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AUSTRIA'S CLIMATE NEUTRALITY: AN IN-DEPTH EVALUATION OF THE POTENTIAL CONTRIBUTION OF CCU AND CCS FOR THE AUSTRIAN LONG-TERM CLIMATE GOALS

**ACRP-SESSION 1 / AUSTRIAN CLIMATE DAY 2024 / 03.04.2024**

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# Project Key Facts



- **Lead:** Energieinstitut an der JKU Linz (EI-JKU)
- **Consortium:** Montanuniversität Leoben (MUL) (Energy Network Technology / Process Technology and Environmental Protection / Reservoir Engineering / Petroleum Geology), denkstatt, CCCA (subcontract)
- **Funding scheme:** 14th Austrian Climate Research Programme (ACRP)
- **Duration:** August 2022 – January 2025 (30 Months)

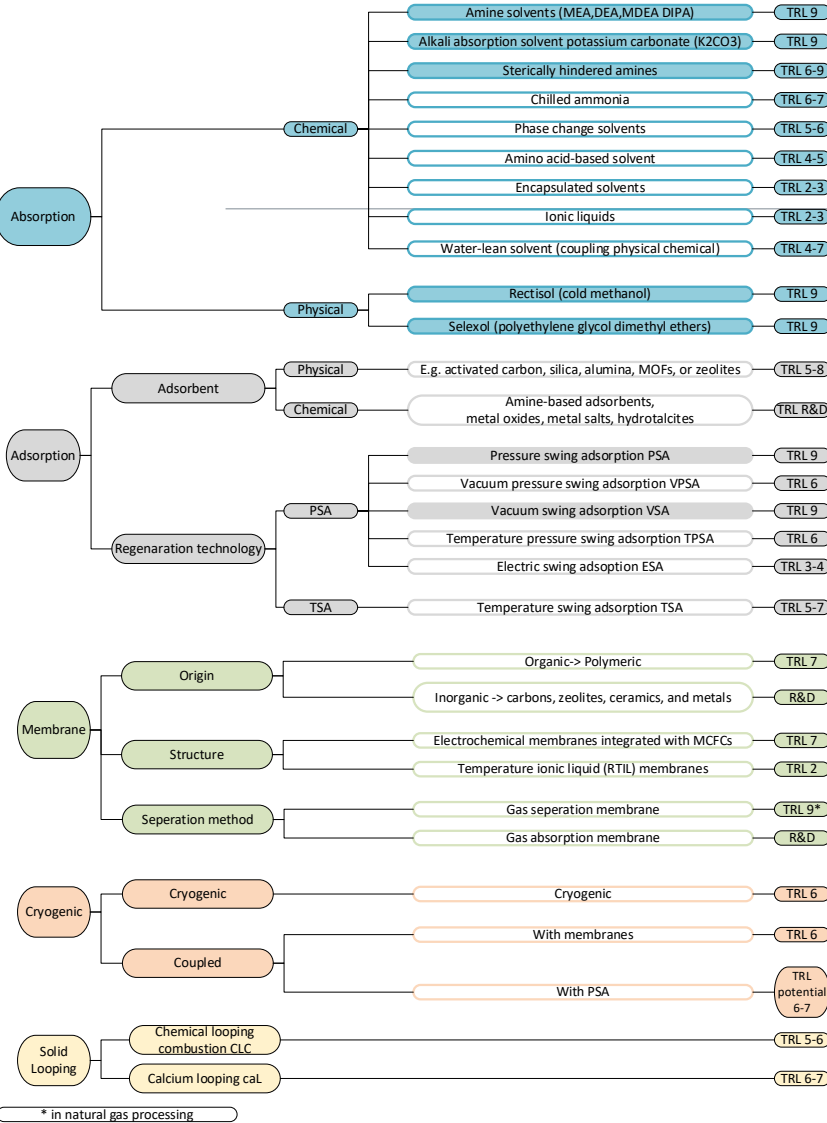
“In the scenarios for meeting the 1.5°C target, Carbon Capture and Storage (CCS) or Carbon Capture and Utilization (CCU) is de facto unavoidable” (see IPCC Special Report on 1.5°C).

→ CaCTUS addresses the **lack of reliable data and information** on the potential of these technologies **in Austria**

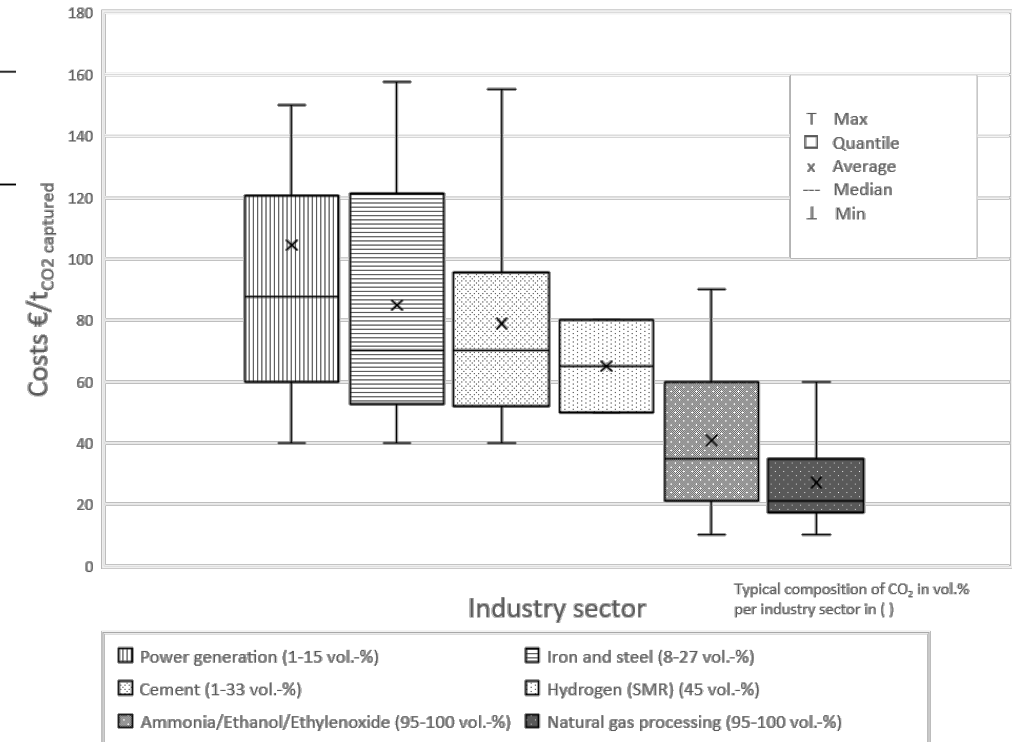
## Objectives

- **Identification and quantification of technical potentials** for CCU/CCS in Austria
- Identification of **source-specific climate impacts** and **sink-related net mitigation potentials** of CCU/CCS
- **Techno-economic assessment** of the identified carbon pathways and their **contribution to climate neutrality**
- Assessment of **current barriers and regulatory shortcomings** that hinder early implementation and maximize impact

# Carbon Capture – Energy Demand & Costs (WP2)

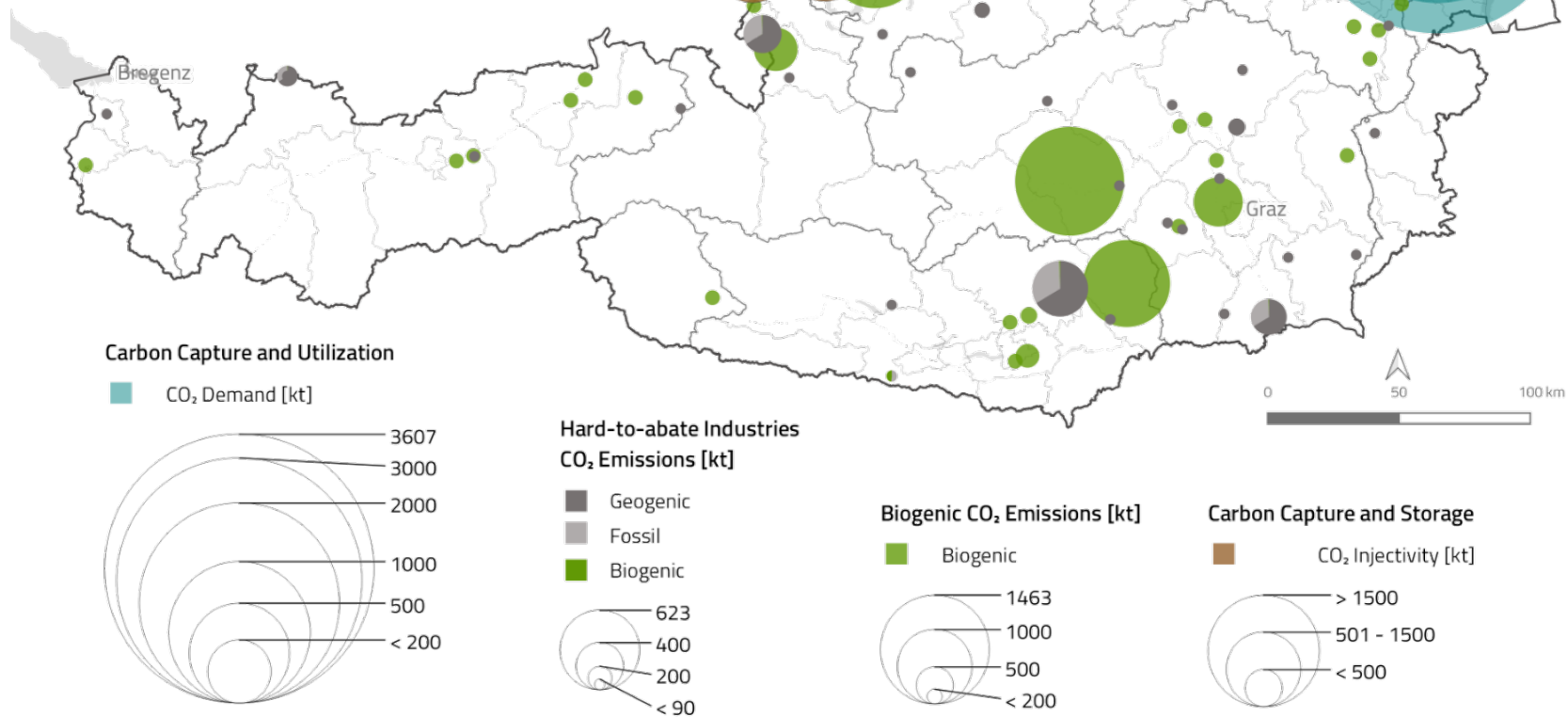
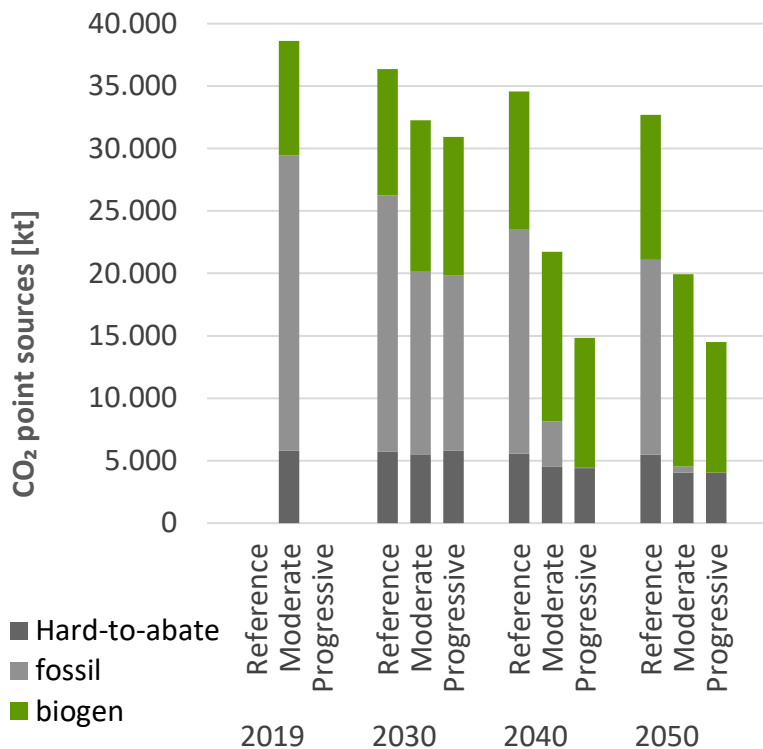


Technology	Energy demand (th) GJ/t <sub>CO2</sub>
<b>Absorption</b>	<b>2,0 - 9,2</b>
MEA, DEA, MDEA, etc.	3,0 - 4,5
New/optimised solvents	2,1 - 2,9
Potassium carbonate	2,0 - 2,6
Chilled ammonia	2,0 - 2,9
Amino acid-based solvent	2,4 - 3,4
<b>Adsorption</b>	<b>2,4 - 9,0</b>
Amine-based adsorbents	1,3 - 2,0
Metal-organic frameworks	0,4 - 0,8
<b>Membrane</b>	<b>0,5 - 6,0</b>
<b>Cryogenic</b>	<b>2,4 - 5,2</b>
<b>Solid Looping</b>	<b>2,0 - 10,0</b>



→ CCA fact sheet on Carbon Capture Technologies in press!  
 → Several conference presentations in Q4/23 and Q1/24

# CO<sub>2</sub> point sources and sinks in 2050 (WP2 / WP3)



3 decarbonization pathways  
based on NEFI and UBA scenarios

- Journal article on CO<sub>2</sub> point sources in Austria under review
- Journal article on CO<sub>2</sub> sinks in preparation
- Several conference presentations in Q4/23 and Q1/24

# Quantification of CCUS potentials and demands (WP2)

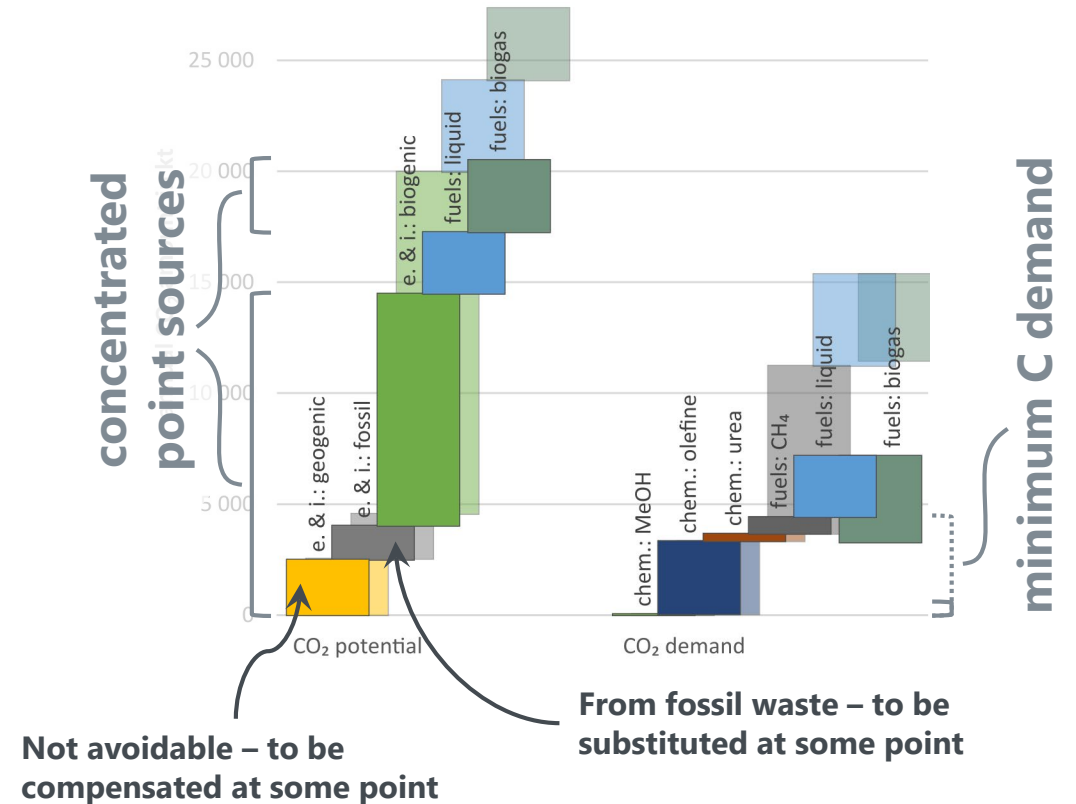
## Identification of relevant products and demands – carbon balance

- total “emissions”: **17.3 – 27.3 Mt/yr**
  - capturable: **14.5 – 23.2 Mt/yr**
    - fossil/geogenic: **4.0 – 4.6 Mt/yr**
  
- utilizable CO<sub>2</sub>\*: **3.3 – 15.4 Mt/yr**
  - circular: **0.5 – 11.2 Mt/yr**

\* if all e-fuels produced in AT; upper bounds without exploiting biogas potentials

Contact to other ACRP projects

- NetZero2040
- Prof. K. Steininger/Wegener Center (e.g. FAREcarbon project)
- Contact planned regarding nature-based solutions (e.g. UNRAVEL / BOKU)



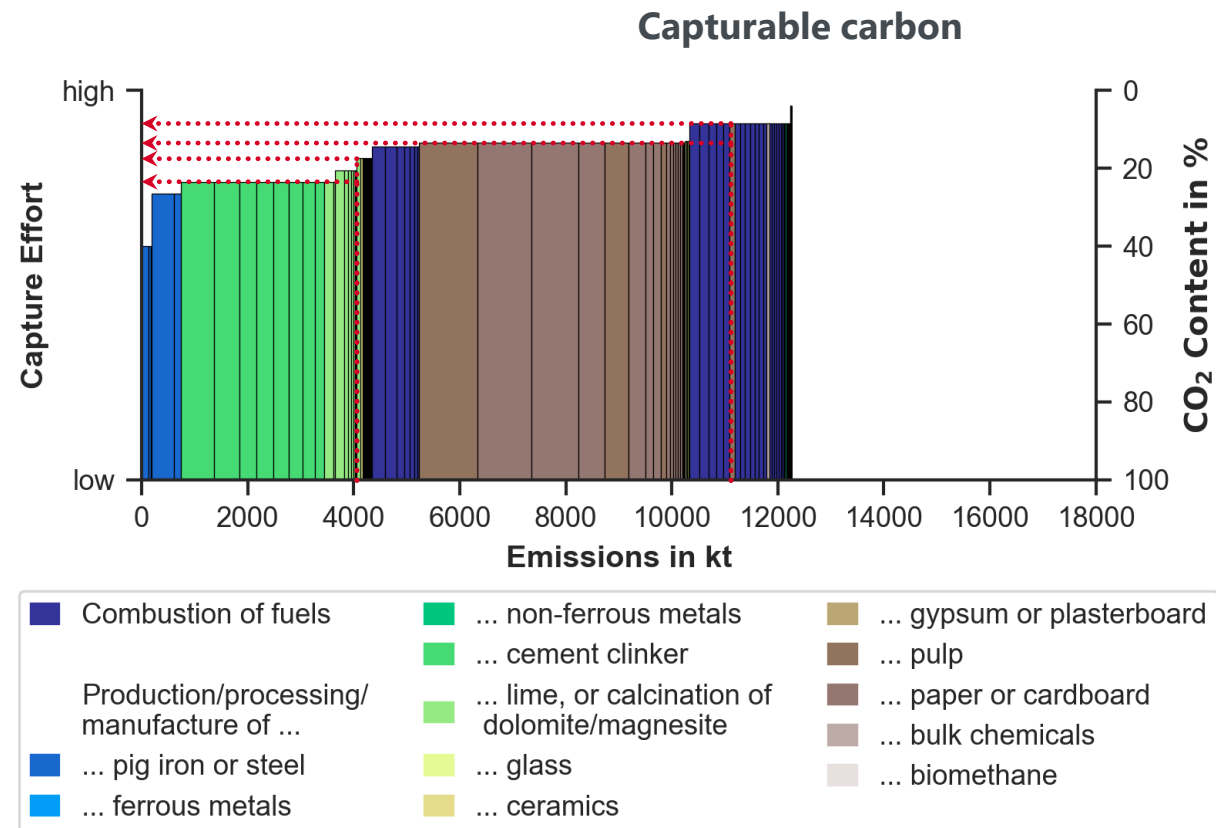
# Assessment of CO<sub>2</sub> avoidance costs for the identified CCU/CCS paths (WP4)

## Determination of capture effort and merit of sources

- **high-purity CO<sub>2</sub> streams will not suffice** to compensate long-term fossil/geogenic emissions
- depending on exploited **CCU** potentials, the **use of highly diluted sources** will become necessary

to be considered:

- omitting potentials from **biogas production** shifts the curve towards higher efforts
- with higher carbon demands, **decentralization of sources** increases
- **additional efforts** for transport, purification, etc. yet to be included



# Analysis of the legal and regulatory framework on CCU and CCS (WP4)

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- Legal situation regarding CCU and CCS strongly influenced by **EU law**
- Main legal basis at European level regarding CCS: Directive 2009/31/EG on the geological storage of carbon dioxide (CCS-Directive)
  - Outline and analysis of the provisions of the CCS-Directive
  - Right not to allow any storage in the Member State → Austria has made use of this: Federal Act on the **Prohibition of Geological Storage of Carbon Dioxide**
  - **Evaluation of the ban** at regular intervals; next evaluation upcoming: presentation to the Council of Ministers (AT, Ministerrat) that it will probably be recommended that geological storage of CO<sub>2</sub> be permitted exclusively for **residual emissions in "hard-to-abate" sectors**
  - Analysis of the conditions for an **exemption from the obligation to surrender allowances in the EU ETS** in connection with CCU and CCS
  - Exemption for CCS as defined by the CCS Directive
  - Exception regarding CCU only if CO<sub>2</sub> is permanently chemically bound in products

→ Presented in January 2024 (Energierechtstagung an der JKU Linz)



# Stakeholder interaction (WP5)

- **Stakeholder WS in Q2/23**
- **Survey on CC / CCU / CCS**
  - General information
  - CCUS Potentials
  - CCUS Barriers and Opportunities
  - Activities in the area of carbon capture
  - Activities in the area of carbon storage
  - Activities in the area of carbon utilisation
- **Interviews in Q4/23 + Q1/24**
  - Necessary advancements in the company
  - Regulations
  - Subsidies
  - Technical criteria
- **Stakeholder WS in Q3/24**



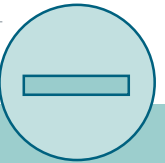
## Technical

Amine and membrane technologies receive highest interest for CC

Chemical-catalytic methods appear most promising for CCU implementation

Depleted oil and gas reservoir storage receives most interest for CCS

- Work in progress!
- Policy Briefs planned for the final project period
- Project partners are in contact with policy makers, e.g. via Carbon Management Strategy Development for Austria by BMK & BMF



## Barriers

CCU: **Financial burden** and lack of enabling instruments

CCS: **Legislative restrictions**, lack of political will and negative public perception



## Drivers

CCU: **Updated ETS regulation** and improved profitability

CCS: **impact towards climate targets**, reduced costs and updated ETS regulation



# Contact

## Consortium Lead

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## Homepage

<https://project-cactus.at/>



## Partners



[www.unileoben.ac.at](http://www.unileoben.ac.at)



<https://denkstatt.eu>



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