



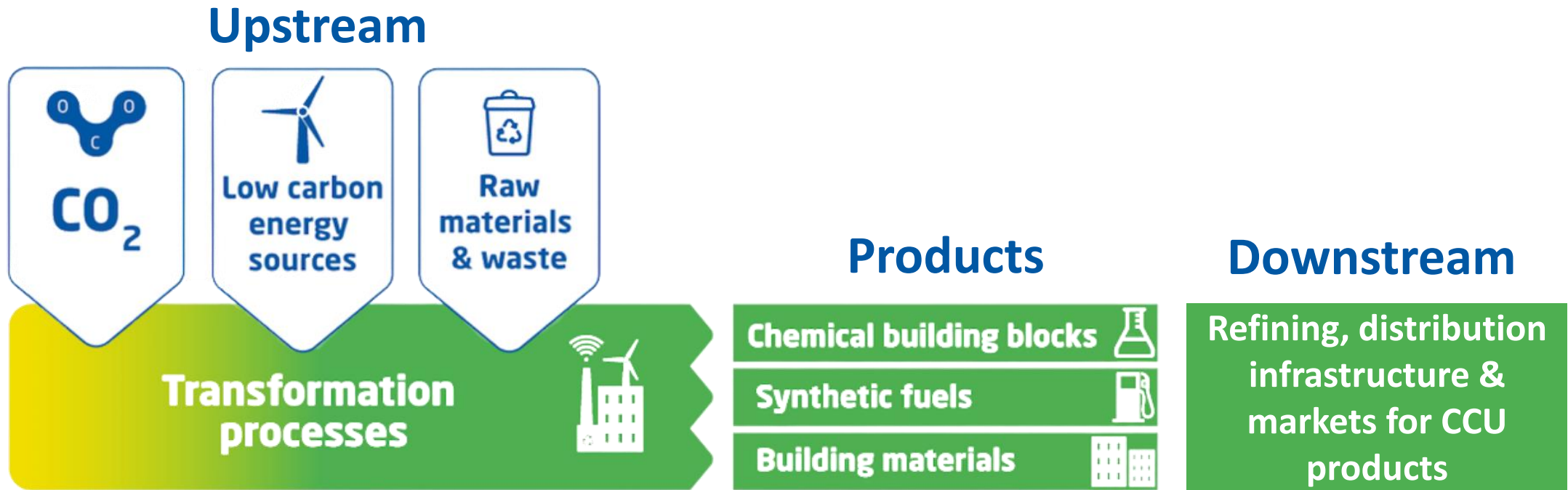
CO₂ VALUE
EUROPE

CCU on the European scene: progress & perspectives

**Tudy Bernier, Senior Policy Manager,
CO₂ Value Europe**

CO₂ Value Europe: the organisation

CO₂ Value Europe is the only European association dedicated to CO₂ Utilisation, bringing together stakeholders from the complete CCU value chain and across industries



Multinational Companies, SMEs, Regional Clusters, Research Institutions, Universities

CO₂ Value Europe: 74 members



Our CCU projects database

- ✓ More than 200 CCU projects referenced
- ✓ Details for each on partners, timeline, technology used, end product
- ✓ Publicly available
- ✓ Supported by Horizon2020 research & innovation programme

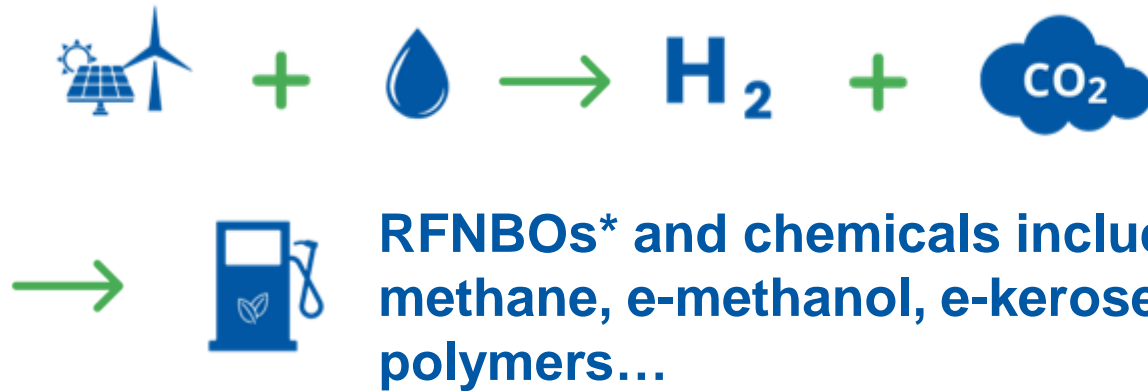
The screenshot displays the CO2 VALUE EUROPE CCU Projects Database interface. At the top, there is a navigation bar with 'Companies (soon)' and 'Projects' tabs. Below this, a search bar is labeled 'Search for project'. A filter section includes dropdown menus for 'Project status', 'Activities', 'Location', 'CCU Technology', 'TRL', and 'Product category', each with a 'Filter' button. A 'Reset' button is also present. The main content area features a world map with 'Map' and 'Satellite' views. The map shows project locations marked with colored pins and numbers: Canada (3), United States (3), United Kingdom (3), Denmark (43), Germany (57), France (34), Italy (7), Spain (17), Sweden (6), Norway (6), Finland (6), Poland (7), Austria (7), Romania (7), Belgium (7), China (3), South Korea (3), and Japan (3). The map also shows various countries and regions like Greenland, Russia, Kazakhstan, Mongolia, and others.

What is CCU and what it can do?

Our definition of Carbon Capture and Utilisation ('CCU')

CCU is a broad term that covers all **established and innovative industrial processes that aim at capturing CO₂** – either from industrial point sources or directly from the air – and **at transforming the captured CO₂ into a variety of value-added products such as:**

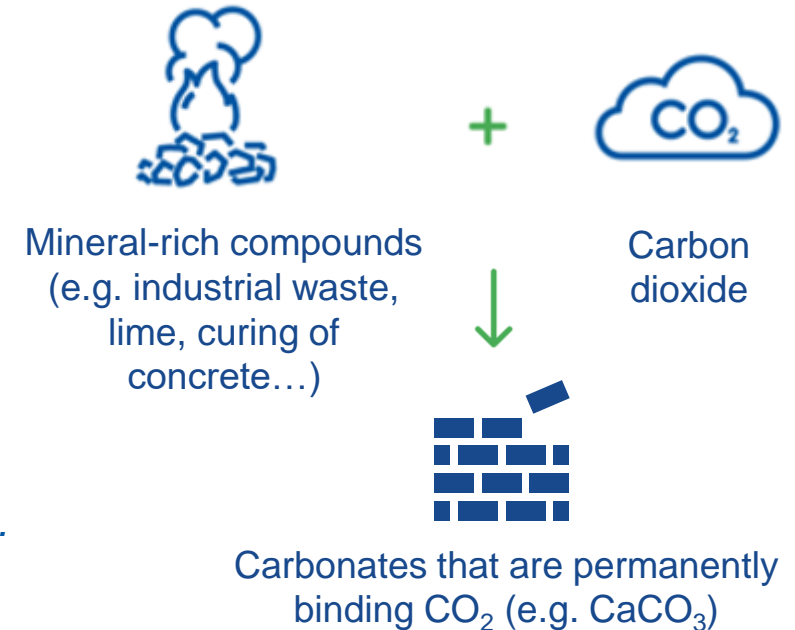
Renewable fuels



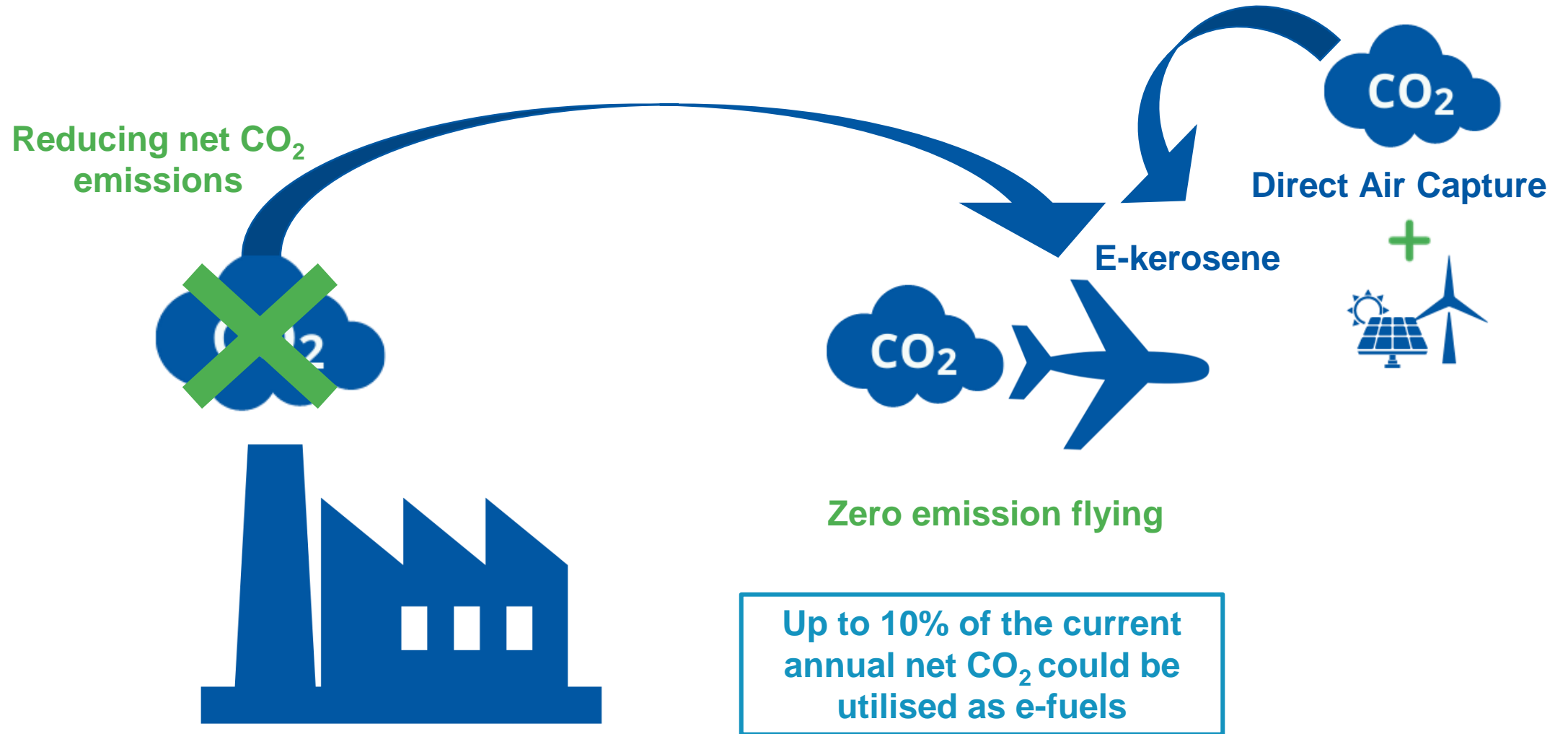
**RFNBOs = Renewable Fuels of Non Biological Origin
Also called e-fuels, CCU-fuels, synthetic fuels, powerfuels...*

Chemicals

Building materials



The example of synthetic aviation fuels



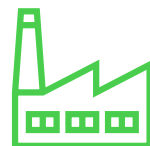
What can CCU do?

Reducing CO₂ emissions

Substantial GHG emission reductions compared to conventional production as shown by LCAs

Creating industrial symbiosis

Linking economic sectors (transport, cement and lime, chemicals, steel...) by reusing CO₂ from one sector to generate products used in another



Building a circular economy

Carbon circularity through CCU and “closed-loops” by recycling & reusing CO₂ over and over again

Removing CO₂ from the atmosphere

DAC-to-mineralisation or biogenic CO₂-to-mineralisation lead to permanent CO₂ binding

Defossilising industries

Scalable alternative feedstock to fossil carbon, available everywhere and without putting pressure on land uses

A game changer? CCU recognised for the first time in IPCC report from April 2022



“Reducing emissions from the production and use of chemicals would **need to rely on life-cycle approach**, including increased plastics recycling, fuel and feedstock switching, and **carbon sourced through biogenic sources**, and, depending on availability, **CCU, direct air CO₂ capture, as well as CCS**”

Source: IPCC, 6th Assessment Report, Working Group 3, Mitigation of Climate Change, April 2022, p. 38.

Science confirming the role of CCU to mitigate climate change



Sustainable Energy & Fuels

PAPER

View Article Online
View Journal | View Issue



A Guideline for Life Cycle Assessment of Carbon Capture and Utilization

Leonard Jan Müller¹, Arne Kätelhön¹, Marvin Bachmann¹, Arno Zimmermann²,
André Sternberg³ and André Bardow^{1,4*}



Closing the carbon cycle to maximise climate change mitigation: power-to-methanol vs. power-to-direct air capture

H. A. Daggash,¹ C. F. Patzschke,^d C. F. Heuberger,¹ L. Zhu,^c K. Hellgardt,^c
P. S. Fennell,^{†d} A. N. Bhave,^e A. Bardow¹ and N. Mac Dowell^{1,†*bc}

Cite this: *Sustainable Energy Fuels*,
2018, 2, 1153

Sustainable Conversion of Carbon Dioxide: An Integrated Review of Catalysis and Life Cycle Assessment

Jens Artz, Thomas E. Müller, and Katharina Thenert

Institut für Technische und Makromolekulare Chemie, RWTH Aachen University, Worringerweg 2, Aachen 52074, Germany

Johanna Kleinekorte, Raoul Meys, André Sternberg, and André Bardow*

Chair of Technical Thermodynamics, RWTH Aachen University, Schinkelstrasse 8, Aachen 52056, Germany

Walter Leitner*

Institut für Technische und Makromolekulare Chemie, RWTH Aachen University, Worringerweg 2, Aachen 52074, Germany
Max-Planck-Institute for Chemical Energy Conversion, Stiftstrasse 34-36, Mülheim an der Ruhr 45470, Germany

Applied Energy 263 (2020) 114599

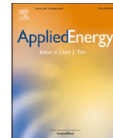


ELSEVIER

Contents lists available at ScienceDirect

Applied Energy

journal homepage: www.elsevier.com/locate/apenergy



Environmental impacts of CO₂-based chemical production: A systematic literature review and meta-analysis

M.A. Nils Thonemann

Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT, Osterfelder Straße 3, 46047 Oberhausen, Germany



nature

Explore content | About the journal | Publish with us

[nature](#) > [perspectives](#) > article

Perspective | Published: 06 November 2019

The technological and economic prospects for utilization and removal

Cameron Hepburn, Ella Adlen, John Beddington, Emily A. Carter, Sabine Fuss, Niall Mac Dowell, Jan C.
Minx, Pete Smith & Charlotte K. Williams

Nature 575, 87–97 (2019) | [Cite this article](#)

84k Accesses | 252 Citations | 388 Altmetric | [Metrics](#)

PNAS

Proceedings of the
National Academy of Sciences
of the United States of America

Keyword, Author,

Home

Articles

Front Matter

News

Podcasts

Authors

RESEARCH ARTICLE

Climate change mitigation potential of carbon capture and utilization in the chemical industry

Arne Kätelhön, Raoul Meys, Sarah Deutz, Sangwon Suh, and André Bardow
[+ See all authors and affiliations](#)



Supporting the development of innovative projects



INITIATE demonstrates how **residual carbon-rich gas from the steel sector can be used as a valuable feedstock for the chemical sector.** Such emissions are used to produce ammonia, a precursor for urea, a widely used fertiliser.



Take-Off develops **cost-effective sustainable aviation fuel using CO₂ emissions and renewable energy**, helping the aviation sector reach the EU 2050 climate-neutrality targets.



CO2SMOS will develop, in a circular approach, of a set of **technologies to transform the CO₂ emissions produced in bio-based industries (BBIs) into high-value chemicals** for the manufacturing of bio-based products.








VIVALDI proposes a circular and sustainable solution to **convert off-gas emissions from Bio-industries to produce 4 industrially relevant organic acids**, which can re-enter to the production process of biorefineries.



SUNER-C creates an **innovation community and ecosystem in the field of solar fuels and chemicals**, aiming at overcoming common challenges and fostering ongoing research and innovation activities in Europe.

Why is it a pivotal policy moment at EU level for CCU?

CCU directly addressed in Fit-for-55 Package

Policy instrument	Impact on CCU
 <p><u>EU Emissions Trading System (EU ETS) revision</u></p>	<ul style="list-style-type: none"> ✓ CO₂ which is chemically and permanently bound in a product under normal use (e.g. CO₂ mineralisation) is excluded from the obligation to surrender allowances ✓ Avoid double-counting of emissions released by the use of RFNBOs*
 <p><u>Renewable Energy Directive (REDII) revision</u></p>	<ul style="list-style-type: none"> ✓ At least 2.6% of the energy supplied to transport by 2030 is covered by RFNBOs ✓ 50% of the use of hydrogen in the industry is covered by RFNBOs
 <p><u>ReFuelEU Aviation</u></p>	<ul style="list-style-type: none"> ✓ Binding targets per volume shares for RFNBOs: min 0.7%, 8%, 28% of RFNBOs by 2030, 2040, 2050, respectively
 <p><u>Fuel EU Maritime</u></p>	<ul style="list-style-type: none"> ✓ Binding GHG reduction targets for ships: 2%, 6%, 26%, 75% in 2025, 2030, 2040, 2050, respectively, by including RFNBOs to reach these targets
 <p><u>Energy Taxation Directive revision</u></p>	<ul style="list-style-type: none"> ✓ Minimum taxation rate of zero for 10 years for RFNBOs for specific types of air and waterborne navigation

* RFNBO: Renewable fuels of non-biological origin (i.e. incl. CCU fuels)

Recognition of CCU in EU initiatives



- **Recognition of CCU in current REDII legislation**

- Obligation under Renewable Energy Directive to adopt Delegated Acts by end 2021
- Adoption delayed to 2022
- Call to **remove constraints for access to renewable energy for hydrogen and CCU-fuels production**

- **CCU inclusion in EU taxonomy**

- EU taxonomy lists economic activities considered as sustainable under EU law
- **No holistic inclusion of CCU for now: we advocate for its immediate & full inclusion**

CCU activities currently covered in taxonomy

- 1) equipment for production/use of hydrogen
- 2) manufacture of H₂ and H₂ synthetic fuels
- 3) manufacture of other low carbon tech
- 4) R&D for direct air capture of CO₂

- **Low carbon technologies EU roadmap includes CCU**

- EU roadmap discusses “carbon capture pathways” as a key enabler for major emission cuts
- **CCU considered as step in accelerating CO₂ reduction particularly for steel & chemicals production**

Carbon removals and carbon cycles: the next horizon

- **Communication on Restoring Sustainable Carbon Cycles**

- **Clear recognition of CCU:** *“promote technological solutions for carbon capture and use (CCU) and the production of sustainable synthetic fuels or other non-fossil based carbon products”*
- **Tracing the origin of CO₂ used in products**
- **Setting up targets for replacing carbon feedstock:** *“Reaching climate neutrality requires capturing carbon from the atmosphere for storage and for use as substitute to fossil carbon (...). At least 20% of the carbon used in the chemical and plastic industry should be from non-fossil sources by 2030”*

- **Carbon Removal Certification Mechanism (CRCM)**

- Incoming discussion on specifications of removal of CO₂
- Timeline: final quarter (Q4) of 2022
- Consultations & contributions throughout 2022



REPowerEU: EU plan for more affordable, secure and sustainable energy

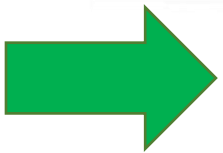
❑ Released on 8 March 2022

❑ Objectives:

- Achieving EU independence from Russian gas before the end of the decade
- Accelerating green transition by reducing dependency on imported fossil fuels
- Protecting consumers against price hikes

❑ Mechanisms:

- Boosting access to renewable H2
- Supporting H2-based solutions & low carbon tech
- Fostering renewable energy projects
- Reinforcing Fit-for-55 targets



Direct impact on CCU

EU package on making sustainable products the norm



Ecodesign for Sustainable Products Regulation

Provisions on circularity, energy, resource-efficiency



Empowering consumers for the green transition

Energy and environmental labelling



Sectoral initiatives: textiles, construction, packaging

Future regulations with specific environmental performances targets

- ❑ Package of legislations released on 30 March 2022
- ❑ Aiming to foster responsible supply chains and fight greenwashing
- ❑ Where CCU can play a role in the package
 - CCU contributes directly to reaching circularity objectives
 - Environmental labelling will reflect carbon footprint, CO₂ reductions to be included ?
 - CCU can be further deployed through additional sectoral targets on use of renewable carbon feedstock and specific CO₂-based products quotas

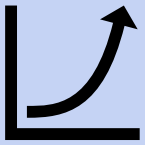
What are the policy challenges ahead for CCU?

Building a supportive EU policy framework for CCU



The latest EU proposals all recognise the role of CCU to mitigate climate change

- We advocate for their adoption and support from EU policy-makers, industries and civil societies



Some measures in those legislations can be strengthened to promote CCU

- We champion more ambitious RFNBOs targets in REDIII, in ReFuelEU Aviation, in FuelEU Maritime
- We advise for ETS revision to give the right incentives to producers to invest in CO₂ mineralisation



Financial incentives and enablers can be used to further deploy CCU

- We support encouraging CCU-projects via the EU Innovation Fund



National policymakers can amplify EU objectives

- We encourage the adoption of specific national legislations to enshrine CCU targets into law and support local CCU projects



CO₂ VALUE
EUROPE

Thank you!

Tudy Bernier

Senior Policy Manager

tudy.bernier@co2value.eu

FOLLOW US ON



in