



## Market Reports Library

### Summary

The **Circular Carbon Network (CCN)** maintains this bibliography as a shared resource and living library for members of our Network to access the latest third-party reports about the investment, economic, and impact opportunities in the Carbontech and Carbon Removal Sectors. This document links to reports that contain an overview of commercial markets for and investments opportunities in carbon capture solutions, carbon-to-value solutions, and carbon removal solutions, the key policies that may accelerate or slow growth in these sectors, technical challenges and opportunities, and perspectives from key stakeholders.

### Nominate a Report:

If you don't see a report listed below that you think would be relevant to capital providers, entrepreneurs, corporates, and other stakeholders in the Circular Carbon Economy, please let us know. We are primarily focused on providing educational resources to our Network that can accelerate investment and commercial activity in the sector (thus not, per se, on technology-focused documents more useful to a highly technical audience). Please email us at [community@circularcarbon.org](mailto:community@circularcarbon.org) with your suggestions. Thank you!

## LIST OF REPORTS

1. [\*Investing in Climate Innovation: The Environmental Case for Direct Air Capture of Carbon Dioxide\* \(Bipartisan Policy Center – 2020\)](#)
2. [\*The Value of Carbon Capture and Storage \(CCS\)\* \(Global CCS Institute – 2020\)](#)
3. [\*Capturing Investment: Policy Design to Finance CCUS Projects in the U.S. Power Sector\* \(Columbia University Center on Global Energy Policy – 2020\)](#)
4. [\*Carbonomics: The Future of Energy in the Age of Climate Change\* \(Goldman Sachs – 2019\)](#)
5. [\*A Review of Global and U.S. Total Available Markets for Carbotech\* \(Carbon 180 – 2018\)](#)
6. [\*The technological and economic prospects for CO<sub>2</sub> utilization and removal\* \(Nature – 2019\)](#)
7. [\*Putting CO<sub>2</sub> to Use\* \(International Energy Agency – 2019\)](#)
8. [\*Clearing the Air: A Federal RD&D Initiative and Management Plan for Carbon Dioxide Removal Technologies\* \(Energy Futures Initiative – 2019\)](#)
9. [\*Transforming Industry through CCUS\* \(International Energy Agency – 2019\)](#)
10. [\*Capturing Leadership: Policies for the US to Advance Direct Air Capture Technology\* \(Rhodium Group – 2019\)](#)
11. [\*Carbon Removal: Comparing Historical Federal Research Investments with the National Academies' Recommended Future Funding Levels\* \(Bipartisan Policy Center + Energy Future Initiatives – 2019\)](#)
12. [\*Gaseous Carbon Waste Streams Utilization: Status and Research Needs\* \(The National Academies of Sciences – 2019\)](#)
13. [\*Direct Air Capture of Carbon Dioxide\* \(ICEF – 2018\)](#)
14. [\*Negative Emissions Technologies and Reliable Sequestration: A Research Agenda\* \(The National Academies of Sciences – 2018\)](#)

15. [\*New Business Opportunities Based on Biogenic Carbon Dioxide Utilization\* \(VTT Technical Research Centre of Finland – 2018\)](#)
16. [\*Greenhouse Gas Removal\* \(The Royal Society – 2018\)](#)
17. [\*Techno-Economic Assessment & Life-Cycle Assessment Guidelines for CO<sub>2</sub> Utilization\* \(University of Michigan Global CO<sub>2</sub> Initiative – 2018\)](#)
18. [\*Novel Carbon Capture and Utilisation Technologies\* \(High Level Group of Scientific Advisors, European Commission – 2018\)](#)
19. [\*Why Commercial Use Could Be the Future of Carbon Capture\* \(McKinsey and Company – 2018\)](#)
20. [\*Carbon Dioxide Utilization \(CO<sub>2</sub>U\) ICEF Roadmap 2017\* \(ICEF – 2017\)](#)
21. [\*Circular Carbon Innovation: An Unrealized Investment Opportunity\* \(The Circular Carbon Network – 2017\)](#)
22. [\*The Potential and Limitations of Using Carbon Dioxide\* \(The Royal Society – 2017\)](#)
23. [\*CO<sub>2</sub> Utilisation Today\* \(EIT Climate-KIC EnCO<sub>2</sub>re – 2017\)](#)
24. [\*A Roadmap for the Global Implementation of Carbon Utilization Technologies\* \(The Global CO<sub>2</sub> Initiative – 2016\)](#)
25. [\*Carbon Capture Utilization and Storage: Climate Change Economic Competitiveness and Energy Security\* \(Department of Energy – 2016\)](#)
26. [\*CO<sub>2</sub> Building Blocks: Assessing CO<sub>2</sub> Utilization Options\* \(National Coal Council – 2016\)](#)
27. [\*Carbon Capture Utilization and Storage\* \(SETIS Magazine – 2016\)](#)
28. [\*A Strategic European Research and Innovation Agenda \(SERIA\) for Smart CO<sub>2</sub> Transformation in Europe\* \(Smart CO<sub>2</sub> Transformation – 2015\)](#)

## **SUMMARY OF RECENT REPORTS**

(Most recent reports listed first)

### **1. Investing in Climate Innovation: The Environmental Case for Direct Air Capture of Carbon Dioxide**

Category: Policy, R&D

Date: May 13, 2020

Issued by: Bipartisan Policy Center's Direct Air Capture Advisory Council

Summary: 14 page concise paper makes the case for federal investment in Direct Air Capture (DAC) of carbon dioxide, through four key observations: carbon removal is necessary to achieve climate goals, the difficulty of removing some distributed greenhouse gas emissions, DAC should partner with other carbon removal strategies, and DAC can help catalyze broader support for action to limit climate change.

[PDF link](#)

### **2. The Value of Carbon Capture and Storage (CCS)**

Category: Market data, commercial deployment

Date: May 13, 2020

Issued by: Global CCS Institute

Summary: 23 page report analyzes the major benefits of the large-scale investment and deployment of CCS and discusses the existing evidence related to the value of CCS under two overarching themes (CCS is a necessary technology for meeting long-term climate targets + CCS is a driver of economic growth and employment).

[PDF link](#)

### **3. Capturing Investment: Policy Design to Finance CCUS Projects in the U.S. Power Sector**

Category: Policy

Date: April 28, 2020

Issued by: Columbia University Center on Global Energy Policy

Summary: 55 page in-depth analysis to help predict which policy configurations would incentivize widespread deployment of CCUS in the US electric generation industry. The analysis features key findings on the effect of ownership structure, the 45Q tax credit, capital cost incentives, and revenue enhancement incentives.

[PDF link](#)

### **4. Carbonomics: The Future of Energy in the Age of Climate Change**

Category: Market data, R&D

Date: December 11, 2019

Issued by: Goldman Sachs

Summary: 39 page detailed market report on the mitigation of climate change through technological innovation and capital markets pressure. Key observations include the cost curve

of de-carbonization, the requirement of carbon pricing/innovation/sequestration to reduce net carbon emissions, and capital markets having a leading role in financing the energy transition.

[PDF link](#)

## **5. A Review of Global and U.S. Total Available Markets for Carbontech - 2017**

Category: Capital, market data

Date: November 2018

Issued by: Carbon180

Summary: 11 page segmented report, organized by product categories (fuels, chemicals, building materials, wood and timber, and plastics), featuring a market assessment for each product category with a market segment valuation / 7 page executive summary breaking down the U.S. and global TAM for the carbontech space, \$1.1 trillion, and \$5.9 trillion, respectively.

[PDF link](#) / [PDF link](#)

## **6. The technological and economic prospects for CO<sub>2</sub> utilization and removal**

Category: R&D, commercial deployments

Date: November 6, 2019

Issued by: Nature

Summary: 11 page comprehensive study of ten different usages of CO<sub>2</sub>, ranging from fuels, chemicals and plastics to building materials, soil management and forestry. Explores the scope and hurdles for each.

[PDF link](#)

## **7. Putting CO<sub>2</sub> to Use**

Category: R&D, commercial deployments

Date: September 25, 2019

Issued by: IEA

Summary: 86 page detailed report on the new opportunities of using carbon dioxide in the development of products and services in a near-term market view. Proposes that climate change mitigation is the primary driver for this increased interest, but other factors include technology leadership and supporting a circular economy.

[PDF link](#)

## **8. Clearing the Air: A Federal RD&D Initiative and Management Plan for Carbon Dioxide Removal Technologies**

Category: R&D, policy

Date: September 25, 2019

Issued by: Energy Futures Initiative

Summary: 186 page comprehensive report with both recommendations and detailed implementation plans for a 10-year, \$10.7 billion RD&D initiative to bring new pathways for technological carbon dioxide removal to commercial readiness.

[PDF link](#)

## **9. Transforming Industry through CCUS**

Category: R&D, policy, commercial deployments

Date: May 29, 2019

Issued by: IEA

Summary: 62 page report on the technologies and approaches needed to address the decarbonization challenge while supporting sustainable and competitive industries. Highlights include strengthening the policy response, fully developing CO<sub>2</sub> transport and storage networks, and establishing markets for premium lower-carbon materials.

[PDF link](#)

## **10. Capturing Leadership: Policies for the US to Advance Direct Air Capture Technology**

Category: Policy

Date: May 9, 2019

Issued by: Rhodium Group

Summary: Report on the large potential for the Direct Air Capture (DAC) industry in the U.S. and the policies needed to unleash it.

[PDF link](#)

## **11. Carbon Removal: Comparing Historical Federal Research Investments with the National Academies' Recommended Future Funding Levels**

Category: R&D, policy

Date: April 2019

Issued by: Bipartisan Policy Center + Energy Futures Initiative

Summary: 32 page review of National Academies' research agenda. Proposes that as decades of federal research investment drove efficiency and cost improvements for many of the technologies Americans enjoy today— including fuel-efficient vehicles, lithium-ion batteries, and natural gas production— so, too, will it be necessary to advance the next generation of technologies involving carbon removal.

[PDF link](#)

## **12. Gaseous Carbon Waste Streams Utilization: Status and Research Needs**

Category: Capital, R&D, commercial deployments, market data, policy,

Date: Early 2019

Issued by: The National Academies of Sciences, Engineering, and Medicine

Summary: 256 page study of the global status and progress of CCU technologies. Analyzes the current challenges faced by the industry to achieve viability and commercialization. Lays out ways for researchers to overcome these barriers, including implementing pilot plant facilities, optimizing bioreactors and cultivation, and avoiding stoichiometric additives.

[PDF link](#)

### **13. Direct Air Capture of Carbon Dioxide**

Category: Policy, R&D

Date: December 2018

Issued by: ICEF

Summary: 43 page in depth report on the current state of Direct Air Capture (DAC) technologies and future policies around the industry.

[PDF link](#)

### **14. Negative Emissions Technologies and Reliable Sequestration: A Research Agenda**

Category: R&D, commercial deployments

Date: October 2018

Issued by: National Academy of Sciences

Summary: 511 page detailed look at all carbon removal technologies, including Direct Air Capture, land management, ocean sequestration, and geological carbon formation.

[PDF link](#)

### **15. New Business Opportunities Based on Biogenic Carbon Dioxide Utilization**

Category: R&D, commercial deployments, market data

Date: October 25, 2018

Issued by: VTT Technical Research Centre of Finland

Summary: 21 slide PowerPoint exploring new biogenic CCU technology opportunities in 4 key areas: chemical-looping combustion, polyols, paraffinic wax production, and P2X technically feasible processes.

[PDF link](#)

### **16. Greenhouse Gas Removal**

Category: R&D, commercial deployments, market data, policy

Date: September 2018

Issued by: The Royal Society and Royal Academy of Engineering

Summary: 124 page detailed overview of scientific and engineering views on greenhouse gas removal reviewing GGR methods, cross-cutting issues, and scenarios of implementation.

Suggests both methods of building the pathway to GGR, the possibility of reaching 130 MtCO<sub>2</sub> annually by 2050, and the global scenario of 810 GtCO<sub>2</sub> by 2100.

[PDF link](#)

### **17. Techno-Economic Assessment & Life-Cycle Assessment Guidelines for CO<sub>2</sub> Utilization**

Category: R&D, market data

Date: August 29, 2018

Issued by: University of Michigan Global CO<sub>2</sub> Initiative

Summary: 157 page in-depth analysis of possible technologies (increased renewable power generation and broad scale electrification, increased energy efficiency, and carbon-negative

technologies) and their implementation through necessary techno-economic and life-cycle assessments. Provides guidelines for said assessments to be used as a tool for promoting carbon capture and utilization (CCU) technology development.

[PDF link](#)

### **18. Novel Carbon Capture and Utilisation Technologies**

Category: Policy

Date: April 2018

Issued by: High Level Group of Scientific Advisors, European Commission

Summary: 76 page exploration into the circumstances under which CCU can deliver climate benefits in the mid- and long-run. Recommends implementing an institutional framework for promoting CCU technologies, whether that be through grant qualifications requiring quantitative data about the amount of carbon utilized, a stable regulatory environment, or R&D initiatives.

[PDF link](#)

### **19. Why Commercial Use Could Be the Future of Carbon Capture**

Category: Commercial deployments

Date: January 2018

Issued by: McKinsey and Company

Summary: 6 page summary document providing an overview of CCU technologies and applications. Outlines 3 main uses for CCU: captured carbon-created fuels, carbon-cured concrete, and carbon dioxide turbines.

[PDF link](#)

### **20. Carbon Dioxide Utilization (CO<sub>2</sub>U) ICEF Roadmap 2017**

Category: Policy

Date: November 2017

Issued by: ICEF

Summary: 60 page report introducing policy proposals to expand CO<sub>2</sub> utilization through tax credits, investment in R&D, adoption of life-cycle analysis standards, product standards, and national policy recognition.

[PDF link](#)

### **21. Circular Carbon Innovation: An Unrealized Investment Opportunity**

Category: Commercial deployments, market data

Date: September 2017

Issued by: The Circular Carbon Network

Summary: 22 page overview of the circular carbon economy and its potential. Sets up a compelling case for the rapidly expanding sector of circular carbon, laying out the myriad uses



of carbon from chemicals, fuels, and building materials, to polymers, agriculture, and industrial gases.

[PDF link](#)

## **22. The Potential and Limitations of Using Carbon Dioxide**

Category: Commercial deployments, policy

Date: May 2017

Issued by: The Royal Society

Summary: 11 page policy brief explaining the myriad uses and applications of carbon for use as a feedstock. Outlines the potential for commercial use of carbon dioxide in polymers, mineralization, and syngas. Addresses challenges to carbon dioxide commercial viability in the areas of research partnerships, life-cycle analysis, catalysis, and demonstration facilities.

[PDF link](#)

## **23. CO<sub>2</sub> Utilisation Today**

Category: Commercial deployments, policy

Date: April 2017

Issued by: EIT Climate-KIC EnCO<sub>2</sub>re

Summary: 48 page report presenting various perspectives on CO<sub>2</sub> utilization from chemists, social scientists, start-up founders, and policy makers. Discusses the technical, economic, and social viability of CCU technologies. Recognizes that regardless of opinions about viability, if the right technical, political, economic and societal conditions present themselves, CCU technology could be transformational.

[PDF link](#)

## **24. A Roadmap for the Global Implementation of Carbon Utilization Technologies**

Category: Commercial deployments, market data

Date: November, 2016

Issued by: CO<sub>2</sub> Sciences | The Global CO<sub>2</sub> Initiative

Summary: This 12 page summary briefing provides a market assessment on the environmental and economic impact of 25 products over 6 markets for carbon recycling.

[PDF link](#)

## **25. Carbon Capture Utilization and Storage: Climate Change Economic Competitiveness and Energy Security**

Category: Commercial deployments, policy

Date: August 2016

Issued by: Department of Energy

Summary: 12 page document by the department of energy that outlines the advantages of CCUS for energy security, economic development, industry sector opportunities, differences and overlaps between natural gas and coal CCUS, and proposed policy incentives for CCUS.

[PDF link](#)

## **26. CO<sub>2</sub> Building Blocks: Assessing CO<sub>2</sub> Utilization Options**

Category: Commercial deployments, market data, policy

Date: August 2016

Issued by: National Coal Council

Summary: 112 page US focused document that provides rationale for CCU, criteria for assessment, overview of CCU market, assessment of CCU as a pathway to CCS and the economic opportunity.

[PDF link](#)

## **27. Carbon Capture Utilization and Storage**

Category: Commercial deployments, market data, policy

Date: January 2016

Issued by: SETIS Magazine - CCUS (European Strategic Energy Technology Plan)

Summary: 52 page summary with an update and overview of activities in Europe that advance carbon capture and utilization along with key technological breakthroughs for CO<sub>2</sub> as a feedstock for chemicals, waxes, fuels, polymers, storage, cement, urea.

[PDF link](#)

## **28. A Strategic European Research and Innovation Agenda (SERIA) for Smart CO<sub>2</sub> Transformation in Europe**

Category: Commercial deployments, market data

Date: July 2015

Issued by: Smart CO<sub>2</sub> Transformation (SCOT) project

Summary: 45 page summary document that sets out a SERIA for CO<sub>2</sub> utilization. Results of over 300 interviews, 10 workshops, a detailed regional assessment to map CO<sub>2</sub> utilization actors, a comprehensive socio-economic analysis to map emitters, elaborate desk research on three CO<sub>2</sub> transformation routes: mineralization, power to fuels, and chemical building blocks.

[PDF link](#)