

# Accelerating Energy Sector Decarbonization through Waste-Derived Fuels and CCS Technology

Jochen STRÖHLE

Webinar

20<sup>th</sup> November 2024





|               |   |  |
|---------------|---|--|
| 09:00 – 09:30 | <u>Introduction</u> <ul style="list-style-type: none"><li>Decarbonizing the Energy Sector from an Operator's Perspective</li><li>Project Overviews</li></ul>  | M. Kost ( <i>FORTUM</i> )<br>J. Ströhle ( <i>TU Darmstadt</i> )  |
| 09:30 – 10:00 | <u>Pilot testing using waste-derived fuels</u> <ul style="list-style-type: none"><li>Oxyfuel CFB Combustion</li><li>Chemical Looping Combustion</li></ul>   | A. Kuhn ( <i>TU Darmstadt</i> )<br>P. Mohn ( <i>TU Darmstadt</i> )                                     |
| 10:00 – 10:30 | <u>Corrosion Measurements</u> <ul style="list-style-type: none"><li>In Waste-to-Energy Retrofit CFB Power Plants</li><li>In Chemical Looping Combustion</li></ul>   | V. Barisic ( <i>Sumitomo SHI FW</i> )<br>M. Kaiser ( <i>CheMin</i> )                                   |
| 10:30 – 10:45 | <i>Coffee break</i>   |  |
| 10:45 – 11:15 | <u>Technology Upscaling</u> <ul style="list-style-type: none"><li>Simulation of Full-Scale Co-Combustion CFB Power Plants</li><li>Design of a Chemical Looping Combustion Demoplant</li></ul>   | P. Stamatopoulos ( <i>CERTH</i> )<br>S. Schmitt ( <i>Doosan Lentjes</i> )                              |
| 11:15 – 11:45 | <u>Multi-Level Impact Assessment</u> <ul style="list-style-type: none"><li>Techno-Economic &amp; Life Cycle Assessment of Waste-to-Energy Plants</li><li>Techno-Economic Assessment of CLC for Acetic Acid Production</li><li>Life Cycle Assessment of Chemical Looping Combustion Plants for CCS</li></ul> | M. Casa / M. Bogliolo ( <i>RINA-C</i> )<br>K. Atsonios ( <i>CERTH</i> )<br>I. Modahl ( <i>NORSUS</i> ) |
| 11:45 – 12:30 | <u>Outlook beyond the projects</u> <ul style="list-style-type: none"><li>Insights from the 3 MW<sub>th</sub> CLC Demonstration Unit in China: Pushing the Boundaries of Clean Energy</li><li>Conclusion, Outlook, and Open Discussion</li></ul>   | N. Vin ( <i>IFPEN</i> )<br>J. Ströhle ( <i>TU Darmstadt</i> )  |

# Overview of projects **LOUISE** and **REBECCA**

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# PROJECT GOALS



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The logo for REBECCA, with the word in green and a small icon of a book or document to the left.

**Retrofit** of existing coal-fired fluidized bed CHP plants

- Waste as fuel (replacing coal)
- CO<sub>2</sub> capture

The logo for LOUISE, with the word in grey and a small icon of a recycling symbol to the left.

**New-built** waste-to-energy plants with integrated CO<sub>2</sub> capture

- Chemical looping combustion

# REBECCA OVERALL AIM

REBECCA



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Improve sustainability and economics of existing coal-fired CFB power plants

- by utilization of **waste-derived fuels**
  - Replacing coal by waste → lower CO<sub>2</sub> footprint
  - Active bed material → lower air excess, higher efficiency
- and **CO<sub>2</sub> capture** technology
  - Oxyfuel combustion → air separation required
  - Chemical looping combustion → high efficiency, low cost

7/2021 – 12/2024



Fortum's CHP plant in Zabrze



# REBECCA CONSORTIUM

REBECCA



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Sumitomo  
SHI/FW

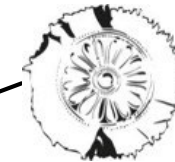
RWE



TECHNISCHE  
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fortum

RINA



CERTH  
CENTRE FOR  
RESEARCH & TECHNOLOGY  
HELLAS

# LOUISE OVERALL AIM

LOUISE

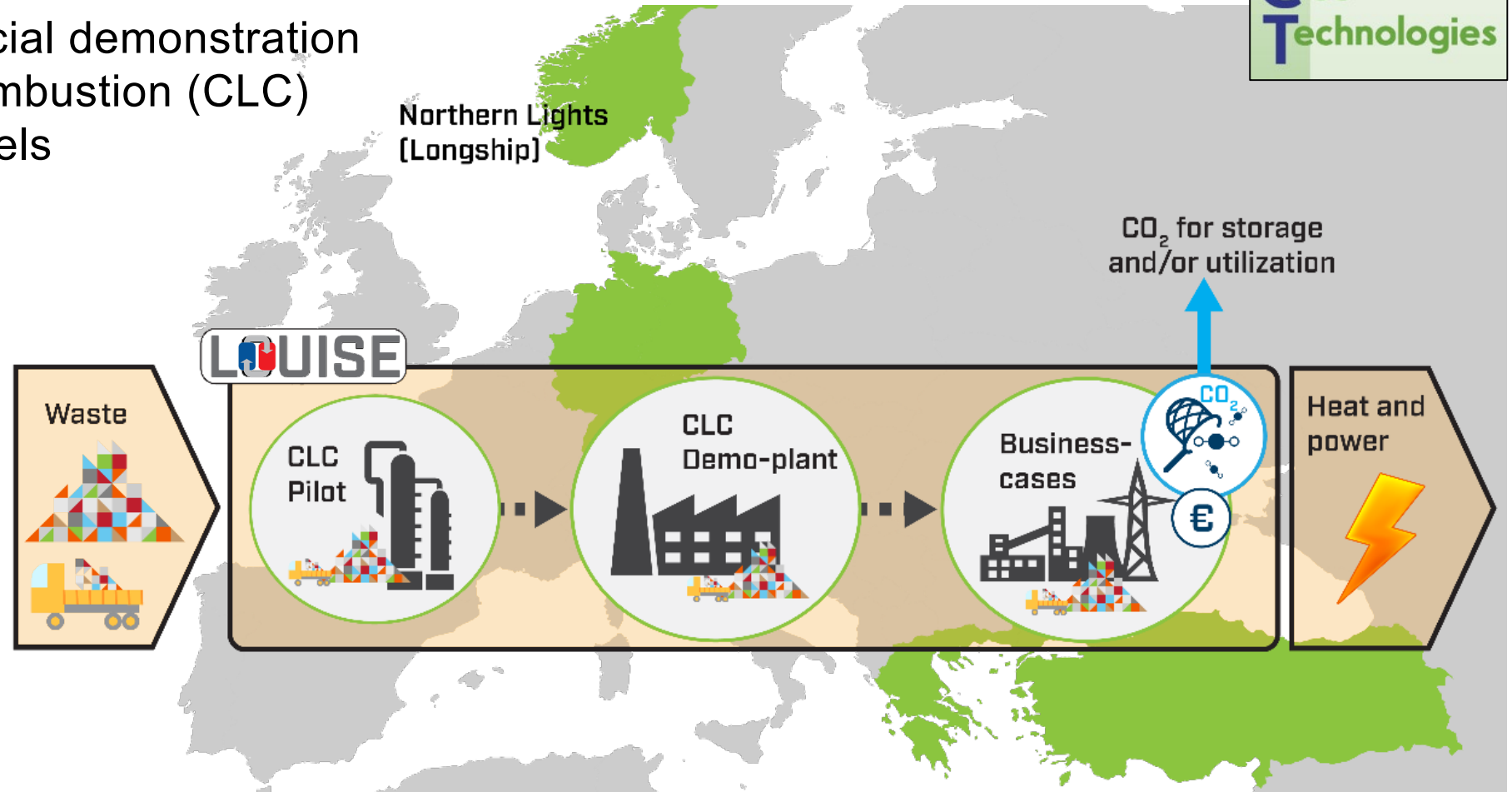


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Prepare for pre-commercial demonstration  
of Chemical Looping Combustion (CLC)  
of solid waste-derived fuels

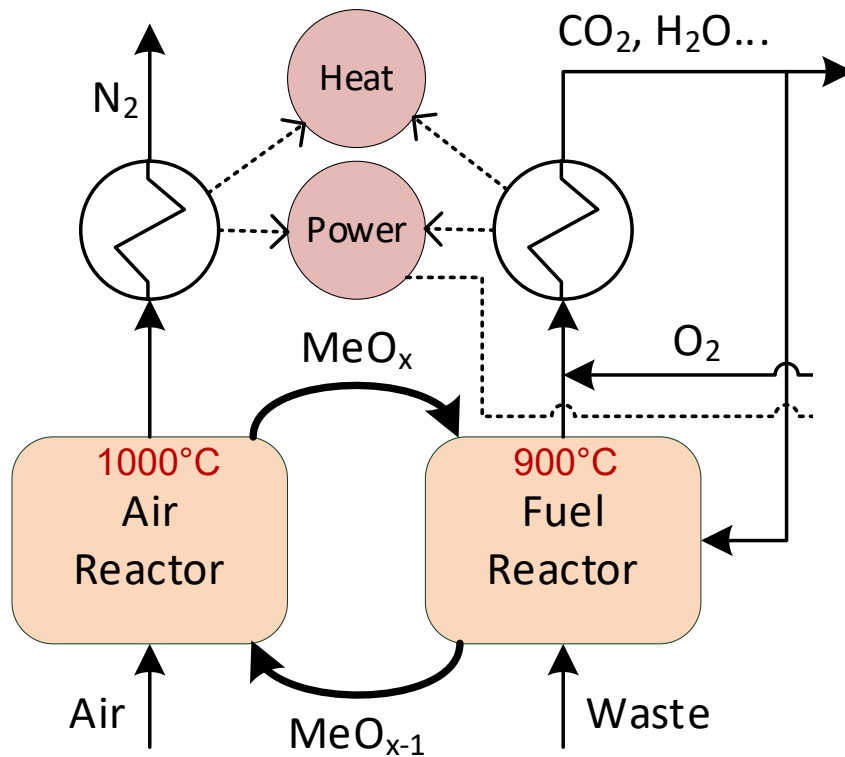
10/2021 – 12/2024



# CHEMICAL LOOPING COMBUSTION (CLC)



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- Inherent CO<sub>2</sub> separation  
→ **low cost**
- “Clean” air reactor  
→ **high electrical efficiency**
- MeO<sub>x</sub> re-use  
→ **synergies w/ mineral & metal processing industries**

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



# LOUISE CONSORTIUM

LOUISE



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# COMMON ASPECTS

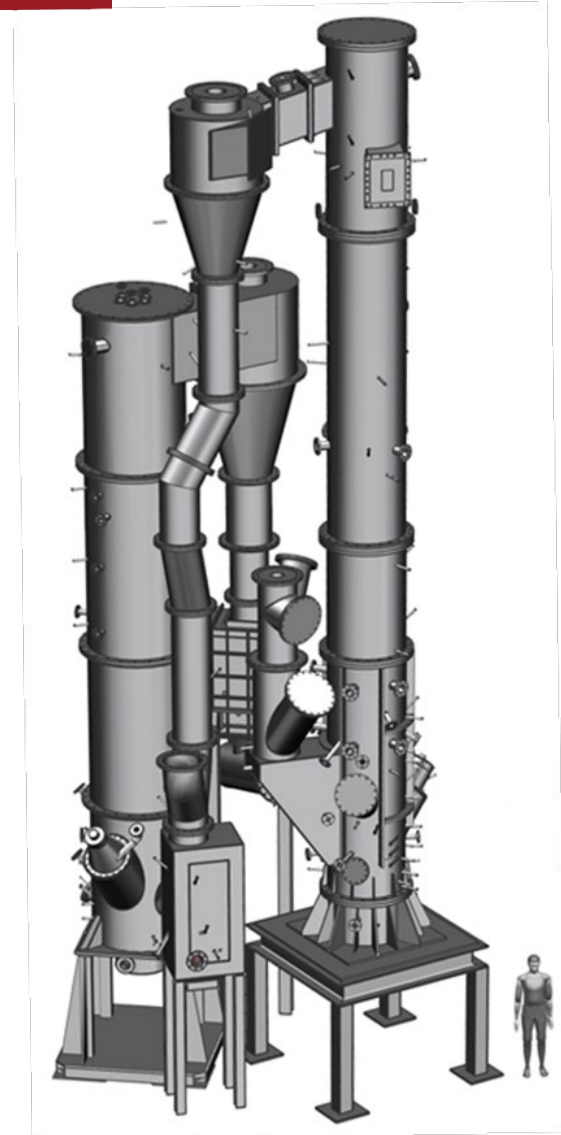


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- Pilot testing at 1 MW<sub>th</sub> scale
- Evaluation of fouling and corrosion
- Model development and scale-up
- Techno-economic, environmental, social assessment

 **This Webinar**

The logo for LOUISE REBECCA, with 'LOUISE' in grey and 'REBECCA' in green, featuring a stylized blue and red icon.



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LOUISE



Federal Ministry  
for Economic Affairs  
and Climate Action

Accelerating  
CCS  
Technologies



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This work 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) (ACT LOUISE) and from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 871143.

# THANK YOU



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Technische Universität

This work has received funding from the **European Union, Research Fund for Coal and Steel**, under grant agreement number 101034024 (Retrofitting Fluidized Bed Power Plants for Waste-Derived Fuels and CO<sub>2</sub> Capture). The content of this work reflects only the author's view, and the European Commission is not responsible for any use that may be made of the information it contains.