



Energy Systems
and Technology
Prof. Dr.-Ing. B. Epple



TECHNISCHE
UNIVERSITÄT
DARMSTADT

LOUISE: Low-Cost CO₂ Capture by Chemical Looping Combustion of Waste-Derived Fuels

Jochen Ströhle

ACT Knowledge Sharing Workshop

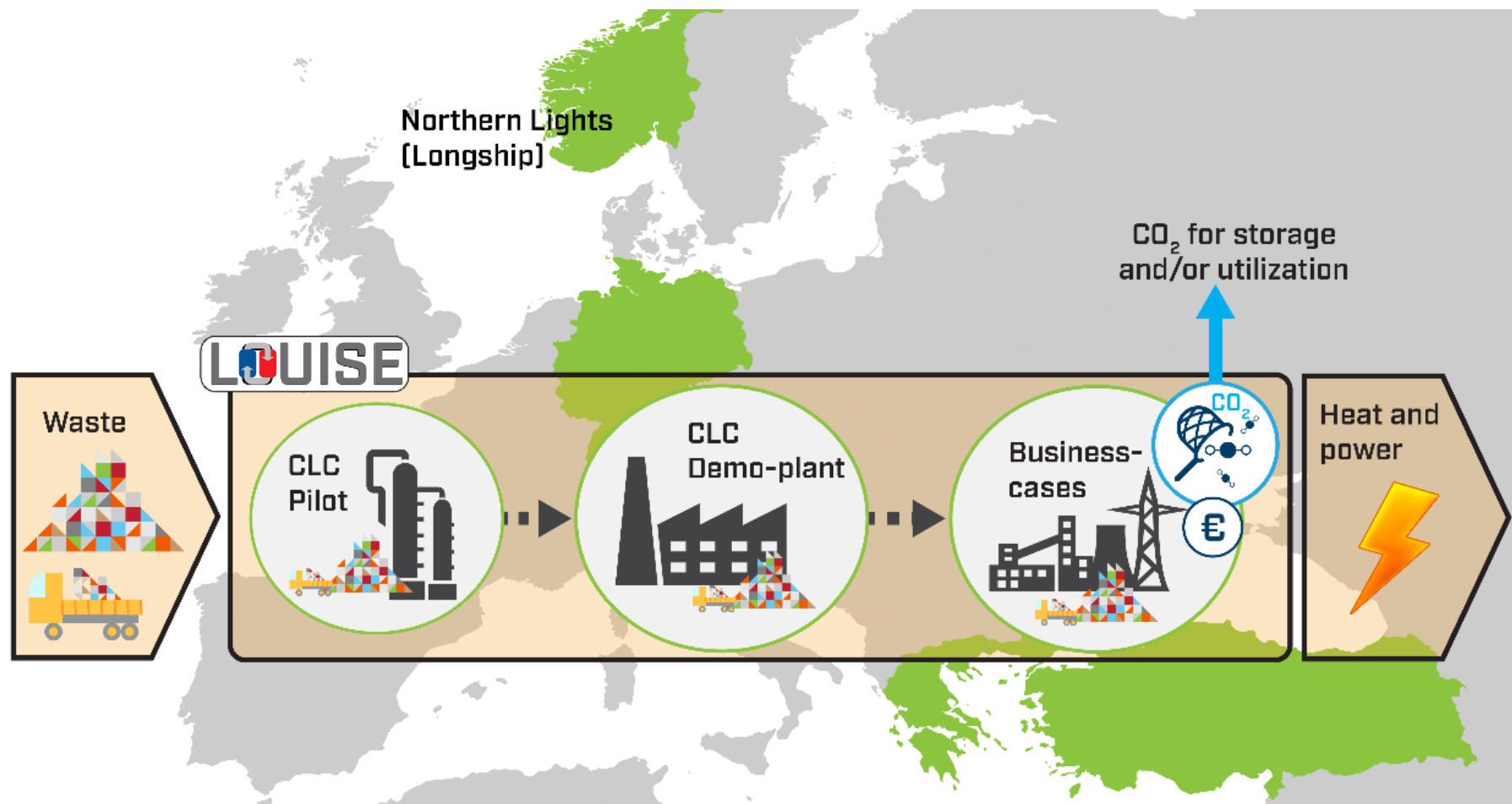
4 October 2023



Overall Aim

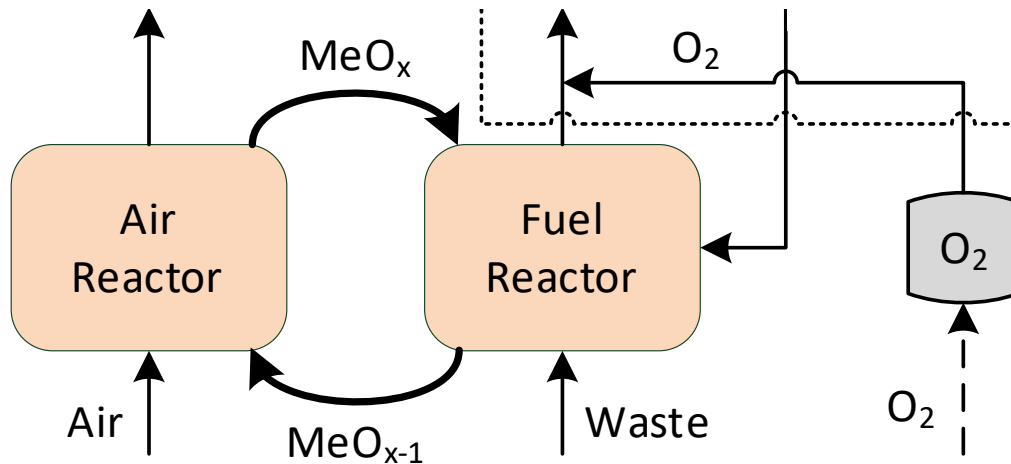
Prepare for pre-commercial demonstration of Chemical Looping Combustion (CLC) of solid waste-derived fuels

10/2021 – 09/2024



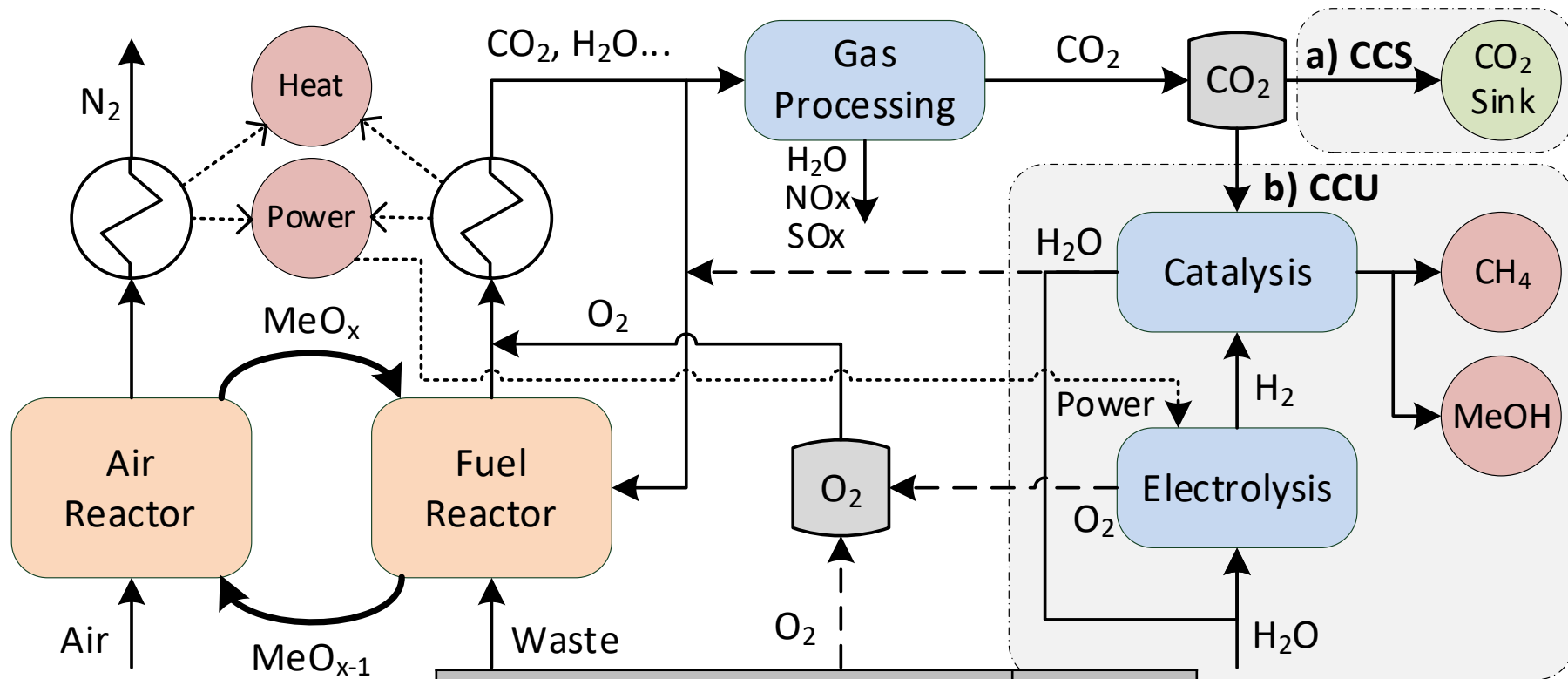


*National consortium leader



- Inherent CO_2 separation → **low cost**
- Problematic substances in fuel reactor → **high electrical efficiency**
- MeO_x re-use → **synergies with mineral and metal processing industries**

CLC Process Concept



KPI	Target
CO ₂ capture efficiency	> 90 %
Fuel reactor CO ₂ concentration	> 90 %
Net electrical efficiency	> 35 %
CO ₂ avoidance costs	< 25 €/t
Net CO ₂ emissions	< 0
Utilization of spent material	> 90 %

- 1) **Demonstrate CLC** of solid **waste**-derived fuels in realistic environment (TRL 6)
 - pilot unit testing at 150 kW_{th} and 1 MW_{th} scale

- 2) **Basic design** of 10 MW_{th} **CLC demo plant** (TRL 7) for waste-derived fuels
 - including flue gas cleaning + CO₂ processing steps

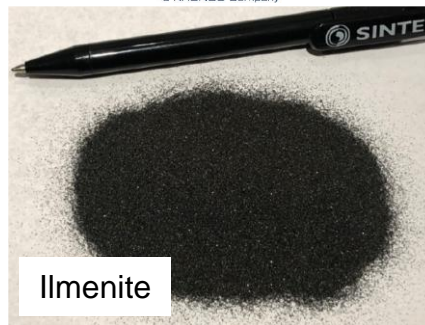
- 3) **Reduce CO₂ avoidance costs** by > 7 %,
 - synergies with other industries
 - re-use > 90 % of the spent OC materials in metal processing industry

- 4) **Provide business cases** for WtE plants applying CLC technology
 - Cases in 4 countries

WP1 – Pilot Testing

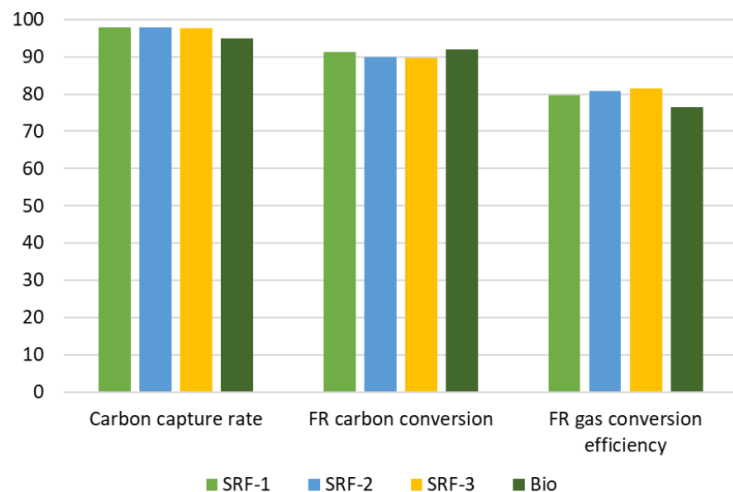


150 kW_{th} pilot plant

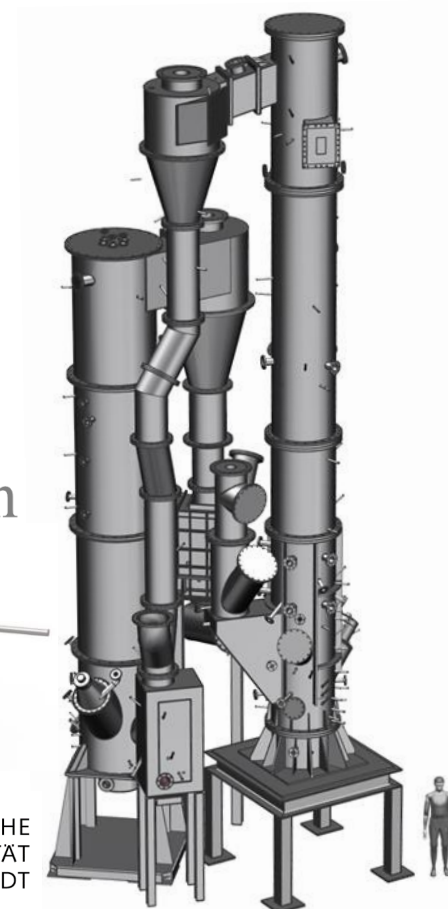


1 MW_{th} pilot plant:

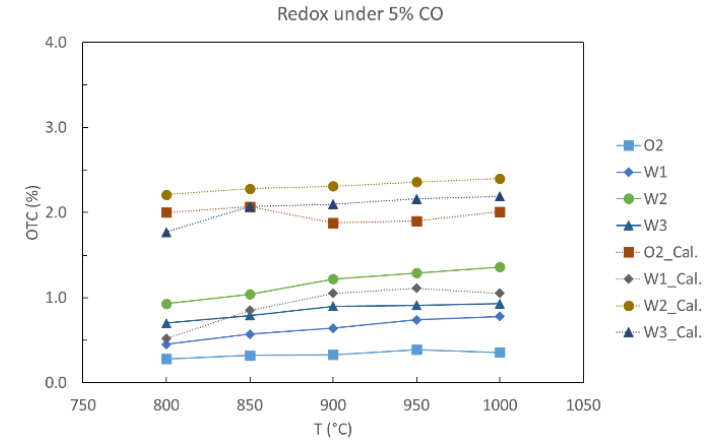
➤ Tests in Jan 2024



TECHNISCHE UNIVERSITÄT DARMSTADT



- Evaluation of Turkish OC materials
 - Iron ores (O)
 - By-products from steel industry (W)



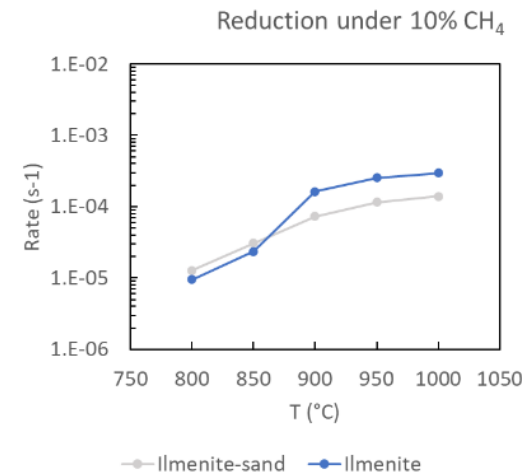
- OC validation, interaction with waste

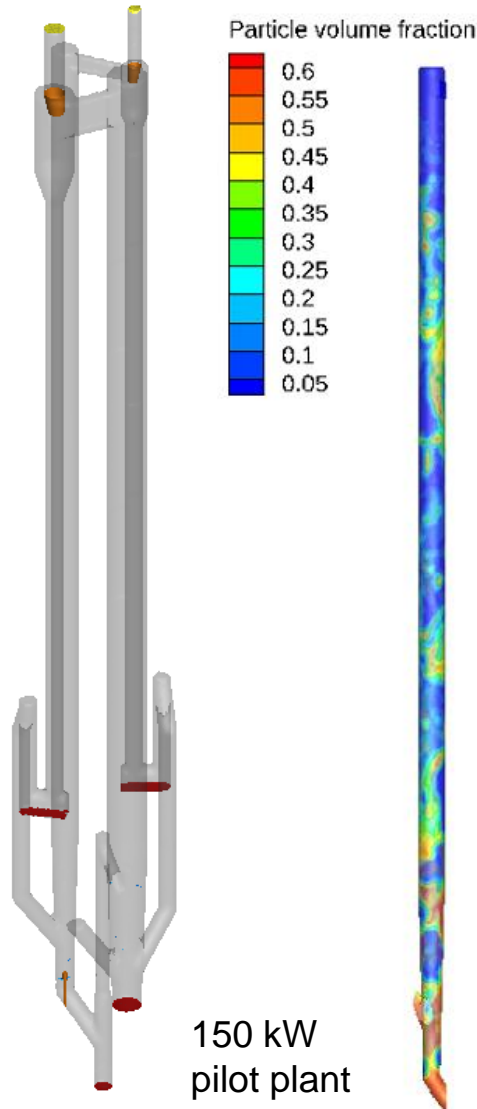


New reactor

- Re-use of spent OC materials

➤ Ilmenite sand





CFD model for CLC developed

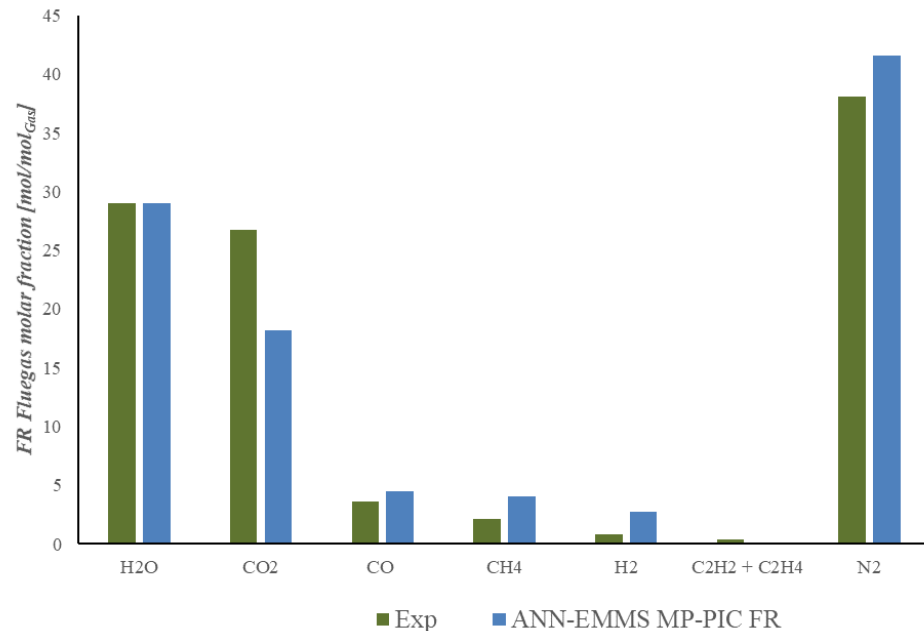
- Novel drag model (ANN-EMMS)
- Implementation in Barracuda™
- Validation by 150 kW and 1 MW pilot tests



CERTH
CENTRE FOR
RESEARCH & TECHNOLOGY
HELLAS



➤ Design of demo plant



Definition of case studies

Location	Operator	Biz Case responsibility	CCS	CCU MeOH	CCU CH ₄	CCU HOAc
Frankfurt, Germany	ISH	PHS	X	X	(X)	-
Fredrikstad, Norway	BIO-EL	BIO-EL / SINTEF-ER	X	-	-	-
Petkim site, Turkey	SOCAR	CERTH	-	X	-	X
Attiki/Thessaloniki, Greece	HELECTOR	CERTH	X	X	X	-



- Concept development, process simulations



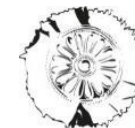
TECHNISCHE
UNIVERSITÄT
DARMSTADT



- Life cycle assessment



- Business cases



- Logo created
- Website online
- 2 newsletters
- 9 presentations at conferences
- 2 journal publications (submitted)



The screenshot shows the LOUISE website homepage. At the top is the LOUISE logo with the tagline "LOW-COST CO₂ CAPTURE BY CHEMICAL LOOPING COMBUSTION OF WASTE-DERIVED FUELS". Below the logo is a navigation menu with links for HOME, ABOUT, RESEARCH, PARTNERS, NEWS, and RELATED PROJECTS. The main content area is divided into two columns. The left column contains the text "What is LOUISE?" followed by a paragraph explaining the project's aim to reduce CO₂ capture costs. Below this is "The objectives" section, which lists the goals of demonstrating CLC technology. A central diagram illustrates the process flow: Waste → CLC Pilot → CLC Demo plant → Business cases → CO₂ for storage or utilization and Heat and power. The right column features a "LATEST NEWS" section with three news items: "Introducing NORSUS", "First ACT LOUISE General Assembly Meeting Held in Darmstadt", and "SINTEF Visits Pilot Plant at Technische Universität Darmstadt". Below the news is a "Stay updated" section with a newsletter sign-up form and a "Subscribe" button. The footer contains copyright information, the "Accelerating CCS Technologies" logo, and a list of funding sources.

What is LOUISE?
LOUISE aims to reduce the cost of CO₂ capture by demonstrating an innovative method that generates power and heat from waste and provides a constant stream of CO₂. [Read more](#)

The objectives
The objective are to demonstrate chemical looping combustion (CLC); to accelerate the deployment of CLC by providing a base design for a demonstration plant; to increase the commercial attractiveness of the method by exploiting synergies with other industries; to provide business cases for waste-to-energy plants to apply CLC technology. [Read more](#)

LATEST NEWS

Introducing NORSUS

First ACT LOUISE General Assembly Meeting Held in Darmstadt

SINTEF Visits Pilot Plant at Technische Universität Darmstadt

ACT LOUISE Website Launched

Stay updated
Join the ACT Louise newsletter to stay updated on project progress and results

Email Address *

Subscribe

We'll use your address only to send you the newsletter.
You will receive an email with a link to activate your subscription.

Copyright © 2022 Louise

Accelerating CCS Technologies

This project LOUISE is funded through the ACT program (Accelerating CCS Technologies, Horizon2020 Project No. 691712). Financial contributions made by the German Federal Ministry of Economic Affairs and Energy (grant no. 03EE5096), the Research Council of Norway (grant no. 323886), the Greek General Secretariat for Research and Technology (grant no. T12EPAS-00023), and the Scientific and Technological Research Council of Turkey (grant no. 221N265) are gratefully acknowledged.

Contact

Thank you for your attention.

LOUISE



TECHNISCHE
UNIVERSITÄT
DARMSTADT

This project has been subsidized through ACT (EC Project no. 691712) by the German Federal Ministry of Economic Affairs and Energy (grant no. 03EE5096), the Research Council of Norway (grant no. 329886), the Greek General Secretariat for Research and Technology (grant no. T12EPA5-00023), and the Scientific and Technological Research Council of Turkey (grant no. 221N265).

Accelerating
CCS
Technologies

