Energy Systems
and Technology
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LOUISE

TECHNISCHE UNIVERSITÄT DARMSTADT

LOUISE: Low-Cost CO_2 Capture by Chemical Looping Combustion of Waste-Derived Fuels

Jochen Ströhle

ACT Knowledge Sharing Workshop

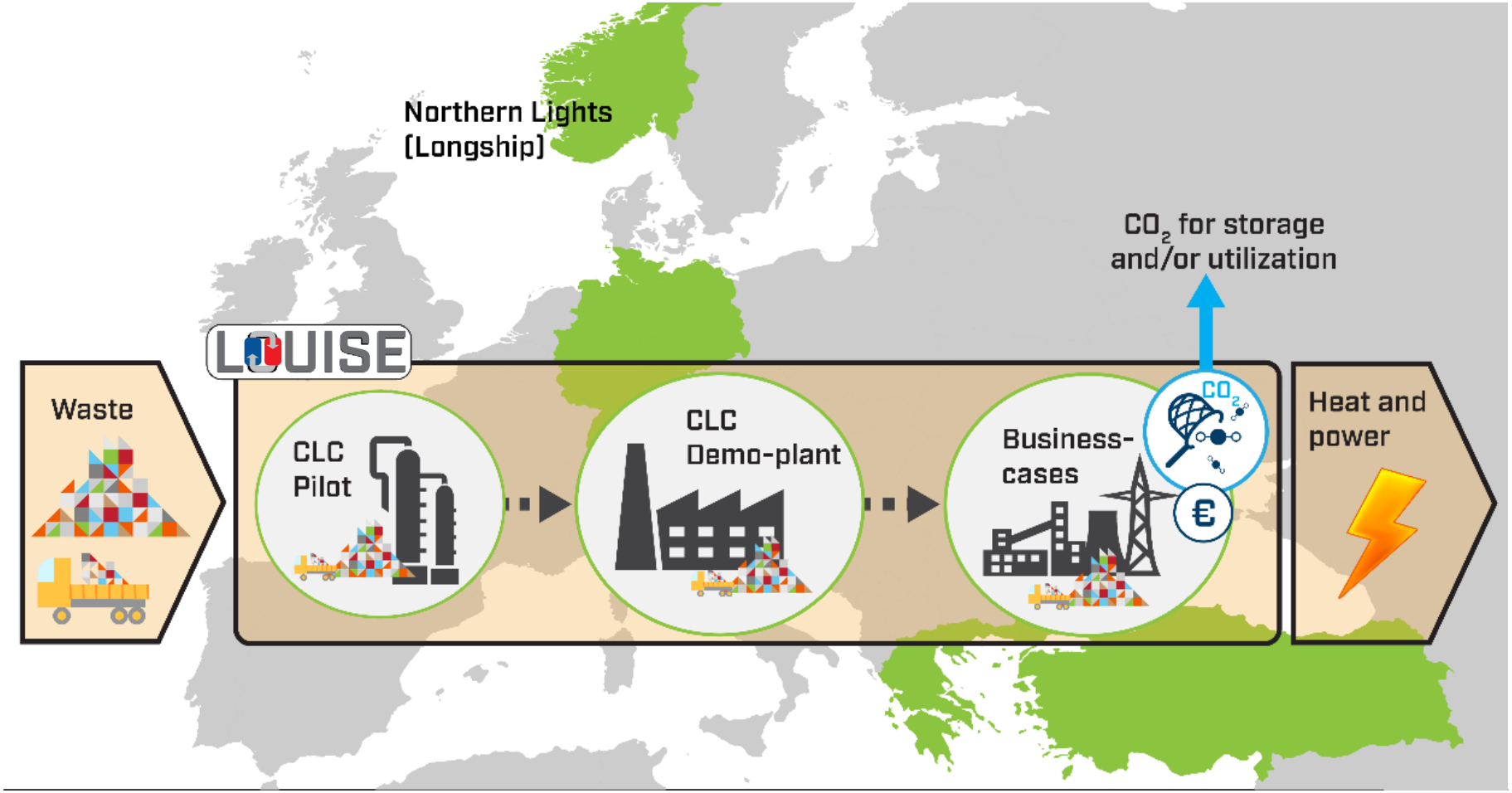
4 October 2023

Accelerating CCS Technologies

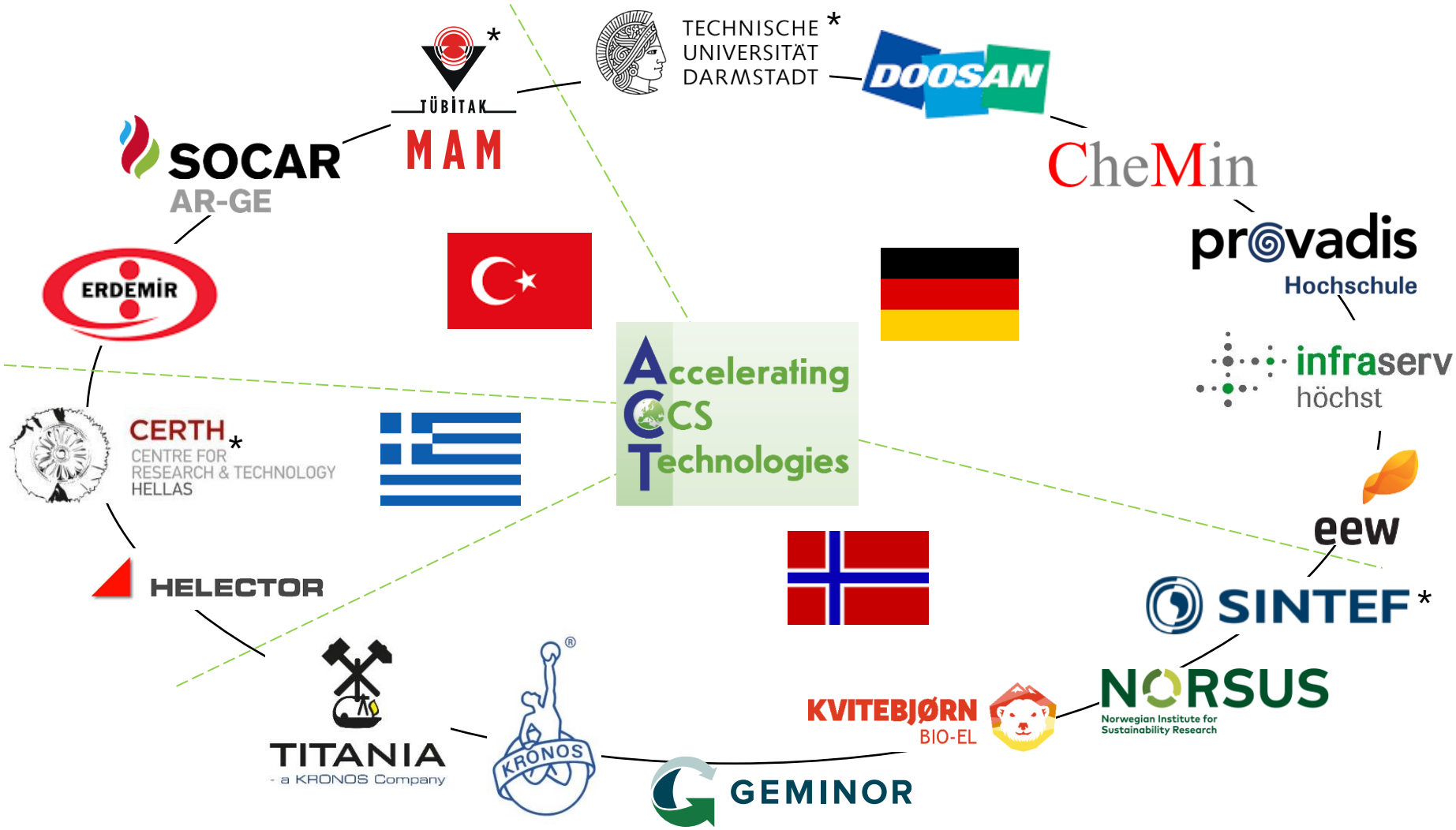
Overall Aim

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

10/2021 – 09/2024

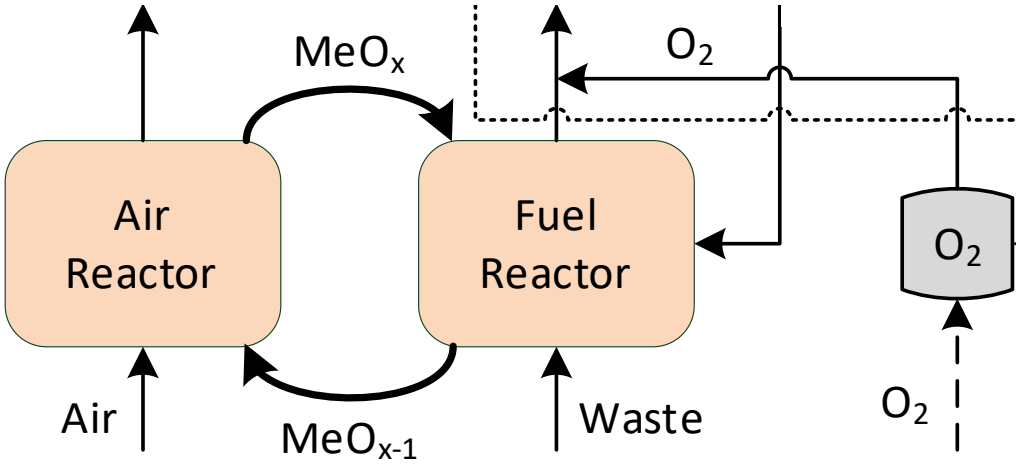


Consortium



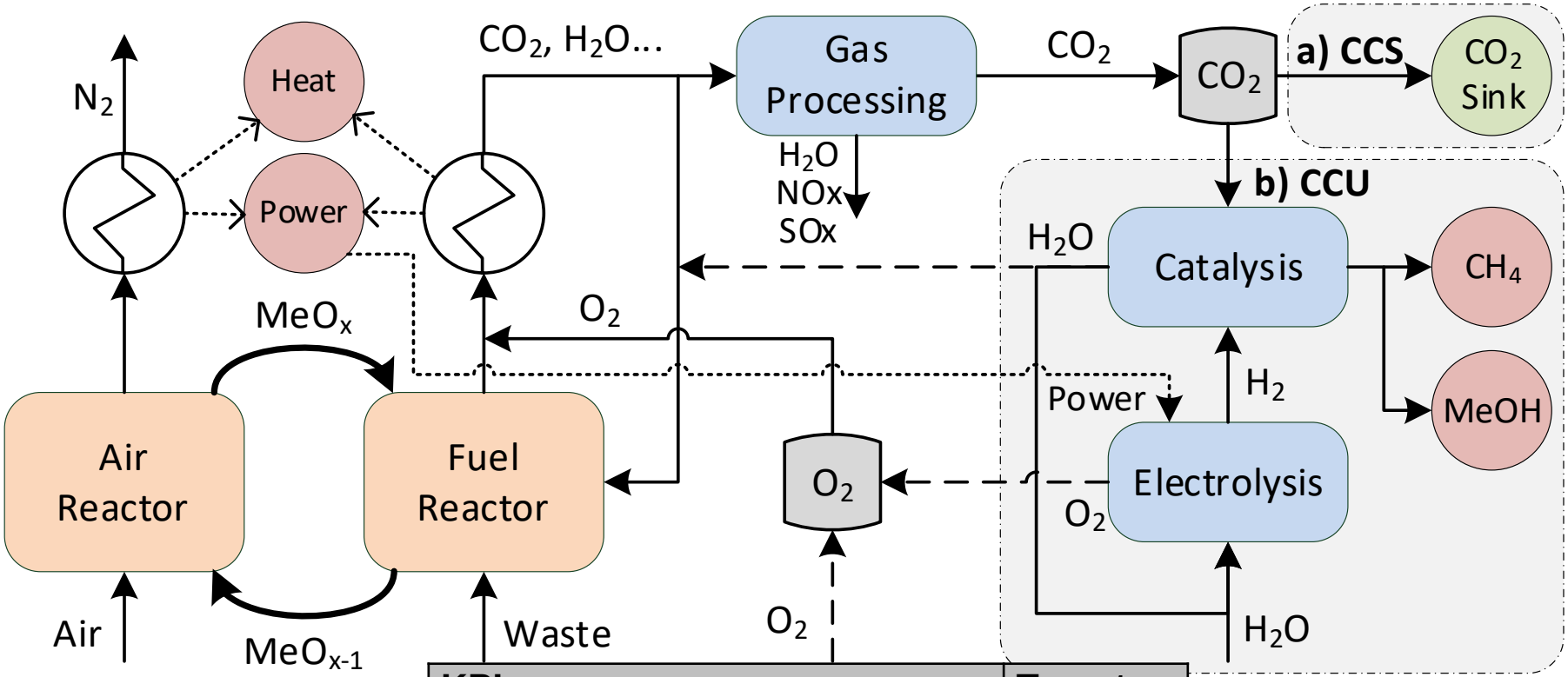
*National consortium leader

CLC Process Concept



- 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 %

Objectives

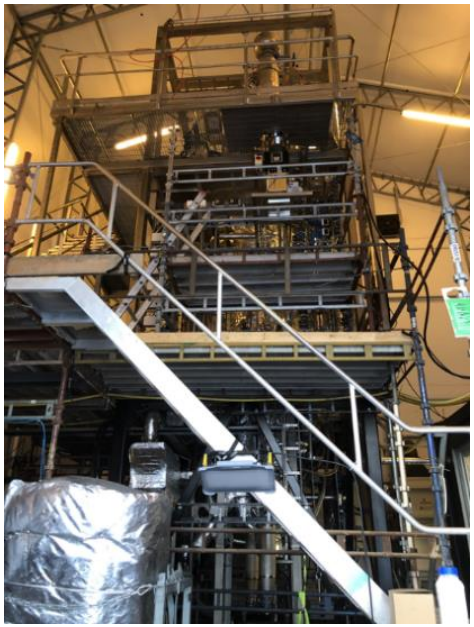
1) **Demonstrate CLC** of solid **waste**-derived fuels in realistic environment (TRL 6)
   - pilot unit testing at 150 kW_{th} and 1 MW_{th} scale

2) **Basic design** of 10 MW_{th} CLC **demo plant** (TRL 7) for waste-derived fuels
   - including flue gas cleaning + CO_2 processing steps

3) **Reduce** CO_2 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

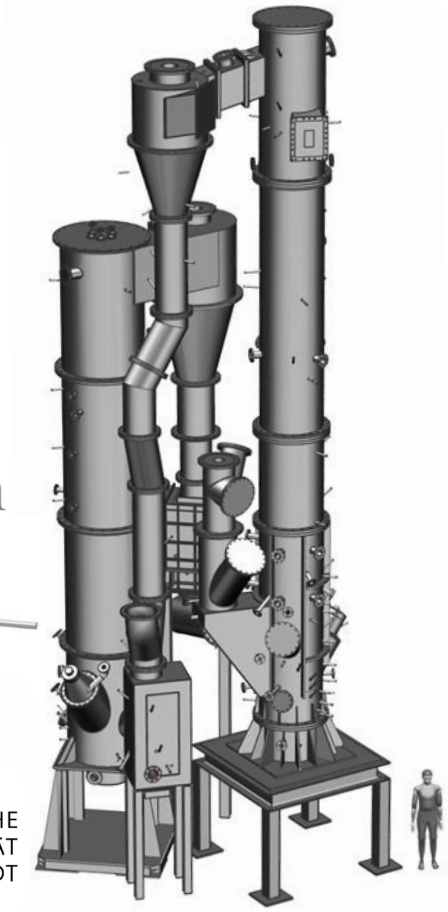
SINTEF

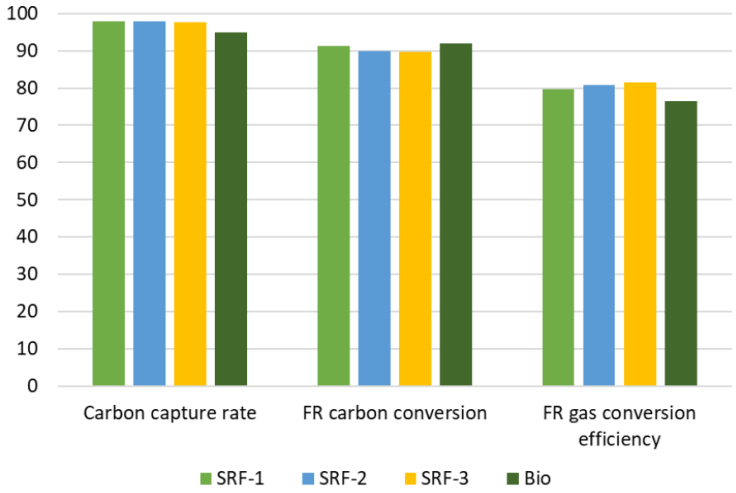
GEMINOR

TITANIA
- a KRONOS Company

1 MW_{th} pilot plant:

- Tests in Jan 2024





CheMin

Corrosion
Fouling

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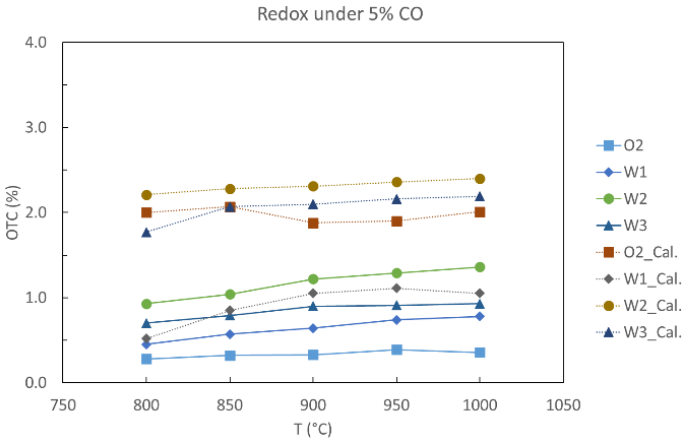
WP2 – OC Material Validation / Reuse

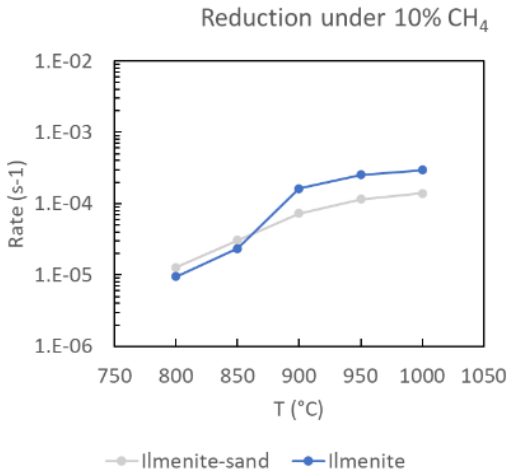
- Evaluation of Turkish OC materials
  - Iron ores (O)
  - By-products from steel industry (W)



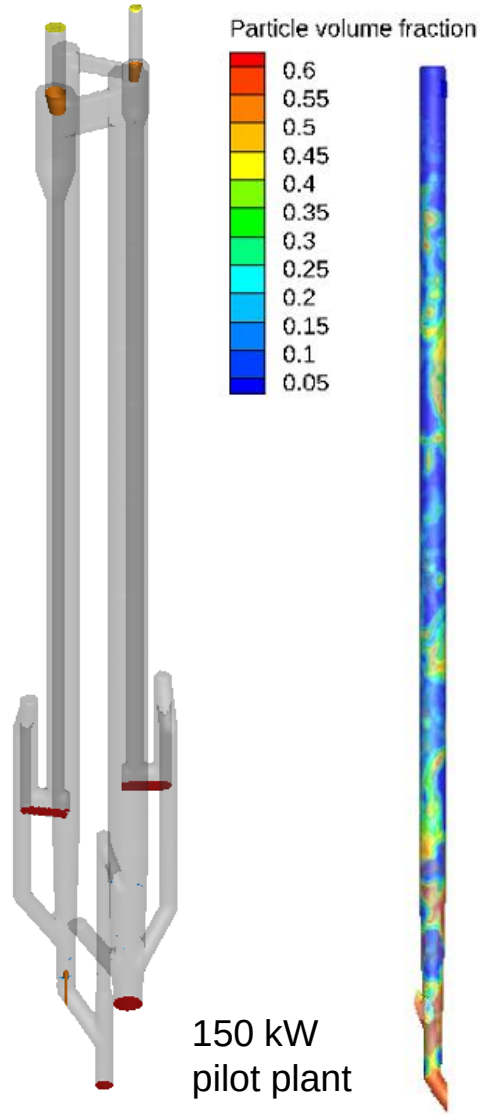
- OC validation, interaction with waste

New reactor

- Re-use of spent OC materials
  - ➢ Ilmenite sand



WP3 – Basic Design of Demo Plant

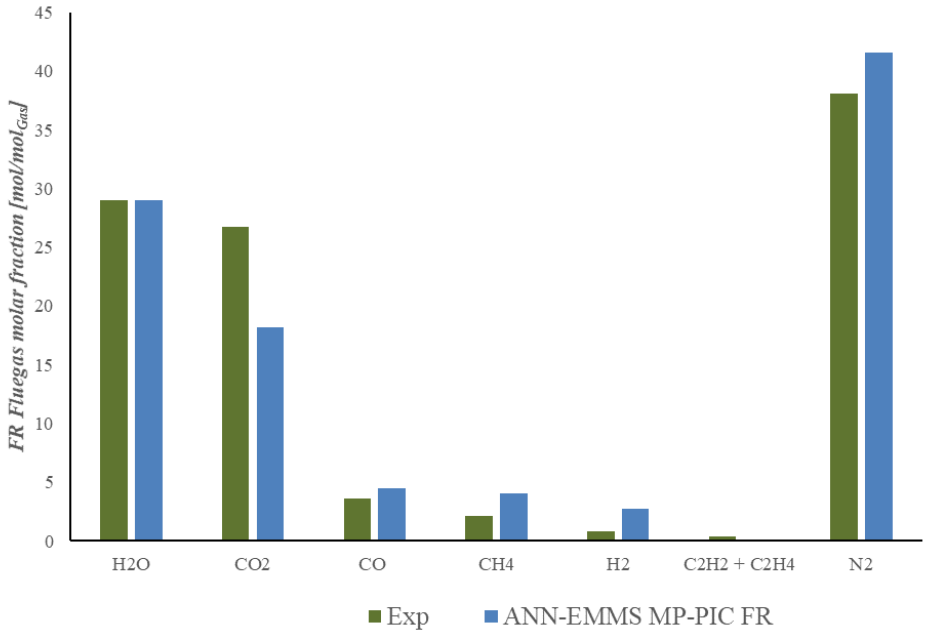


150 kW
pilot plant

CFD model for CLC developed

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

➢ Design of demo plant



WP4 – Business Case Development

- 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
- Life cycle assessment
- Business cases

WP5 – Dissemination & Exploitation

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

www.act-louise.net

Thank you for your attention.

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