

Committee: Environmental Committee

Issue: Investing in Carbon Capture Technologies as a Means to Reduce Greenhouse Emissions

Student Officer: Marios Pasoglou

Position: President

PERSONAL INTRODUCTION

Dear Delegates,

My name is Marios Pasoglou, I am 16 years old and at the time of the conference I will be attending the 11th Grade of Pierce – The American College of Greece. In this year’s DSTMUN conference I have the utmost honor of serving as the President of this year’s Environmental Committee. This will be my 6th time chairing and I am very eager to participate in this DSTMUN conference.

I started MUN when I joined my school’s MUN club last year and since then I have developed both as a person and as a student. MUN can have many benefits to those participating in it such as improving students’ public speaking and critical thinking skills, something that is very important both in an academic and professional environment. Moreover, students can develop their writing and research skills through reading the study guides and writing resolutions. Finally, through MUN you can learn and further understand the global issues that affect our world.

This year’s agenda topic of “Sustainable Climate Action: Shifting the Focus toward the Environment” is directly related to the mandate of this committee and is of utmost importance these last few years. The topics that have been selected and especially the one on Carbon Capture, address climate change and provide significant solutions to combat such a crisis.

This study guide is by no means the sole preparation you should do for this conference. A good delegate should always have done much more research based on the contents of this guide while taking advantage of the bibliography already included. If you want clarification on any part of this guide, feel free to contact me at: m.pasoglou@acg.edu

Kind Regards,

Marios Pasoglou

TOPIC INTRODUCTION

Climate change, being one of the most crucial challenges our generation faces, has far-reaching complications for the environment, economy, and society in general. Climate change mainly refers to the increase in the concentration of greenhouse gases such as carbon dioxide (CO₂) in the Earth's atmosphere, which lead to the rise of global temperatures and severe meteorological events. It is critical that society takes action so as to reduce the emissions of such gases and alleviate the impacts of climate change.

An imperative aspect of addressing such crucial matters is the adoption and advancements of relevant technologies such as carbon capture. This technology offers promising solutions in reducing the emissions of greenhouse gases through the capture of CO₂ generated in industrial processes. Essentially, carbon capture technologies intercept and contain CO₂ emissions from factories and other such sources before they can be released to the atmosphere. As a result of that carbon capture provides a feasible pathway towards limiting the impact of heavy industry and energy production from fossil fuels.

Taking action to address climate change is urgent. As many experts warn society, the amount of time attributed to taking action against it, is limited. The Intergovernmental Panel on Climate Change (IPCC) has been one of the key agencies in warning that we have to limit global warming to below 2 degrees Celsius as it has outlined in the Paris Agreement. These carbon capture technologies are a viable way to mitigate the impacts of climate change while not limiting the energy production of countries. They, additionally provide steps that countries and companies can take towards reducing their carbon footprints.

It is important to note that investing in such technologies effectively reduces the emissions of greenhouse gases such as CO₂ while increasing sustainability. Such technologies effectively store and utilize CO₂ that would otherwise end up in the atmosphere reducing the effect of it on the environment. Moreover, the effects of this technology help mitigate the impact of climate change and promote cleaner energy production. In conclusion, investing in carbon capture technologies is a crucial aspect of sustainable climate action which helps in the shift toward the environment and the creation of a more sustainable future.

DEFINITION OF KEY TERMS

Greenhouse Gas (GHG)

A greenhouse gas is "any gas that has the property of absorbing infrared radiation [...] emitted from Earth's surface and reradiating it back to Earth's surface,

thus contributing to the greenhouse effect.”¹ Some such gases include Carbon Dioxide (CO₂) and Methane (CH₄).

Climate Change

“Climate change is a long-term change in the average weather patterns that have come to define Earth’s local, regional and global climates.”²

Global Warming

“Global warming is the long-term heating of Earth’s surface observed since the pre-industrial period (between 1850 and 1900) due to human activities, primarily fossil fuel burning, which increases heat-trapping greenhouse gas levels in Earth’s atmosphere.”²

Carbon Pricing

Carbon Pricing is a way to reduce greenhouse gas emissions by charging companies on emissions or providing incentives to companies that pollute the atmosphere less.

Renewable energy

“Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed.”³

Carbon Footprint

“Carbon footprint is the amount of GHG emissions to the atmosphere by an individual, organization, process, product, or event from within a specified boundary”⁴

BACKGROUND INFORMATION

Greenhouse Gas Emissions

Greenhouse gas emissions have a significant impact on the environment and especially climate change as they contribute to the greenhouse effect. The greenhouse effect is the natural process in which the Earth regulates its temperature by trapping heat in the atmosphere. However, human activities that produce greenhouse gases such as burning fossil fuels and deforestation quicken the process

¹ Mann, Michael E.. "greenhouse gas". Encyclopedia Britannica, 19 Jun. 2023, <https://www.britannica.com/science/greenhouse-gas>. Accessed 9 July 2023.

² “Overview: Weather, Global Warming and Climate Change.” NASA, 7 Feb. 2023, climate.nasa.gov/global-warming-vs-climate-change/.

³ “What Is Renewable Energy?” United Nations, www.un.org/en/climatechange/what-is-renewable-energy. Accessed 9 July 2023.

⁴ “Carbon Footprint.” Carbon Footprint - an Overview | ScienceDirect Topics, www.sciencedirect.com/topics/agricultural-and-biological-sciences/carbon-footprint. Accessed 9 July 2023.

and lead to global warming. The main greenhouse gases responsible for climate change include Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O) and fluorinated gases. Most of these stem from human activities such as burning fossil fuels, agricultural activities and refrigeration. As previously mentioned, the accumulation of such gases in the atmosphere is the natural greenhouse effect and leads to global warming. As a result, the effects of climate change become much more evident.

The Impact of Climate Change

Climate change has a significant impact on both our daily lives and the planet. It is primarily driven by human activities such as those mentioned previously that have a significant impact on climate change. One significant effect of climate change is the rise of global temperatures which have been increasing at a rapid rate this past century. Furthermore, climate change is directly related to an increase in extreme weather events such as hurricanes, heatwaves, wildfires, floods and droughts. Climate change is also correlated to the accelerated melting of the ice caps which in turn contributes to the rise of sea levels. As a consequence of the rise of sea levels, coastal communities are threatened, and millions of people may be displaced from their homes.

Carbon Capture Technologies

Process and Role of Carbon Capture

Carbon capture technologies are a key tool in fighting climate change as they control the release of greenhouse gases in the atmosphere. They work by capturing CO₂ emissions produced by industrial facilities such as power plants and factories before they are released to the atmosphere. This can happen through many methods such as post and pre-combustion capture and oxy-fuel combustion. The CO₂ is then kept in storage to be used later. By reducing the emissions using these methods, carbon capture technologies can be used to slow down global warming.

There are several companies working with carbon capture technologies. Some of the leading companies include: CarbFix, CarbonFree and Quest which is owned by Shell Canada. CarbFix has a unique approach to carbon capture as it injects captured CO₂ into the basaltic rock formations deep below the Icelandic surface storing it away for centuries.

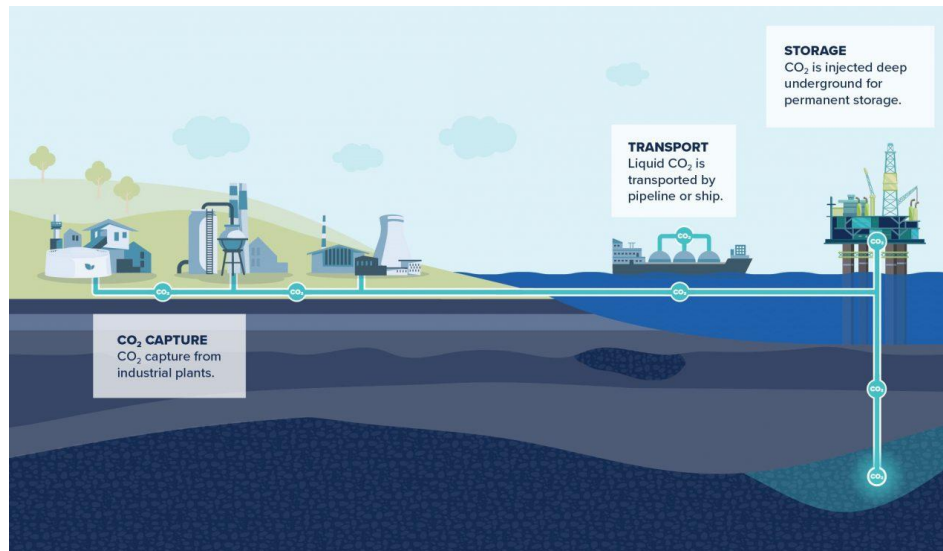


Figure 1: The process of carbon capture⁵

Challenges and Limitations

Carbon capture technologies also face numerous challenges that often limit their ability to combat climate change. The most significant challenge that such technologies encounter is the high cost of implementing and operating them. This is because the process is very energy demanding and requires a substantial investment to set up the necessary infrastructure. While MEDCs find it easier to attract such investment or provide the money and energy needed to set up such infrastructure LEDCs often find it difficult to fully implement such technologies due to their costs. Lastly, the limited storage capacity of carbon capture facilities is a critical challenge in ensuring the success of carbon capture technologies. This happens because most possible storage sites for CO₂ are in shortage of oil and gas reservoirs or saline aquifers that are either hard to find or have been closed by their previous users.

Another issue encountered by such technologies is related to their efficiency. The main factor that contributes to reduced efficiency is the method used. As there are many methods for carbon capture the key to optimal efficiency is choosing the correct one for every case. Another contributing factor is the installation used as most industrial facilities are retrofitted to accommodate such technologies as it often leads to technical issues and reduced efficiency. Lastly, CO₂ can be corrosive to the equipment used and as such lead to facilities having reduced efficiency with both capturing and storing the CO₂.

⁵ Global CCS Editors. "CCS Explained: The Basics." *Global CCS Institute*, www.globalccsinstitute.com/resources/ccs-101-the-basics/. Accessed 9 July

Potential Benefits of Carbon Capture

Carbon capture also has many potential benefits to the environment of each nation adopting it. First of all, by implementing such technologies companies and nations can offset the impacts of climate change such as global warming. Secondly, biodiversity is preserved as ecosystems and wildlife that would otherwise eclipse due to global warming, can be preserved. Likewise, the air quality can be improved through the removal of pollutants from industrial processes that leads to healthier lives for both humans and animals. Lastly, with the increasing use of carbon capture, less CO₂ is absorbed by the oceans and as such ocean acidification is mitigated and marine life is unharmed.

Such technologies can have many benefits on the economical side too. Through the application of carbon capture many jobs can be created as many workers are needed for the maintenance of such facilities. Additionally, building such facilities can attract investments for the rest of the area. Also, companies are able to support their revenue by selling any CO₂ they may have captured or by getting carbon credits that can be sold afterwards in carbon markets. Lastly, the public image and reputation of a company is severely increased as they demonstrate the use of sustainable practices.

Conclusion

Greenhouse gas emissions have one of the biggest impacts on climate change which usually leads to an increase in global temperatures and extreme weather events such as hurricanes that endanger both the planet and humankind. The use of carbon capture technologies provide an encouraging alternative in limiting the CO₂ released to the atmosphere. However, such technologies face significant challenges such as high costs and limited storage capacity which makes widespread deployment of carbon capture especially in LEDCs very challenging. Despite such challenges carbon capture has significant benefits related to both the environment and the economy such as improving air quality or increased revenue for companies. As such countries and businesses should invest in both researching and implementing those systems in order to effectively combat climate change and its effects.

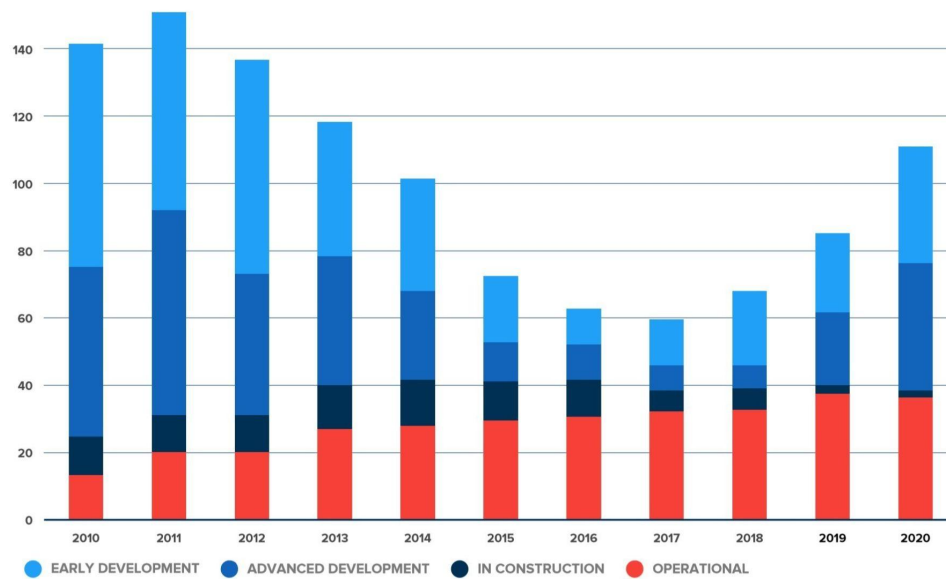


Figure 2: Pipeline of commercial carbon capture and storage facilities⁶

MAJOR COUNTRIES AND ORGANISATIONS INVOLVED

United States of America (USA)

The US has taken significant steps to limit the emissions of factories and power plants through the implementation of carbon capture technologies. As a country the US has invested heavily into the research of carbon capture technologies. Furthermore, it has incentivized investment by the private sector to develop carbon capture plants. It has also invested in renewable energy sources to reduce its emissions.

Australia

Australia has been involved in the development of carbon capture technologies for many years. It has established many carbon capture plants across the country contributing greatly in the effort against climate change. Furthermore, the Australian state also provides financial incentives and support for businesses to encourage them to adopt carbon capture technologies in order to reduce their carbon footprint.

China

China has been one of the major contributors in developing carbon capture technologies. It has invested heavily in the research and development of such technologies and has been key in their adoption by other countries. They have been incorporating carbon capture mechanisms into many large-scale industrial projects

⁶ WEF Editors. "Carbon Capture and Storage Can Help Us Beat Climate Change." *World Economic Forum*, www.weforum.org/agenda/2020/12/carbon-capture-and-storage-can-help-us-beat-climate-change/. Accessed 9 July 2023.

such as power plants, steel production and cement manufacturing. As a country its aim is to reduce the carbon dioxide output in order to contribute to the global fight against climate change.

Japan

Japan is another country that has been heavily involved in carbon capture. It has been actively promoting the use of carbon capture technologies for many years. It has also been implemented in many industrial installations within the country. Japan is also one of the key players in the market surrounding carbon capture with many of the leading companies of the market being based in the country.

European Union (EU)

The European Union, by adopting the EU Green Deal and the Climate Law has played a significant part in combating global warming. Through the attempts mentioned it has made carbon capture a key part of reducing the EU's carbon output. The European Commission also provides key directives in regulating the transport and storage of CO₂ and Carbon capture technologies. It has also awarded key projects related to carbon capture through its Innovation fund. The EU Commission additionally supports the research and development of such technologies through the Horizon EU program.

United Nations Environment Program (UNEP)

The UNEP is a key agency in addressing climate change and all its aspects around the world. As one of the UN agencies directly related to the environment it has played a crucial role in the promotion of sustainable practices and the implementation of innovative solutions. Furthermore, through its many partnerships it has helped deploy many carbon capture installations in power plants and factories. Furthermore, it has been encouraging the adoption of such technologies helping reduce greenhouse emissions and paving the way to net-zero.

United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC since its establishment in 1992 has been on the forefront of combating climate change by using many technologies such as carbon capture. It was established by an international treaty aimed at addressing climate change and its impacts. The UNFCCC has actively promoted the research and development of carbon capture technologies. It has also incentivized countries to adopt such methods in their plans to address climate change.

International Energy Agency (IEA)

The International Energy Agency was founded in 1974 as an autonomous intergovernmental organization. Its primary objectives are to ensure energy stability and encourage sustainable energy policies. One of the key technologies that can be used in addressing these are carbon capture and storage technologies.

BLOCS EXPECTED

Bloc A

The first bloc should primarily consist of More Economically Developed Countries (MEDCs) that have already implemented or have plans to implement carbon capture and storage systems (e.g. EU and North American countries). Their goal should be to further advance carbon capture technologies to combat climate change.

Bloc B

The second bloc should consist of Less Economically Developed Countries (LEDCs) that cannot afford systems like carbon capture but want to find a way to implement such technologies. Their objective should be to get funding from other states or international organizations in order to implement carbon capture solutions, to make such technologies cheaper through research and make MEDCs that usually release more pollutants reduce their output.

TIMELINE OF EVENTS

Date	Description of event
9 th May, 1992	The UNFCCC is adopted in Geneva which established the international framework against climate change
11 th December, 1997	The Kyoto Protocol is adopted setting emission targets for countries
1 st January, 2005	The EU creates the Emission Trading Scheme (ETS) which becomes the largest carbon market
15 th December, 2015	The Paris Agreement is adopted in the 21st conference of the UNFCCC parties which established limiting global warming to below 2 degrees Celsius
30 th November, 2015	Mission Innovation is announced by President Barack Obama which helped research and developed carbon capture technologies
24 th May, 2018	The IEA along with the Clean Energy Ministerial launches the CCUS Initiative

	on the advancement of carbon capture technologies
--	---

RELEVANT RESOLUTIONS, TREATIES AND EVENTS

Paris Agreement⁷

The Paris Agreement was established in 2015 and aims to combat climate change by limiting global warming to under 2 degrees Celsius above pre industrial levels. Furthermore, although the main goal of the Paris Agreement is mitigating the impacts of climate change it recognizes the importance of technologies such as carbon capture and storage. Lastly, it encourages cooperation between countries to reach the goal of reducing the impacts of climate change.

Kyoto Protocol⁸

The Kyoto Protocol is an international treaty established in 1997 which has a pivotal role in addressing climate change globally. One of its major establishments was binding emission targets for MEDCs. Through such targets, nations are forced to reduce their emissions of greenhouse gases to combat climate change. To achieve such goals multiple innovative mechanisms were implemented by the Kyoto Protocol such as the Carbon Trading and the Clean Development Mechanism (CDM). Carbon trading is a concept that gives countries economic incentives to reduce emissions and allows them to trade their allowances. The CDM allows MEDCs to invest in projects that reduce emissions such as carbon capture in LEDCs. The Kyoto protocol was a significant attempt in facing the effects of climate change and is still regarded as one of the most significant treaties related to it.

Intergovernmental Panel on Climate Change in 2018⁹

The Intergovernmental Panel on Climate Change released a report in 2018 titled “Carbon Dioxide Capture and Storage”. This special report provides information that can be used to either implement Carbon Capture systems or reduce CO2 emissions. It aims to show the potential that carbon capture systems have. Furthermore, it provides multiple resources on both the sources, capture and transport of CO2. In conclusion this report by the IPCC provides valuable information related to all aspects of carbon capture.

PREVIOUS ATTEMPTS TO SOLVE THE ISSUE

⁷ “The Paris Agreement.” UNFCCC, unfccc.int/process-and-meetings/the-paris-agreement. Accessed 10 July 2023.

⁸ “What Is the Kyoto Protocol?” UNFCCC, unfccc.int/kyoto_protocol. Accessed 10 July 2023.

⁹ “Carbon Dioxide Capture and Storage.” Edited by Bert Metz et al., Intergovernmental Panel on Climate Change, Mar. 2018, www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport.pdf.

Carbon Pricing Initiatives

Carbon pricing initiatives launched by various countries and organizations have contributed significantly in the fight against climate change by incentivizing the reduction of emissions. Such initiatives work by putting a price on carbon emissions by companies or countries. With the use of such programs innovations such as carbon capture are encouraged and implemented easier as companies have a financial incentive to lower their emissions. Moreover, there is more funding for other green methods such as renewable energy and reforestation.

Energy Efficiency Programs

Energy efficiency programs contribute significantly in the fight against climate change. Such programs focus on optimizing energy use by using alternatives such as LED lighting, smart home systems and appliances that have a lesser impact on the environment. Furthermore, financial incentives like tax credits and grants bring further investment in green technologies. In conclusion, such programs significantly reduce greenhouse gas emissions and minimize the environmental impact of households.

Mission Innovation

Mission Innovation is a worldwide initiative that aims to make clean energy more affordable and accessible through means such as investment in research and development. These goals aim to accelerate the path to net-zero as set by international agreements. Furthermore, they regularly help with reforestation efforts in many countries promoting biodiversity and limiting the emissions of carbon dioxide. In conclusion, Mission Initiative plays a crucial role in reducing the impact of climate change and advancing toward net-zero.

Limitation of Industrial Emissions

Many countries and organizations have launched attempts aimed to reduce industrial emissions. Regulations such as these set caps on the pollutants released in the atmosphere by companies. Through such policies industries are prompted to adopt cleaner technologies and improve energy efficiency. As a result, the carbon footprint of industrial companies decreases and the impact of climate change such as rising temperatures are mitigated.

POSSIBLE SOLUTIONS

Financial Incentives for companies

Financial incentives for companies by each nation is a great way in reducing their impact on the environment and encouraging the adoption of carbon capture technologies. One of the foremost incentives that can be given to companies are tax incentives or grants aimed at making the adoption of carbon capture systems by companies more economically viable. Furthermore, intergovernmental organizations

can create carbon pricing mechanisms that offer an economic incentive for companies to reduce their emissions and invest in technologies such as carbon capture.

Establishment of Policies and Regulations

Another step to reducing the impact of climate change is establishing policies and regulations around carbon capture technologies. Such policies should be established by both intergovernmental organizations and each nation's government. Through such policies companies would either be encouraged or forced to use carbon capture technologies in factories and other high emitting facilities. Furthermore, standards should also be set around the use of renewable energy. Lastly, strict regulations should be established around heavy industries that clearly set emission reduction targets.

Research and Development Initiatives

One of the last major ways to combat climate change and promote the use of carbon capture technologies is the adoption of initiatives around research and development. Governments and international agencies can invest in such initiatives that are focused on advancing carbon capture systems to make them more affordable and easier to implement. Furthermore, other technologies aimed at reducing the impact of climate change can be discovered and adopted through investment in such initiatives.

BIBLIOGRAPHY

- "About the Secretariat." *About the Secretariat | UNFCCC*, unfccc.int/about-us/about-the-secretariat. Accessed 10 July 2023.
- "Carbon Capture Utilization and Storage." *Clean Energy Ministerial*, www.cleanenergyministerial.org/initiatives-campaigns/carbon-capture-utilization-and-storage/. Accessed 10 July 2023.
- "Carbon Capture, Utilisation and Storage - Fuels & Technologies." *IEA*, www.iea.org/fuels-and-technologies/carbon-capture-utilisation-and-storage. Accessed 10 July 2023.
- "Carbon Dioxide Capture and Storage." *UNEP*, www.unep.org/resources/report/carbon-dioxide-capture-and-storage. Accessed 10 July 2023.
- "Carbon Footprint." *Carbon Footprint - an Overview | ScienceDirect Topics*, www.sciencedirect.com/topics/agricultural-and-biological-sciences/carbon-footprint. Accessed 9 July 2023.

- “EU Emissions Trading System (EU ETS).” *Climate Action*, climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en. Accessed 10 July 2023.
- Evans, Simon. “Around the World in 22 Carbon Capture Projects.” *Carbon Brief*, 7 Oct. 2014, www.carbonbrief.org/around-the-world-in-22-carbon-capture-projects/.
- “Mission Innovation.” *Mission Innovation*, mission-innovation.net/about-mi/overview/. Accessed 10 July 2023.
- “Overview: Weather, Global Warming and Climate Change.” NASA, 7 Feb. 2023, climate.nasa.gov/global-warming-vs-climate-change/.
- “The Paris Agreement.” UNFCCC, unfccc.int/process-and-meetings/the-paris-agreement. Accessed 10 July 2023.
- “UN Report Calls for Scaling-up Carbon Capture, Use and Storage | UN News.” *United Nations*, Mar. 2021, news.un.org/en/story/2021/03/1086312.
- “What Is Climate Change?” *United Nations*, www.un.org/en/climatechange/what-is-climate-change. Accessed 10 July 2023.
- “What Is Renewable Energy?” *United Nations*, www.un.org/en/climatechange/what-is-renewable-energy. Accessed 9 July 2023.
- “What Is the Kyoto Protocol?” UNFCCC, unfccc.int/kyoto_protocol. Accessed 10 July 2023.
- Ahmad, Mariam. “Top 10: Leading Carbon Capture Companies.” *Energy Magazine*, 22 Feb. 2023, energydigital.com/top10/top-10-leading-carbon-capture-companies.
- Ahmad, Mariam. “Top 10: Leading Carbon Capture Companies.” *Energy Magazine*, 22 Feb. 2023, energydigital.com/top10/top-10-leading-carbon-capture-companies.
- “Carbon Capture, Storage and Utilisation.” *Energy*, energy.ec.europa.eu/topics/oil-gas-and-coal/carbon-capture-storage-and-utilisation_en. Accessed 26 July 2023.
- “Carbon Dioxide Capture and Storage.” Edited by Bert Metz et al., Intergovernmental Panel on Climate Change, Mar. 2018, www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport.pdf.
- “UN Report Calls for Scaling-up Carbon Capture, Use and Storage | UN News.” *United Nations*, news.un.org/en/story/2021/03/1086312. Accessed 26 July 2023.
- Unep. “Climate Action.” UNEP, www.unep.org/explore-topics/climate-action. Accessed 26 July 2023.

Bodnar, Paul, and Dave Turk. "Announcing: 'Mission Innovation.'" National Archives and Records Administration, 29 Nov. 2015, obamawhitehouse.archives.gov/blog/2015/11/29/announcing-mission-innovation.

Dixon, Tim. "Clean Energy Ministerial Launches CCUS Initiative: 'A Second Birth for CCUS.'" IEAGHG, 25 May 2018, ieaghg.org/ccs-resources/blog/clean-energy-ministerial-launches-ccus-initiative-a-second-birth-for-ccus.

"Lex - 32003L0087 - En - EUR-Lex." EUR, eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32003L0087. Accessed 6 Aug. 2023.