CLUSTER
CHEMICAL LOOPING & GASIFICATION

Webinar series

BioNETzero X Bio-Flex CLC

Innovations in Near-Zero-Emission Biomass Heat and Power, Including Carbon Capture

11:00 **Introduction to BioNETzero project**
Amy Brunsvold-Hellemans, SINTEF Energy Research



11:10 **Introduction to Bio-FlexCLC project**
Amir Soleimani Salim, Research Institutes of Sweden



11:20 **Flexible Chemical Looping Combustion Pathways for Sustainable Bioenergy Conversion**
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11:35 **From Regional Potential to Value Chains – Showcases Methodology and Preliminary Results**
Paweł Gładysz, AGH University of Krakow



11:50 **Q&A**

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DATE
18 Nov 2026

TIME
11am -12pm

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BioNETzero

A NEGATIVE EMISSIONS TECHNOLOGY FOR A NET-ZERO EUROPE

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the European Union



Vision for BioNETzero

ADVANCING SUSTAINABLE BIOMASS-BASED CHP

The BioNETzero project will lead the transition towards a more sustainable Europe, **integrating renewable energy-based CHP solutions with low-cost, low-emission carbon capture**, enabling carbon dioxide removal at the scale needed for a net-zero Europe by 2050.

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FAST FACTS

- HORIZON-CL5-2023-D3-02: Development of near zero-emission biomass heat and/or CHP including carbon capture
- Should reach TRL 5: Large-scale validation
- May 2024 – April 2027
- €3,999,782.50

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PARTNERS



SINTEF

AALBORG UNIVERSITY

Silesian University of Technology

Air Liquide

AGH University of Science and Technology

VEOLIA

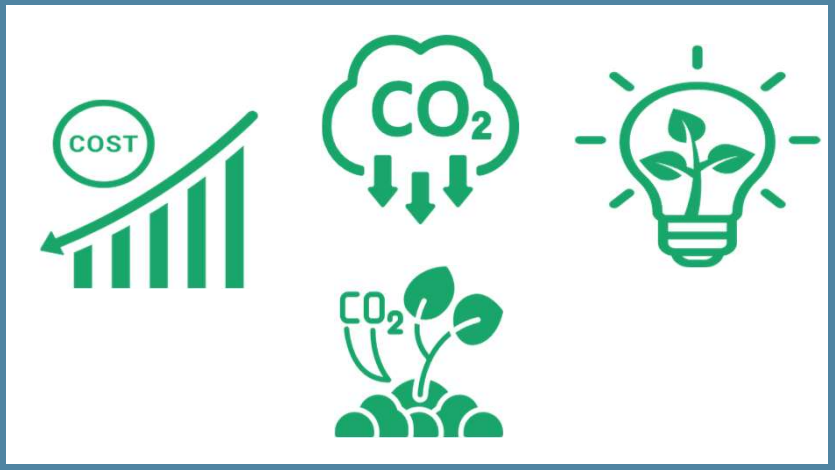
ciudad de la energía

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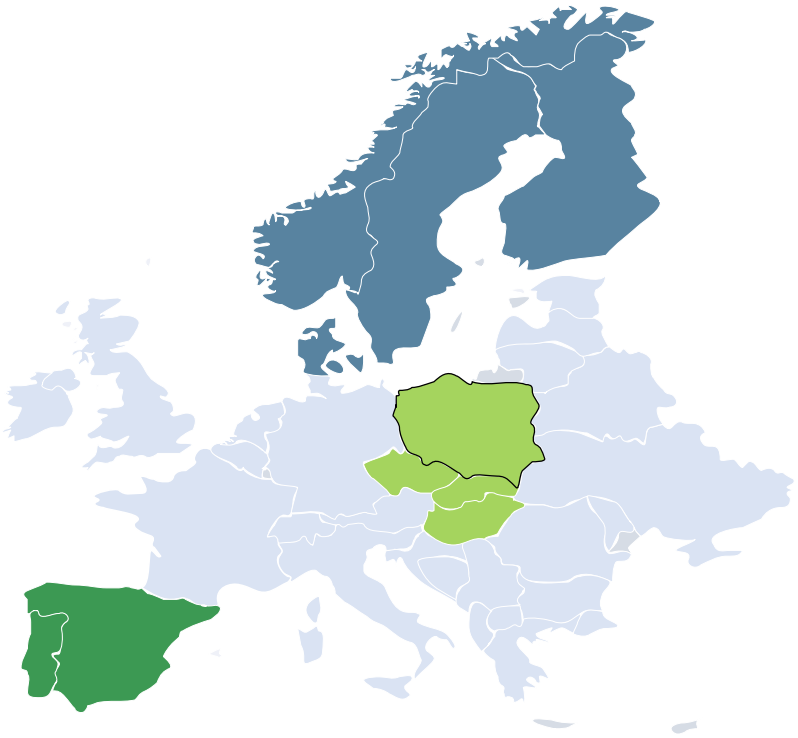
GOAL

- Develop a suite of novel **oxy-combustion technologies** and concepts and evaluate their applicability in different regions of Europe





A regional approach, integrated across all value chains



Pre-feasibility study for region in transition

CHP plant from Veolia group; Modernisation of PC boiler for oxy-mode biomass combustion and integration with conventional ASU

Regional showcases

V4 countries – region in transition

Iberian Peninsula countries – region in transition

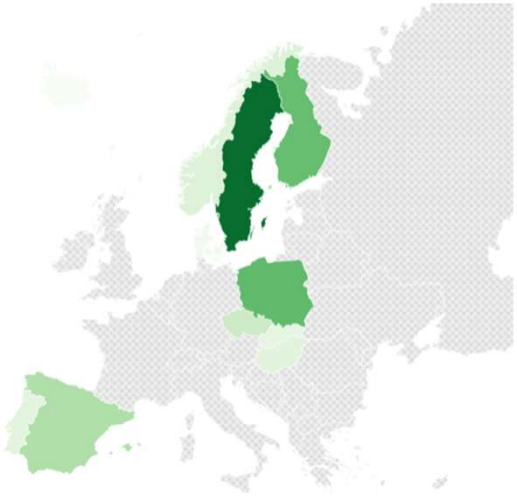
Nordic countries – tested for novel technology implementation

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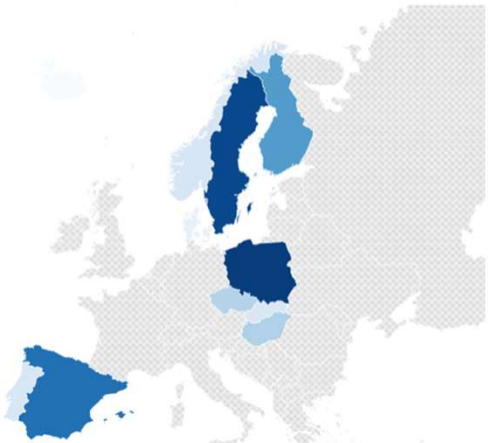
Map of regional biomass residues

*Energy potential**

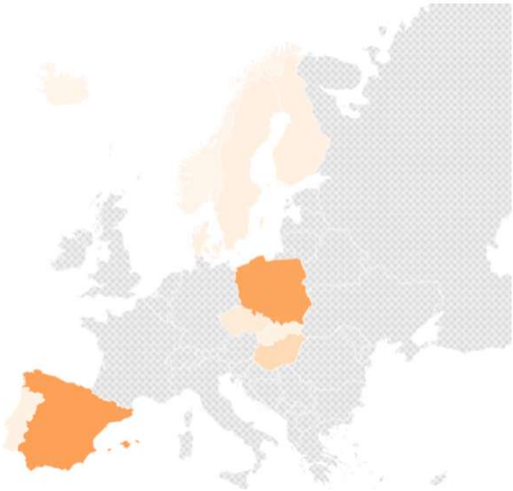
Forestry residues



Total residual biomass



Agricultural residues & Energy crops

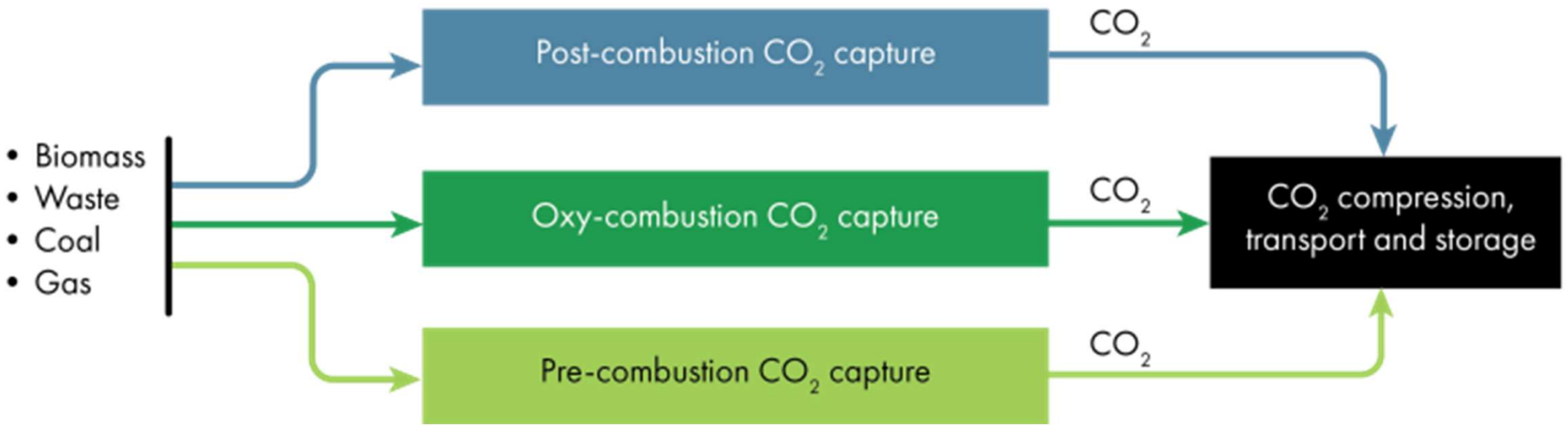


https://public.flourish.studio/story/2804956/

*Energy potential refers to the maximum energy that can be extracted from the available biomass

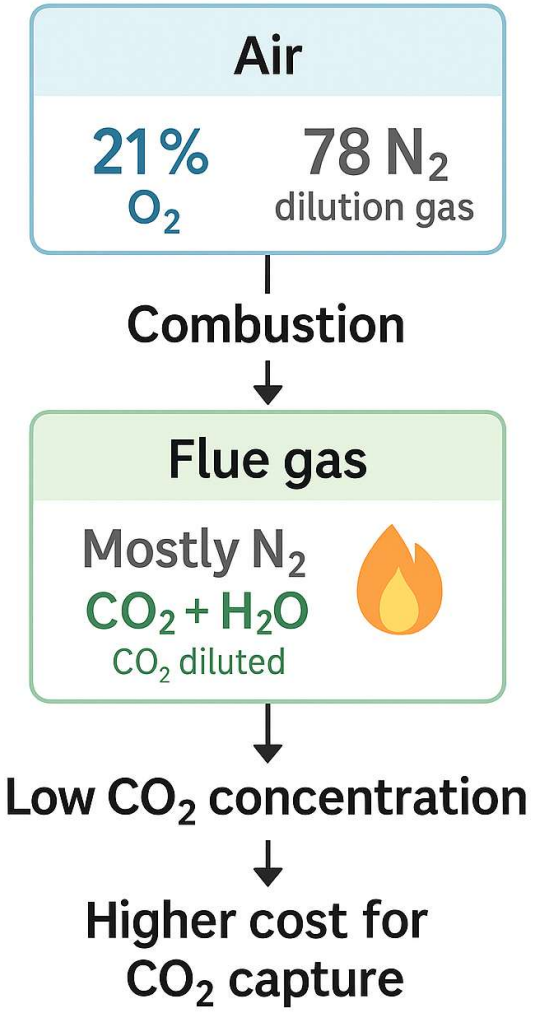
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Typical CO_2 capture pathways

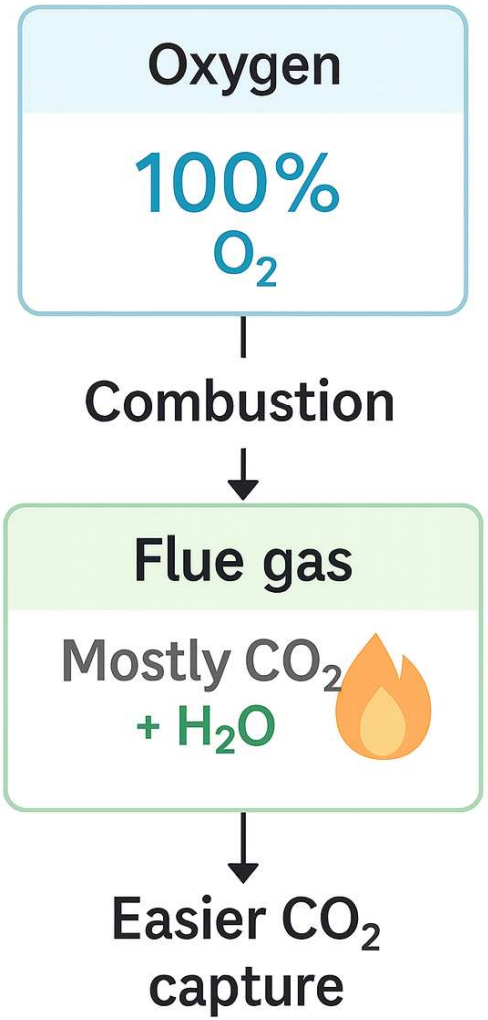


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Why Air-Based Combustion Makes CO_2 Capture Difficult



Oxy-Combustion Simplifies CO_2 Capture



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Advantages of oxy-combustion



Lower pollutant emissions



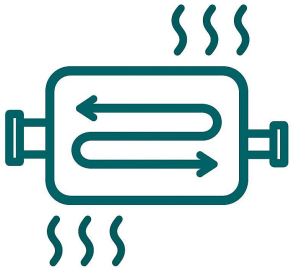
Higher combustion efficiency



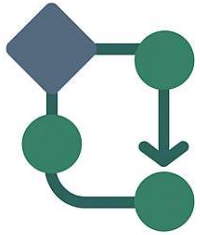
Compact plant design



Flue gas is mainly CO_2 and water vapour.



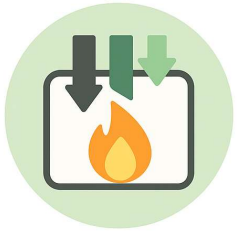
Improved heat recovery potential



Better process control and flexibility

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Oxy-combustion concepts in BioNETzero



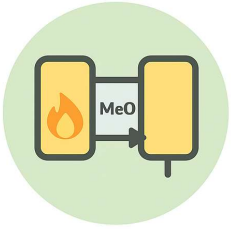
Oxy-MILD – Moderate or **I**ntense **L**ow-oxygen **D**ilution combustion

A flameless combustion approach in which pure oxygen and recirculated CO_2-rich flue gas are intensely mixed to achieve uniform high-temperature combustion with very low NOx and CO emissions.



Oxy-CFB – **C**irculating **F**luidised **B**ed oxy-combustion

A circulating fluidised-bed oxy-combustion system that mixes recirculated flue gas with oxygen to fluidise bed material, enabling flexible biomass fuel use with low emissions and high combustion efficiency.



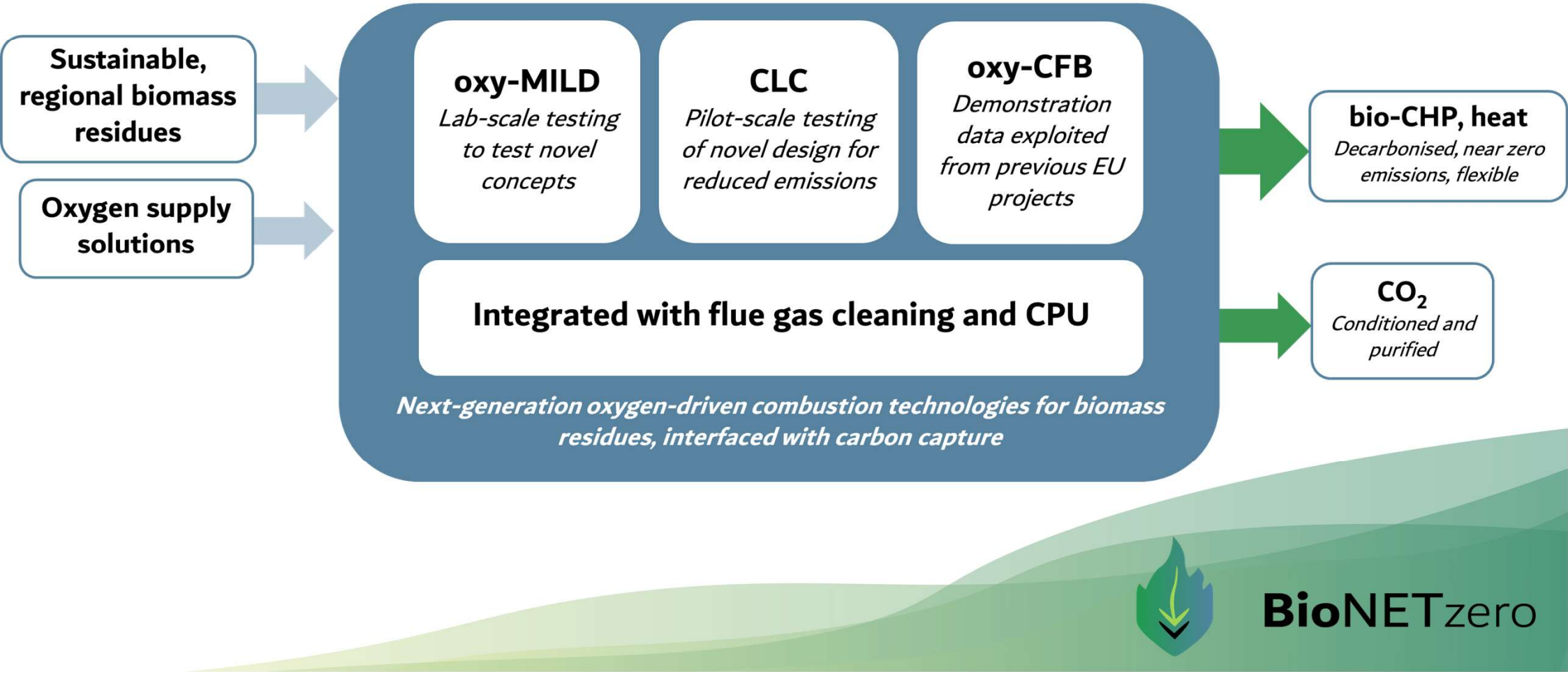
CLC – **C**hemical **L**ooping **C**ombustion

A two-reactor looping process using metal-oxide oxygen carriers instead of an ASU, allowing high-efficient fuel conversion, inherent oxygen separation and high-purity CO_2 output for capture.

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Regional Case Studies to Evaluate Societal and Industrial Value Creation



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THANK YOU

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