

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

Bochum, Germany

29 – 30 September 2026

**Novel energy storage for heat and power
utilizing existing coal-fired fluidized bed boilers**

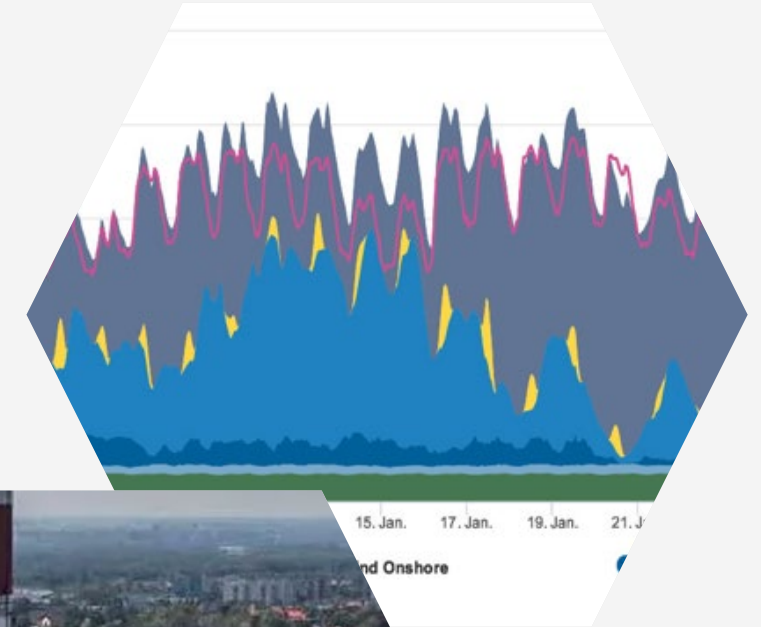
Jochen Ströhle, TU Darmstadt

Organised by



Problems tackled

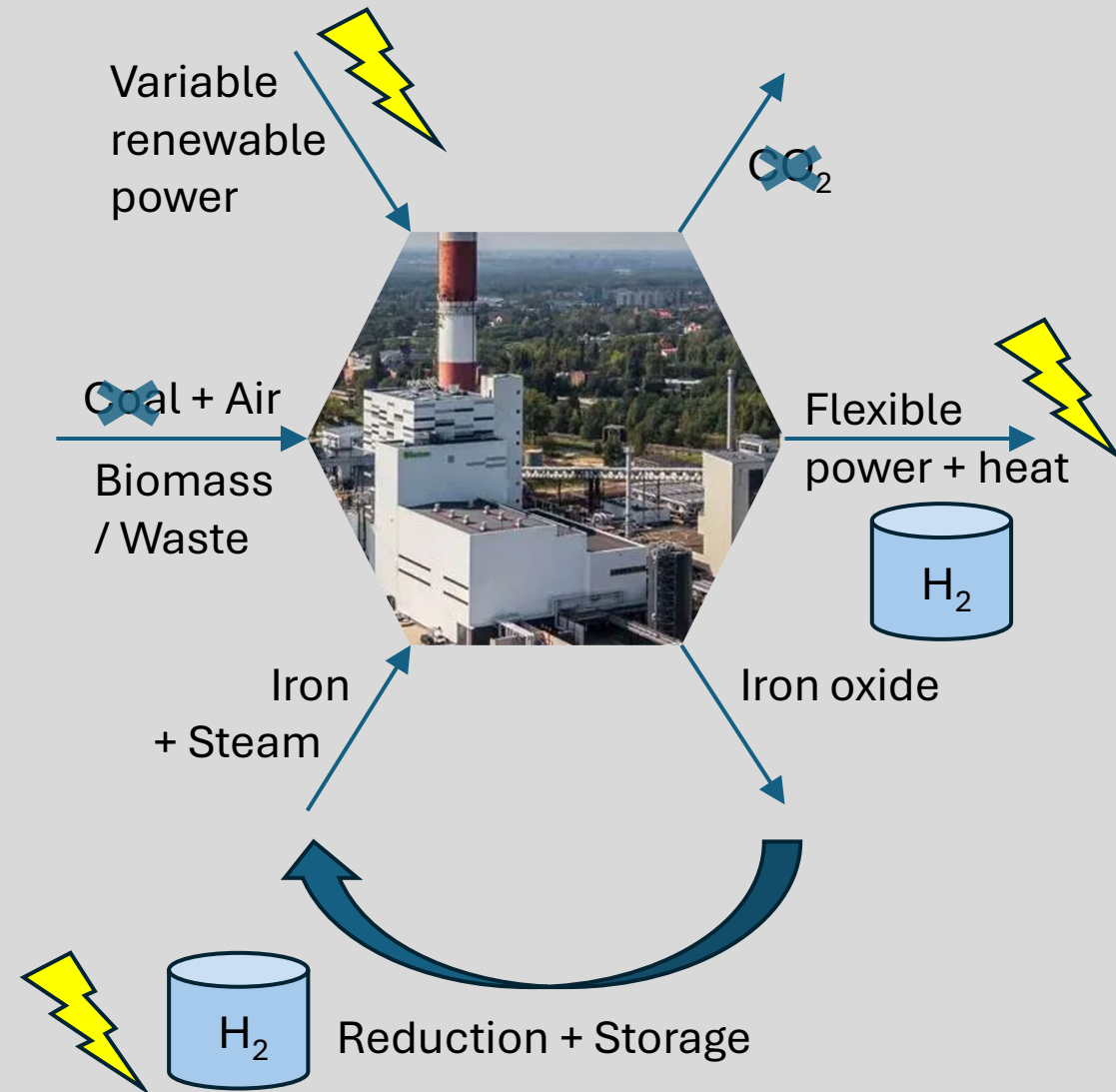
- Need for storage/transport of variable renewable energy to provide flexible electricity + heat
- Long-term (seasonal) storage
 - **H₂** implies high costs for storage/transport due to compression
 - **Metals** are a low-cost alternative
- Short-term (daily) storage
 - **Batteries** imply high investment 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
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HIGHWAY



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Combustion of Rechargeable Metal Fuels in Fluidized 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 Fluidized Bed Systems

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

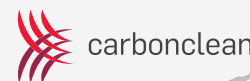
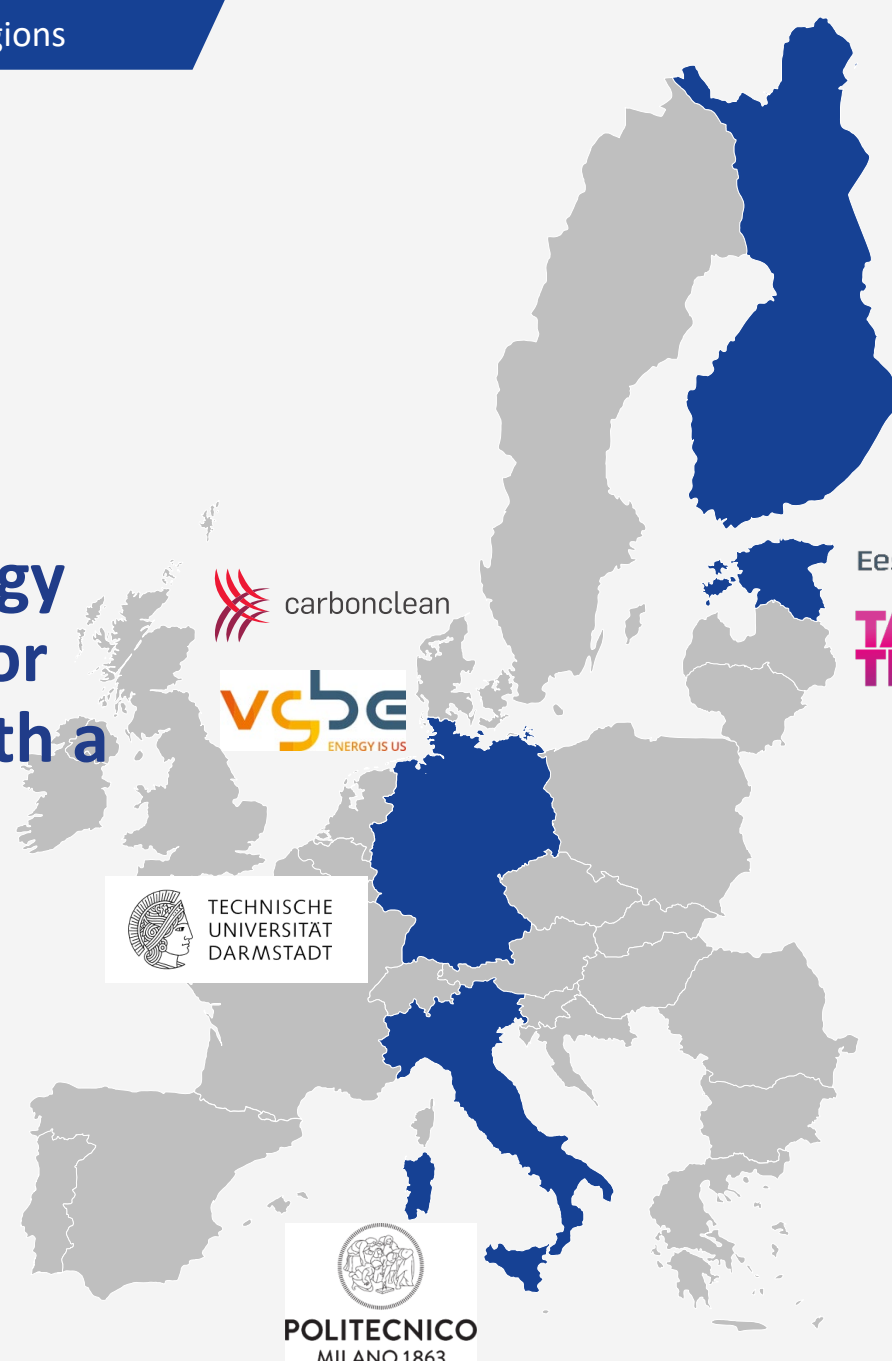


HIGHWAY

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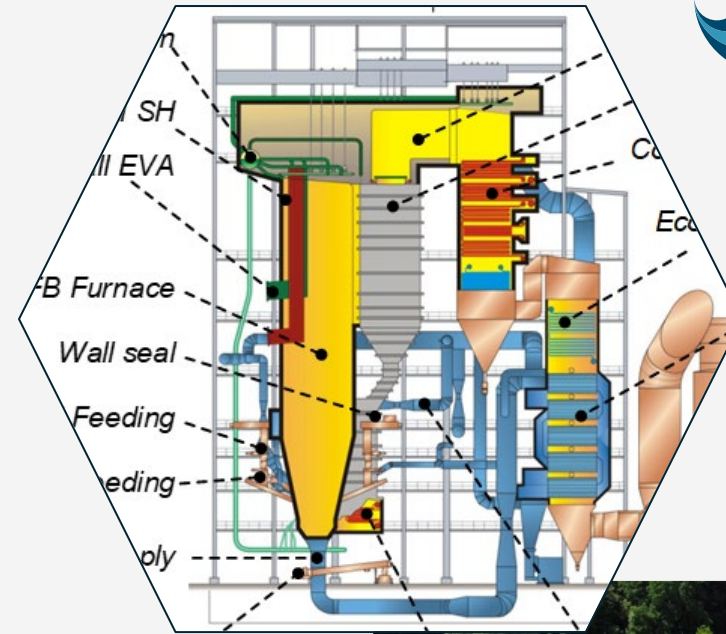
High-Temperature Thermal Energy Storage Enabling a Second Life for Existing Fluidized Bed Boilers with a High Efficiency

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



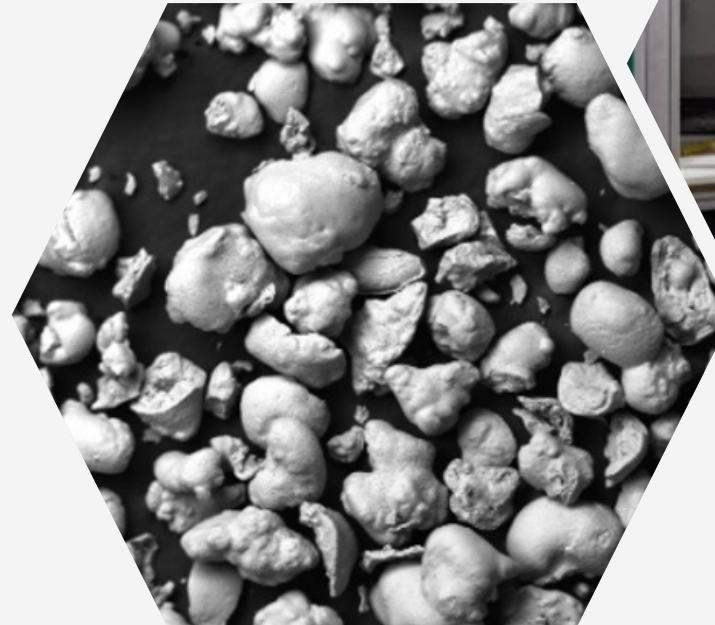
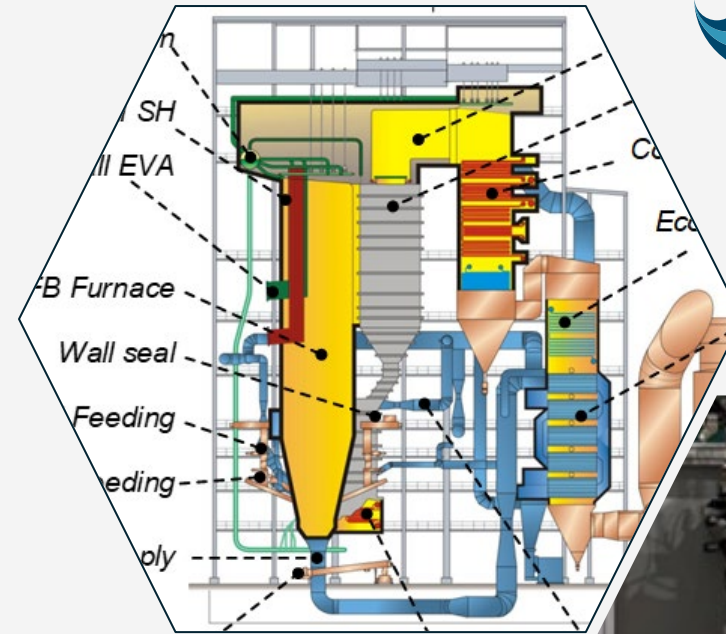
Objectives of projects

- 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



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



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Thank you!

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www.project-coral.eu



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