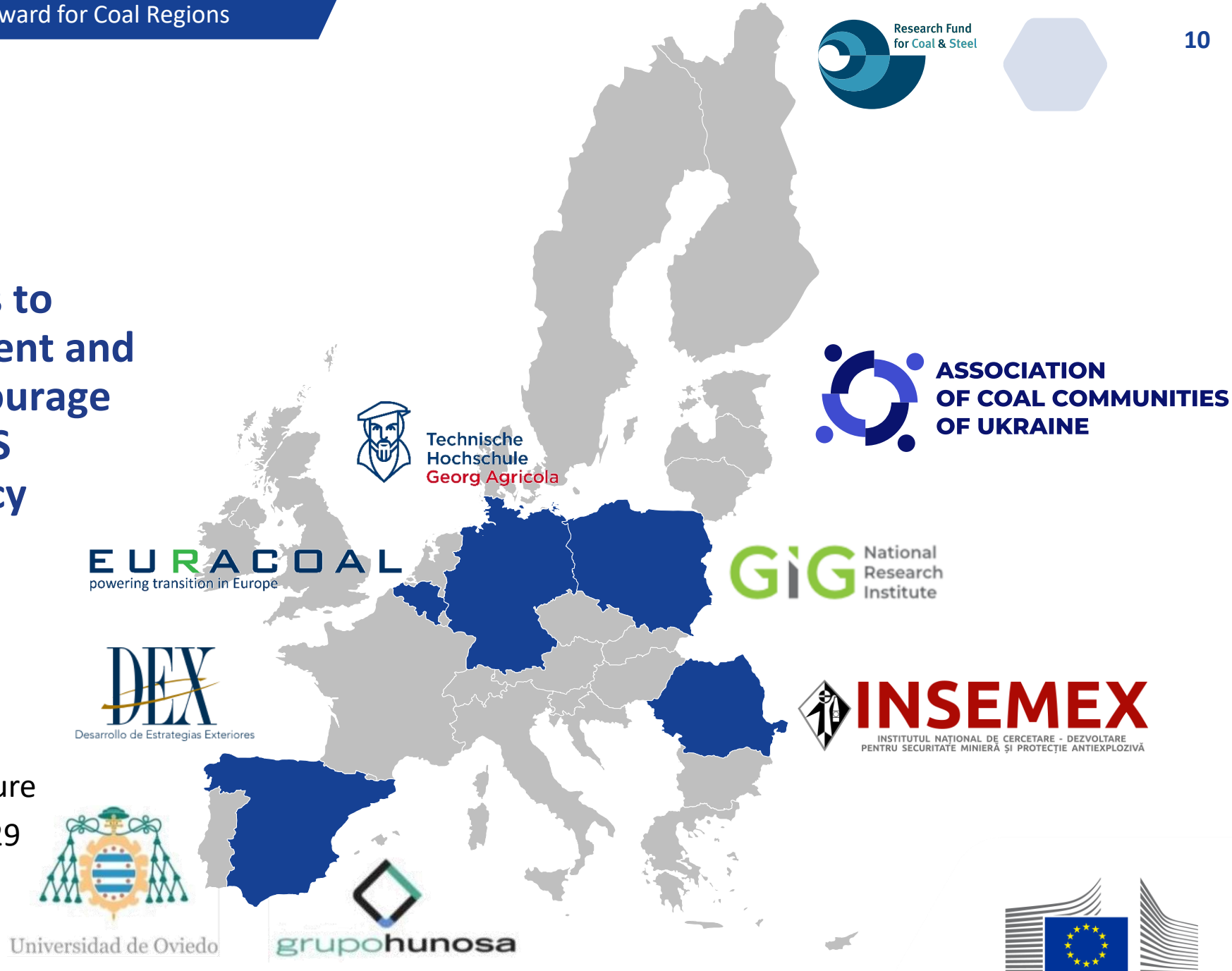
A series of high-level events to spread knowledge from recent and ongoing RFCS projects, encourage new players to join the RFCS community, and foster policy dialogue

Coordinator: Central Mining Institute (GIG-PIB), Poland

Call: RFCS 2025 Accompanying Measure

Timeline: March 2026 – February 2029

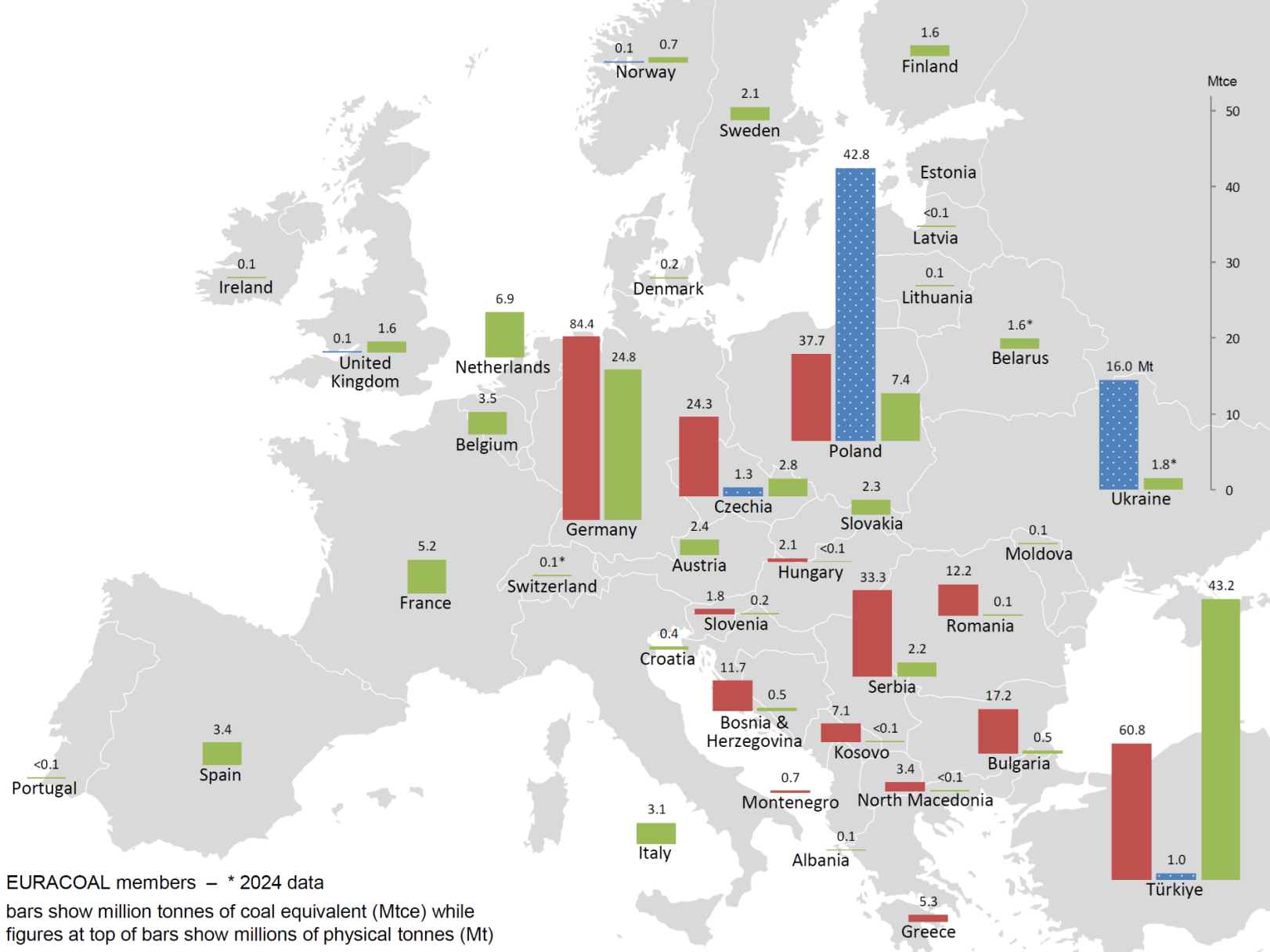
Total cost: €0.77 million



Coal in Europe 2025

lignite production, hard coal production & imports

EURACOAL



Source: EURACOAL members – * 2024 data

Note: bars show million tonnes of coal equivalent (Mtce) while figures at top of bars show millions of physical tonnes (Mt)



Energy and restoration belong together

From research perspectives to regional development

Energy production and storage

New uses for mines,
power-plant sites and infrastructure



Restoration and risk management

Land, water, stability
and long-term monitoring

Future use depends on site conditions



Research capabilities meet regional needs

Convened by EURACOAL and HIGH-LEVEL





Previous high-level RFCS events

2023



Brussels

23 May

2024



Spain

8 May

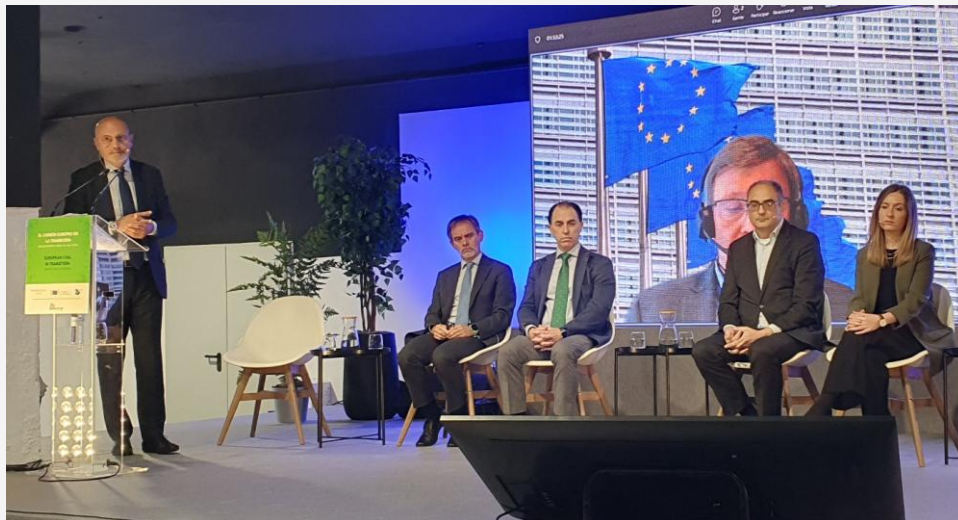
2025



Poland

15 May

High-Level
European coal in transition





HIGH-LEVEL: continuing the exchange



Share knowledge. Involve new participants. Connect regions.

2026



Bochum, Germany

29–30 September

Energy production and storage; land restoration and risk management

2027



Romania

September 2027

Methane management; environment, health and safety

PLANNED

2028



Spain

September 2028

Infrastructure repurposing; materials and waste reuse; critical raw materials

PLANNED



Day 1 is funded by the EU under an Accompanying Measures project of the Research Fund for Coal and Steel under grant agreement no. 101295753.



Hih-Level

European coal in transition

**From research results
to practical opportunities
for coal regions.**

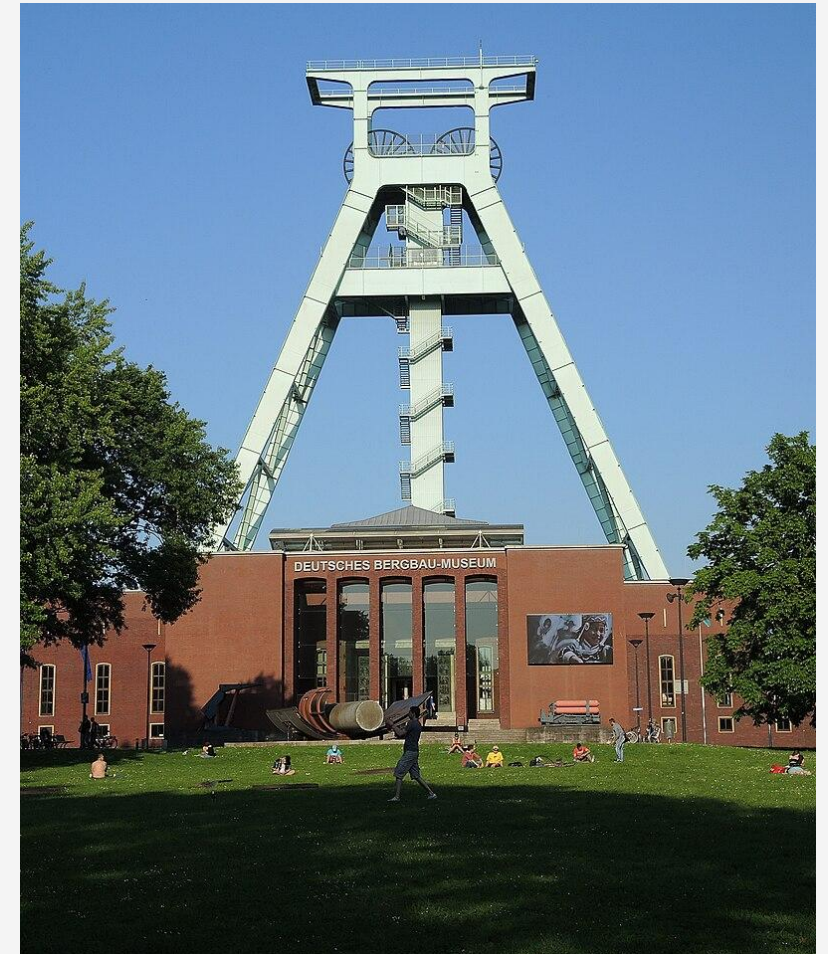
Identify needs. Test applicability.
Connect partners.

Thank you

euracoal@euracoal.eu

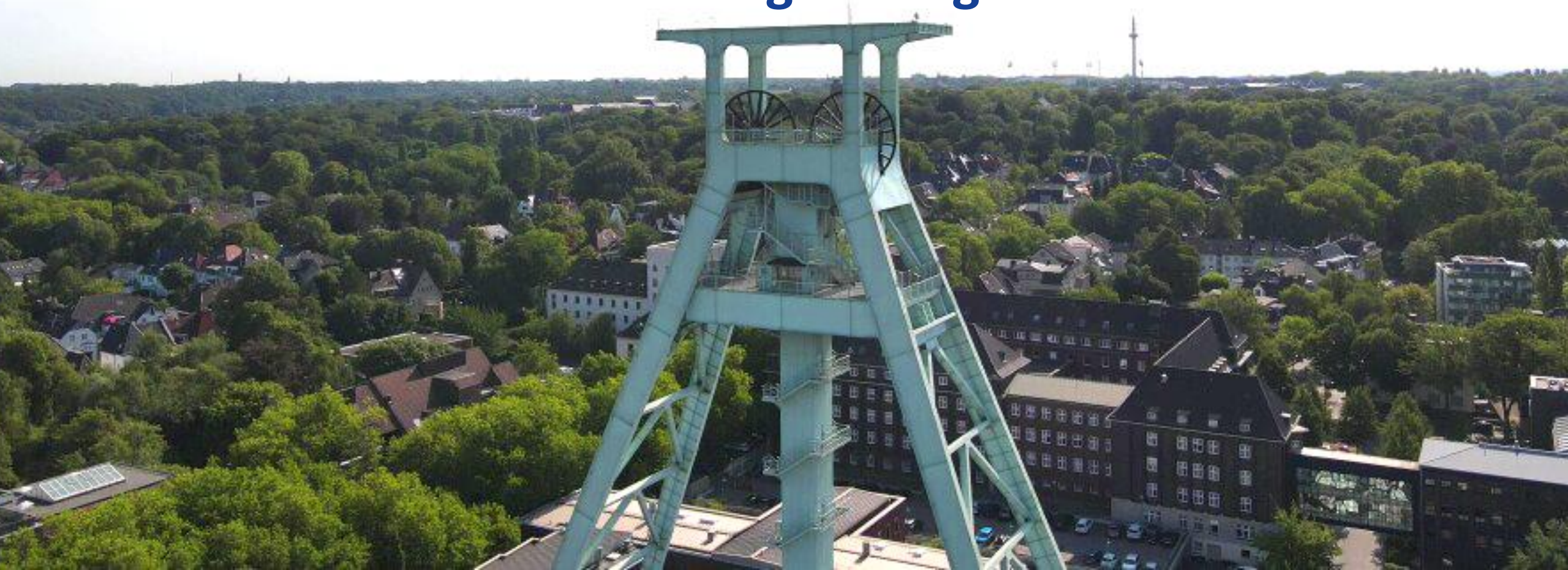


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Keynotes on driving water resilience across Europe's need for strategic autonomy in Critical Raw Materials and water use to restore the Rhenish lignite region





Veronica Manfredi

Director for Zero Pollution, Water Resilience and Green Urban Transition, Directorate-General for Environment, European Commission



Dr. Christian Eling

Head of Mine Planning, RWE Power



Water brings the future to life

The creation of pit lakes in the
Rhenish mining area

Dr. Christian Eling, RWE Power, Head of the Opencast Mine Planning Division
Euracoal 2026 in Bochum, 29 September 2026

The Rhenish mining area is one of the largest lignite mining areas in Europe and is undergoing far-reaching change as a result of the phase-out of coal

RWE

We are shaping the energy transition and will become **climate-neutral** by 2040.

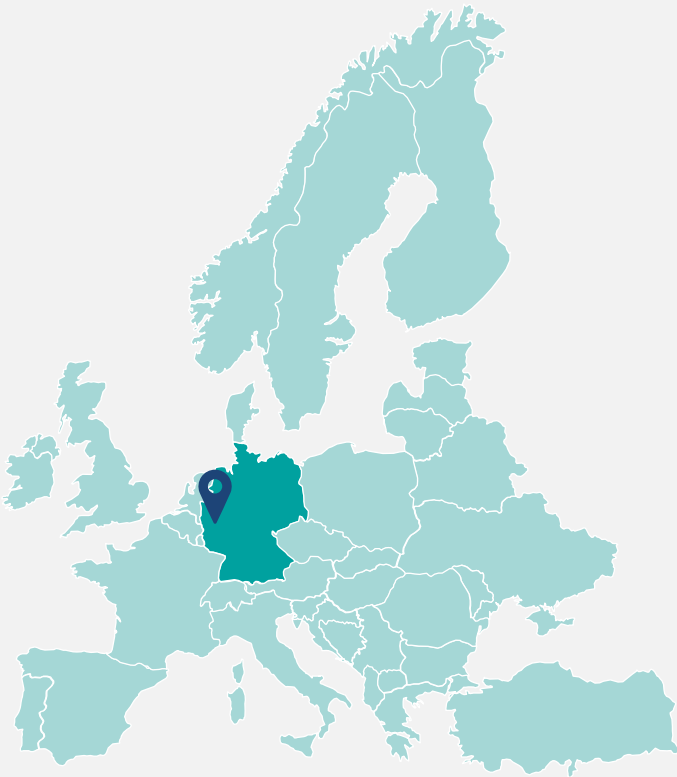


2030

We are implementing the accelerated **phase-out of coal** in a responsible manner.



We carry out **high-quality recultivation** and support the region through **structural change**.

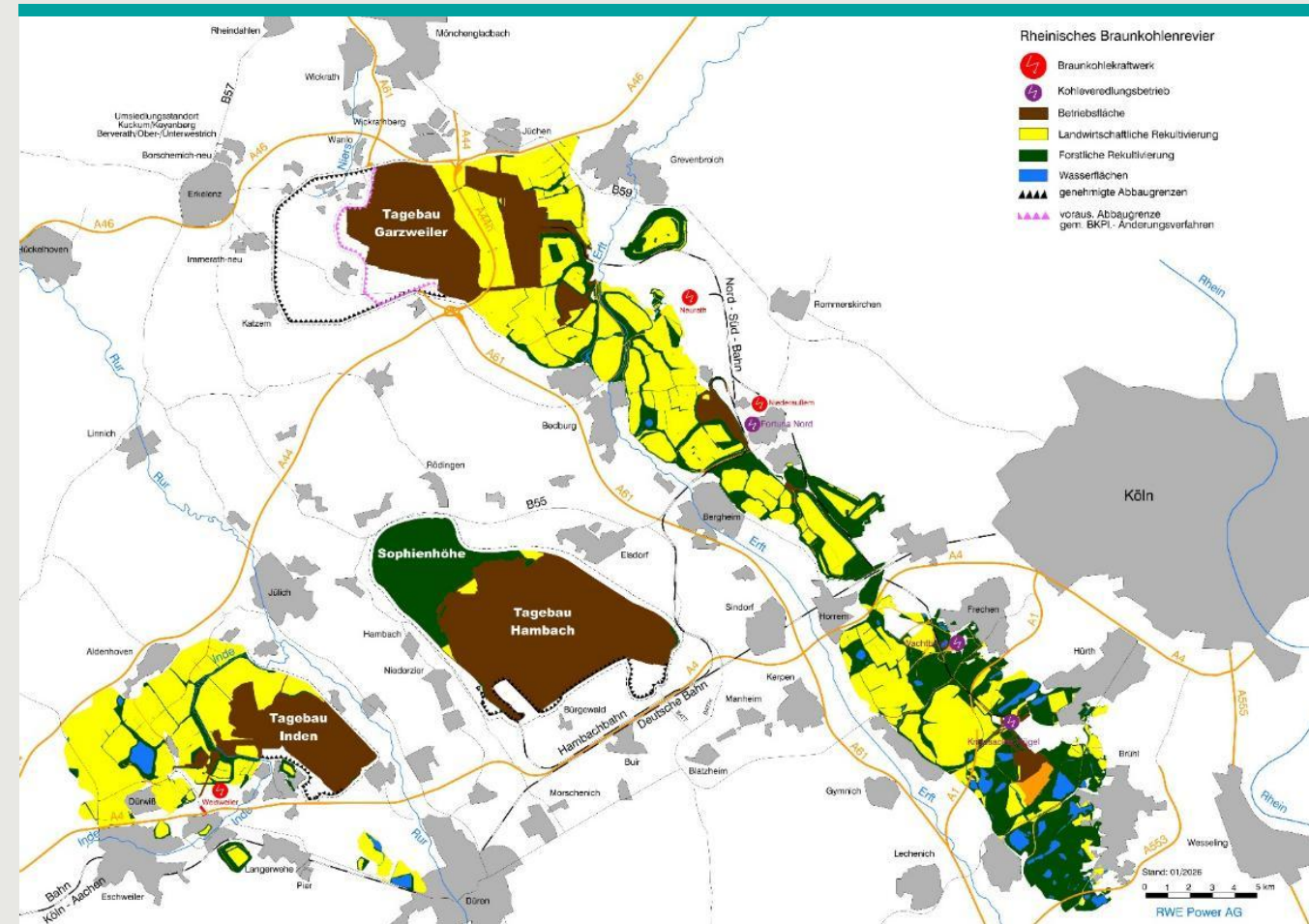


The Rhenish mining area in 2025

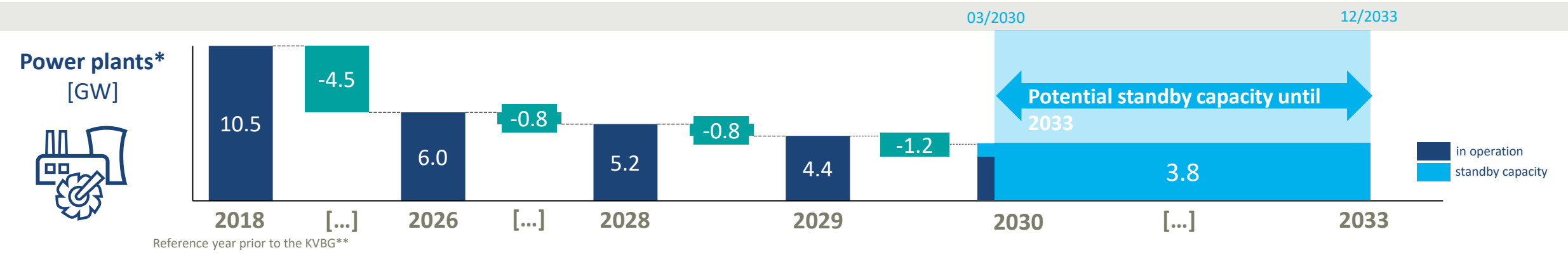
From active opencast mining to a future lake landscape

	6 GW installed capacity
28	TWh/a electricity produced
	3 opencast mines: Hambach, Inden & Garzweiler
38	Mt/a lignite mined
	3 refining sites
4	Mt/a refining capacity
	~5,900 employees
430 m EUR	procurement volume in the Rhenish mining area in 2025
	600 m EUR total wages and salaries in the Rhenish mining area in 2025

Last updated: 31/12/2025



Focus on continuing the phase-out of lignite by 2030 – standby operation still under consideration and recultivation on track



*with 2 x 200MW topping gas turbines (VGT) in Weisweiler
**Coal-fired Generation Termination Act

! Phasing out lignite mining by 2030 whilst creating a landscape suitable for a variety of uses

! In the event of standby operation, the mining boundary and recultivation remain unchanged

Recultivation

High-quality rehabilitation completed or ongoing

2030 2040

Pit lakes

2030: Start of lake filling at Hambach; 1,300ha of lake area after just 10 years; target water level to be reached after approx. 40 years

Garzweiler opencast mine

Lignite is sourced from the Garzweiler opencast mine, the rehabilitation of which will continue until 2035, even without standby operation

Water from and around the opencast mine

Groundwater drawdown enables opencast mining operations while simultaneously supplying the region, industry and the natural environment with water

‘Why do we lower the groundwater level?’

1

Occupational and operational safety

2

Stable slopes

3

Targeted groundwater management

‘What do we use the extracted water for?’



Conservation of wetlands



Discharge into rivers



Drinking water supply



Power plant cooling



Air pollution control in opencast mines



Fire-fighting water for all sites



Targeted groundwater management in opencast mining not only safeguards operations but has also, for decades, ensured a supply of drinking water and water for the wetlands in the Rhenish mining area.

Three pillars of hydrological rehabilitation:

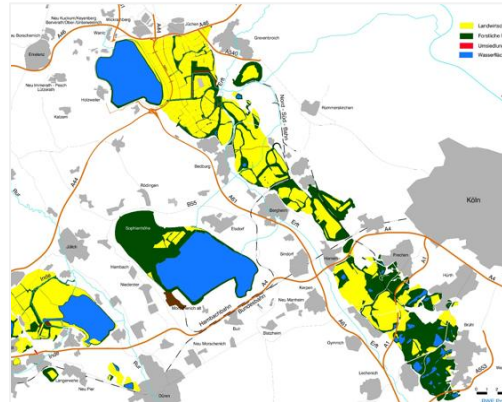
Substitute and ecological water, lake filling and groundwater management restore the water balance

Provision of substitute, compensatory and ecological water



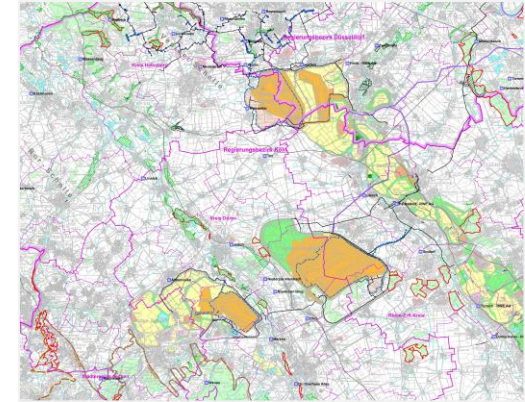
Protects wetlands and ensures compensatory measures are in place in the region – until the groundwater level has fully recovered.

Filling of pit lakes (recultivation)



Recultivation of the pit lakes in Inden, Hambach and Garzweiler – step by step.

Establishment of a permanently stable groundwater regime



Restoration of a sustainable, self-regulating water balance in the mining area – without the need for perpetual management.



The Rhine and the Rur – the powerful watercourses in the Rhenish mining area – form the basis for hydrological rehabilitation.

The Rhine water transport pipeline

A reliable source for Hambach and Garzweiler



From the Rhine to the lakes

The Rhine water transported via the RWTL* is suitable for direct lake filling

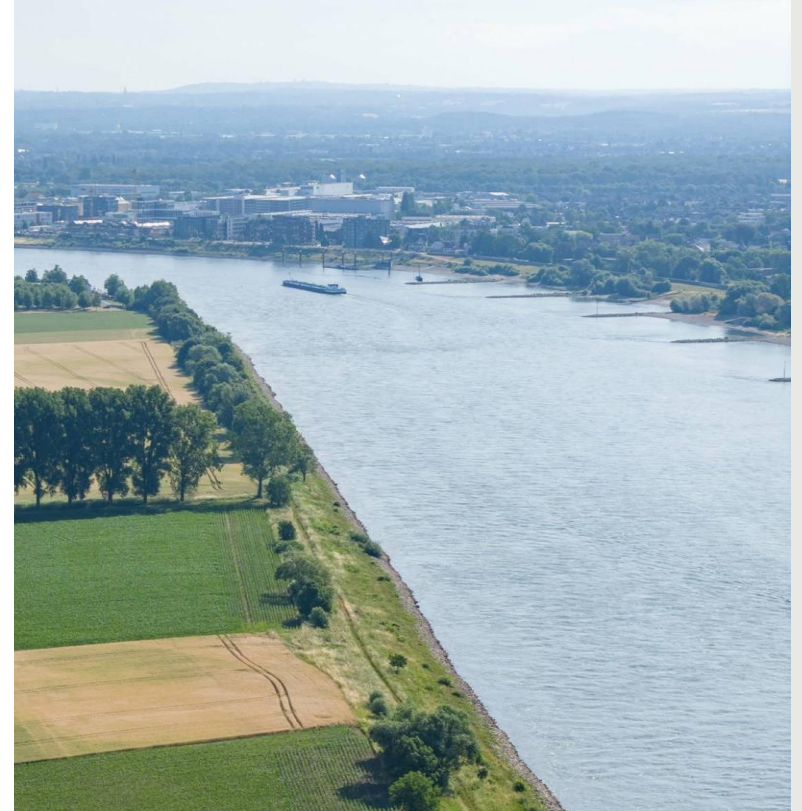
Expert reports and approval procedures carried out to date demonstrate that Rhine water will enable the pit lakes to develop into **ecologically valuable clear-water lakes**.

Further considerations will be addressed in the **upcoming planning approval procedures in accordance with the WFD and the NRW River Basin Management Plan**. Supplementary expert reports will be prepared for this purpose.

A monitoring system is being established for the use of water from the Rhine, enabling comprehensive assessment and control throughout the entire filling period.

Care is required, but there is no need for concern: the Rhine already serves as a source of drinking water (bank filtrate), is home to Natura 2000 sites, is used for recreational purposes, supplies enormous volumes of water without ecological drawbacks, and is rigorously monitored.

*Rhine water transport pipeline



The Rhine provides sufficient water in terms of both quantity and quality. This ensures that the filling of the pit lakes is secured for the long term and ecologically sound, and that it can be reliably implemented.

Indesee – from opencast mine to the first major pit lake

From 2030, the lake will be filled with water from the nearby River Rur

The planning approval procedure under water law comprises three sub-projects

- **Creation of the pit lake**
(incl. lake filling, shoreline profiling, outflow channels, discharge structure)
- **Rur water diversion**
(incl. intake structure, control gauge, Rur water abstraction, feeder pipeline, transfer shaft)
- **Post-mining dewatering**

Water abstraction from the River Rur

- Abstraction will take place depending on the discharge of the River Rur, via a new intake structure to be constructed.
- The water will be conveyed via an approx. 800-metre-long gravity conduit and a discharge structure into the pit lake.



The filling of the Inden pit lake and the groundwater rebound will create the first major pit lake in the Rhenish mining area – promoting the sustainable development of the region.



Welcome to the Rhenish Lake District

The creation of the
pit lakes



From lignite mining to the future of water management

Together, we are transforming the Rhenish mining area from an opencast mining landscape to a lake region with a variety of uses

Lake filling

The use of water from the Rhine and the Rur forms the basis for the Hambach, Garzweiler and Inden pit lakes.

Wetlands and water supply

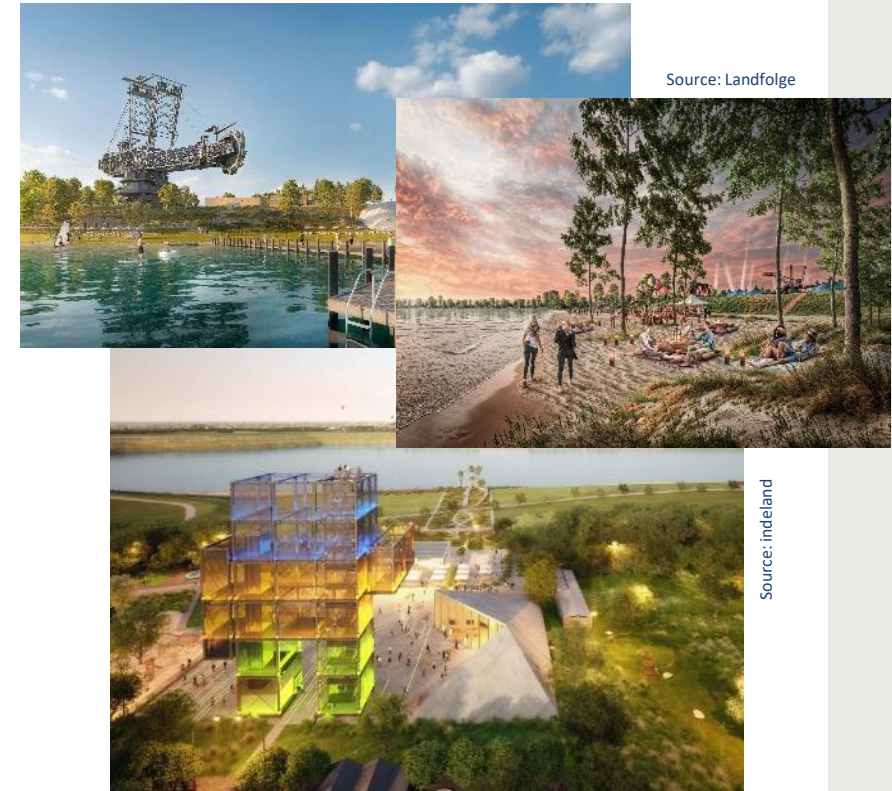
Water for ecological purposes and the controlled groundwater rebound, accompanied by substitute water schemes, ensure the long-term protection of wetlands and the water supply.

A stable, self-sustaining water balance

The filled lakes will establish a self-sustaining water balance without the need for perpetual management measures.

Cooperation with the region

Initiatives in the mines' environs and regional stakeholders are already developing plans for the use of the land and giving people an early glimpse of the future lake landscape.



RWE is assuming responsibility for implementation and post-closure care – and laying the foundation for an ecologically sound, safe and accessible lake landscape in the Rhenish mining area.

Water brings the future to life!

Thank you very much for
your attention





Dr.-Ing. Thomas Kempka

Head of Working Group Coupled Processes in Hydrosystems,
GFZ Helmholtz Centre for Geosciences

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Dr. Jerzy Jagoda

Design and Research Specialist,
KOMAG Institute of Mining Technology

Dr. Dariusz Jasiulek

Head of Projects and Implementation Department, ENNECOR Sp. z o.o. /
Coordinator of SCoLINE, KTKM Sp. z o.o





Session 1 – RFCS projects on energy production and energy storage



Clean Energy, Restored Lands: The Path Forward for Coal Regions

Bochum, Germany

29 – 30 September 2026

ATLANTIS: Pumped-hydro power storage of excess energy in open-pit coal mines

Thomas Kempka, GFZ Helmholtz Centre for Geosciences, Germany

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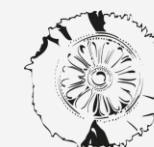
ATLANTIS

An interdisciplinary feasibility study
on hybrid pumped-hydro power
storage of excess energy
in open-pit coal mines

- **Coordinator:** GFZ Helmholtz Centre for Geosciences, Germany
- **Call:** RFCS 2020 Research Project
- **Timeline:** September 2021 – August 2024
- **Total costs:** €2.72 million



Górnictwo i Energetyka
Konwencjonalna S.A.



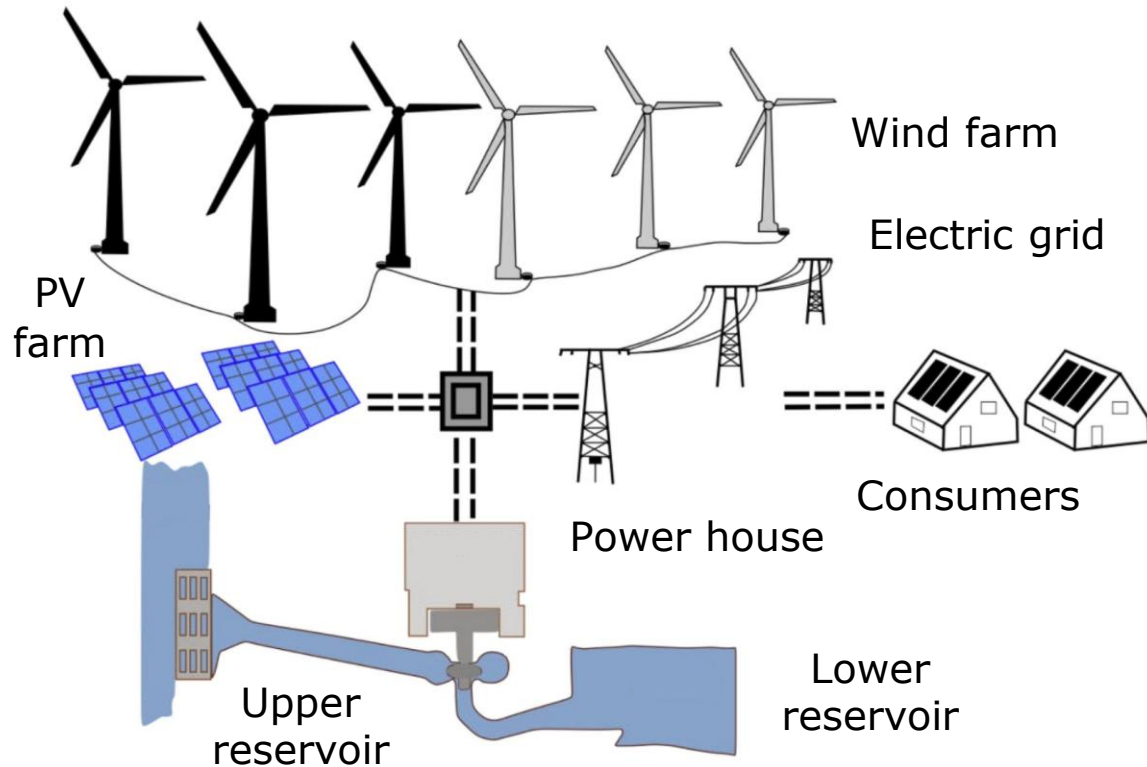
CERTH
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HELLAS



Problem tackled by ATLANTIS

- Large-scale storage of excess energy from renewable sources and electric grid balancing are main challenges of EU energy transition
- Restoration of abandoned open-pit coal mines in mining regions in transition is currently highly cost-intensive with limited socio-economic impacts



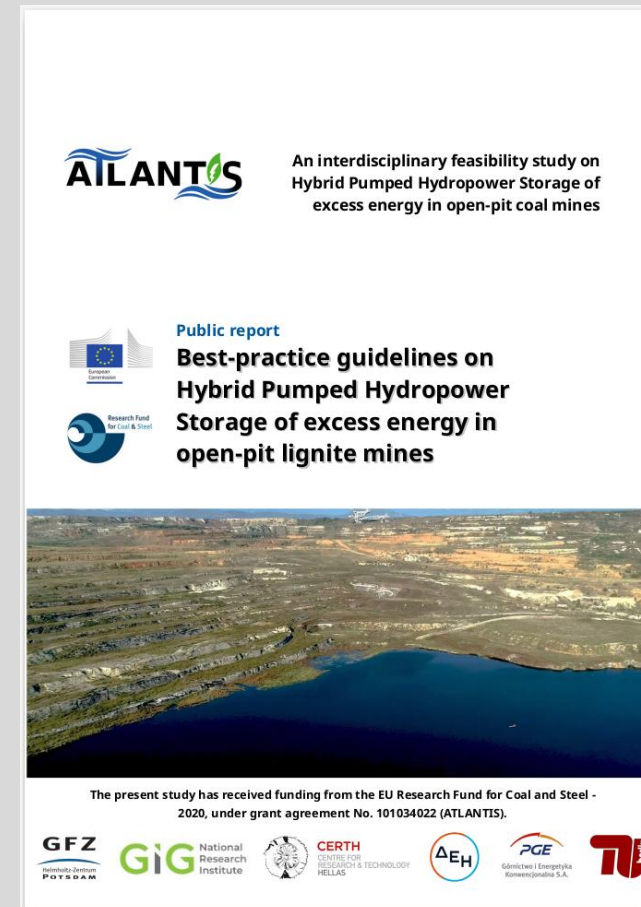


Main objectives of ATLANTIS

- Technical and economic feasibility study on transforming open-pit coal mines into hybrid energy storage projects
- Quantification and mitigation of uncertainties and environmental risks impacting HPHS system operation and efficiency

Main results of ATLANTIS

- Best-practice guidelines and public workshop to support the activities of decision makers, regulatory bodies, mining authorities, stakeholders and operators
- Open Access publications in peer-reviewed scientific journals and contributions to scientific conferences



Executive Summary	
Current Status of Hybrid Pumped Hydropower Storage (HPHS)	1
Development of Pumped Hydropower Technology in Recent Years	3
The Role of HPHS as an Energy Storage Technology	6
Challenges and Opportunities of Abandoned Coal Mines for Energy Storage	9
Current Regulatory Framework	12
Design, Operation, Power Grid Integration and Implementation Potentials of HPHS	14
Infrastructure	15
Technical Concept and Design Criteria for HPHS in Open-Pit Coal Mines	18
HPHS Operational Management, Efficiency Optimisation and Power Grid Integration	20
Potentials for HPHS Implementation in Open-Pit Coal Mines	23
Environmental Considerations	26
Hydrogeochemical Impacts of HPHS Operation Due to the Potential Release and Migration of Waterborne Contaminants	27
Geotechnical Impacts of HPHS Operation on Slope Stability, Surface Displacements and Erosion	30
Quantification of Environmental Risks for Selected HPHS Locations and Recommendations for Region-Specific Environmental Monitoring	33
Economic Considerations	36
Model Parametrisation	37
Energy Availability	40
Cost Analysis and Financial Viability	42
Economical Risks and Resulting Possible Cost Bandwidths	45
Socio-Economic Footprint	48
Conclusions	52
References	56





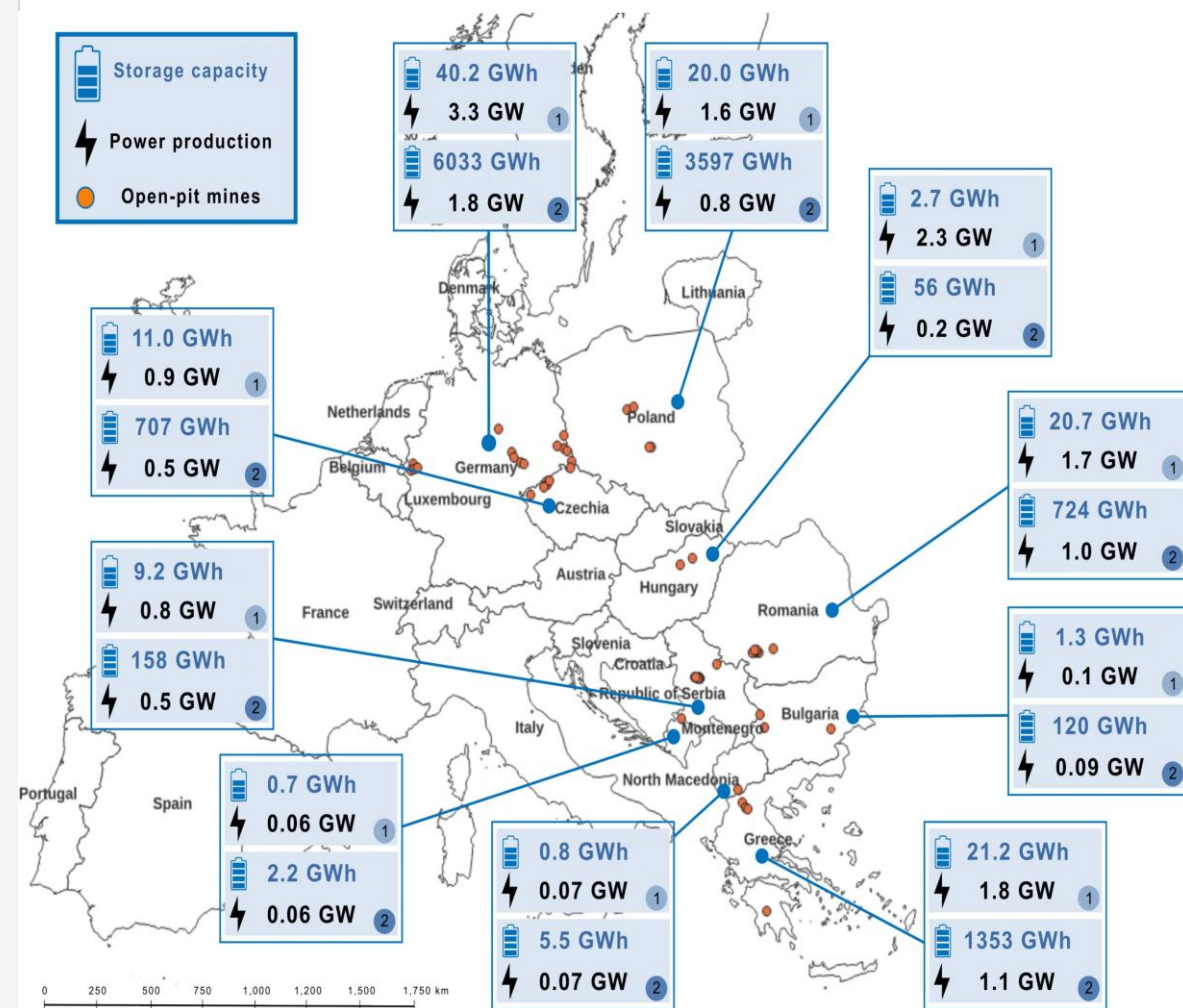
Main industrial and socio-economic impact

- Basis of decision-making on envisaged implementation of HP HS technology in **two EU mining regions in transition** supporting the current EU strategy
- PPC Group (Greece) currently implements **two pumped hydro power plants** with €750 million budget and plans third one
- **Contribution to EU policies on large-scale energy storage** integration with fluctuating energy supply and demand to achieve net-zero carbon emissions by 2050



Lessons learnt - recommendations

- High (socio-)economic potentials identified by stakeholders
- Interdisciplinary assessments required for sustainable and economically beneficial technology implementation
- EU strategy and policy integration will support timely implementation of proposed technology





Amynteon mine, Greece

Next steps

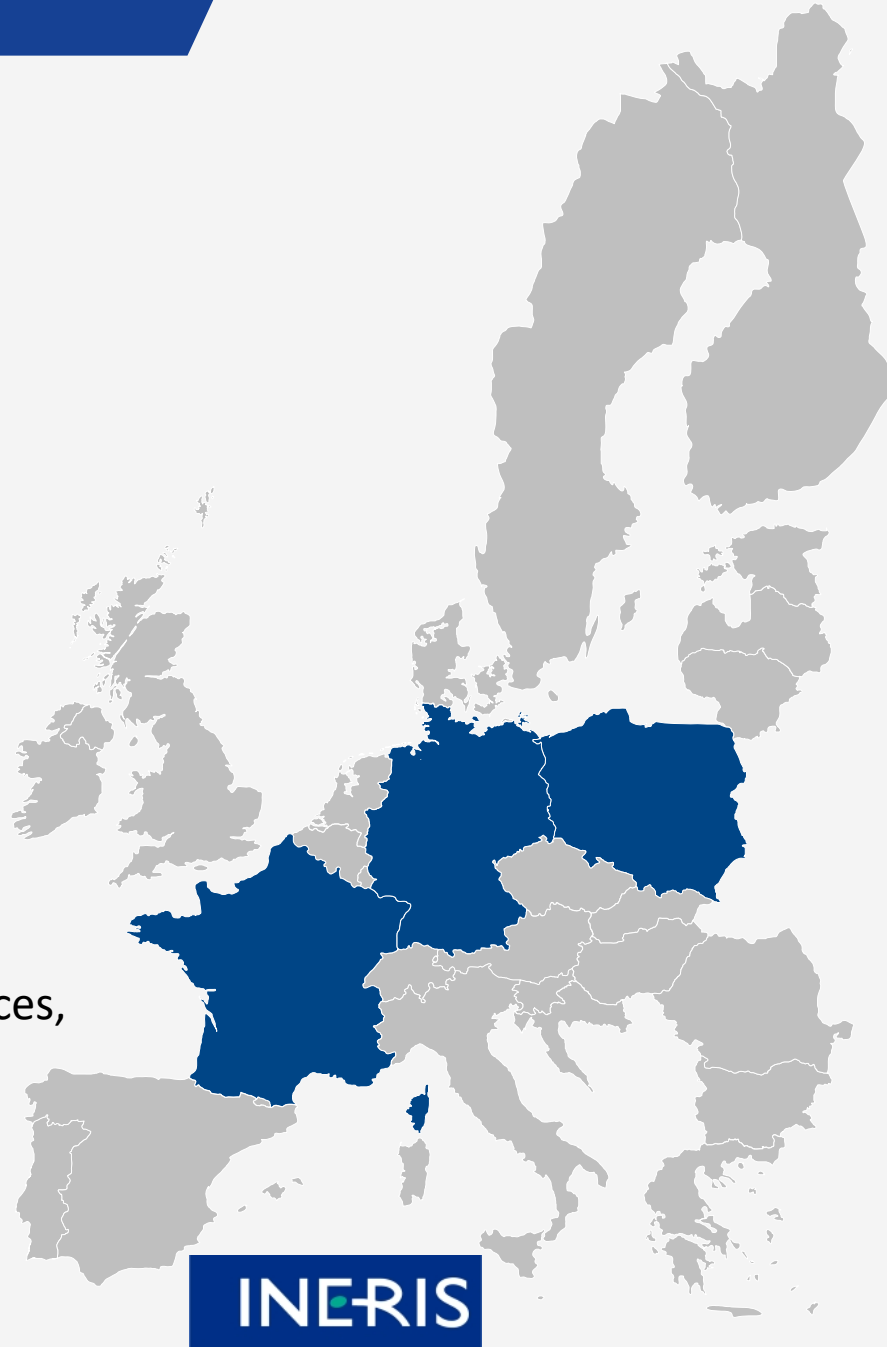
- EU and national funding required for timely implementation of HPHS in open-pit mines at the commercial scale
- Political and societal support to optimise regional socio-economic benefits of technology implementation



TRIDENT

Thermal energy storage in post-mining lakes for district heating transformation

- **Coordinator:** GFZ Helmholtz Centre for Geosciences, Germany
- **Call:** RFCS 2025 Research Project
- **Timeline:** October 2026 – September 2029
- **Total costs:** €3.0 million

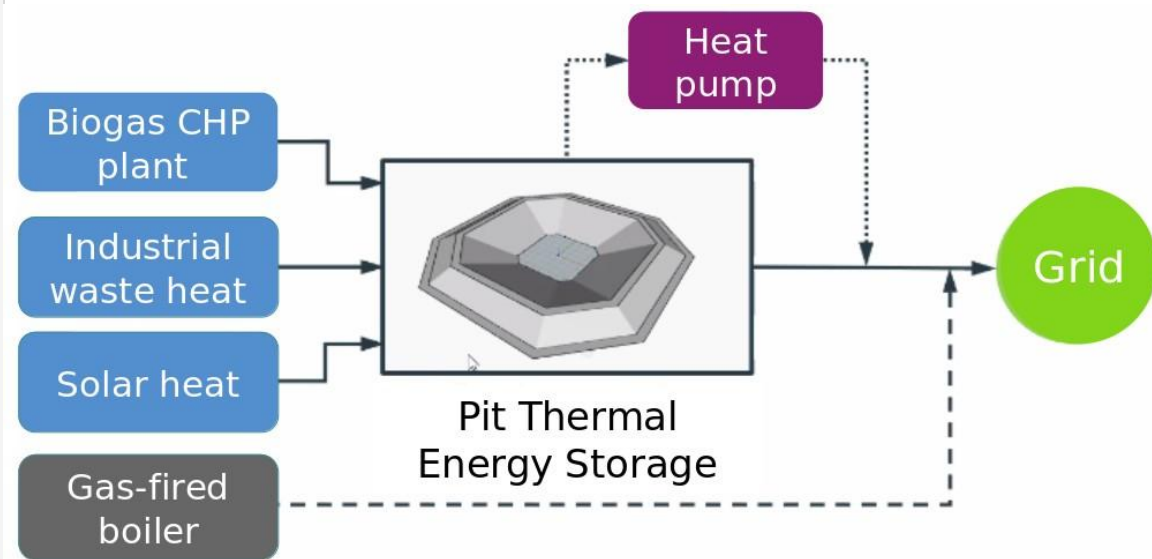


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Problem tackled by TRIDENT

- Decommissioning of lignite mining in Europe as planned requires **innovative and economic implementation strategies** to support coal regions in transition
- Restoration of abandoned open-pit coal mines in mining regions in **transition is currently highly cost-intensive** with limited socio-economic impacts



CHP: Combined heat and power unit



Main objectives of TRIDENT

- Technical and economic feasibility study on Pit Thermal Energy Storage in post-mining lakes
- Integration of renewable energy sources into district heating systems
- Quantification and mitigation of uncertainties and environmental risks impacting system operation and efficiency



Thank you!

<https://www.atlantis-project.eu>

<https://www.trident-project.eu>

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ATLANTIS
Best-practice
Guidelines



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Clean Energy, Restored Lands: The Path Forward for Coal Regions

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**Novel energy storage for heat and power
utilising existing coal-fired fluidised bed boilers**

Jochen Ströhle, TU Darmstadt

Organised by



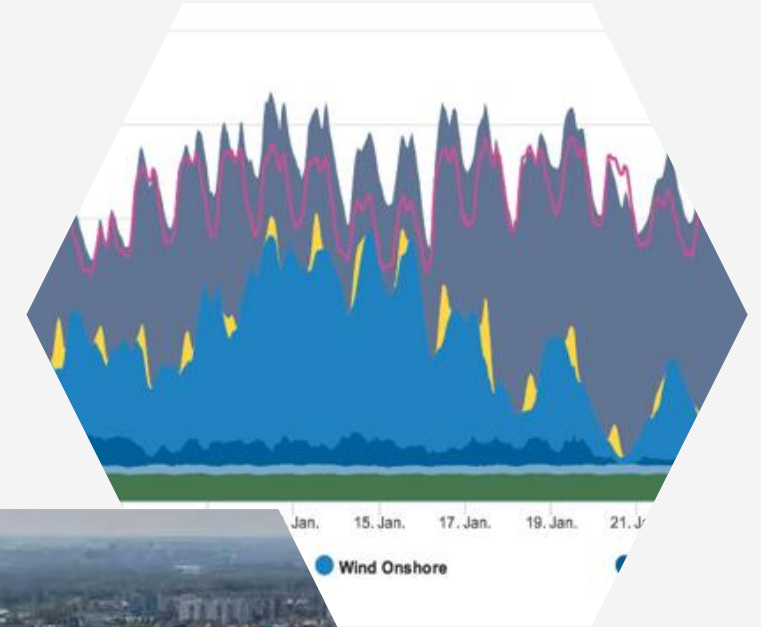
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Problems tackled

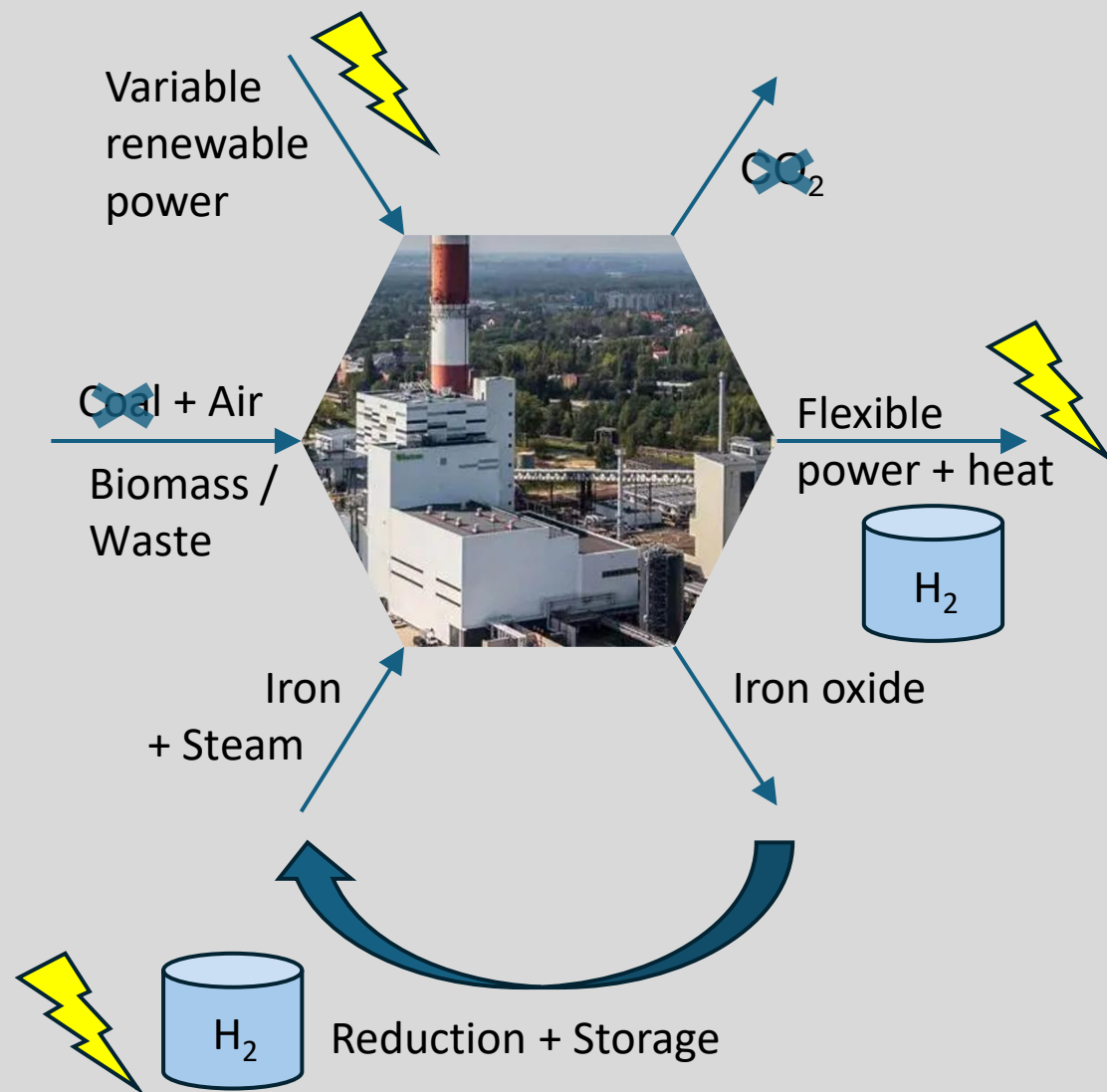
- Need for storage/transport of variable renewable energy to provide flexible electricity + heat
- Long-term (seasonal) storage
 - **H₂** implies high costs for storage/transport due to compression
 - **Metals** are a low-cost alternative
- Short-term (daily) storage
 - **Batteries** imply high investment costs and rare-earth elements
 - **Thermal** storage is a low-cost alternative
- Further use of existing coal-fired CFB boilers



Technical Solutions

- Switch fuel to **biomass/waste**, with CO₂ capture
- Switch fuel to **iron**, which can be regenerated
- Produce **H₂** by oxidation of **iron with steam**
- **Store** high temperature **heat** in solid structure

REBECCA
CORAL
HELIA
HIGHWAY



CORAL

CORAL

Combustion of Rechargeable Metal Fuels in Fluidised Bed Boilers

- **Coordinator:** TU Darmstadt
- **Call:** RFCS-2023 Research project
- **Timeline:** 09/2024 – 02/2028
- **Total costs:** 4.0 Mio €



HELIA

HELIA

Sustainable Hydrogen Production via Metal-Steam Redox Cycles in Circulating Fluidised Bed Systems

- **Coordinator:** LUT University
- **Call:** RFCS-2025 Research project
- **Timeline:** 10/2026 – 03/2030
- **Total costs:** 5 Mio €

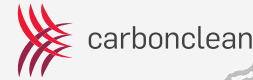


HIGHWAY

HIGHWAY

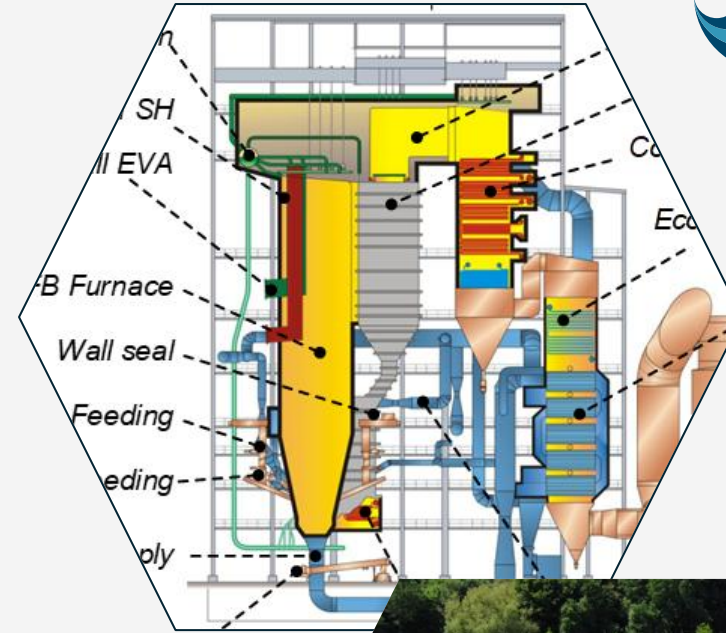
High-Temperature Thermal Energy Storage Enabling a Second Life for Existing Fluidised Bed Boilers with a High Efficiency

- **Coordinator:** LUT University
- **Call:** RFCS-2024 Research project
- **Timeline:** 12/2025 – 05/2029
- **Total costs:** 4.1 Mio €



Objectives of projects

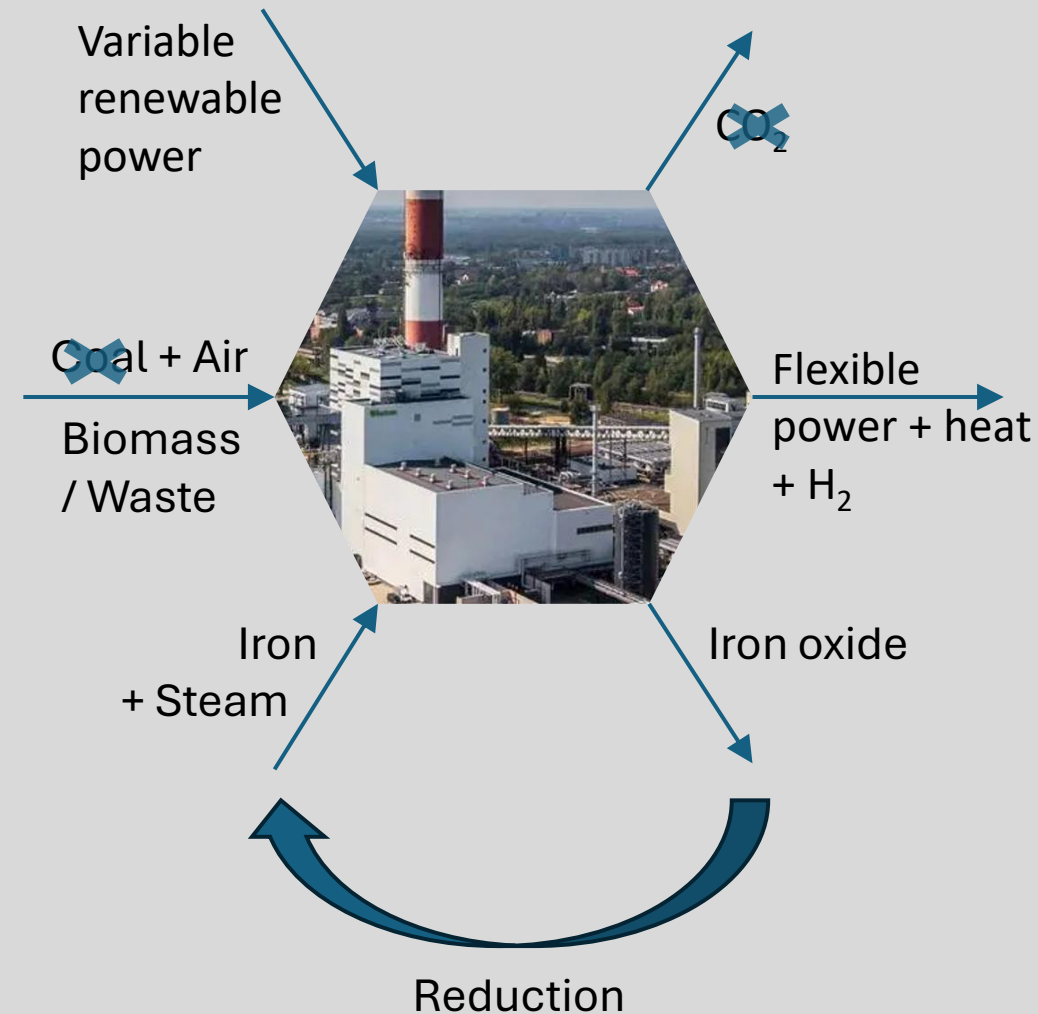
- Provide retrofitting concepts for CFB boilers
- Demonstrate concepts at lab & pilot scale
- Develop & validate models for scale-up
- Assess impact on economics, environment, and society



Technical Solutions

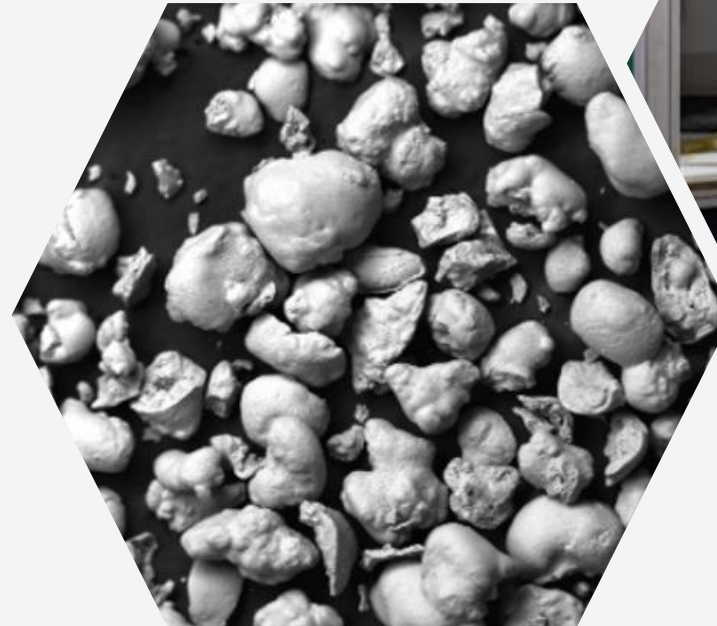
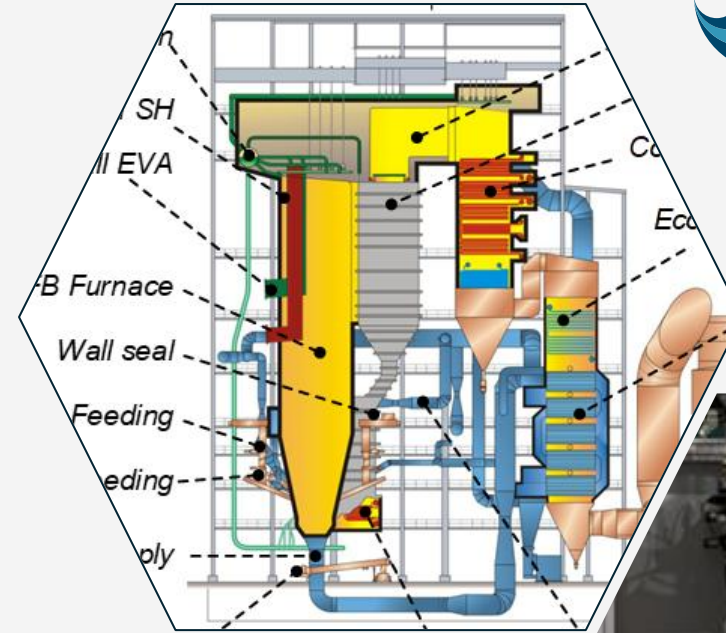
- Switch fuel to **biomass/waste**, with CO₂ capture
- Switch fuel to **iron**, which can be regenerated
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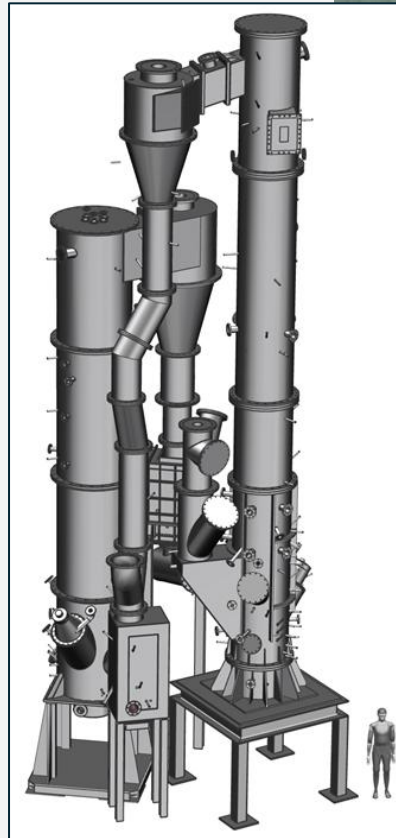
Main Results of CORAL

- Required **adaptions** of existing CFB boiler for iron firing identified
- Suitable **iron powder** for CFB operation selected
- Oxidation and reduction successfully **tested** at lab scale
- **Models** for oxidation and reduction developed
- **Market** potential highlighted (in progress)



Implementation Roadmap (CORAL)

- Testing at 1 MW **pilot** scale (2027)
- Erection and operation of **demo** plant (2028 – 2032)
 - New-built plant, or
 - Retrofit of a small CHP plant
- Commercial deployment (from 2033)
- Infrastructure for reduction, storage, transport needed
 - Synergies with **iron & steel industry** (direct reduction with H₂)
 - Storage/transport of iron is **established** technology



CORAL

Thank you!

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www.project-coral.eu



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**Scalable, innovative floating photovoltaic power plant
using energy buffer storage and easily relocatable
single-wire power transmission**

Jerzy Jagoda, KOMAG Institute of Mining Technology, Poland

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POSTEN

POSTEN

Scalable, innovative floating photovoltaic power plant using energy buffer storage and easily relocatable single-wire power transmission

- **Coordinator:** KOMAG Institute of Mining Technology
- **Call:** RFCS-2024-JT – Big tickets for Coal
- **Timeline:** March 2025 – February 2029
- **Total costs:** €13.73 million



GiG National
Research
Institute

KOMAG

SWE
SUN WIND ENERGY

KTKM



Silesian University
of Technology

NOVUM-SERVIS
S.r.l.





Problem tackled by POSTEN

Why conventional solutions do not fit difficult post-mining sites

1 Difficult land conditions

Many former mining areas remain flooded, swampy or unstable, which strongly limits conventional redevelopment options.

2 Infrastructure mismatch

Traditional PV support structures and power lines are poorly suited to reservoirs, difficult access and changing site conditions.

3 Reclamation changes the site

As reclamation progresses, the energy system should be modular and relocatable rather than permanently tied to one location.



Difficult post-mining terrain



Main objectives of POSTEN

The goal of the project is to develop an innovative energy system



PV / PVT

Floating PV structures and solar-following tracker concepts for post-mining reservoirs.



ENERGY STORAGE

Battery-buffered storage to stabilise generation and support system operation.



EMS

Integrated control, optimisation, statistics, alarms and remote monitoring.



SWET

Relocatable single-wire transfer for difficult terrain and remote loads.

1

Anchor safely

Validate anchoring under static and dynamic loads, including saline mine-water conditions.

2

Integrate the system

Combine generation, storage, SWET and EMS into one pilot-ready architecture.

3

Prove it in the field

Build, instrument and validate pilot infrastructure with data shared among partners.



Main results of POSTEN

From pilot validation to a scalable demonstrator for European coal regions



5 pilot systems

1 demonstrator

Core result

A general demonstrator concept integrating floating PV, tracking, anchoring, EMS and single-wire power transfer.

Validated modules

Floating PV and tracking solutions adapted to post-mining reservoirs and difficult terrain.

System integration

An energy concept combining generation, storage, control and relocatable power delivery.

Reliable operation

Anchoring and site adaptation for saline mine-water and changing reclamation conditions.

Transferability

A solution framework that can be replicated in other European mining-transition regions.

up to 2 MWp PV

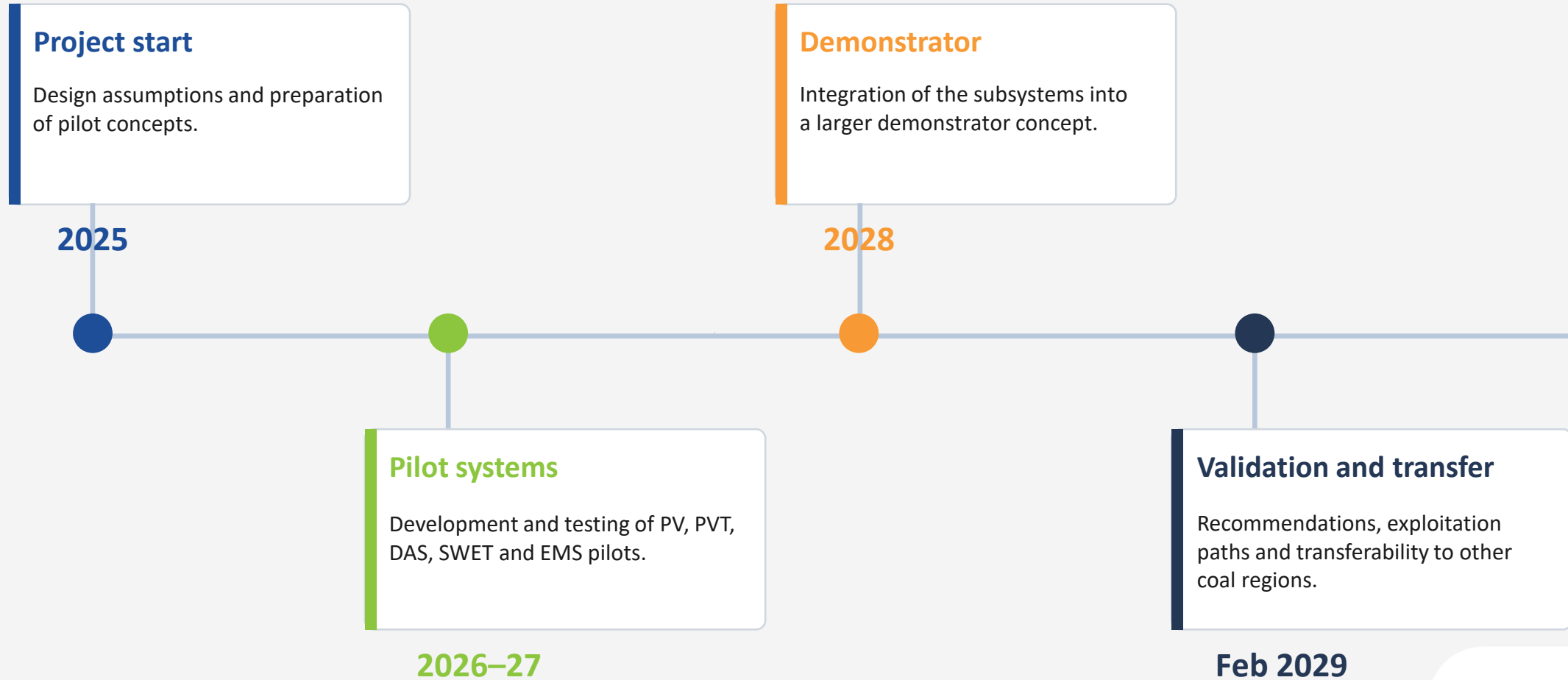
about 2 MWh storage

100 kW SWET line



Next steps

From pilots and validation to transfer and uptake



RFCS BIG TICKETS PROJECT



Scalable, innovative floating photovoltaic power plant using energy buffer storage and easily relocatable single-wire power transmission

Thank you!

<https://posten.komag.eu>



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Project web page:



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SCoLINE RFCS Big Ticket

Dariusz Jasiulek, KTKM Sp. z o.o.

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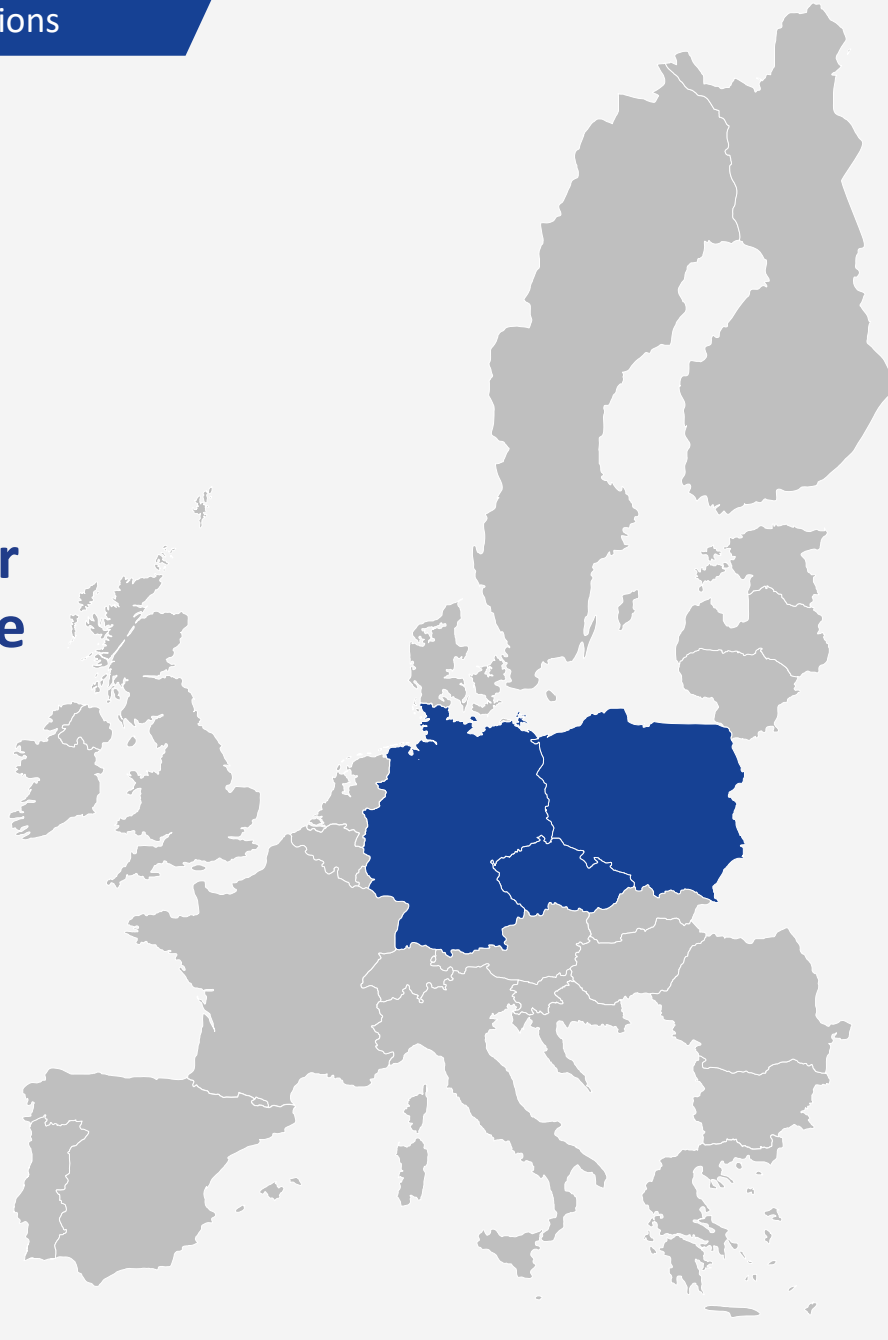


SCoLINE

SCoLINE

Innovative composite slings system for PV and power line based on composite poles for live power line construction on post-mining areas to transform them into green energy production area.

- **Coordinator:** KTKM Sp. z o.o.
- **Call:** RFCS 2025 Big Ticket
- **Timeline:** 03.2026 – 02.2030
- **Total costs:** €16.3 million



KTKM

GiG National
Research
Institute

NCT

ennecor

GFZ Helmholtz Centre
for Geosciences

m:KP
KOMPOZIT





Problem tackled by SCoLINE

How to turn difficult post-mining areas into clean-energy assets?

European coal regions contain large areas of degraded land with significant potential for renewable energy generation. However, their practical redevelopment remains challenging.

- Steep slopes and unstable ground limit conventional PV deployment.
- Difficult access increases construction and grid-connection costs.
- Standard foundations and power infrastructure are poorly adapted to mining waste heaps.
- Post-mining regions need new economic functions and investment opportunities.

Post-mining land should become an asset of the energy transition, not a long-term development burden.



Main objectives of SCoLINE

An integrated solution for renewable energy on post-mining areas

- Develop lightweight **PV supporting structures (CS)**.
- Develop dedicated **composite anchoring systems (CAS)**.
- Develop lightweight **composite poles (CP)**.
- Integrate the technologies into a full-scale demonstrator.
- Evaluate environmental and economic impacts.

SCoLINE combines renewable generation and power infrastructure in one system.



Main results of SCoLINE

From prototypes to full-scale demonstration

- **2027** – Composite Pole design and first validation.
- **2028** – Integrated demonstrator: PV + composite infrastructure + power line.
- **2029** – CAS, CS and industrial production technologies validated.
- **2030** – Final demonstrator and market deployment pathway.

Target: TRL 7–8

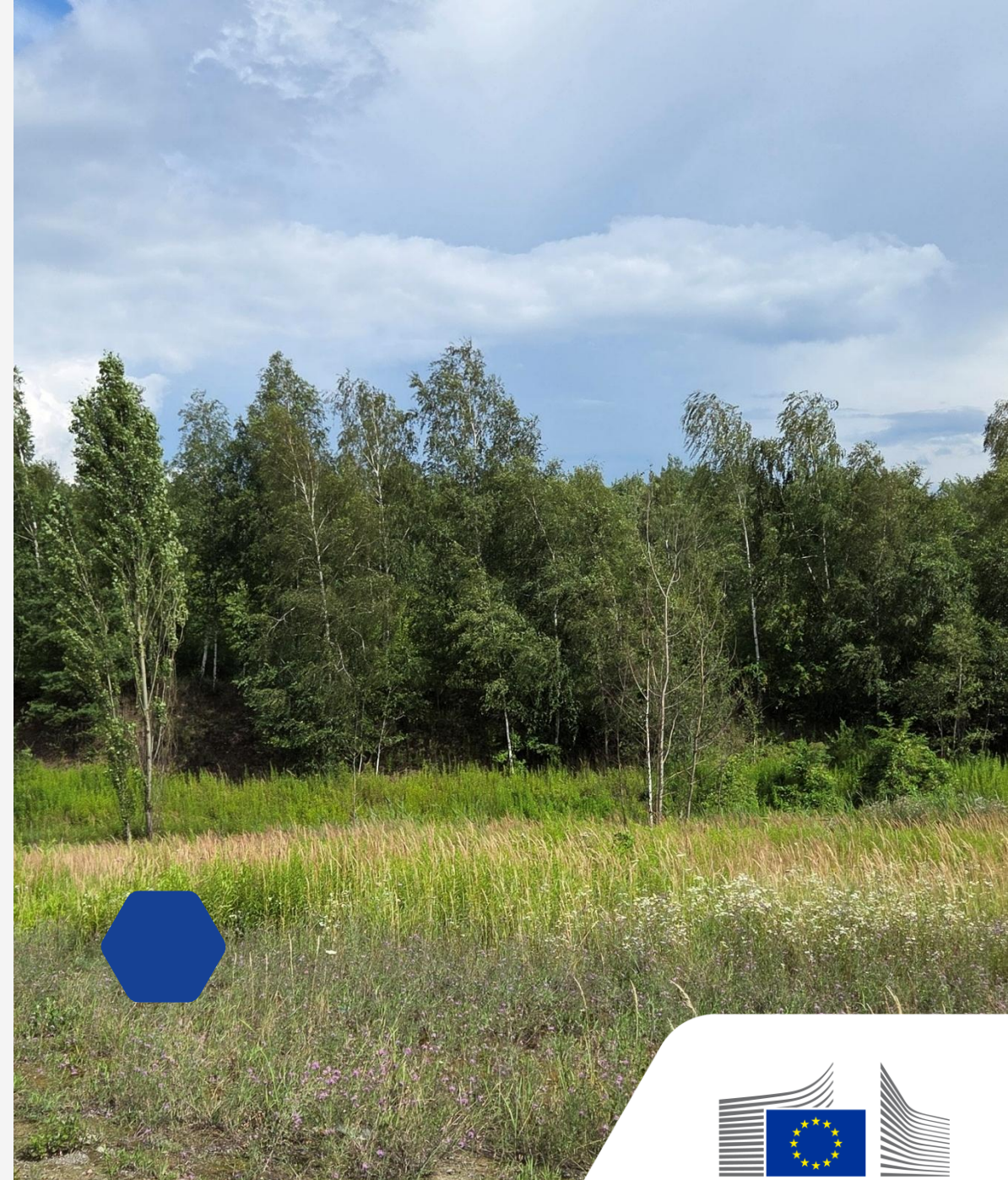
By 2030, SCoLINE will deliver a validated solution ready for further deployment.

Contribution to EU policies

Supporting EU climate and transition goals

- **Climate neutrality** – supports lower-emission energy infrastructure.
- **Renewable Energy Directive** – enables new areas for PV deployment.
- **REPowerEU** – supports renewable generation and stronger electricity grids.
- **Just Transition** – gives post-mining land a new productive function.
- **Circular economy** – promotes resource-efficient composite technologies.

SCoLINE turns EU climate and Just Transition goals into a practical solution for coal regions.





SCoLINE

Innovative composite slings system for PV and power line based on composite poles for live power line construction on post-mining areas to transform them into green energy production area

Thank you!

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Co-funded by
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Dr. Ángeles Gómez Borrego

INCAR-CSIC &
Chair of RFCS Technical Group



Session 2 – Challenges linked to site restoration and risk management in the coal and lignite regions





Dr. Julia Haske

Head of Land Use & Transition, Research Center of Post-Mining,
Technische Hochschule Georg Agricola (DMT-THGA)



Krasimira Ilieva

Head of Project Management Unit, Investment Department,
Mini Maritsa Iztok EAD

Dr. Barbara Rogosz

Director, Poltegor Institute



Clean Energy, Restored Lands: The Path Forward for Coal Regions

Bochum, Germany

29 – 30 September 2026

POTENTIALS & CRMDataSpace – An Introduction

Dr.des. Julia Haske, Research Center of Post-Mining at THGA University

Organised by



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EU-RFCS Project POTENTIALS: On the opportunities for end-of-life coal mines and coal-fired power plants

01



POTENTIALS

RFCS AM PROJECT

POTENTIALS

Synergistic potentials of end-of-life coal mines and coal-fired power plants: update and re-adoption of territorial just transition plans

- **Coordinator:** Central Mining Institute (GIG), Poland
- **Call:** RFCS 2020 Research Project
- **Timeline:** July 2021 – June 2023
- **Total costs:** €0.79 million



Universidad de Oviedo



CERTH
CENTRE FOR RESEARCH & TECHNOLOGY HELLAS



Main objectives of POTENTIALS

- Identification of potential synergies between neighbouring industrial sectors through coupling
- Sustainable and considerate use of assets and resources by existing infrastructure
- Integration of renewable energies, energy storage and circular economy in scenario building of business models on former mining sites
- Stimulation of economic activity and job creation to generate new value for post-mining sites



Source: THGA

Main results of POTENTIALS

- Economic impact assessment for economic diversification, potential commercial viability and added value
- Business model justification for an Eco-Industrial Park (EIP) as a multi-use tool with possible extension of, e.g. a virtual power plant or green hydrogen
- Identification and engagement of stakeholders, ranging from mine operators and political decision-makers to industry and academia
- Best-Practice Guideline for the roadmap of updating and re-adopting of territorial just transition plans for Coal Regions in Transition



Source: THGA



Main results of POTENTIALS – EIP with virtual power plant

“Integrated alternative to be developed within coupled end-of-life coal mine sites and coal-fired power plants along with surrounding residential, industrial areas for sustainable renewable energy generation (geothermal, photovoltaic, wind), storage technologies, circular economy contributions and synergies for reducing waste and pollution by promoting short-distance transport and optimising park’s material, resource and energy flows, producing the goods needed for the industrial transition”.

1. Should be based on district networks allowing multiple energy sources to be connected to various energy consumption points.
2. Should be supported by pursuing financial privileges and other benefits to boost and diversify the area’s economy, attracting external investment easier.



EU-RFCS Project CRMDataSpace: An Introduction

02





CRMDataSpace

Common European Data Space on Critical Raw Materials for the Green Deal: Recovery Potential from Closed Extractive Coal Waste Facilities

- **Coordinator:** Central Mining Institute (GIG), Poland
- **Call:** RFCS 2024 Research Project
- **Timeline:** July 2025 – June 2028
- **Total costs:** €2.38 million



Universidad de Oviedo

satec_

DEX

Desarrollo de Estrategias Exteriores



UNIVERSIDAD DE BURGOS



Technische Hochschule
Georg Agricola



EURACOAL



Main objectives of CRMDataSpace

- Developing a technical guideline and a demonstrator for assessing the potential of critical raw materials in disused mining sites
- Developing of the first European data catalogue for CRMs, integrating metadata, multimedia and analytical tools
- Building of a functioning Minimum Viable Data Space (MVDS) that serves as a blueprint for a future common European data space for CRM
- Greater involvement of stakeholders, from both the coal mining sector and the wider mining industry, thereby strengthening Europe's resilience in the supply of CRM



Source: Hernan Flores, THGA



Thank you!

Julia.Haske@thga.de



Co-funded by
the European Union



Clean Energy, Restored Lands: The Path Forward for Coal Regions

Bochum, Germany

29 – 30 September 2026

REECOL – Rehabilitation of post-mining areas (building on MiDSafe & RAFF)

Barbara Rogosz, PhD „Poltegor-Institute” Opencast Mining Institute

Organised by



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Nordrhein-Westfalen





MiDSafe

Advancing Post-Mining Waste Dump Safety and Sustainability

- **Coordinator:** Poltegor Institute
- **Call:** RFCS-2023-01-RPJ
- **Timeline:** July 2024 – June 2027
- **Total costs:** €2.8 million

SYSTRA
SUBTERRA

VUHU
MOST

poltegor – instytut

GiG Państwowy
Instytut
Badawczy

 Politechnika Wrocławska



 **Complexul Energetic Oltenia**
Energia pamantului romanesc

LIGNITE MINES OF ACHLADA S.A.



TECHNICAL
UNIVERSITY
OF CRETE



National Technical
University of Athens



Problem tackled by MiDSafe

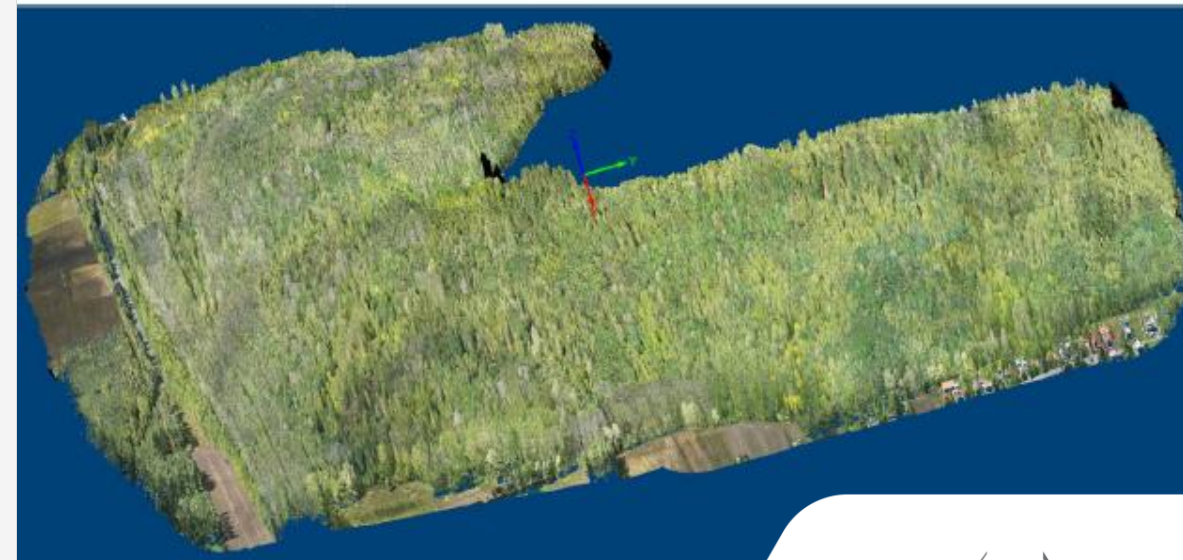
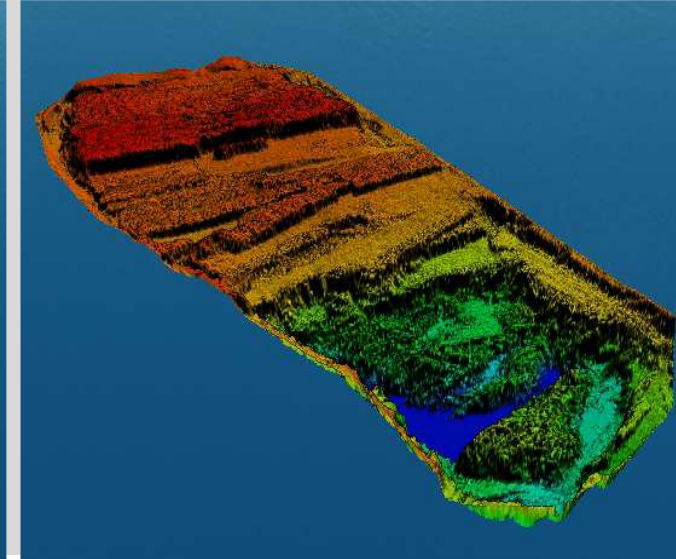
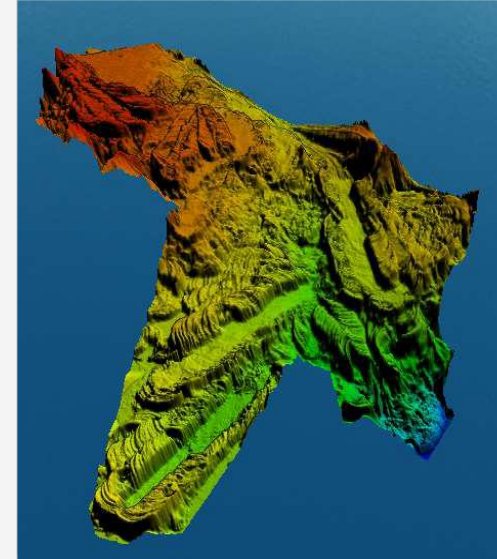
Post-mining waste dumps are heterogeneous, water-sensitive and difficult to monitor as integrated systems.

350+

dump records assembled in
a new European database

THE SYSTEM CHALLENGE

- Heterogeneous spoil properties obscure failure mechanisms
- Rainfall, groundwater & vegetation change can accelerate instability
- Monitoring, modelling and risk decisions remain fragmented





MiDSafe connects evidence, monitoring and intervention

ONE SYSTEM, THREE WORKSTREAMS

Detect instability earlier, assess risk more reliably and enable safer, sustainable reuse of mine waste dumps.

01 KNOW

Build the European database and identify critical factors, failure mechanisms and reuse constraints.

02 SENSE

Combine UAV, LiDAR and in-situ sensors for continuous, multi-source monitoring.

03 ACT

Translate models into risk guidance, early-warning thresholds and remediation materials.



The first half built a shared evidence base across Europe

RESULT 1 · DATABASE + FIELD EVIDENCE

Archival studies, field surveys and public input now anchor the technical work.

350+ dump records

A structured European database supports cross-site analysis.

6 data categories

Location · geometry · geotechnics ·
infrastructure · market · context

+700 survey responses

residents consulted on preferred reuse pathways

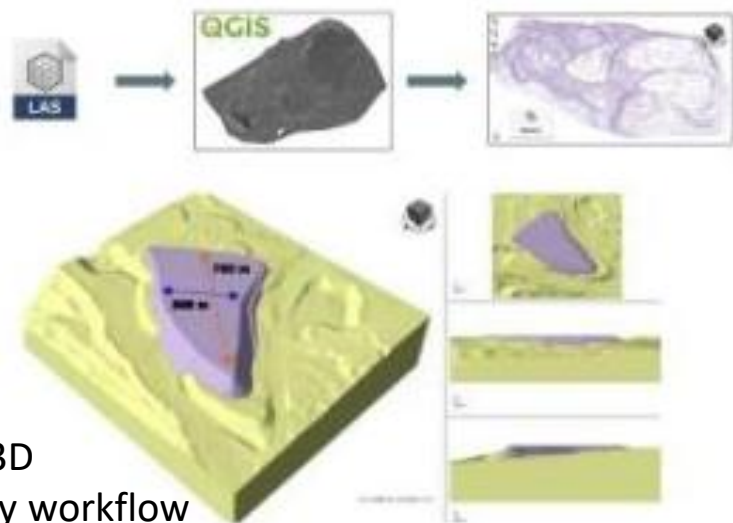
UAV · LiDAR · site surveys · archival designs · failure cases · regulations · reuse pathways



MiDSafe



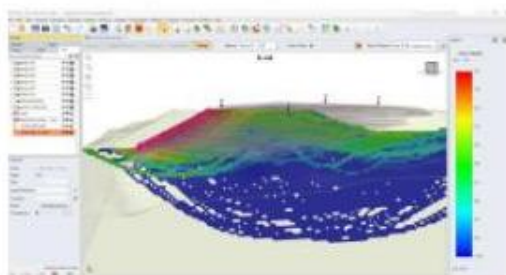
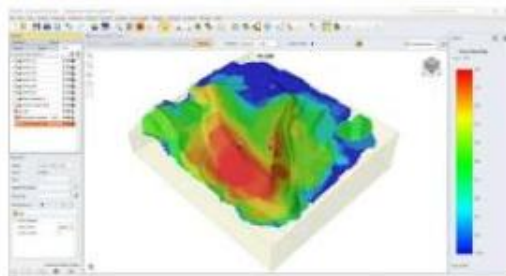
Monitoring and 3D models are converging into a live stability system



UAV-to-3D
geometry workflow

3D stability models

Preliminary
geometries and
factor-of-safety
results support
sensor placement.



RESULT 2 · SENSE + PREDICT

3D

models of case-study dumps now support
monitoring design

Geometry, sensors and models now form one monitoring architecture.

Priority signals include displacement, pore-water pressure, soil moisture, rainfall, vegetation change and groundwater level.

Next: integrate the data streams into a viable digital twin and early-warning logic.

The second half turns models into risk decisions and remediation

RESULT 3 · ASSESS + MITIGATE

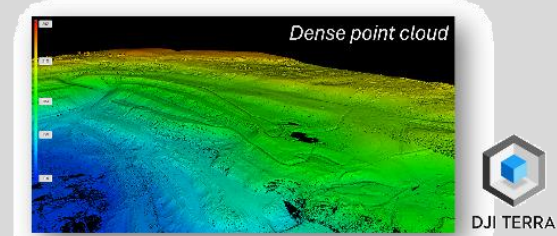
MiDSafe is moving from deterministic checks to probability-based risk.

- 01 **QUANTIFY** Integrate spatial variability and rainfall-driven pore pressure into failure probability.
- 02 **VALIDATE** Calibrate 3D and geo-neuronal models against monitoring data and observed behaviour.
- 03 **MITIGATE** Test geopolymers for soil stabilisation and synthetic zeolites for pollutant removal.

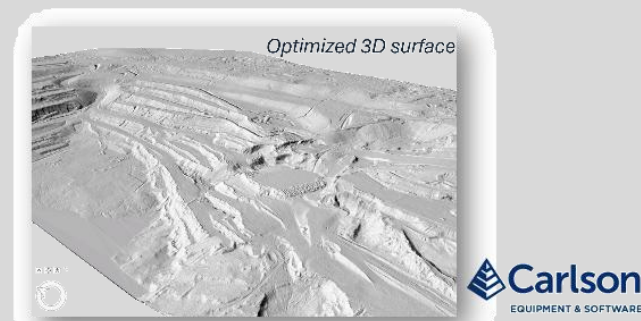
UAV DATA ACQUISITION



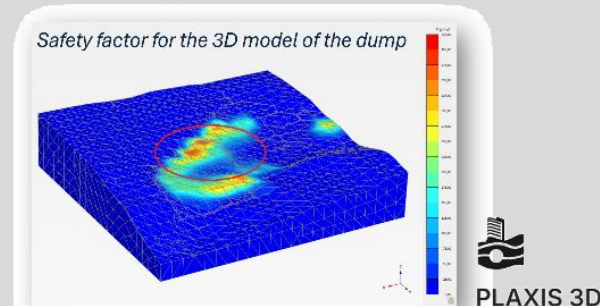
LiDAR POINT CLOUD PROCESSING



SURFACE PREPARATION



FINITE ELEMENT MODELLING





Risk Assessment of Final Pits During Flooding

- **Coordinator:** Poltegor Institute
- **Call:** RFCS-2018
- **Timeline:** June 2019 – May 2022
- **Total costs:** €3.42 million



Problem tackled by RAFF

Flooding is Europe's default route to reclaim exhausted lignite pits—but the safety of these new lakes is difficult to predict.

≈50

lignite mines across Europe will require reclamation

≈280 m

depth already reached at Bełchatów and Szczerców

THE CORE UNCERTAINTY

- Pit geometry changes during and after filling
- Groundwater recovery and filling speed alter slope stability
- Legacy designs do not fully describe present-day conditions



Lake Most (Czechia) during flooding in 2009 (Bajcar & Burda, 2020)



Main objective of RAFF

ONE OBJECTIVE, THREE WORKSTREAMS

Create a universal, evidence-based method to assess and manage risk while final mine pits are flooded—and after they become lakes.

01 UNDERSTAND

Combine archives, field monitoring and laboratory evidence to reveal how pit lakes behave.

02 QUANTIFY

Model the factors controlling slope stability, groundwater movement and water quality.

03 TRANSLATE

Turn the evidence into classifications, risk maps and practical guidance for safe reclamation.



RAFF assembled a cross-border evidence base for safer pit lakes

RESULT 1 · OBSERVE THE REAL SYSTEM

Field evidence replaced assumptions with measured geometry, material behaviour and groundwater conditions.

6

case-study sites

Most · Medard · Milada · Lubstów ·
Maczki-Bór · South Pesteană

3

countries

Czechia · Poland · Romania

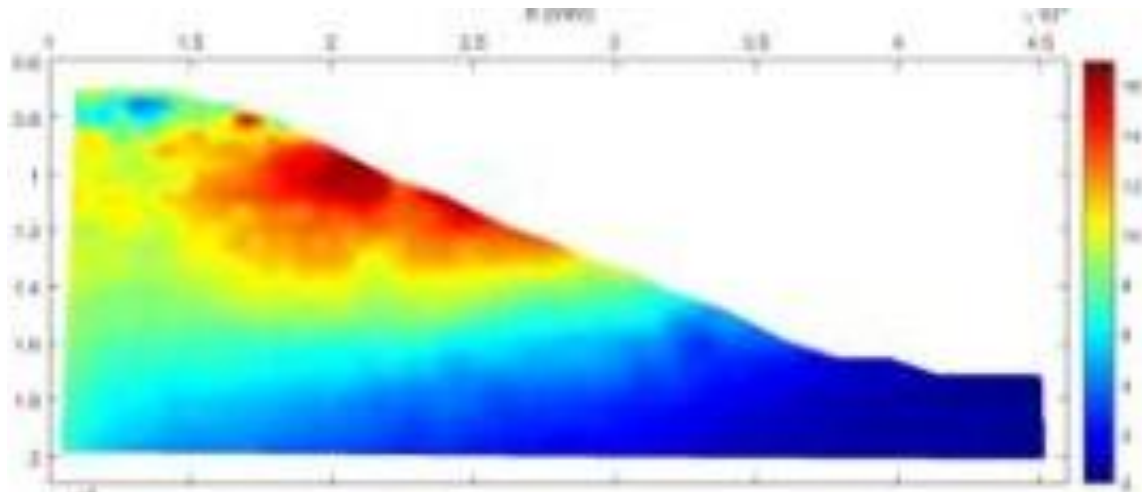
34

probes + samples

21 CPT probes + 13 core samples

Bathymetry · LiDAR · CPT · groundwater monitoring · water chemistry · laboratory characterisation





Numerical displacement contours



80g centrifuge

15° and 24° slopes
tested under cyclic
water-level change

Water-level cycles emerged as a decisive stability driver

RESULT 2 · TEST AND MODEL

500 tests

Cyclic water levels caused plastic deformation to accumulate—not reset.

Critical controls included weak-zone inclination and friction angle, groundwater regime, material heterogeneity and drawdown depth.

Physical and numerical models showed the same displacement trend.

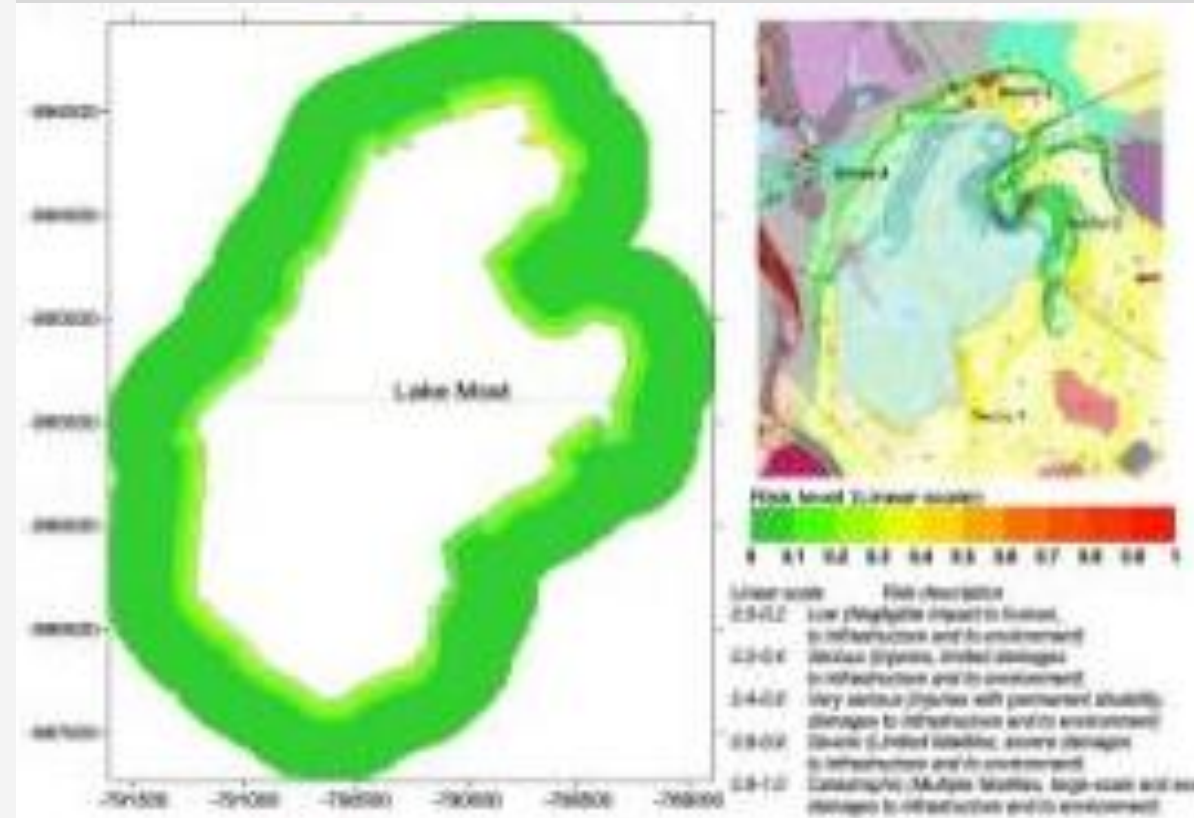


RAFF translated research into tools for real-world decisions

RESULT 3 • APPLY THE EVIDENCE

A flexible risk framework now links site data to mitigation priorities.

- 01 **CLASSIFY** Four hydrogeological classes distinguish simple through complex flooding conditions.
- 02 **MAP** Spatial risk maps identify where people, infrastructure and the environment face the greatest exposure.
- 03 **MANAGE** ISO 31000-aligned guidance supports risk registers, corrective measures and ongoing monitoring.



Lake Most risk map: high-risk locations become visible and actionable

REECOL

Ecological rehabilitation and long
term monitoring of post mining areas

- **Coordinator:** Poltegor Institute
- **Call:** RFCS-2022
- **Timeline:** July 2023 – December 2026
- **Total costs:** €2.9 million



Problems tackled by REECOL

- Existing approaches to ecological rehabilitation of post-mining areas still require significant improvement.
- Current methods for ecological rehabilitation may not adequately consider all relevant factors specific to a post-mining area.
- Ensuring the long-term environmental sustainability and viability of rehabilitated post-mining areas.
- There is a need for new, impactful research to support the transition of coal regions.



Overall goal of REECOL

To support the transition of coal mining regions by establishing a comprehensive procedure for ecological rehabilitation and monitoring, tailored to future land uses, climate change impacts, and cost affordability.

Key objectives

1

Catalogue Existing Experience

Assess and systematise rehabilitation approaches across different sites, land-use goals and climate conditions.



2

Develop and Validate Innovative Solutions

Create and field-test new technologies for soil restoration and revegetation, supported by cost-benefit analyses.



3

Advance Monitoring Approaches

Use field indicators and remote sensing (satellite & UAV) to track ecosystem recovery over time.



4

Establish Audit and Certification Criteria

Develop an audit framework and certification methodology to ensure high-quality and standardised rehabilitation practices.



5

Engage Key Stakeholders

Increase awareness and capacity of local authorities, mine operators and communities about sustainable rehabilitation options and their long-term benefits.





Chosen results of REECOL

- Framework for the classification of degraded areas
- Tool (impact matrix) to support decision-making
- Method for the steered succession of low-growing plants
- Non-contact soil remediation technology
- Technology for soil regeneration with composts of high biological activity
- Monitoring tools, procedures and Guidelines
- European Audit Catalogue to support management of reclamation



Directed succession method for revegetation of post-mining areas

- **Rapid revegetation** - establishes a stable, low-growing vegetation cover within **two growing seasons**.
- **Low-cost reclamation** - uses soil amendments and native seed mixtures, avoiding the need for extensive topsoil replacement.
- **Controlled succession** - directs natural vegetation development towards a **stable herbaceous community**, limiting invasive species and unwanted woody growth.
- **Soil stabilisation & ecosystem services** - reduces erosion, improves water retention and supports **pollinators and local biodiversity**.
- **Future land-use compatibility** - maintains the site in a condition suitable for **future industrial or commercial redevelopment**.
- **Cost-effective implementation** - based on standard agricultural machinery, enabling an **asset-light service model** without major capital investment.
- **Monitoring-based verification** - effectiveness can be demonstrated using **satellite imagery, UAV-based NDVI analysis and field surveys**.
- **Industrial readiness** - the method has been **field-tested and can be implemented at operational scale** using existing agricultural equipment.

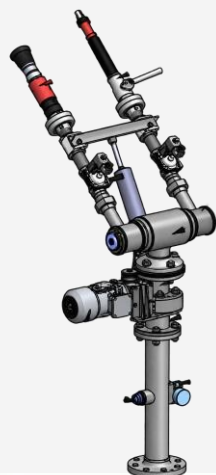
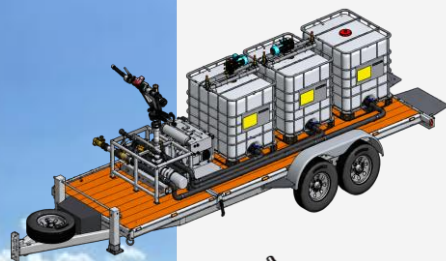




Technology for soil regeneration by composts of high biological activity

- **Bioactive compost** - developed specifically to restore the biological and physicochemical functionality of degraded post-mining soils.
- **Waste-based formulation** - combines **wheat straw (60%), poultry feathers (20%) and low-calorific lignite (20%)**, valorising agricultural, food-industry and mining residues.
- **Specialised microbial inoculum** - three complementary bacterial strains enhance the degradation of **keratin, cellulose and lignite**, improving the functionality of the final compost.
- **Controlled production process** - dynamic composting in rotary bioreactors with forced aeration, mixing and moisture control; production cycle of approximately **4–5 weeks**.
- **Improves soil functionality** - supports **moisture retention, microbial activity, soil structure and vegetation establishment**, rather than providing only nutrients.
- **Field application** - recommended rate of approximately **15 Mg/ha (1.5 kg/m²)**, incorporated into the upper **15–20 cm** of soil before revegetation.
- **Validated at TRL 6** - tested from laboratory and semi-technical scale through to **field application under relevant conditions**.
- **Innovation protected by patents** - two Polish patent applications filed in **2026**, covering the compost production and the inoculum.





Technology for non-contact soil Rehabilitation and control of soil parameters

- **Integrated reclamation system** - combines **UAV remote sensing, environmental monitoring, spatial analysis and automated spraying** in one workflow.
- **Site-specific treatment** - identifies areas requiring intervention and applies reclamation materials **only where needed**, based on actual site conditions.
- **Precision application** - GPS-based treatment zones enable accurate and repeatable distribution of seeds, compost, water and other materials.
- **Sequential treatments** - separate application of **seed-mulch and compost-water mixtures** allows each treatment to be optimised for vegetation establishment and soil regeneration.
- **Continuous monitoring** - UAV imagery (including **NDVI**) and measurements of soil moisture, temperature, pH and atmospheric conditions support ongoing assessment.

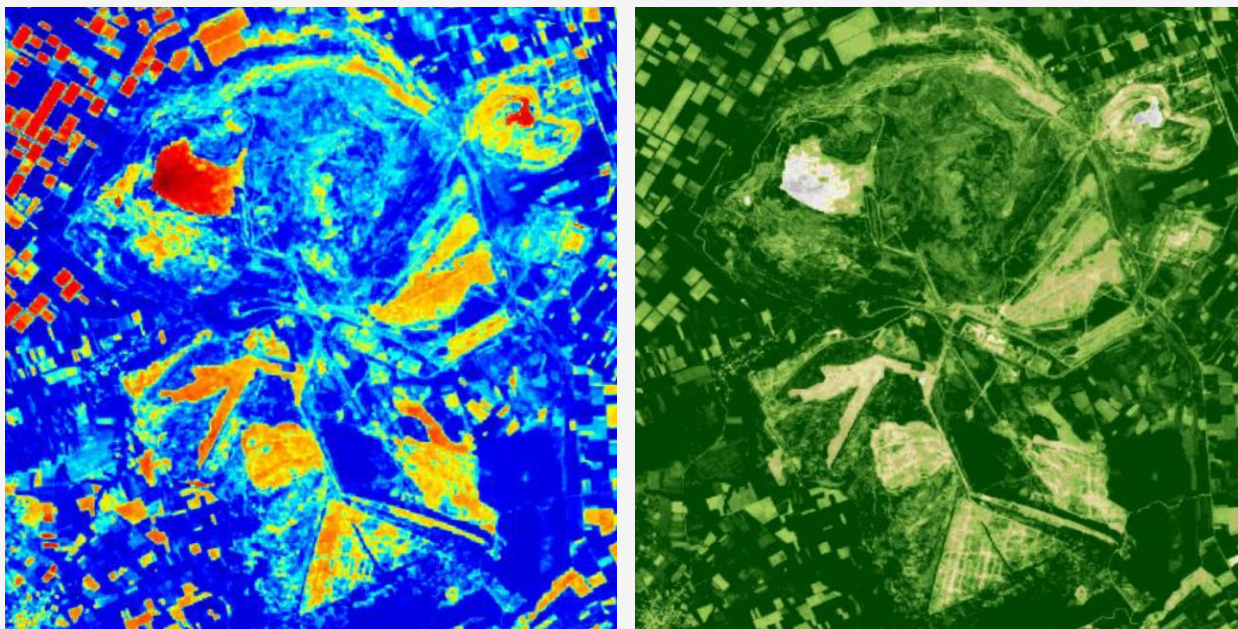
Adaptive reclamation - monitoring results are used to adjust subsequent treatments and provide **targeted supplementary interventions**.

Resource efficiency - reduces unnecessary consumption of **water, seeds and soil amendments** while improving the uniformity of application.

Field validated - the integrated system was tested under real conditions, demonstrating its **operational feasibility and potential for industrial deployment**.



Short- and long-term monitoring of ecosystem rehabilitation



- **8 monitoring campaigns completed** across diverse post-mining areas in **5 European countries**.
- **Guidelines for short- and long-term monitoring** are currently under development.

Parameter	Habitat and biodiversity regulation	Nutrient capture for soil organisms and plants	Organic matter storage and cycling	Soil structure for maintenance for plants	Water retention and infiltration	Pollutant attenuation and degradation
Texture	✓	✓		✓	✓	✓
Porosity	✓			✓	✓	
Compaction	✓			✓	✓	
Soil depth	✓			✓	✓	
Aggregate stability	✓			✓	✓	
Soil density	✓			✓	✓	
Soil water holding capacity	✓			✓	✓	
Soil water availability					✓	
Soil water permeability					✓	
Soil organic matter	✓	✓	✓	✓	✓	✓
Soil organic carbon	✓	✓	✓		✓	✓
Thermolabile carbon		✓	✓			
Thermoresistant carbon		✓	✓			
Soil inorganic carbon		✓	✓			
pH water	✓	✓		✓		✓
Total nitrogen		✓	✓			
Mineral Nitrogen	✓	✓	✓	✓		
Total phosphorus		✓	✓			
Phosphorus availability	✓	✓	✓	✓		✓
Cationic exchangeable capacity	✓	✓		✓		✓
Carbon / Nitrogen ratio	✓	✓	✓	✓		
Contaminant concentrations (total and extractable)	✓	✓	✓			



European Audit Catalogue to evaluate and certify ecological rehabilitation

Assessment

Location: Land reclamation of the orchard area

Overall Progress: 72%

Monitoring & Evaluation - Question 5 of 6: 83%

← Section Menu

4.5. Risk and issue tracking

- 5** The risk and issue tracking system is fully developed and highly effective, ensuring that all risks and issues are consistently identified, monitored, and addressed in real-time. The system includes detailed risk assessments, categorization, and prioritization, allowing for proactive management. Risks and issues are documented with clear action plans and assigned ownership, and there is excellent transparency and accountability in tracking their progress. Regular updates are provided, and the system is flexible enough to adapt to new risks or issues as they emerge.
- 4** The risk and issue tracking system is well-established and mostly effective, though minor adjustments could enhance its performance. Risks are regularly reviewed, and issues are systematically documented, but slight improvements could be made in areas such as increasing the frequency of updates or providing more thorough documentation on low-priority risks. Overall, the system meets most needs effectively, with minimal refinements required to optimize performance.
- 3** The risk and issue tracking system is functional but has several areas that need improvement. While some risks and issues are tracked, there are inconsistencies in documentation, prioritization, or follow-up actions. The system could benefit from clearer risk classification and an improved escalation process for high-impact issues. Moderate improvements, such as adding a more systematic approach to risk assessment and regularly updating risk status, are absent, decreasing the system's effectiveness.
- 2** The risk and issue tracking system exists but is underdeveloped, leading to gaps in risk identification, documentation, and response. Risks and issues are tracked inconsistently, with limited documentation or follow-up on mitigation actions. High-impact risks are not adequately prioritized, and the system lacks ownership assignment or accountability measures, causing delays in resolution.
- 1** There is currently no risk and issue tracking system in place, which represent a major oversight in project management. Without a formal tracking system, risks and issues may go unidentified or unaddressed, leading to potential project delays or failures. The absence of a risk and issue tracking system is a critical gap that requires urgent attention.

Your Rating (1-5):

3

Justification (Optional):

The risk and issue tracking system is functional but has several areas that need improvement. Moderate improvements, such as adding a more systematic approach to risk assessment and regularly updating risk status, are absent decreasing system's effectiveness.

← Previous

Next →

✓

Section Complete!

Monitoring & Evaluation

Q1: Regular progress reporting

Results of measurements and analyses are kept in electronic files and in hard copy as well as in special diaries which are immediately available for control bodies. An annual environmental quality report is prepared which contains data on compliance with the prescribed limits, a general quality assessment as well as the problems encountered during the reporting period.

5

Q2: Monitoring performance indicators

Environmental monitoring program: soil, geotechnical characteristics, atmospheric environment, aquatic environment, solid waste, acoustic environment/vibrations (EIA)

5

Q3: Environmental impact tracking

Follows the current environmental legislation (EIA)

5

Q4: Stakeholder feedback mechanisms

A consultation of the EIA was employed, where the stakeholders could express their concerns. Could be improved: The communication frequency

4

Q5: Risk and issue tracking

The risk and issue tracking system is functional but has several areas that need improvement. Moderate improvements, such as adding a more systematic approach to risk assessment and regularly updating risk status, are absent decreasing system's effectiveness.

3

Q6: Adaptive management

Largely effective. Minor improvements could be made: increasing the frequency of reviews or enhancing data collection methods to inform adaptations.

4

Section Average:

4.33

Back to Menu



Land reclamation - Orchard Area - Ptolemais mining

← Back to Programs

Program Leader:
Alkaterini Services

Strategic Plan Year:
2001

Strategic Plan:
Agricultural reclamation

6

Total Audits

2.77

Average Score

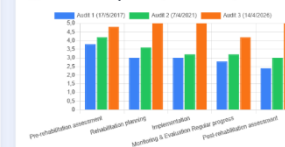
14/4/2026

Latest Audit

Score Evolution Over Time



Sections Comparison (Last 3 Audits)



REECOL FINAL CONFERENCE

5 November 2026, Katowice, Poland



Register now!





MiDSafe



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Thank you!



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Clean Energy, Restored Lands: The Path Forward for Coal Regions

Bochum, Germany

29 – 30 September 2026

PRIMI: Creating value from mining waste

Krasimira Ilieva, Mines Maritsa Iztok EAD, Bulgaria

Organised by



Under the patronage of

Die Landesregierung
Nordrhein-Westfalen





Piloting Research and Innovation at Maritsa Iztok using waste clay extracted during lignite mining for traditional and alternative construction materials

- **Coordinator:** Mines Maritsa Iztok EAD, Bulgaria
- **Call:** RFCS 2024 Big Ticket Project
- **Timeline:** July 2025 to June 2029
- **Total cost:** € 6.52 million





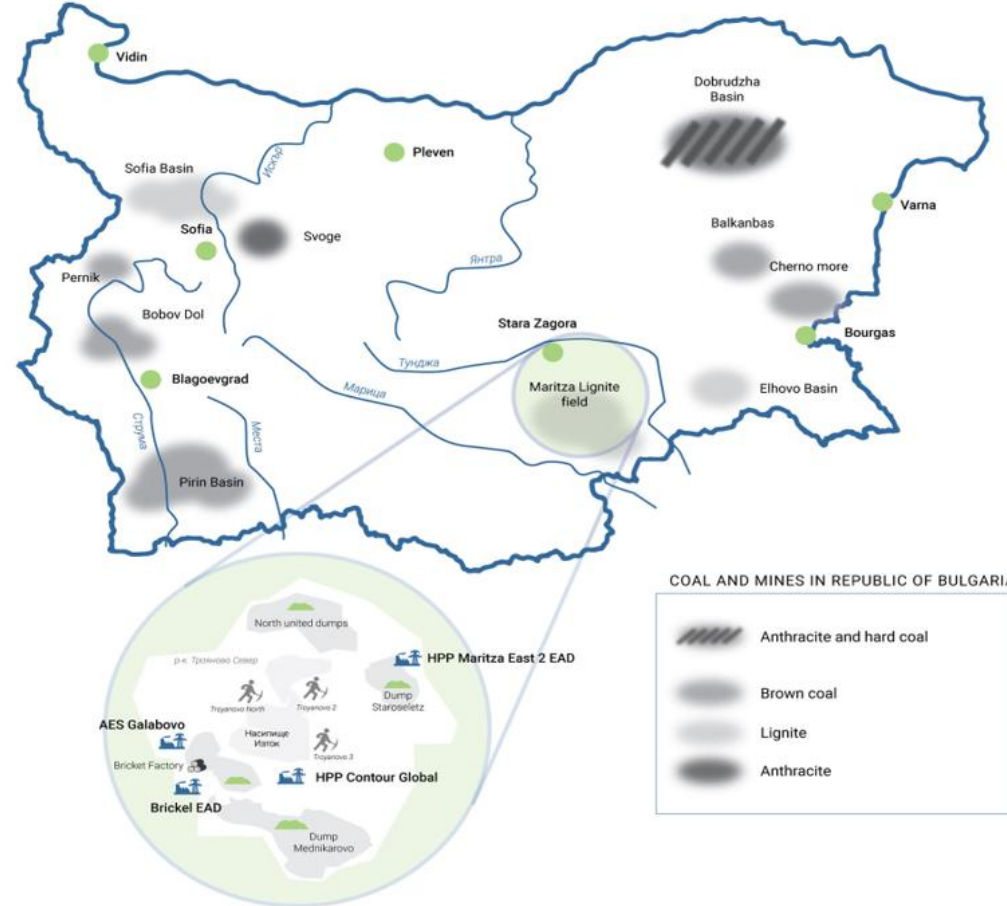
Main Challenges

- Maritsa Iztok Complex in Bulgaria is one of the largest lignite mining and lignite coal-based energy production regions in Southeast Europe consisting of the three open-pit mines of the company Mines Maritsa Iztok EAD and four lignite-firing power plants near the mines.
- **Main challenges:** Ongoing energy market reforms and the implementation of the new Energy Act are accelerating the phase-out of coal-fired power generation, creating significant **economic** and **social** challenges for the region:
 - **Economic challenges:** The dramatic reduction in lignite production causes major financial issues to the mining company. New sources of income are needed. New fields of development are sought using the available resources.
 - **Social challenges:** The decrease in production will affect mineworkers. Many are at risk of losing their jobs. New jobs need to be created.



An unused opportunity

- Mini Maritsa Iztok EAD operates a lignite deposit covering an area of about **240 km²**.
- To reach and extract the lignite, huge amounts of earth (overburden, which is mining waste), containing mainly clay, must be excavated, transported and backfilled.
- The cost of all this processing is included in the lignite price, which, in practice, means the **current price** of this waste is “**zero**”.
- With an annual production of approximately **80–100 million m³ of clay**, these **waste clays** represent a potentially **valuable resource** for the development of **conventional** and **low-carbon construction products**, contributing to the **circular economy** and regional transition.



Main objectives of PRIMM

- To demonstrate the feasibility of producing **innovative and sustainable construction materials** by using:
 - high proportions of **waste clays** generated by Maritsa Iztok mining operations;
 - additional **industrial by-products**, including coal fly ash, waste glass, glass wool and waste-derived sodium silicate.
- To support mineworkers and local communities by **creating new jobs**, training and retraining of people.

Research activities focus on the development of:

1.



Lightweight ceramic foams and composites with improved thermal and acoustic insulation

2.



Low-firing and clinker ceramic bricks with enhanced mechanical properties

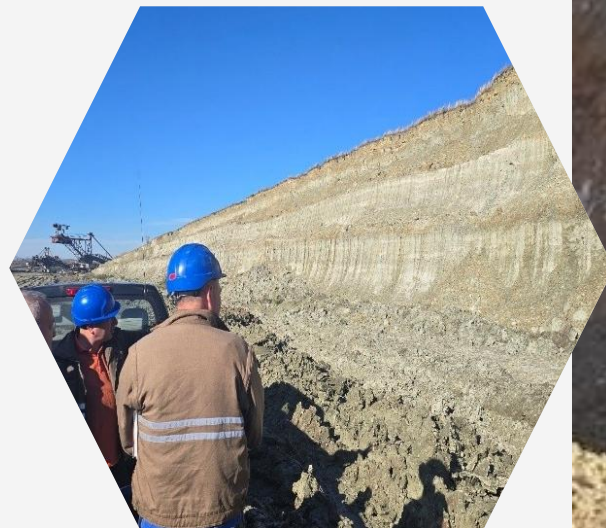
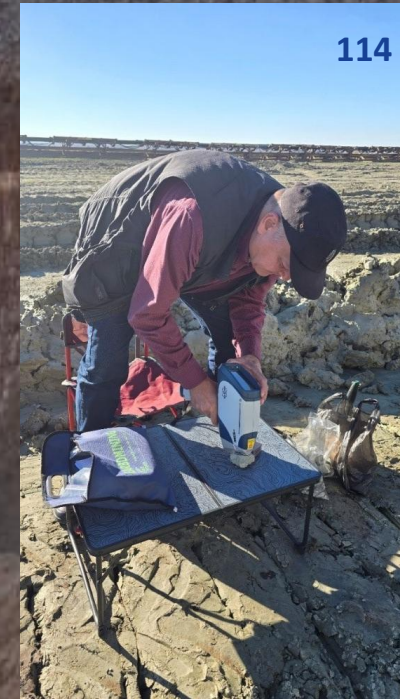
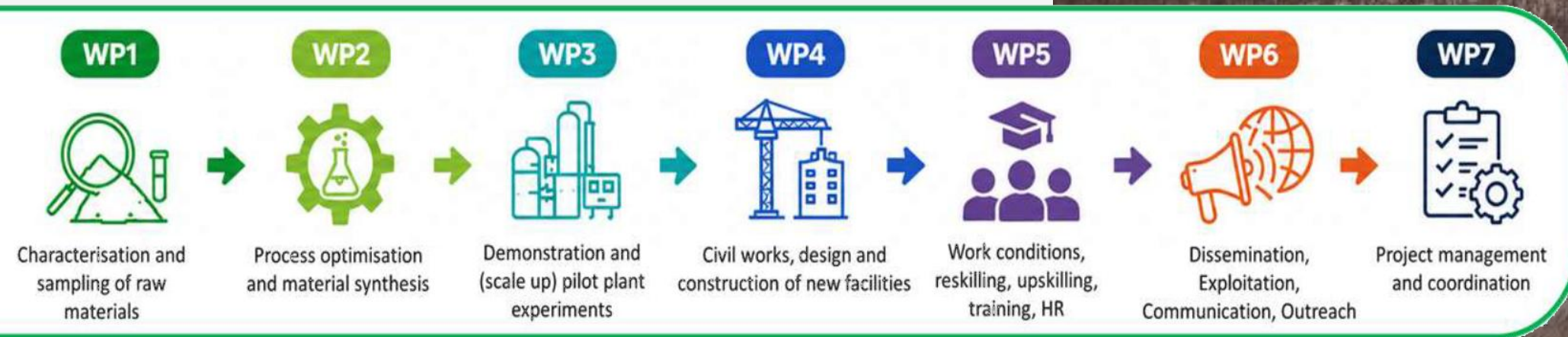
3.



Geopolymer materials and advanced geopolymer-based composites



Plan to achieve the objectives



The current stage of work

- **Samples** at ten different points around the mines have been taken.
- **Physical and chemical analyses** of the samples and additional raw materials have been made.
- Several **dissemination events** have been attended. Presentations, posters and leaflets have been created.
- Preparation of the **site** for pilot plants is ongoing.
- Preparation of **public procurement procedures for pilot plants** construction and equipment has started.
- An Upskilling and Reskilling Plan has been developed and **preparation for the training course** is ongoing.





Analyses completed

- Chemical Analysis (XRF)
- Mineralogical analysis of clays (XRD)
- Moisture content & Loss of Ignition at 950°C
- Optimal moulding moisture content
- Plasticity according to Pfefferkorn
- Air shrinkage
- Firing shrinkage at 900°C
- Flexural “green” strength
- Colour after firing
- Other analyses

Next project steps

- Clay-based construction material formulations will be developed
- Construction of pilot plants at the mines and equipment delivery:
 - a laboratory for researching the physical-mechanical properties of new materials;
 - a pilot plant for the production of water glass, as an additive for the synthesis of geopolymers and new foam materials;
 - a closed room (building) with a dryer/wet room for aging moulded geopolymer products;
 - a kiln for calcining clays from the so-called flash calciner type.
- Experiments will be scaled-up to close to productive conditions (pilot plants).





Expected advantages of the new materials

- **High quality and suitability** – guaranteed by analysing and studying their physical, chemical, and other properties.
- **Improved mechanical, thermal and acoustic properties** – guaranteed by synthesising – only the materials with the best performance and most suitable for use in construction will be selected.
- **Significantly lower carbon emissions** during production, thanks to:
 1. absence of limestone decarbonisation (which is the reason for the high carbon emissions in the production of Portland cement), and
 2. significantly lower temperature required for geopolymers hardening.





What are our plans after the project

Once the applicability of the clays and the competitiveness of the resulting construction materials have been proven during the project implementation, the following steps will be taken:

- the pilot plant will be **expanded and supplemented** (pilot plant has this option);
- the work started within the project will be scaled-up to **larger-scale production**;
- new **training courses** for greater number of mining workers;
- some of the **heavy mining machines** will be used to transfer the clay from the disposal /dump site/ and excavating points to the production facility;
- **transporting systems** /conveyor belts, drive stations etc./ will be adjusted to transfer the clay;
- existing **infrastructure** at the mines /roads, railway, distribution lines, substations/ can be used to provide power supply for the new facility and transport of the produced materials for sale;
- **dissemination events** and personal meetings with stakeholders will be carried out to promote the improved properties, economic benefits and environmental friendliness of the new products.



Thank you!

<https://primi-project.com/>



Co-funded by
the European Union





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Associate Professor, School of Mining and Metallurgical Engineering, National Technical University of Athens



Future opportunities, conclusions and closing remarks





Brian Ricketts

Secretary-General, EURACOAL



Cyril Robin-Champigneul

Deputy Head of Unit for Industrial Transformation Unit,
DG Research and Innovation, European Commission



The reform of the Research Fund for Coal and Steel (RFCS)

Cyril Robin-Champigneul
Deputy Head of Unit – Industrial Transformation

29 September 2026

Reform to start in 2027

Programme to last until 2034

- **Steel and Metals Action Plan** - 19 March 2025
- **Commission proposals** - 8 December 2025
- **Reform adopted** - 29 June 2026
- **RFCS Work Programme 2027-2028**
being prepared under the reformed legal basis.



Reference documents:

https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/research-fund-coal-and-steel-rfcs_en

Continuity and Predictability

- **Definitions** of coal and steel and **scope** of the programme broadly unchanged – but simplified.
- **Two deadlines** per year (low and mid TRL / high TRL and dual use) within **less prescriptive** 2-year work programmes.

Research objectives for coal (article 4)

1. Research projects shall aim to **accelerate the transition, by 2050, towards a climate-neutral Union economy**, with the objectives of supporting the **phasing out of fossil fuels, especially coal**, and supporting the **social, economic and ecological revitalisation of coal regions**, developing **alternative activities on former mine sites** and **avoiding or addressing the environmental damage** from coal mines in the process of closure, formerly operating coal mines and the regions in which coal mines are located.
2. Special attention shall be given to strengthening Union leadership in **managing the transition, including repurposing, of formerly operating coal mines and coal-related infrastructure** through technological and non-technological solutions, while supporting technology and non-technology transfer. Research activities with those objectives shall present **tangible climate and environmental benefits** in line with the objective of climate neutrality by 2050.

Research objectives for coal (article 4)

3. Research projects shall take into account **issues concerning safety** in coal mines in the process of closure and formerly operating coal mines with a view **to improving working conditions, occupational health and safety**, as well as **environmental issues harmful to health**.
4. Research projects shall seek to **eliminate the impact** of coal mines in the process of closure and of formerly operating mines **on the climate, atmosphere, water and soils**.
5. Research projects shall consider:
 - a) new and improved technologies to **avoid environmental pollution, such as methane leakage** and associated greenhouse emissions and **contamination of water tables**, of coal mines in the process of closure, formerly operating mines **and their surroundings**, including the atmosphere, land, soils and water;
 - b) solutions for **managing and reusing mining wastes**, improving **circularity** and **restoring the environment**; and
 - c) technologies to **restore and protect sites from long-term effects**.

Higher budgets and funding rates

- Allocation of **up to EUR 120 million / year**
- **Unchanged shares for coal and steel: 27.2% / 72.8% respectively**
- **Funding rates** aligned with Horizon Europe 2028-2034
 - ✓ Industry: up to 70%
 - ✓ SMEs: up to 100%
 - ✓ Non-profit: up to 100%

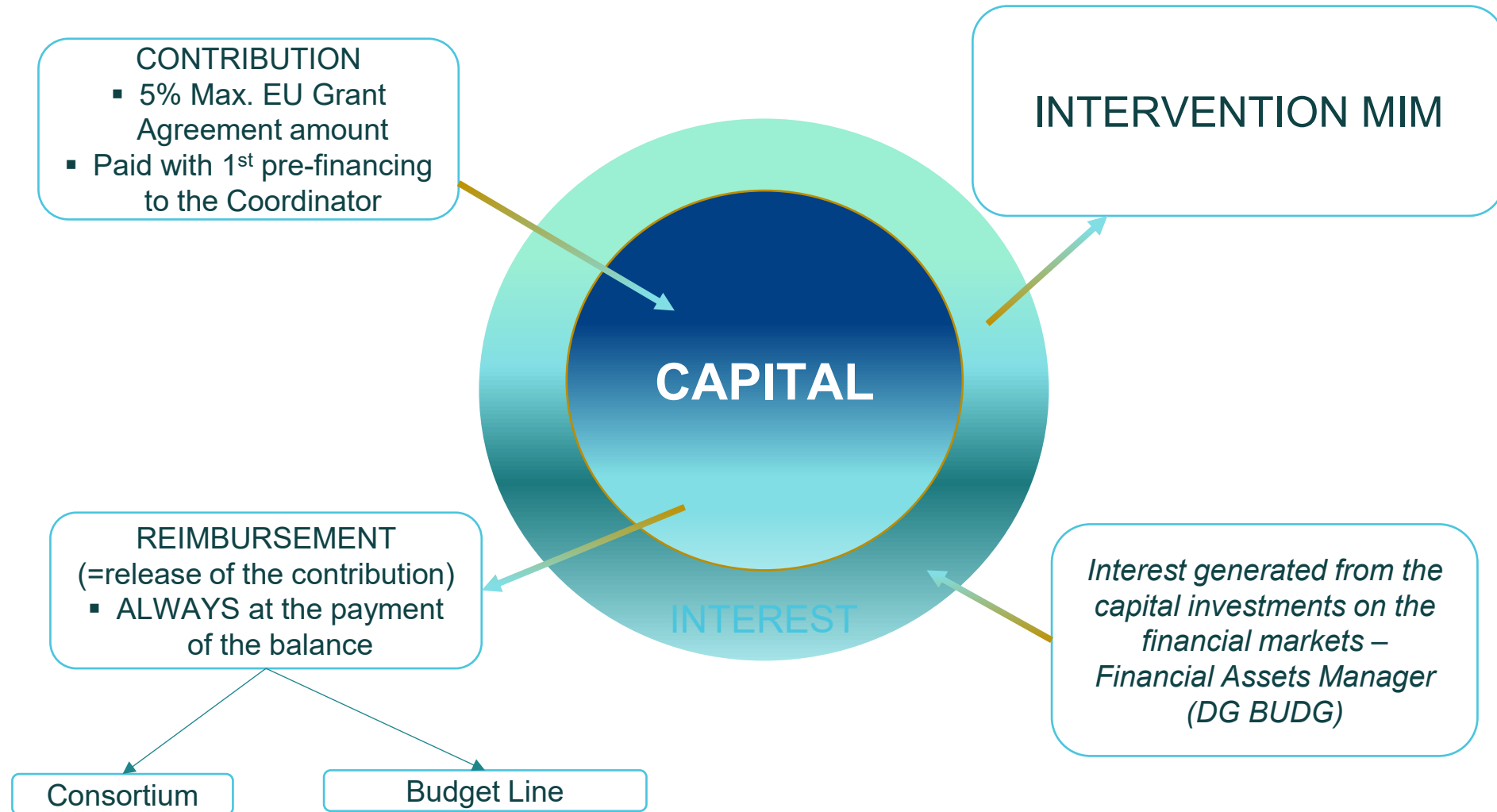
Industry-led orientation and dual use

- The RFCS will support collaborative research with an **industry-led orientation**, including **research on dual-use applications**.
- The new legal basis foresees the **security conditions** for appropriate management of dual-use applications and projects.

Mutual Insurance Mechanism (MIM)

- A simplification mechanism **replacing bank guarantees** to **cover the risk** associated with non-recovery of sums due
- Enabling **higher pre-financing** rates

How does MIM work?



Governance of the programme

The Commission and the Research Executive Agency manage the RFCS programme with the assistance of:

- The **Coal and Steel Committee (COSCO)** composed of representatives of Member States.
- The **Coal Advisory Group (CAG)** and the **Steel Advisory Group (SAG)**, composed of experts representing industrial producers and users, research centres, and universities.



Alejandro Ulzurrun

Acting Director for Directorate B,
Directorate-General for Energy,
European Commission



Dr. Sebastiano Fumero

Head of Unit for Future Low Emission Industries,
European Research Executive Agency



Research Fund for Coal and Steel

Results and opportunities for the coal sector
in 2026 and 2027

Dr. Sebastiano Fumero
Head of Unit
REA. B1 Future Low Emission Industries

29 September 2026
Bochum, Germany

From ECSC to RFCS - History & context

1951

Treaty of Paris

ECSC established by 6 western European countries



1952

Entry into force

Headquartered in Luxembourg - First step in European integration

1967

Merger Treaty

ECSC became one of 3 European Communities

2001

Treaty expiry

2002

RFCS establishment

ECSC assets transferred to RFCS



2021

RFCS first reform

2027

RFCS second reform (in progress)

RFCS - Research Fund for Coal and Steel

Funding



Financed through revenues of former ECSC assets - outside the EU Multiannual Financial Framework.

Own Legal Framework



Current legal basis: 3 Council Decisions (2021). New legal basis to enter into force January 2027

Mission



Support R&I in the coal and steel sectors, in line with the ECSC legacy.

The RFCS Research Programme



Societal Benefits

- **Reduced emissions** and energy consumption
- **Improved waste management**, increased recycling
- **Reduced environmental footprint of steel industry** and safety concerns



Networks

- **Efficient platform for collaboration** between industry and academia



Leverage Effect

- **€1 RFCS funding**
→ # **€3 beneficiaries' benefit**
- **€1 RFCS beneficiaries' R&I spending**
→ # **€5 benefit**

Committed investments overall 2021-2026: €376 million to 169 projects (160 active)

Committed investments coal 2021-2026: €106 million to 42 coal projects (39 active)

- €55 million via annual call for 36 projects
- €51 million via high TRL calls for 6 projects

Participants alignment with EU policy goals

RFCS calls for proposals are designed to fund projects that not only advance technical innovation in coal and steel but also **align with EU policy goals** as defined by:

Sustainable economic prospects supporting climate neutrality

European Climate Law & Just Transition Mechanism

Repurposing of former mining assets and energy infrastructure supporting energy security & clean energy transition

Energy Union Strategy, REPowerEU Plan, Clean Industrial Deal, Affordable Energy Action Plan

Restoration of post-mining landscapes

EU Biodiversity Strategy for 2030 and the Nature Restoration Regulation

Protection and sustainable management of water resources

Water Framework Directive

Recovery of value from mining residues

Circular Economy Action Plan and the Critical Raw Materials Act

RFCS – CRiT event

Clean Energy, Restored Lands: The Path Forward for Coal Regions

Registration survey

Key Metrics

Total Participants: 343

EU Participants: 249 (72.6%)

Non-EU Participants: 94 (27.4%)

Countries Represented: 42

Organization Types: 11 categories

Survey findings

- **Strength** - Strong academic & public sector engagement
- **Success Factors:** Institutional capacity, regulatory clarity, and industry engagement.

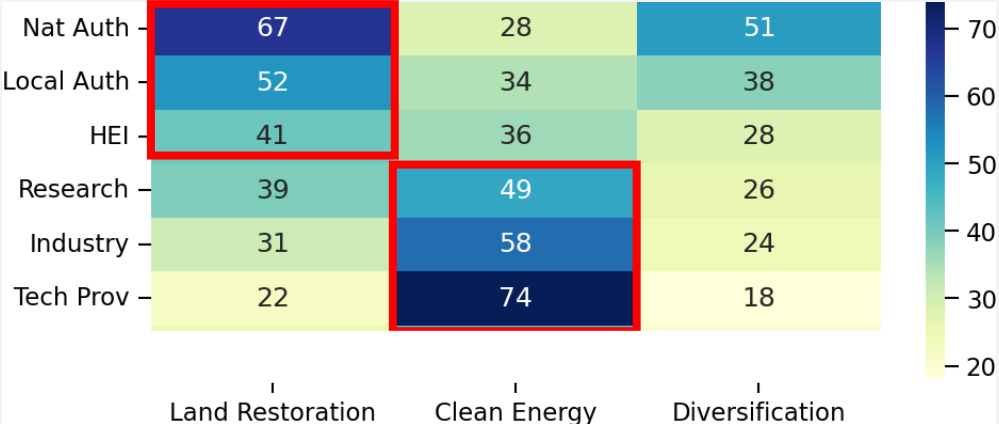
Survey recommendation pathways

1. **Build capacity** - Invest in institutional frameworks and skills
2. **Harmonise rules** – Streamline permitting and regulatory frameworks using pre-normative research to accelerate technology deployment.
3. **Engage industry** - Strengthen and linking academic innovation and markets.

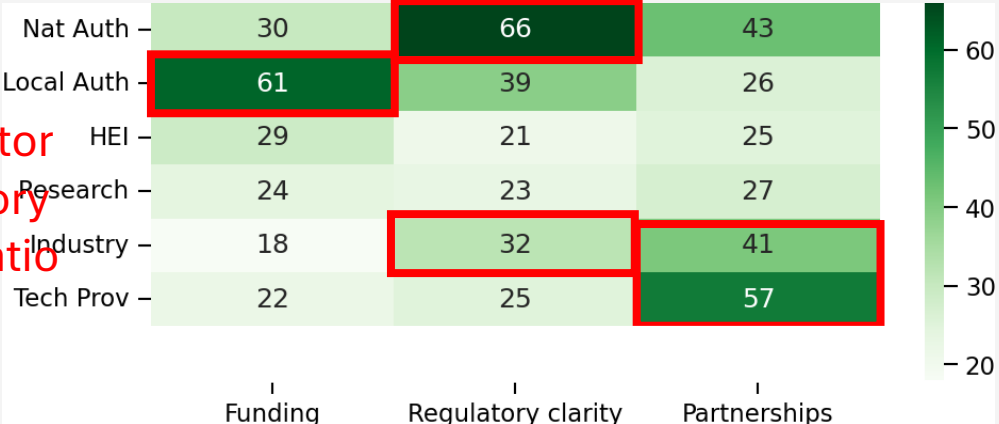
Policy Alignment

- **Top Priority:** Land restoration & mine closure (40%).
- **Secondary Focus:** Clean energy (33%) and regional economic diversification (28%).
- **Social Transition:** Underemphasized (20%).

Public sector →
Restoration
Private sector →
Energy



Public sector → regulatory harmonisation
Private sector → Partners + harmonisation



Enabling Factors for Transition

- **Critical Needs:** National/regional public funding (35%) and regulatory clarity (29%).
- **Industrial Partnerships:** 27% see them as essential.

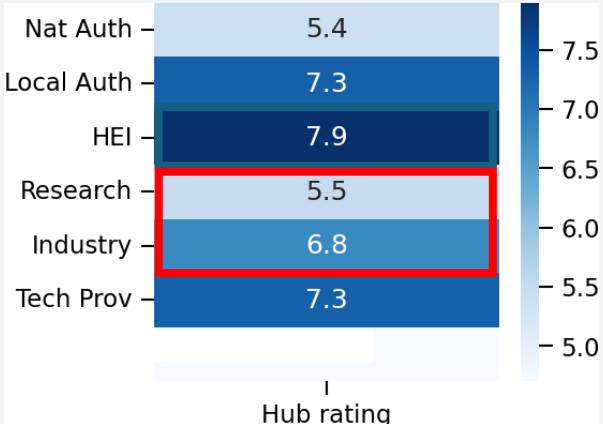
Barriers to Transition

- **Top Barriers:** Limited local/regional capacity (37%) and regulatory/permitting barriers (36%).
- **Finance:** Lack of access to finance (32%).

Public sector →
Capacity + Permitting



Hubs →
↑Academia
↓Private sector



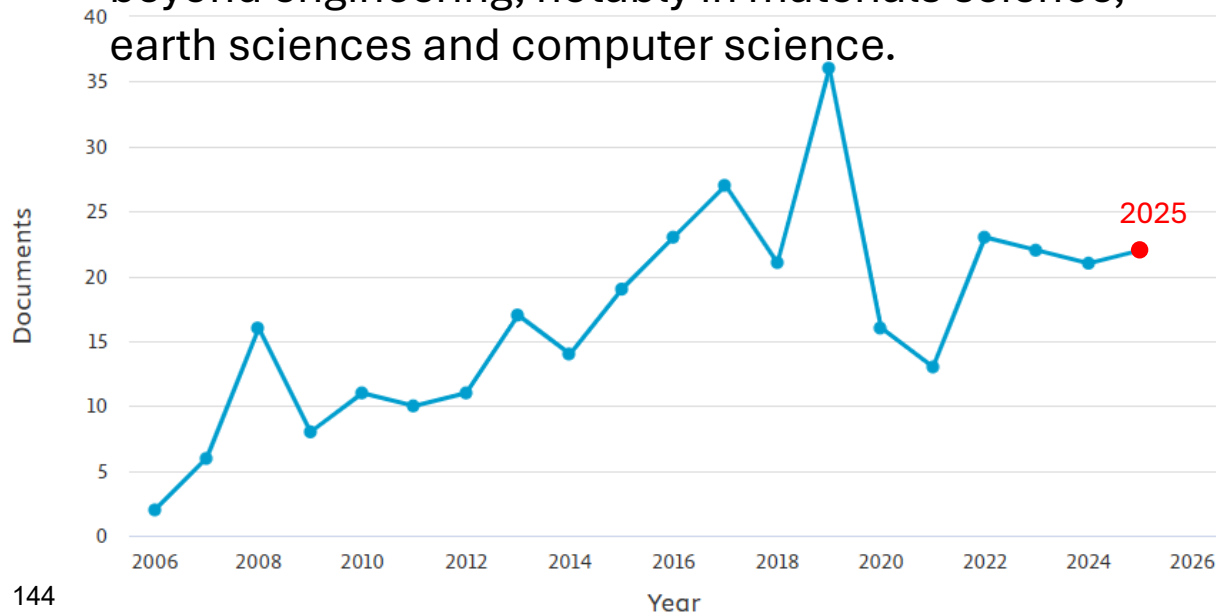
Innovation Hubs Rating

- **High Support:** Higher education (8/10) and regional authorities (7/10).
- **Skepticism:** Industry (6/10).

RFCS publications trends

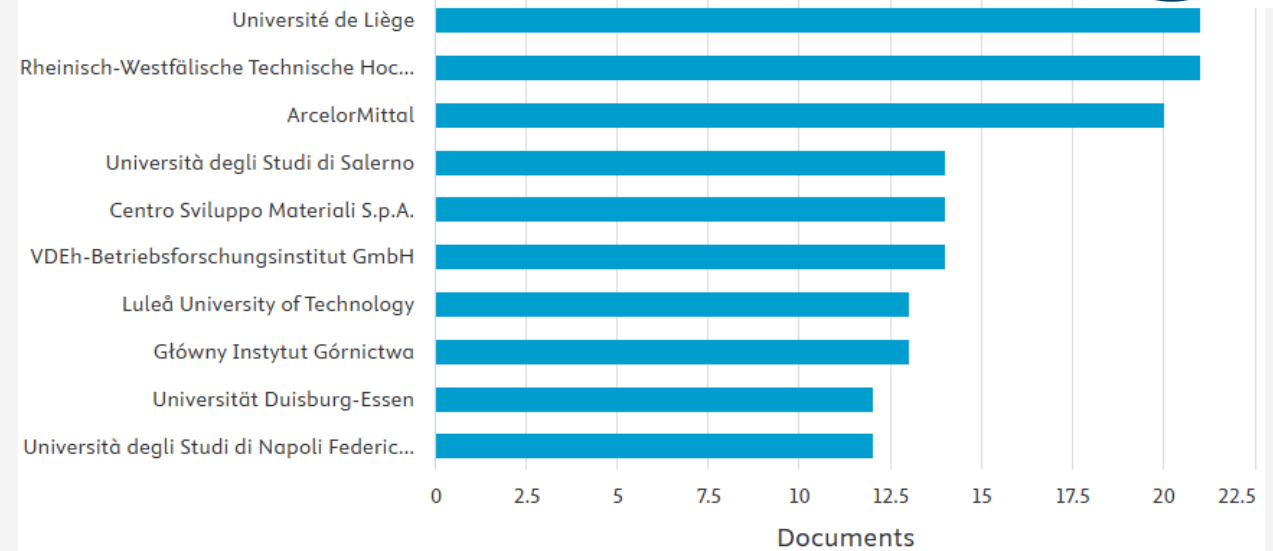
- ✓ **Source:** Scopus-indexed research papers with specific RFCS funding attribution.
- ✓ **Scope:** Covers both coal and steel sectors.
- ✓ **Momentum:** Clear upward trend in scientific output over the last decade.
- ✓ **Industrial fund:** Less priority on scientific papers; the core focus on IPR/patents, standards, and demonstrators.
- ✓ **Diverse impact:** Significant research output beyond engineering, notably in materials science, earth sciences and computer science.

Documents by year

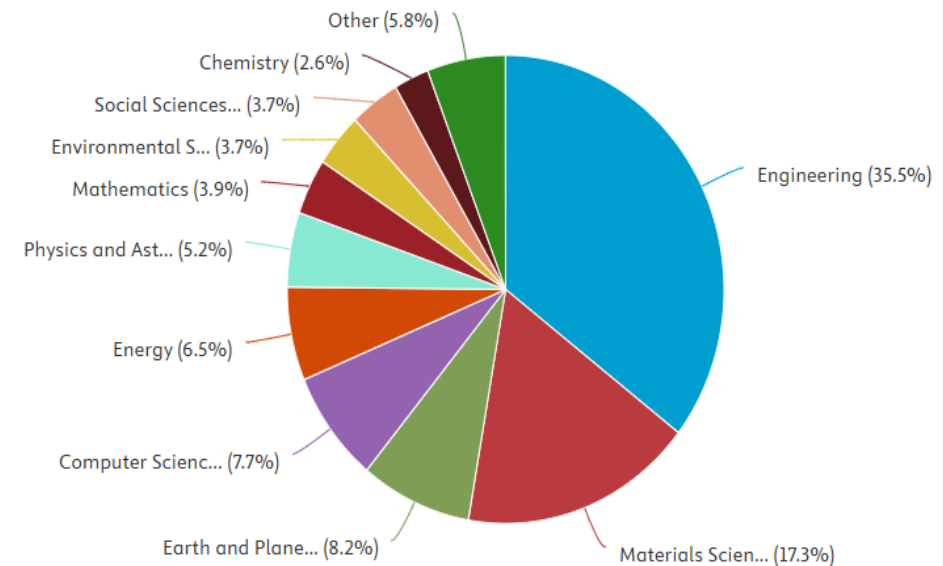


Documents by affiliation

Compare the document counts for up to 15 affiliations.



Documents by subject area



RFCS - feedback to policy



<https://data.europa.eu/doi/10.2848/0557021>



Research Fund for Coal and Steel
A summary of the findings of
the coal research technical groups – 2023

<https://data.europa.eu/doi/10.2848/5815364>



How research investments of the Research Fund
for Coal and Steel support EU policies in
emissions abatement and just transition

KEY MESSAGES FOR POLICYMAKERS

- RFCS projects support EU policies like the Methane Regulation by advancing technologies and harmonised measurement standards.
- A tailored just transition approach supports workers and communities through training

- and re-skilling in emerging technologies, preserving knowledge and skills.
- A strong feedback loop between industry, researchers, and policymakers ensures R&D efforts align with policy needs, identifies knowledge gaps, and informs decisions.

"The transformation is happening here and now - we are in the middle of it, but at the same time we are aware that it is a process that is still ahead of us. We are not running away from this challenge. However, we know that it must be done responsibly - so as not to lead to a catastrophic situation in the region." Polish Minister of Industry Marzena Czarnecka at the RFCS event in Jastrzębie-Zdrój

RESEARCH AND INNOVATION FOR A JUST AND CLIMATE-NEUTRAL ECONOMY

The Fund
The Research Fund for Coal and Steel (RFCS) is a European Union fund that supports research and innovation in the coal and steel sectors. Within the coal sector, RFCS focuses on promoting a sustainable and environmentally friendly transition, supporting the development of new technologies and methodologies that reduce the environmental impact of coal mines in the process of closure and promote the repurposing of coal mines.

The fund supports a diverse project portfolio focusing on environmental sustainability, including methane leakage reduction, environmental restoration, mine infrastructure repurposing, and raw material recovery from mining waste. Currently, the RFCS is supporting over 30 projects in the coal sector, with a total funding commitment of over €120 million. These projects aim to support the European Union's main policy objectives, including the achievement of a climate-neutral economy by 2050, the reduction of greenhouse gas emissions, and the promotion of sustainable growth and development.

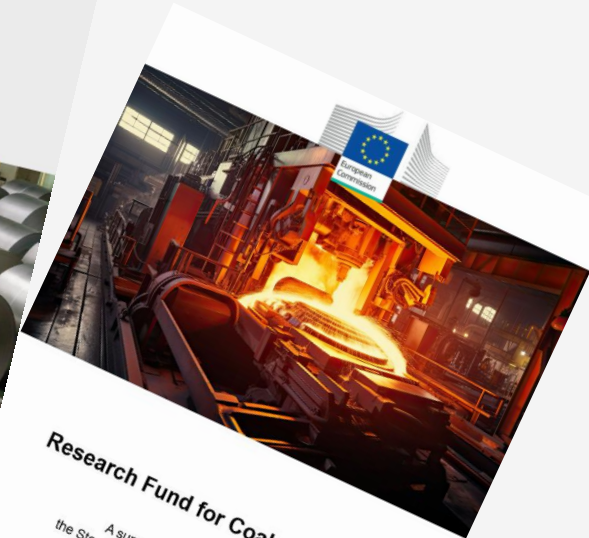
Figure 1 – RFCS project lifecycle & process indicating an 8-month time-to-grant period



<https://data.europa.eu/doi/10.2848/7851061>



<https://data.europa.eu/doi/10.2848/5843295>



Research Fund for Coal and Steel
A summary of the findings of
the Steel Research Technical Groups - 2023

<https://data.europa.eu/doi/10.2848/8540830>

RFCS calls: who is eligible for funding



EU MEMBER STATES

Entities can participate and can receive funding



CANDIDATE COUNTRIES

Entities can participate without receiving funding



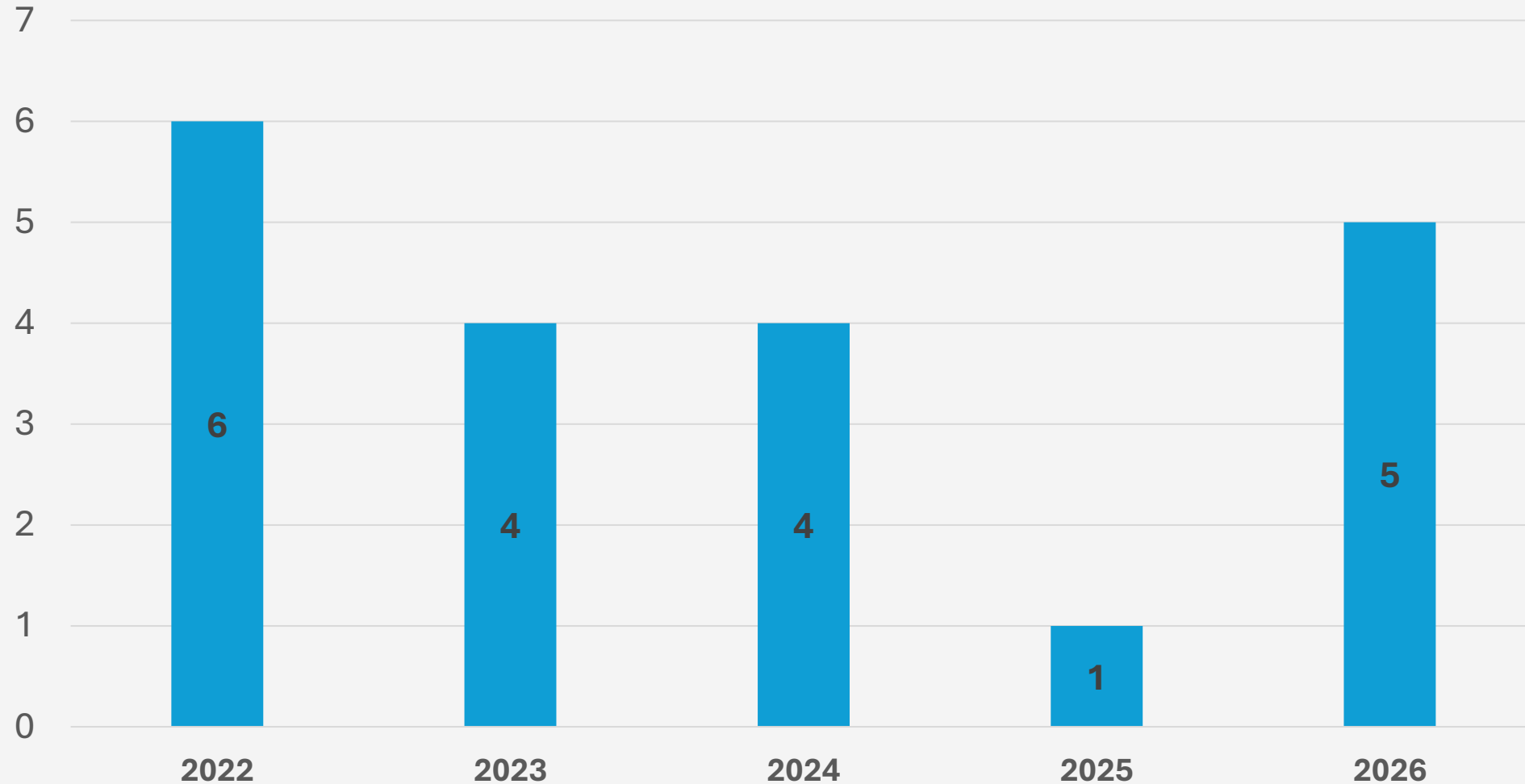
THIRD COUNTRIES

Entities can participate **without receiving funding**, provided that such participation is **in the European Union's interest**.

⚠ The United Kingdom is also considered as a Third Country in RFCS

RFCS Big Tickets 2026 - Coal

Evolution over the years of the number of Coal proposals submitted (Big Ticket calls)



Call objectives of the 2026 Big Tickets call to support Just Transition



Repurposing of formerly operating coal and lignite mines or those in the process of closure and coal-related infrastructure including power supply services

2 proposals



Materials and waste reuse, and development of alternative materials, including recovery of critical raw materials

2 proposals



Land monitoring, modelling, stabilisation and/or restoration

1 proposal



Processing of methane emissions

0 proposal



Monitoring, management and/or treatment of mine water and water tables in coal mines in the process of closure and formerly operating mines

0 proposal

RFCS 2026 Big Tickets Coal: submission statistics



Proposals submitted

5



Call budget

35 MEUR



Requested EC contribution

32,3 MEUR



Applicants in total

34

RFCS 2026 Big Tickets Coal: statistics on proposals selected for funding

**Currently in GAP
preparation
expected to be
signed in
December 2026**

2 proposals selected for
funding



success rate 40%



Call available budget

35 MEUR



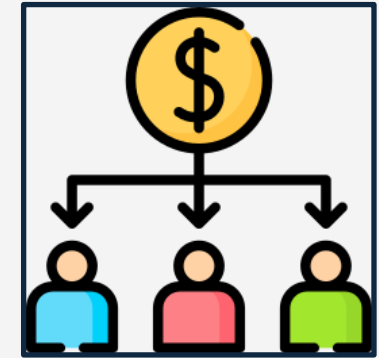
Total proposals cost

22,2 MEUR



EC contribution

11,1 MEUR

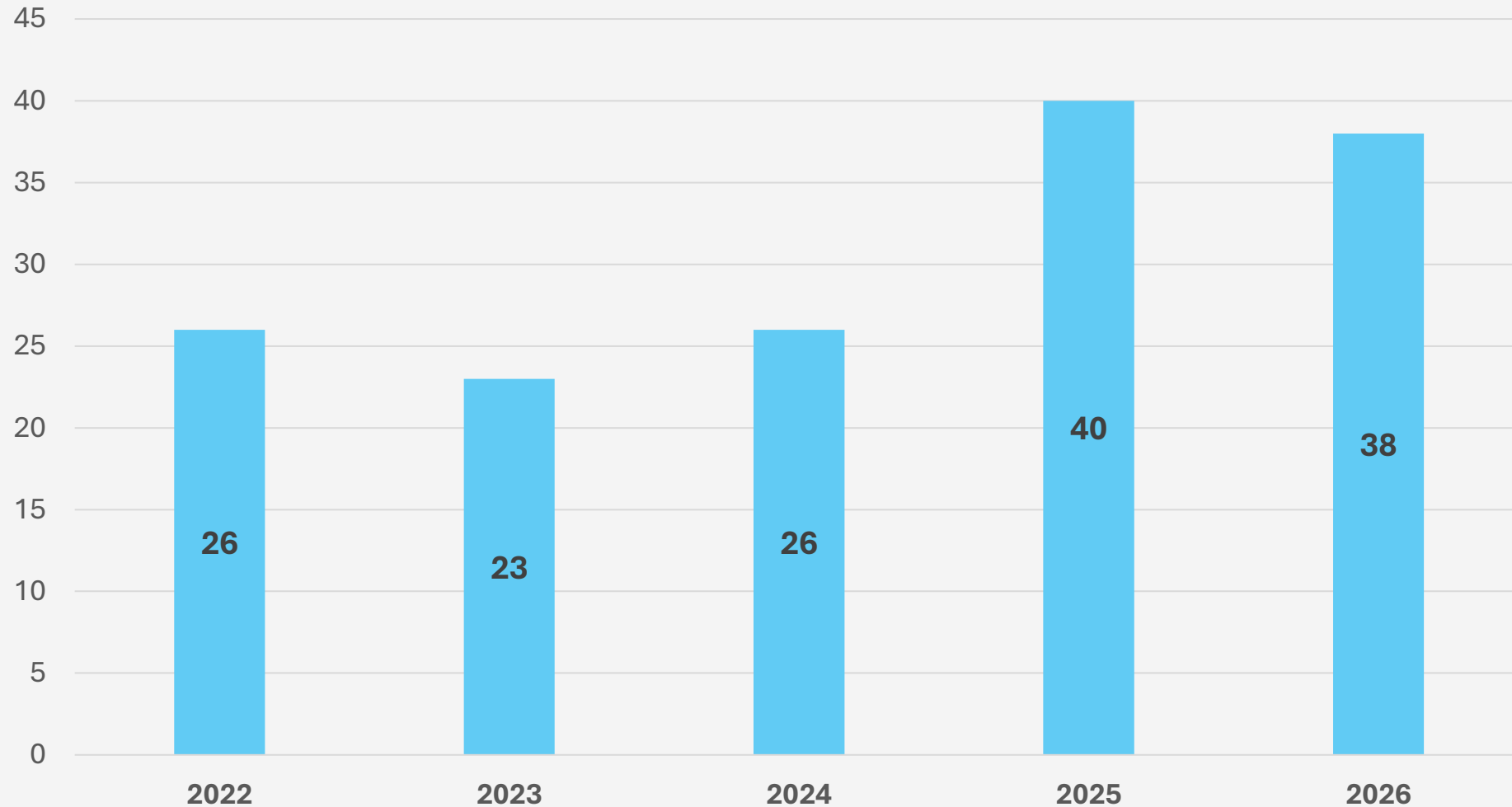


N° of beneficiaries

11

RFCS Annual Call 2026 - Coal

Evolution over the years of the number of Coal proposals submitted (Annual calls)



Research objectives for the coal sector of the 2026 RFCS annual call



Supporting the
just transition of
the coal sector
and regions

Art. 4*



Improving
health and
safety

Art. 5*



Minimising the
environmental
impacts of coal
mines in transition

Art. 6*

** Current RFCS legal basis (Council Decision 2008/376/EC, in force until December 2026)*

RFCS 2026 Annual call Coal: submission statistics



Proposals submitted

38



Call budget

10,9 MEUR



Requested EC contribution

54,3 MEUR

***Evaluation of the
proposals currently
ongoing, to be completed
by November 2026***

RFCS 2027

calls for proposals & next steps

RFCS 2027 Calls for proposals - Timeline

RFCS-2027-BT-Coal & RFCS-2027-BT-Steel

Calls open:

3 February 2027

Calls Deadline:

28 April 2027

RFCS-2027 (Annual Call)

Calls open:

~ June 2027

Calls Deadline:

~ September 2027

Upcoming RFCS reform (2027-2034) - key elements

- Maintain **definitions** of coal and steel
- Maintain **programme committee** (COSCO) and **advisory groups** (CAG-SAG)
- **Yearly calls with two deadlines** per year (maintain Annual Calls and Big Tickets approach) with a **less prescriptive** 2-year work programmes.
- **Simpler research objectives** (unchanged scope) and **dual use** (separate topic).
- **Higher financing rates** aligned with Horizon Europe proposal up to 70% for industry, 100% for SMEs, 100% for non-profit.
- **Remains industry-led**, with clear conditions set in work programmes and calls.
- **Mutual Insurance Mechanism**: reduce risks in case of partner default and increase the pre-financing.
- Allocation of up to **EUR 120 million / year**, with unchanged shares for coal and steel: **27.8% / 78.2% respectively**.
- Work programmes and calls to **continue until 2034**.

RFCS - Upcoming events

RFCS Infoday

February 2027 *TBC*
Brussels, Belgium
(Hybrid)



RFCS - Upcoming events

RFCS Steel Dissemination Event 2026:

Steel Innovation for Europe's future

2 December 2026
Krakow, Poland
(Hybrid)

COMING SOON





Let's stay in touch



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Thank you!



Thank you!

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