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** Partner, Blank Rome, Pittsburgh, PA, USA. Email: ryan.haddad@blankrome.com. An earlier version of this paper was presented at the Foundation for Natural Resources and Energy Law's Special Institute on Carbon Capture, Utilization, and Storage (CCUS) Law and Policy, Houston, TX, March 7, 2024. Thanks to Wyoming Law Review staff, particularly James H. Bell (J.D. Candidate 2024), Scarlett Forrest (J.D. Candidate 2024), and Hannah G. Clancy (J.D. Candidate 2024), for their editorial assistance in the process of publishing this article.

ABSTRACT

The aim of reaching a low or net-zero carbon emissions economy sustainably within the medium to long term requires technologies that capture carbon dioxide emissions from industrial, manufacturing, and energy-related point sources. Applying carbon capture, utilization, and storage (CCUS) systems in these sectors can help reduce the emissions intensity of products, services, and energy production that cannot be efficiently or reliably produced otherwise. In this regard, offtake and transportation agreements serve as key instruments for negotiating the terms and conditions for the transfer of captured carbon oxides, including delivery and subsequent use or sequestration. CCUS projects are designed to capture carbon emissions in sufficient quantities from different industrial or energy-related sources, followed by processing and transportation to predesignated underground storage sites or utilization points. It is necessary to effectively connect operators and resources from different interdependent aspects of the project via carefully structured and bankable agreements. This Article discusses how offtake and transportation agreements provide a transactional framework for outlining the respective roles and obligations of project developers, equity investors, and other interested parties in an ideal CCUS project. The discussion highlights the applicable project risks and reviews the evolving U.S. policy measures and incentives driving commercial interests and investment decisions regarding such risks. The contractual tools are essential for the deployment of CCUS applications at the right scale needed to meaningfully contribute towards decarbonization objectives provided that firm commitments from project participants are secured and feasibility issues are properly addressed by the parties.

I. INTRODUCTION: CAPTURING CARBON OXIDES AND OFFTAKE ARRANGEMENTS

About thirty carbon capture, utilization, and storage (CCUS) projects were operational globally as of 2022, while about seventy were in advanced developmental phases.[1] CCUS projects are capital-intensive, requiring firm

[1] Tade Oyewunmi, *Underground Property Rights for Carbon Capture,* KLEINMAN CTR. FOR ENERGY POL'Y INSIGHTS NEWSL. (June 7, 2023), https://kleinmanenergy.upenn.edu/news-insights/underground-property-rights-for-carbon-capture/ [https://perma.cc/L8FG-AGP5]. According to the International Energy Agency (IEA), about forty commercial facilities are already in operation applying CCUS to industrial processes, fuel transformation, and power generation. *Tracking Carbon Capture, Utilisation and Storage*, INT'L ENERGY AGENCY, https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage#tracking [https://perma.cc/6XR5-FR6P] (last visited Aug. 7, 2024). Since January 2022, project developers have announced ambitions for around fifty new capture facilities to be operating by 2030, capturing around

commitments to meet significant upfront costs and risk management considerations. Government institutions and private stakeholders play key roles in developing the required infrastructure and coordinating resources from interdependent aspects involving (i) the installation of carbon capture technology on an existing or new industrial or energy facility and (ii) securing access to CO_2 transportation networks and storage in predetermined geologic formations or delivery to end users. To secure timely investments, the parties need bankable contractual arrangements that clearly outline the terms and conditions under which they can confidently invest in the project, fulfill their obligations, and mitigate plausible risks.[2] From a financing and commercial perspective,[3] it is opined that when faced with two investment opportunities and limited financial resources, a typical risk-neutral investor would consider the potential gains of each investment and, all things being equal, ignore the likely downside risks. In contrast, an ideal risk-averse investor will ordinarily pass up the

125 Mt CO2 per year. Mathilde Fajardy, Carl Greenfield & Rachael Moore, *How New Business Models Are Boosting Momentum on CCUS*, INT'L ENERGY AGENCY (Mar. 24, 2023), www.iea.org/commentaries/how-new-business-models-are-boosting-momentum-on-ccus [https://perma.cc/LL8G-R3CW]; INT'L ENERGY AGENCY, CCUS POLICIES AND BUSINESS MODELS: BUILDING A COMMERCIAL MARKET 107–09 (2023) [hereinafter BUILDING A COMMERCIAL MARKET], https://iea.blob.core.windows.net/assets/d0cb5c89-3bd4-4efd-8ef5-57dc327a02d6/CCUSPoliciesandBusinessModels.pdf [https://perma.cc/T8BX-LC5M].

2 In Project Financing, "bankability" refers to the acceptability of a project's structure to potential lenders (including commercial banks and institutional investors) to the extent that they are willing to provide financing to the project developer typically on a limited recourse basis. Bankability or project feasibility enables the developer to (a) build, modify, or rehabilitate the project; and/or (b) refinance the project's existing debt if necessary. Other parties involved in the transaction (for example, the contractor and equity investors) may also conduct a bankability analysis, but the lenders' analysis and determination are often the most essential before the project gets a go-ahead (i.e., an investment decision) from its sponsors. A determination of bankability involves an (i) analysis of the parties involved in the transaction, their rights and obligations, and their potential impact on the project vis-à-vis the lenders' rights; (ii) identification, allocation, and mitigation of the project's risks; (iii) analysis of the documents governing the project's construction, operation, and maintenance, as well as how the project company will generate sufficient revenues necessary to repay the debt to lenders and meet its other obligations; (iv) analysis of the lender's rights under the transaction documents, including their ability to enforce their rights under these documents and to foreclose on the project assets and other collateral securing the project company's obligations under the transaction documents. See *Bankability*, WESTLAW'S PRACTICAL LAW GLOSSARY (last visited Aug. 7, 2024) (available at https://perma.cc/WRB7-PKGE).

3 *See generally Risk Aversion*, CORP. FIN. INST., https://corporatefinanceinstitute.com/resources/wealth-management/risk-aversion/ [https://perma.cc/E8HN-ACSS] (last visited Jan. 15, 2024); Heitor Almeida, Kristine Watson Hankins & Ryan Williams., *Risk Management with Supply Contracts*, 30 REV. FIN. STUD. 4179, 4179–215 (2017); Kenneth A. Froot, David S. Scharfstein & Jeremy C. Stein, *Risk Management: Coordinating Corporate Investment and Financing Policies*, 48 J. FIN. 1629, 1629–58 (1993).

opportunity for a large gain in ventures where hard-to-reduce risks significantly hinder the safety and certainty of expected returns.[4]

CCUS projects are multifaceted, involving interdependent segments and requiring significant upfront capital investments and commitments. To boost commercial interests and secure firm commitments from potential project developers, the provisions of policies and fiscal incentives that, for instance, increase the value of the project output and guarantee corporate and project financing are essential. The Global CCS Institute notes that most CCS facilities have been developed on the books of large corporations or state-owned enterprises.[5] These corporations tend to have a deep working knowledge of the relevant technologies, as well as the contractual tools and operational practices that underpin CCS projects such as gas metering, treatment, transportation, and the nature of geological formations used for carbon storage or sequestration. Thus, they would ordinarily be more familiar with the risks involved and the tools needed to reasonably execute their project commitments.[6] The carbon dioxide (CO_2) *offtake and transportation agreement* is one of the essential project planning and risk allocation tools. These agreements establish necessary terms and conditions under which the party or parties engaged in capturing and/or sequestration of carbon oxides (CO_x) emitted from industrial, or energy facilities can guarantee the revenue stream to support the project's feasibility.[7]

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4 LOUIS EECKHOUDT, CHRISTIAN GOLLIER & HARRIS SCHLESINGER, ECONOMIC AND FINANCIAL DECISIONS UNDER RISK 9–10 (2005). A risk-averse firm may like risky and expensive ventures if the expected payoffs or reasonable return on investments are certain and large enough to make the project feasible. In the CCUS context, for instance, CO_2 capture, and subsurface injection for utilization or sequestration is a mature technology in sectors like gas processing and enhanced oil recovery. In contrast, the technology is currently less mature in applications relating to the power sector and heavy industry or chemicals production where there are still several demonstration and pilot projects in advanced research and developmental phases. Thus, in addition to private sector corporate or project financing mechanisms, it is essential to have government policy support tools, fiscal incentives, and public stakeholder support to boost investor confidence and certainty and drive the bankability of projects currently being considered.

5 DOMINIC RASSOOL, UNLOCKING PRIVATE FINANCE TO SUPPORT CCS INVESTMENTS 8–11 (2021), https://www.globalccsinstitute.com/wp-content/uploads/2021/06/Unlocking-Private-Finance-for-CCS-Thought-Leadership-Report-1.pdf [https://perma.cc/MJ4J-NS7J]. These operators, mostly from the oil and gas sector, are typically more comfortable with CCS project risks than other emitters and are large enough to absorb the costs of these risks if they materialize. Newer industries and operators, such as in ethanol, steel, or cement production sectors, would require firm governmental support and feasible project financing and offtake arrangements.

6 *Id.*

7 BUILDING A COMMERCIAL MARKET, *supra* note 1, at 80; *see also, e.g.*, *Offtake Agreement*, WESTLAW'S PRACTICAL LAW GLOSSARY (last visited Aug. 7, 2024) (available at

CCUS projects utilize technologies that remove CO_x from point sources to prevent such emissions from entering the atmosphere.[8] Thus, carbon capture technologies are mainly designed to curtail emissions from industrial and energy-related facilities pre- or post-combustion. Such technologies differ from carbon dioxide removal (CDR) systems, which comprise alternative approaches to remove CO_2 directly from the atmosphere. The common CDR technologies include direct air capture (DAC) coupled with storage of the captured molecules, bioenergy with carbon capture and storage (BECCS), soil carbon sequestration, enhanced mineralization, ocean-based CDR, and afforestation/reforestation.[9]

CCUS can contribute to carbon emission reductions and pathways to a net-zero modern industrialized economy in at least four important ways. First, it curbs emissions from existing and critical energy assets, most of which still have lengthy technical and operational lifespans.[10] In a true net-zero or low-carbon economy scenario, carbon-intensive plants and facilities may have to shut down prematurely if they are no longer able to run economically, thus, potentially creating stranded assets for utilities that

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https://perma.cc/AWT9-8BHX); *Overview of Offtake Agreements*, GLOB. TRADE FUNDING, https://globaltradefunding.com/project-finance/project-finance-documents/offtake-agreements/ [https://perma.cc/3LUP-9DNJ] (last visited Dec. 12, 2023).

8 Carbon oxides, sometimes called oxocarbons, are a family of organic molecules composed entirely of carbon and oxygen. Carbon monoxide and carbon dioxide (CO_2) are the most basic oxocarbons. Notable point sources include industrial applications in (i) cement, steel, and iron production, (ii) fuels, gas, and chemical processing, (iii) ammonia and ethanol production, etc.

9 *See generally* Neil Segel, *Direct Air Capture Facilities and Production of Carbon-Neutral Hydrocarbons*, 51 ENV'T L. REP. 10390 (2021); Tracy Hester, *Legal Pathways to Negative Emissions Technologies and Direct Air Capture of Greenhouse Gases*, 48 ENV'T L. REP.10413, 10413 (2018), https://www.law.uh.edu/faculty/thester/Legal%20Pathways%20to%20Broad%20Use%20of%20NETs%20and%20DAC%20by%20Hester.pdf [https://perma.cc/3SAY-QVHD]; MICHAEL B. GERRARD & TRACY HESTER, CLIMATE ENGINEERING AND THE LAW (2018). CDR does not include carbon capture from point sources in the hydrocarbon or industrial sectors. *See Carbon Dioxide Removal*, OFF. OF FOSSIL ENERGY AND CARBON MGMT., U.S. DEP'T OF ENERGY (July 2022), https://www.energy.gov/fecm/articles/fact-sheet-carbon-dioxide-removal. Bioenergy with carbon capture and storage (BECCS) involves capturing and permanently storing CO_2 from processes where biomass (which extracts CO_2 from the atmosphere as it grows) is burned to generate energy. *Id.* A power station fueled with biomass and equipped with CCUS is a type of BECCS technology, as are facilities that process biomass into biofuels if the resulting CO2 is captured and stored. *Id.*

10 INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES 2020: SPECIAL REPORT ON CARBON CAPTURE UTILISATION AND STORAGE, CCUS IN CLEAN ENERGY TRANSITIONS 13–14 (2020) [hereinafter CCUS IN CLEAN ENERGY TRANSITIONS] https://iea.blob.core.windows.net/assets/181b48b4-323f-454d-96fb-0bb1889d96a9/CCUS_in_clean_energy_transitions.pdf [https://perma.cc/3Y42-RAUG].

currently own or operate such facilities.[11] Such existing power and industrial plants can, however, be retrofitted with carbon capture technologies, thereby avoiding the waste and systemic issues that may arise if they have to shut down prematurely. Second, it creates a solution for curtailing hard-to-abate emissions, especially from heavy industries like steel, chemicals, and cement, some of which account for almost 20% of global CO_2 emissions.[12] Third, cost-efficiency in scaling up CCUS allows for a reasonable pathway to produce cleaner and alternative energy-related resources such as hydrogen from natural gas (often called "blue hydrogen") and synthetic fuels.[13] Fourth, CCUS serves as an essential decarbonization and air pollution control tool by removing carbon oxides from the atmosphere while economic actors reach their net-zero emissions target in a secure and sustainable manner.[14]

The Sustainable Development Scenario (SDS), highlighted under the International Energy Agency's (IEA) 2020 *Special Report on Clean Energy Innovation*, represents the context in which clean energy technologies are deployed in a manner that leads to the realization of the United Nations climate mitigation objectives, universal access to modern energy by 2030,

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11 *Id.*; *see also* Adam Levy & Zachary Joseph, *Considerations for Climate Stranded Assets*, KPMG, https://kpmg.com/us/en/articles/2022/considerations-for-climate-stranded-assets.html [https://perma.cc/KTT3-UEN3] (last visited Aug. 7, 2024).

12 *See Sources of Greenhouse Gas Emissions*, U.S. ENV'T PROT. AGENCY, www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#industry [https://perma.cc/8XC6-5GDP] (last visited Mar. 2, 2024). In 2021, direct industrial greenhouse gas emissions accounted for 23% of total U.S. greenhouse gas emissions, making it the third largest contributor to U.S. greenhouse gas emissions, after the Transportation and Electric Power sectors. *Id.* From 2020 to 2021, total energy use in the industrial sector increased by just over 1%. *Id.* Including both direct emissions and indirect emissions associated with electricity use, industry's share of total U.S. greenhouse gas emissions in 2022 was 30%, making it the second largest contributor of greenhouse gas emissions of any sector. *Id.*

13 *See* MARTIN LAMBERT, CLEAN HYDROGEN ROADMAP: IS GREATER REALISM LEADING TO MORE CREDIBLE PATHS FORWARD? 3–4 (2023), https://www.oxfordenergy.org/wpcms/wp-content/uploads/2023/09/Clean-Hydrogen-Roadmap-ET25.pdf [https://perma.cc/JBJ6-88U7]; Heather Dziedzic & Tade Oyewunmi, *Decarbonization and the Integration of Renewables in Transitional Energy Markets: Examining the Power to Gas Option in the United States*, 18 OIL, GAS & ENERGY L. INTEL. J., no. 4, Aug. 2020, at 13–15, https://www.tadeoyewunmi.com/_files/ugd/407494_a1128b65bc8f45c296ee3f93a5a6d3d8.pdf [https://perma.cc/STN8-TTWT]; Tade Oyewunmi, *An Instrumental Perspective on Power-to-Gas, Hydrogen, and a Spotlight on New York's Emerging Climate and Energy Policy*, 38 PACE ENV'T L. REV. 221, 250–51 (2021).

14 INT'L ENERGY AGENCY, LEGAL AND REGULATORY FRAMEWORKS FOR CCUS 9 (2022), https://iea.blob.core.windows.net/assets/bda8c2b2-2b9c-4010-ab56-b941dc8d0635/LegalandRegulatoryFrameworksforCCUS-AnIEACCUSHandbook.pdf [https://perma.cc/J6TD-K7W9]; Owen L. Anderson, *Carbon Sequestration: A Fresh Look at an Essential Tool in the War on Climate Change*, 21 OIL, GAS & ENERGY L. INTEL. J., no. 3, July 2023, at 49–50.

and a dramatic reduction in energy-related air pollution.[15] Given the IEA's SDS assumptions, global warming would remain below 1.8°C with a 66% probability if CO_2 emissions remain at net-zero after 2070.[16] The SDS context requires technologies that capture carbon emissions from industrial, manufacturing, and energy-related point sources. The expected effect would be a reduction in the carbon emissions intensity of goods and services produced from these economic activities that may need to rely on hydrocarbons or synthetic fuels involving CO_2 utilization.[17] Several CCUS applications are still in the prototype or demonstration phase.[18] Therefore,

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15 INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES 2020: SPECIAL REPORT ON CARBON CAPTURE UTILISATION AND STORAGE, CCUS IN CLEAN ENERGY TRANSITIONS (2020) [hereinafter CLEAN ENERGY INNOVATION], https://iea.blob.core.windows.net/assets/04dc5d08-4e45-447d-a0c1-d76b5ac43987/Energy_Technology_Perspectives_2020_-_Special_Report_on_Clean_Energy_Innovation.pdf [https://perma.cc/827X-5SH2]; ANDRÉS ALEGRÍA ET AL., SYNTHESIS REPORT SUMMARY FOR POLICYMAKERS (2023), https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf [https://perma.cc/BGL6-ALHR]. In CCUS IN CLEAN ENERGY TRANSITIONS, *supra* note 10, at 49–50, it is noted that

> [t]he contribution of CCUS to reducing global energy sector CO2 emissions in the Sustainable Development Scenario evolves over the projection period, with three distinct periods . . . . In the first phase to around 2030, the focus is on capturing emissions from existing power plants and factories. In the power and industry sectors, over 85% of all CO2 emissions captured in this decade are from plants retrofitted with CO2 capture equipment: coal-fired power units (and, to a lesser extent, gas-fired power units); chemical plants (mainly fertilizers), cement factories, and iron- and steelworks. Some low-cost CO2 capture opportunities in hydrogen and bioethanol production are also developed, building on the current portfolio of projects. Total capture reaches 840 Mt in 2030. Cumulatively to 2030, CCUS contributes around 4% of the overall emissions reductions in the Sustainable Development Scenario relative to the Stated Policies Scenario.

16 CLEAN ENERGY INNOVATION, *supra* note 15, at 62–63; Laura Cozzi & Tim Gould, *What Would It Take to Limit the Global Temperature Rise to 1.5°C?*, INT'L ENERGY AGENCY (Nov. 17, 2019) https://www.iea.org/commentaries/what-would-it-take-to-limit-the-global-temperature-rise-to-15c [https://perma.cc/EH8H-MEPW]. In this context, CCUS—alongside electrification, bioenergy, and hydrogen—is a major component of the portfolio of technology options to deliver deep emissions reductions in the hard-to-abate sectors. While improvements in the performance of existing technologies, material efficiency in heavy industry, and measures to conserve energy in transport by avoiding journeys and shifting between modes can deliver substantial emissions reductions in the near term, it is noted that for the energy sector as a whole to reach net-zero emissions in the longer term, technologies that significantly reduce the emissions intensity of producing a tonne of material or of moving passengers and freight around the world are required. *See* CCUS IN CLEAN ENERGY TRANSITIONS, *supra* note 10, at 61–63.

17 *CCUS in Clean Energy Transitions*, *supra* note 10, at 61–63.

18 For a general outlook on recent emerging trends in CCUS technology developments *See* RASSOOL, *supra* note 5; Tade Oyewunmi & Kim Talus, *Investing in Carbon Capture Technologies and Net-Zero Pathways in the US and EU: Recent Legal and Policy*

supportive policy measures and fiscal incentives promoting research and development (including commercial demonstrators) and technical improvements are essential to deploying CCUS technologies at the scale necessary to sufficiently contribute to global decarbonization goals. Existing research, development, and pilot projects established over the past two decades have promoted a better understanding of the complexities involved in scaling up CCUS.[19]

CCUS project developers and participants face peculiar complexities and financing hurdles that require dedicated measures. First, to secure investment, a given project must be able to capture point source CO_2 emissions and generate sufficient and reliable revenue streams. Second, even if emitters install carbon capture technology at a new industrial facility or retrofit an existing power or cement plan, the success of the project largely depends on the ability of the capturer to (i) transport and sequester the processed CO_2 stream in a predetermined subsurface location or (ii) sell to an offtaker for other utilization schemes. The technicalities and commercial considerations relating to capturing, transporting via pipelines, and accessing suitable storage sites for sequestration create additional complexities that must be addressed. Note that CO_2 emissions are externalities arising from operating a facility that is part of a distinct economic sector (e.g., cement, ethanol, steel, or electricity). The transportation pipeline aspect as well as the sequestration sites for permanent storage are typically subject to a different set of rules and involve other stakeholders such as landowners and regulatory agencies.[20] Third, addressing long-term liability risks for stored CO_2 also presents considerable issues, including the transfer of title and interests of the CO_2

Considerations, OIL, GAS & ENERGY L. INTEL. J., no. 1, Jan. 2024; ANDREW GODDARD, WILL THE US INFLATION REDUCTION ACT (IRA) PUSH CARBON CAPTURE AND STORAGE (CCS) AND CARBON DIOXIDE REMOVAL (CDR) TECHNOLOGIES OVER THE LINE? (2023), https://www.oxfordenergy.org/wpcms/wp-content/uploads/2023/07/CM05-Deal-or-No-Deal.pdf [https://perma.cc/7VAZ-DRQR].

19 EXEC. OFF. OF THE PRESIDENT OF THE U.S., COUNCIL ON ENVIRONMENTAL QUALITY REPORT TO CONGRESS ON CARBON CAPTURE, UTILIZATION, AND SEQUESTRATION 24 (2021) https://whitehouse.gov/wp-content/uploads/2021/06/CEQ-CCUS-Permitting-Report.pdf [https://perma.cc/HLD4-KJ56]; INT'L ENERGY AGENCY GREENHOUSE GAS R&D PROGRAMME, CO_2 CAPTURE IN CEMENT INDUSTRY (July, 2008) [https://perma.cc/X93V-EHHR].

20 Tade Oyewunmi, *Decarbonising Gas and Electricity Systems: An Outlook on Power-to-Gas and Other Innovative Solutions*, *in* TADE OYEWUNMI ET AL., DECARBONISATION AND THE ENERGY INDUSTRY: THE ROLE OF LAW AND REGULATION IN LOW-CARBON AND TRANSITIONAL ENERGY MARKETS (2020); Alexandra B Klass & Elizabeth J Wilson, *Climate Change, Carbon Sequestration, and Property Rights*, 2010 U. ILL. L. REV. 363, 363–428 (2010); Keith B. Hall, *Local Government Regulation of CCUS*, *in* 2024 FOUND. FOR NAT. RES. & ENERGY L. 12-1 (2024).

in place.[21] These hurdles and potential risks can be addressed in part by governmental legislation,[22] and in part by project developers with specific plans and arrangements connecting the interdependent aspects of the CCUS value chain. This includes establishing a consortium typically in the form of a special purpose company or partnership to raise equity while looking to financiers to provide syndicated project loans for the debt side of required capital investments.[23] Investors in the consortium would ideally provide equity, while the lenders would provide the debt portion of the capital requirements for the project. To address potential project hurdles and complexities, sponsors and relevant parties will need to make bankable arrangements, define respective roles and responsibilities, and equitably allocate risks.

Generally, an offtake agreement is an arrangement under which an offtaker buys all or a substantial portion of the output from a given project's production facility and provides the revenue stream supporting the feasibility of the project.[24] The offtaker agrees to buy (subject to terms and conditions) all or some of a resource producer's future output (e.g.,, minerals, gas, or CO_2) from the producing seller's facility at a price or based on a pricing formula. The main forms of offtake agreements that could be adopted in the CCUS context include (i) "take-*or*-pay" contracts, which require the offtaker to pay for CO_2 periodically, regardless of whether the offtaker takes the CO_2 delivery; (ii) "take-*and*-pay" contracts under which the offtaker only pays for CO_2 taken on an agreed price basis; (iii) throughput contracts where a pipeline user agrees to carry a minimum specified volume of CO_2 in the pipeline at a contractually specified price; and (iv) long-term sales contracts whereby the offtaker agrees to take the contractually agreed-upon quantities of CO_2 from the project, usually for the life span of the project.[25]

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21 Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change and Carbon Sequestration: Assessing a Liability Regime for Long-Term Storage of Carbon Dioxide*, 58 EMORY L.J. 103, 103–80 (2008); Oyewunmi, *supra* note 1; *Property Rights in Relation to CCS*, GLOB. CCS INST. (Aug. 30, 2012), http://www.globalccsinstitute.com/resources/publications-reports-research/property-rights-in-relation-to-ccs/ [https://perma.cc/SV8V-V8B7].

22 Several states including Texas, Louisiana, North Dakota, and Wyoming have established trust funds, typically funded by per-ton injection fees to defray long-term post-closure monitoring costs and liabilities. *See* TEX. NAT. RES. CODE § 121.003; 16 TEX. ADMIN. CODE § 5.205; LA. STAT ANN. §§ 30:1108, 19:2(12), 19:9; N.D. CENT. CODE §§ 38-22-14, -15; N.D. ADMIN. CODE § 43-05-01-17; WYO. STAT. ANN. §§ 35-11-313, -320.

23 RASSOOL, *supra* note 5, at 12–13. Globally, most CCS facilities have been developed on the books of large corporations or state-owned enterprises (SOEs) with deep knowledge of the technologies and practices that underpin CCS.

24 *See e.g.*, *Offtake Agreement*, *supra* note 7; *Overview of Offtake Agreements*, *supra* note 7.

25 *Overview of Offtake Agreements*, *supra* note 7.

In a typical sales contract, the pricing is often based on an agreed formula or reference to an established index for pricing common to the specific industry. A common example of a long-term sales contract is the Liquified Natural Gas (LNG) sale and purchase agreement, which plays a critical role in consolidating capital-intensive and often multifaceted LNG projects.[26] Earlier forms of CCS projects are structured to have a single special-purpose entity that is responsible for the capturing and storage operations. The entity takes CO_2 from one single emitting facility, transports it, and ensures its sequestration or use in Enhanced Oil Recovery (EOR). There has, however, been a growing trend of hub-like projects where a group of emitters arrange with a transportation and storage services provider to take CO_2 deliveries and provide the needed shipping and sequestration services.

The main objective in negotiating offtake and transportation arrangements is to outline necessary terms and conditions for the purchase, delivery, use, storage, pricing, and transfer of title or interests in the captured CO_2. Generally, CCUS projects will involve some variation of the Carbon Dioxide Purchase and Supply Agreement (CPSA) or the CO_2 Sequestration Services Agreement (CSSA) discussed in this Article. The CPSA framework would define the terms and conditions under which the emitter (seller) supplies the capturer (buyer) with CO_2 from the emitting facility. Such an offtake agreement could be considered as a simple purchase agreement in which the emitter is selling the carbon molecules to an end-user such as an oil and gas company that injects the CO_2 as part of its EOR operations.[27] Another context that reflects emerging project trends is one in which the CPSA may be drafted as a CO_2 transportation and storage agreement if the offtaker (i.e., buyer) is delivering the CO_2 to the owner of a storage facility for permanent sequestration. Such an arrangement would need to be executed before project construction commences in order to contractually guarantee a revenue stream and necessary support for the capturing party's project

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26 Philip R. Weems & Monica Hwang, *Overview of Issues Common to Structuring, Negotiating and Documenting LNG Projects*, 6 J. WORLD ENERGY L. & BUS. 267, 285–86 (2013); *see LNG Sale and Purchase Agreements Signed in 2023 Support U.S. LNG Projects*, U.S. ENERGY INFO. ADMIN. (Feb. 7, 2024), https://www.eia.gov/todayinenergy/detail.php?id=61384 [https://perma.cc/7DLD-HCHM] (describing how developers are better able to move forward with LNG projects following the signing of sale and purchase agreements in the U.S.).

27 *Enhanced Oil Recovery*, OFF. OF FOSSIL ENERGY & CARBON MGMT., U.S. DEP'T OF ENERGY, www.energy.gov/fecm/enhanced-oil-recovery [https://perma.cc/8HZL-P9Y5] (last visited Dec. 15, 2023). The technology has been used in several states, including Texas, New Mexico, Kansas, Wyoming, Oklahoma, etc. Until recently, most of the CO_2 used for EOR has come from naturally occurring reservoirs. However new technologies are being developed to produce CO2 from industrial applications such as natural gas processing, fertilizer, ethanol, and hydrogen plants in locations where naturally occurring reservoirs are not available.

financing arrangements. This would also ideally reduce the CO_2 seller's risk of being unable to secure a market or buyer for future output. Note that the project's output in this context would be the captured CO_x. Given the emergence of hub-based project forms where multiple emitters seek to engage a service provider, a second model of offtake and transportation arrangement is the CSSA. The CSSA involves a service provider whose business plan is to own, lease, construct, operate, or maintain a CCS system that will capture, transport, and sequester CO_x. Under a CSSA, the emitter or cluster of emitters agrees to engage the service provider to exclusively carry out sequestration services as defined under the contract.

The key factors to consider in the CPSA or CSSA as offtake agreements are the terms, price, and creditworthiness of the offtaker. Hence, the structure of these agreements is that of a supply and purchase agreement for the delivery of products like natural gas, even though the provisions that address transactional issues and risks under the CPSA, or an agreement for the transportation and storage of CO_2 will be particular to the specific CCUS project's value chain and context.[28]

Given the above discussion, this Article aims to examine the legal issues that arise when negotiating carbon offtake and transportation agreements, as a key tool for enhancing the feasibility of CCUS projects and addressing the relevant risks and barriers to obtaining firm commitments from potential developers, financiers, and investors. Part II briefly explains the three main processes for capturing CO_x on a commercial scale from industrial or power facilities, which include the pre-combustion, post-combustion, and oxyfuel combustion capture process.[29] Part III explores the framework of legal and fiscal incentives driving commercial and investment interest in CCUS and DAC projects in the U.S.[30] Part IV expounds on the idea of risk aversion as a useful concept for understanding the disposition of parties in structuring capital-intensive projects such as CCUS and ensuring a feasible venture.[31] Additionally, Part IV discusses securing minimum offtake commitments, fee structure, and the role of parties to an ideal offtake and transportation agreement.[32] Part V discusses the environmental and ownership attributes of CO_x acquired under the ideal carbon offtake agreement.[33] Part VI examines the transactional risks and conditions necessary to consolidate the offtake and

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28 For a discussion on commercial and legal considerations in developing CCUS projects, see Austin Lee et al., *The Way Forward: A Legal and Commercial Primer on Carbon Capture, Utilization, and Sequestration*, 16 TEX. J. OIL, GAS, & ENERGY L. 43, 67–75 (2021).

29 *See infra* Part II.

30 *See infra* Part III.

31 *See infra* Part IV.

32 *See infra* Part IV.

33 *See infra* Part V.

transportation arrangements, including the implications of credit recapture and long-term liability issues.[34] Part VII concludes the discussion by highlighting the significance of carbon offtake and transportation agreements as a tool for addressing relevant risks and fostering bankable CCUS projects.[35] Such measures and arrangements will be essential as private firms operating in carbon-intensive industries become increasingly engaged in decarbonization. Given the increasing policy support and fiscal incentives, as well as a better understanding of the intricacies of the interdependent segments by interested parties, firms who are typically risk-averse would likely (all things being equal) be more inclined to invest in carbon capture projects and offtake arrangements.

II. OVERVIEW OF CAPTURE PROCESSES

The capture process involves taking CO_x, compressing it, and producing a stream of CO_2, usually in a supercritical fluid-like state. As CO_2 emissions are in a gaseous state, converting them into a supercritical fluid-like state makes it more economical to transport via pipelines and for eventual sequestration or utilization.[36] There are three main processes for capturing CO_2 on a commercial scale from industrial or power facilities.[37] First, the post-combustion capture method involves extracting CO_2 from the mixture of gasses released from a facility's exhaust stack. In this regard, an absorber captures the mixture of gasses, called "flue gas" and then scrubs the flue gas thereby capturing about 85% to 95% of the CO_2 emitted from the facility. A stream of concentrated CO_2 is then created, compressed, and transported by pipeline to either storage, disposal, or utilization facilities.[38]

Second, the pre-combustion capture system involves introducing the fuel source to a stream of air (or steam), which produces a separate stream of CO_2 that can be transported for storage, disposal, or utilization. For instance, instead of using coal as fuel in a coal-fired power plant, it can go through a process called "gasification" or "partial oxidation" which results

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34 *See infra* Part VI.

35 *See infra* Part VII.

36 Supercritical CO_2 means that it is in a phase where the temperature is over 31.1°C (88°F) and pressure more than 72.9 atm (about 1,057 psi); this temperature and pressure define the critical point for the captured and treated CO_2. *See Carbon Storage FAQs*, NAT'L ENERGY TECH. LAB'Y, https://netl.doe.gov/carbon-management/carbon-storage/faqs/carbon-storage-faqs [https://perma.cc/6FPZ-9QGP] (last visited Mar. 2, 2024).

37 ANGELA C. JONES & ASHLEY J. LAWSON, CARBON CAPTURE AND SEQUESTRATION (CCS) IN THE UNITED STATES 4–5, 24–25 (2022) https://sgp.fas.org/crs/misc/R44902.pdf [https://perma.cc/49CF-EQEP]; Lee et al., *supra* note 28, at 43, 48–50.

38 JONES & LAWSON, *supra* note 37, at 4–5, 24–25; Lee et al., *supra* note 28, at 43, 48–50.

in a synthetic fuel consisting of mainly carbon monoxide and hydrogen. The carbon monoxide is separated and processed into a stream of CO_2, while the hydrogen may be used for power generation or converted to synthetic gas. For instance, the Great Plains project in North Dakota is designed to gasify coal to produce synthetic natural gas, which is then sold in the natural gas market, while the generated CO_2 is sold to oil and gas exploration and production companies for EOR operations.[39]

Third, the oxyfuel combustion capture process uses a pure or enriched oxygen stream for combustion and produces a flue gas that is mostly CO_2 and water. Next, CO_2 and water are separated, and the CO_2 can be compressed, transported, and stored or used accordingly.[40] In this process, almost all the nitrogen is removed from the air, yielding a stream that is approximately 95% oxygen. As a result, oxy-combustion decreases the volume of produced flue gas (which is approximately 70% CO_2 by volume) by approximately 75% compared to air-fired combustion.[41] The lower gas volume also allows for easier removal of pollutants such as sulfur oxides (SO_x), nitrogen oxides (NO_x), mercury, and particulates from the flue gas. Another benefit to removing nitrogen from the air is the greatly reduced NO_x production.[42] However, the main challenges of using this process include the capital required, energy consumption, and operational challenges of oxygen separation. The oxy-combustion-based power production process involves three major components: oxygen production (i.e., air separation unit), the oxy-combustion boiler (i.e., fuel conversion and combustion unit), and CO_2 purification and compression.[43]

Depending on the type of facility or facilities that produce the CO_x, contracting parties must carefully consider (i) what obligations and activities are included in the 'capture' process, (ii) the capture equipment to be used and the method to be adopted—e.g., pre- or post-combustion or oxy-combustion—and (iii) the respective cost implications.[44] In a typical

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39 JONES & LAWSON, *supra* note 37, at 4–5, 24–25; Lee et al., *supra* note 28, at 48–50; *see Great Plains Synfuels Plant*, NAT'L ENERGY TECH. LAB'Y, https://netl.doe.gov/research/Coal/energy-systems/gasification/gasifipedia/great-plains [https://perma.cc/3JA5-AMV2] (last visited Aug. 7, 2024).

40 JONES & LAWSON, *supra* note 37.

41 *Oxy-Combustion*, NAT'L ENERGY TECH. LAB'Y, https://netl.doe.gov/node/7477 [https://perma.cc/Y4ZN-9A9Q] (last visited Nov. 2, 2023).

42 *Id.*

43 *Id.*

44 In general, carbon capture equipment includes all components of property that are used to capture or process carbon oxide until the carbon oxide is transported for disposal, injection, or utilization. Thus, the capture equipment includes the gathering and distribution lines that bring the captured CO_2 to a central point of collection before the CO_2 is transported, but it does not include the pipeline that transports the CO_2. *See* 26 C.F.R. § 1.45Q-2(c).

offtake agreement, the term "capture" includes the capture, compression, and treatment of CO_2 at the specified capture facility upon receiving the flue gas. The capturer could be the service provider in a CSSA or the special purpose vehicle serving as the capturing entity in a CPSA. It is important to also have a metering system at the delivery point of the capturing facility. Typically, the capture facility at the emitting plant is owned by the service provider or capturing entity. Accurate metering is essential at this point for recouping project costs and calculating revenue because the tax credits attributable to the capture process ordinarily belongs to the person who owns the carbon capture equipment and disposes of the CO_2 (or contracts with someone else to do so). Nevertheless, the owner of the carbon capture equipment can transfer the tax credits to the disposal company that secures CO_2 in geological storage or uses it (i) as a tertiary injectant for enhanced oil or gas recovery or (ii) in a permitted commercial manner. The tax credit is available for twelve years after the capture equipment is placed in service at a qualified facility.[45]

III. GROWING COMMERCIAL INTERESTS AND FISCAL INCENTIVES FOR CCUS AND DAC PROJECTS

Globally, about eight final investment decisions (FIDs) were made for CCUS in 2021, and by 2022, the number of FIDs relating to industry, power, fuel transformation, and DAC projects rose to fifteen.[46] The growing investor confidence and commercial interests are arguably driven, in part, by: improved policy and regulatory initiatives in countries like the United States, Canada, and the United Kingdom; strengthened climate change mitigation pledges; and rising carbon prices and emerging voluntary carbon markets (VCMs).[47]

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45 26 U.S.C. § 45Q(a)(3)(A), (4)(A); 26 C.F.R. § 1.45Q-1(c).

46 Fajardy, Greenfield & Moore, *supra* note 1.

47 In BASSAM FATTOUH, HASAN MUSLEMANI & RAEID JEWAD, CAPTURE CARBON, CAPTURE VALUE: AN OVERVIEW OF CCS BUSINESS MODELS 8–9 (2024), www.oxfordenergy.org/wpcms/wp-content/uploads/2024/02/CM08-Capture-Carbon-Capture-Value_Final.pdf [https://perma.cc/3MAH-6EX8], it is noted that the main market-based revenue streams for CCUS include (a) schemes to use captured CO_2 or produce low-carbon products (e.g. synthetic fuels or low-carbon steel and cement); (c) VCMs; and (d) tradable carbon credits or carbon storage certificates. It was opined that

> CCS project developers can sell carbon credits in the VCM based on certified emissions that have been reduced or removed through CCS. However, the size of the VCM remains quite small and despite the potential for the VCM to grow, many obstacles remain. Particularly, there have been concerns about the quality of the carbon credits which ultimately raised fears of corporate greenwashing. Also, financing through the VCM has been mainly concentrated in a few types of

In the U.S., increasing federal policy support for scaling-up carbon capture projects include: (i) the Inflation Reduction Act (IRA),[48] (ii) amendments to Section 45Q of the Internal Revenue Code (IRC)[49] under the Bipartisan Budget Act of 2018,[50] and (iii) the 2021 Infrastructure Investment and Jobs Act (IIJA).[51] Pursuant to the IIJA, the U.S. Department of Energy (DOE) established the Office of Clean Energy Demonstrations to oversee a $21.5 billion grant for innovative clean energy demonstration projects including clean hydrogen, carbon capture, and grid-scale energy storage.[52] Thus, under the carbon capture demonstration projects program, technology developers, industry, utilities, engineering and construction firms, etc., can demonstrate transformational systems that will significantly improve the efficiency, effectiveness, costs, emissions reductions, and environmental performance of coal and natural gas use.[53]

The demonstration projects test the effectiveness of nascent technologies in real world conditions at the required scale. These projects leverage public-private partnerships to pave the way toward commercialization and widespread deployment. Much of this funding will go to large projects that can be significant engines of local and regional economic development and job creation.[54] The same package also includes the Carbon Storage Validation and Testing Initiative, funding $2.5 billion in grants or cooperative agreements for facilitating the development of new or expanded commercial large-scale carbon sequestration projects and associated carbon dioxide transport infrastructure.[55] Further, the IRA provides a suite of incentives (including tax credits) to expand and improve programs relating to CCS and DAC, thereby complementing the

> projects, namely, renewable energy and nature-based solutions (NBS) avoidance projects.

Id. at 9 (footnote omitted).

48 Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818.

49 26 U.S.C. § 45Q.

50 Bipartisan Budget Act of 2018, Pub L. No. 115-123, 132 Stat. 64.

51 Infrastructure Investment and Jobs Act, Pub L. No. 117-58, 135 Stat. 429 (Nov. 15, 2021).

52 WHITE HOUSE, BUILDING A BETTER AMERICA: GUIDEBOOK TO THE BIPARTISAN INFRASTRUCTURE LAW FOR STATE, LOCAL, TRIBAL, AND TERRITORIAL GOVERNMENTS, AND OTHER PARTNERS (2024), https://www.whitehouse.gov/wp-content/uploads/2022/05/building-a-better-america-V2.pdf [https://perma.cc/4Y3Z-MPC6].

53 *Id.*

54 *Id.*

55 *Id.*

provisions of the IIJA.[56] Under the IRA, the tax credit applicable to advanced energy project investments, as defined in 26 U.S.C. § 48C(c)(1), will benefit taxpayers who invest in carbon capture systems that reduce greenhouse gas emissions by at least 20% at an industrial or manufacturing facility.[57] Further, about $5.8 billion is provided to support the DOE's Advanced Industrial Facilities Deployment Program.[58]

The current package of incentives evolved from 2008 when the tax credit for the sequestration of CO_2 was enacted under Section 45Q of the Internal Revenue Code (IRC).[59] Another major amendment was under the Bipartisan Budget Act of 2018, which led to the increase of tax credits applicable to EOR-related capture and sequestration operations, among other uses.[60] The amount a taxpayer may claim as a Section 45Q tax credit is computed per metric ton of qualified CO_x captured and sequestered.

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56 WHITE HOUSE, GUIDEBOOK TO THE INFLATION REDUCTION ACT 67–70 (2023) [hereinafter GUIDEBOOK TO THE INFLATION REDUCTION ACT], https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf [https://perma.cc/C7BU-LVHZ].

57 The IRA provides a tax credit for investments in advanced energy projects, as defined in 26 U.S.C. § 48C(c)(1).

58 The program is designed to provide financial support to industrial facilities in emissions-intensive sectors, such as the iron, steel, aluminum, cement, glass, paper, and chemicals sectors, to complete demonstration and deployment projects that reduce GHG emissions through the installation or implementation of advanced industrial technologies. This program complements the US$500 million provided to the DOE under the IIJA of industrial demonstration projects. *See* GUIDEBOOK TO THE INFLATION REDUCTION ACT, *supra* note 56, at 67–70.

59 JONES & LAWSON, *supra* note 37. Section 45Q was enacted on October 3, 2008, by section 115 of Division B of the Energy Improvement and Extension Act of 2008, Pub. L. No. 110-343, 122 Stat. 3765, 3829, to provide a credit for the sequestration of carbon oxide. On February 17, 2009, section 45Q was amended by section 1131 of Division B of the American Recovery and Reinvestment Tax Act of 2009, Pub. L. No. 111-5, 123 Stat. 115, 325. Section 45Q was further amended on December 19, 2014, by section 209(j)(1) of Division A of the Tax Increase Prevention Act of 2014, Pub. L. No. 113-295, 128 Stat. 4010, 4030, and again on February 9, 2018, by section 41119 of Division D of the Bipartisan Budget Act of 2018, Pub. L. No. 115-123, 132 Stat. 64, 162, to encourage the construction and use of carbon capture and sequestration projects. On December 27, 2020, section 45Q was amended by section 121 of the Taxpayer Certainty and Disaster Tax Relief Act of 2020, enacted as Division EE of the Consolidated Appropriations Act, 2021, Pub. L. No. 116-260, 134 Stat. 1182, 3051, to extend the beginning of construction deadline for qualified facilities and carbon capture equipment by two years.

60 *See Section 45Q Credit for Carbon Oxide Sequestration*, INT'L ENERGY AGENCY (Aug. 21, 2023), www.iea.org/policies/4986-section-45q-credit-for-carbon-oxide-sequestration [https://perma.cc/2SZE-E8XZ].

Before the 2018 amendments, the tax credit applied exclusively to CO_2, and can now be applied to carbon monoxide (CO), CO_2, or both.[61]

Table 1 below summarizes the progression of applicable fiscal incentives for CCUS investments under Section 45Q, including provisions under the extant IRA amendments.[62] The IRA provided for a series of significant amendments, especially regarding the eligibility requirements and the value per ton of CO_2 captured by a qualified facility under Section 45Q provisions.[63] Amongst other substantive changes, the IRA increased the rates previously established in 2018 and reduced the capture threshold and capacity requirements for eligible projects.[64] Other notable provisions from the IRA include (i) facilities meeting prevailing wages and registered apprenticeship requirements can qualify for bonus credits; (ii) extending the 45Q tax credit framework to entities such as state, local, and tribal governments (the mentioned entities can elect to receive the tax credits in the form of direct payments); and (iii) expanding the 45Q tax credit transferability provisions by allowing generally ineligible taxpayers to transfer all or a portion of certain credits to an unrelated party in exchange for cash.[65]

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61 *The Section 45Q Tax Credit for Carbon Sequestration*, CONG. RSCH. SERV. (Aug. 25, 2023), https://crsreports.congress.gov/product/pdf/IF/IF11455. To be eligible for the tax credit, the qualified carbon oxide is a carbon oxide that would have been released into the atmosphere if not for the qualifying equipment.

62 *Id.*

63 Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818.

64 See GUIDEBOOK TO THE INFLATION REDUCTION ACT, *supra* note 56, at 69–70

65 *Id.*

Table 1: Internal Revenue Code Section 45Q Tax Credit, 2008–2022 by Qualifying Activity

Key Provisions		**2008**[66]	**2018**[67]	**2022 (post IRA)**[68]
Value ($US/ton)	**EOR/Utilization**	$10/ton	$35/ton	$60/ton (Point Source) $130/ton (DAC)
	Geologic Storage[69]	$20/ton	$50/ton	$85/ton (Point Source) $180/ton (DAC)
Claim Period		Capped at 75 million metric tons of CO_2	12-year period after the capture facility is placed in service	12-year period after the facility is placed in service reduced to 5 years if transferred.
Qualified Facility Size	**Power Generation**	500,000 tons/year	500,000 tons/year	18,750 tons/year and a capture design capacity of not less than 75% of baseline emissions
	Industrial	500,000 tons/year	100,000 tons/year 25,000 tons/year for an Industrial Pilot Project	12,500 tons/year 1,000 tons/year for an Industrial Pilot Project
	DAC	Not Applicable	100,000 tons/year	1,000 tons/year
Credit Eligibility[70]		EOR and Sequestration	EOR, Sequestration, Utilization, and DAC	EOR, Sequestration, Utilization, and DAC
Direct Pay		No	No	Yes
Transferability[71]		The capturing party only	An entity that owns the capture equipment and physically or contractually ensures the disposal, utilization, or use as a tertiary injectant of the CO_2	An entity that owns the capture equipment and physically or contractually ensures the disposal, utilization, or use as a tertiary injectant of the CO_2.

66 Federal tax credits for carbon sequestration were first authorized in 2008 with the enactment of the Energy Improvement and Extension Act Division B of Pub. L. No. 110-343. It added Section 45Q to the IRC, which established tax credits for CO_2 disposed of in "secure geologic storage" or through EOR with secure geologic storage. *Id.*

67 The Bipartisan Budget Act amended Section 45Q to increase the tax credit for the capture and sequestration of CO_2 for its use as a tertiary injectant in EOR operations, or for other qualified uses. Following the BBA, carbon utilization processes were defined to include (a) the fixation of qualified CO_2 volumes through photosynthesis or chemosynthesis, such as through the growing of algae or bacteria; (b) the chemical conversion of qualified CO_2 volumes to a material or chemical compound in which such qualified carbon oxide is securely stored; and (c) the use of qualified CO_2 volumes for any other purpose for which a commercial market exists (except use as a tertiary injectant in a qualified enhanced oil or natural gas recovery project), as determined by the Secretary of the Treasury.

68 In 2022, the IRA made numerous changes to Section 45Q. *See* GUIDEBOOK TO THE INFLATION REDUCTION ACT, *supra* note 56; *The Section 45Q Tax Credit for Carbon Sequestration*, *supra* note 61.

A. *Boosting the Value of Tax Credits*

The IRA tax credit provisions have boosted the value of captured CO_x prevented from entering the atmosphere. To benefit from the increased value of the tax credits, it is essential to use the qualifying capture equipment and implement qualified uses, such as EOR for the captured molecules. As shown in Table 1 above, by distinguishing between the periods before the IRA and under the IRA, one can better appreciate the rise in the value of applicable tax credits. Before the IRA, qualifying equipment needed to be placed in service between February 8, 2018, and January 1, 2023; while under the IRA, the qualifying equipment must be placed in service after December 31, 2022, and the developer must begin construction before January 1, 2033. As highlighted in Table 1 above, the IRA provisions made tax credit amounts receivable for using DAC systems significantly higher than amounts receivable by capturing CO_x from emitting point sources such as industrial and energy facilities.

Before the IRA was enacted, the tax credit value for geologically sequestered CO_2 was projected at $40.89 per metric ton of CO_2 in 2023, which could increase proportionately to $50 by 2026. Whereas, under the IRA, the base credit of $17 per metric ton of CO_2 ($36 for DAC), increased to $85 ($180 for DAC) for facilities that pay prevailing wages during the construction phase and for the first twelve years of operation while meeting registered apprenticeship requirements.[72] After 2026, the value of the credit will be adjusted for inflation. Before the IRA, the tax credit for geologically sequestered CO_2 with EOR was $27.61 in 2023 and allowed to increase proportionally to $35 by 2026, then adjusted for inflation. While under the IRA, there is now a base credit of $12 ($26 for DAC), increased to $60 ($130 for DAC) for facilities that pay prevailing wages during the construction phase and during the first twelve years of

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[69] Defined to include storage at deep saline formations, oil and gas reservoirs, and unminable coal seams under such conditions stipulated under regulations issued by the Treasury Secretary, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, and the Secretary of the Interior regarding security measures for the geological storage of qualified carbon oxides under 26 U.S.C. § 45Q.

[70] This row describes the credit eligibility for an entity that owns the capture equipment and physically or contractually ensures the disposal, utilization, or use as a tertiary injectant of the CO_2.

[71] The 2018 BBA allowing owners of carbon capture equipment to claim tax credits instead of the entity capturing the CO_2, facilitates tax-equity investment. IRA extended eligibility to claim the credit to certain nonprofits ("direct pay") and entities without ownership interests ("transferability") and extended the deadline to begin construction to the end of 2032.

[72] *The Section 45Q Tax Credit for Carbon Sequestration*, *supra* note 61.

operation and meet registered apprenticeship requirements. Amounts are adjusted for inflation after 2026.[73]

Before the IRA, the projected credit amount for other qualified uses of CO_2 would have been $27.61 in 2023, and there was a possibility of the value increasing proportionally to $35 by 2026, then adjusted for inflation. While under the IRA, a base credit of $12 ($26 for DAC), increased to $60 ($130 for DAC) when using facilities that pay prevailing wages during the construction phase and for the first twelve years of operation while meeting registered apprenticeship requirements. Amounts are adjusted for inflation after 2026.[74] The types of "qualified" or "permitted" uses of captured CO_2 to earn 45Q tax credits can be deduced from the definition of "utilization of qualified carbon oxide" by the IRS.[75] According to the IRS, utilization means

> (1) the fixation of such qualified carbon oxide through photosynthesis or chemosynthesis, such as through the growing of algae or bacteria; (2) the chemical conversion of such qualified carbon oxide to a material or chemical compound in which such qualified carbon oxide is securely stored; or (3) the use of such qualified carbon oxide for any other purpose for which a commercial market exists (with the exception of use as a tertiary injectant in an EOR or natural gas recovery project), as determined by the Secretary of the Treasury or her delegate.[76]

B. *Defining Qualified Facilities*

Before the passage of the IRA, project developers were required to capture 500,000 metric tons of CO_2 for power generation and 100,000 metric tons for all other projects, including DAC, to receive the tax credit.[77] This high capture threshold was a barrier to entry for several

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73 *Id.*

74 *Id.*; *see also* Matt Bright, *The Inflation Reduction Act Creates a Whole New Market for Carbon Capture*, CLEAN AIR TASK FORCE (Aug. 22, 2022), https://www.catf.us/2022/08/the-inflation-reduction-act-creates-a-whole-new-market-for-carbon-capture/; GUIDEBOOK TO THE INFLATION REDUCTION ACT, *supra* note 56, at 68–69.

75 *Instructions for Form 8933*, INTERNAL REVENUE SERV. (Dec. 2023), https://www.irs.gov/instructions/i8933 [https://perma.cc/6PP3-7GSW]. IRS Form 8933 is amongst other things used by the taxpayer to claim tax credits and to report the volume of CO_2 captured during the year. Where tax credits are assigned to the person disposing of or using the CO_2, both parties must file the form, and the person disposing of or using the CO_2 must attach a copy of the form filed by the capture equipment owner to its form or it will be denied tax credits.

76 *Id.*

77 *See* Bright, *supra* note 74.

developers as they financed projects at the risk of not receiving a tax credit if they came up even just a few tons short.[78] Not only did this affect large-scale projects, but it arguably curbed investment interests in smaller projects.[79] The updated carbon capture thresholds per year are now 18,750 metric tons for power plants (with a carbon capture capacity of 75% of baseline CO_2 production), 12,500 metric tons for industrial facilities, and 1,000 metric tons for DAC.[80] This change significantly affects DAC facilities.[81]

C. *Extending the Date to Begin Construction*

The IRA drastically extended the date to begin construction of the qualified facility.[82] Previously, to qualify for the 45Q tax credit, a CCUS facility's construction must begin by January 1, 2026.[83] Following the IRA, the deadline to begin construction is extended to January 1, 2033.[84] A longer construction window is advantageous since it allows more time for completing the necessary project arrangements and plans, addressing the hurdles to commercialization, and letting well permitting be driven by commercial factors, such as the availability of CO_x emissions, rather than regulatory deadlines.[85]

D. *Payment Option*

Generally, eligible taxpayers can subtract a tax credit, dollar for dollar, from their income taxes, thereby using the value of the credit to reduce their tax bill and potentially increase their refund. However, certain entities such as state, local, and tribal governments; non-profit organizations; U.S. territories; and some tax-exempt organizations without federal tax liabilities may be interested in developing a CCUS project for environmental reasons and benefitting from fiscal incentives under 45Q. Thus, as a credit delivery mechanism, the IRA creates an elective pay (otherwise known as "direct pay") option allowing eligible tax-exempt entities to elect for direct payment options from the government instead

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78 *Id.*

79 *Id.*

80 26 U.S.C. § 45Q(d)(2).

81 *See* Bright, *supra* note 74.

82 Inflation Reduction Act of 2022 § 13104(a)(1).

83 *Inflation Reduction Act Provides Boost and Benefits to Carbon Capture Utilization and Storage Industry*, BAKER HOSTETLER (Aug. 23, 2022), https://www.bakerlaw.com/insights/inflation-reduction-act-provides-boost-and-benefits-to-carbon-capture-utilization-and-storage-industry/ [https://perma.cc/R5K9-GCZ4].

84 Inflation Reduction Act of 2022 § 13104(a)(1).

85 Oyewunmi & Talus, *supra* note 18 at 13–14.

of tax credits.[86] Under the amended IRC Section 6417, an applicable entity can make a direct-pay election, treating tax credits from a renewable energy project (including the Section 45Q credit for capture equipment originally placed in service after December 31, 2022) as equivalent to taxes paid on a filed return.[87]

Eligible partnerships or S corporations can select a direct-pay option if they are the owners of the capture equipment. Thus, they are permitted to opt for the direct-pay option for 45Q credits and receive the direct payment (as opposed to the individual partners or owners). The payment would be treated as tax-exempt income and allocated to the partners or shareholders based on their share of the credit.[88] The income resulting from the election would be treated as originating from an investment activity rather than from conducting a trade or business. Additionally, this would not be regarded as passive income to any partners or shareholders who do not materially participate.[89] The proposed rules released by the IRS provide that an applicable entity may engage with other entities, including for-profit partners, in certain types of ownership arrangements while preserving their ability to make a direct-pay election under IRC Section 6417(a) for its share of the applicable credits.[90]

E. *Transferability and Eligibility to Claim Credit*

The second IRA mechanism for delivering tax credits to applicable entities and project sponsors is provided under Section 6418 of the IRC, which establishes the process for transferring receivable tax credits.[91] Transferability allows entities that qualify for a tax credit but are not eligible to use elective pay (as discussed in (D) above) to transfer all or a portion of the credit to a third-party buyer in exchange for cash.[92] As a result, the transferability concept allows a taxpayer who generates tax credits under Section 45Q provisions for CCUS projects to elect to transfer (sell) all or

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86 *See* Section 6417 Elective Payment of Applicable Credits, 88 Fed. Reg. 40528 (June 21, 2023), https://public-inspection.federalregister.gov/2023-12798.pdf [https://perma.cc/UC6K-A2QF]; *IRS Issues Proposed Rules on Direct-Pay Elections of Applicable Energy Tax Credits*, ERNST & YOUNG, LLP: TAX NEWS (June 20, 2023) [hereinafter Ernest & Young, LLP], https://taxnews.ey.com/news/2023-1102-irs-issues-proposed-rules-on-direct-pay-elections-of-applicable-energy-tax-credits [https://perma.cc/EX6R-ZBYX]; Inflation Reduction Act of 2022 §§ 10101(b)(1), 13801(a).

87 *See Elective Pay and Transferability Frequently Asked Questions: Overview*, INTERNAL REVENUE SERV. (May 7, 2024), https://www.irs.gov/credits-deductions/elective-pay-and-transferability-frequently-asked-questions-overview [https://perma.cc/4JEZ-8FVG].

88 This share is determined under Treas. Reg. § 1.704-1(b)(4)(ii).

89 Ernst & Young LLP, *supra* note 86.

90 *Id.*

91 Inflation Reduction Act of 2022 § 13801(b); *see also Elective Pay and Transferability Frequently Asked Questions: Overview*, *supra* note 87.

92 *Elective Pay and Transferability Frequently Asked Questions: Overview*, *supra* note 87; *see* Section 6418 Transfer of Certain Credits, 88 Fed. Reg. 40496 (June 21, 2023).

a portion of the tax credit to an unrelated third-party transferee (buyer) in exchange for cash. For instance, under the typical CSSA mentioned in Part I, the service provider who owns or operates a CCS system and captures, transports, and sequesters CO_x could consequently earn 45Q credits. Based on the IRA transferability and eligibility provisions, such a party can transfer accruable credits to a third-party buyer for cash. In such transactions, the buyer and seller of the credits would negotiate and agree to the terms and pricing.[93] Given the IRA amendments, eligibility to transfer and claim the tax credits was extended to an entity that owns the capture equipment and physically or contractually ensures the disposal, utilization, or use as a tertiary injectant of the CO_2.

For partnerships or S corporations that directly own the capture facility or property for which an eligible credit is determined, the election to transfer an eligible credit is made at the entity level and no election by any partner or shareholder is allowed concerning such facility or property. Any amount received as consideration for a transferred eligible credit is treated as tax-exempt income. A partner's distributive share of the tax-exempt income is based on the partner's distributive share of the transferred eligible credit.[94]

IV. KEY PARTIES TO INVESTMENTS & FINANCING FOR CCUS PROJECTS

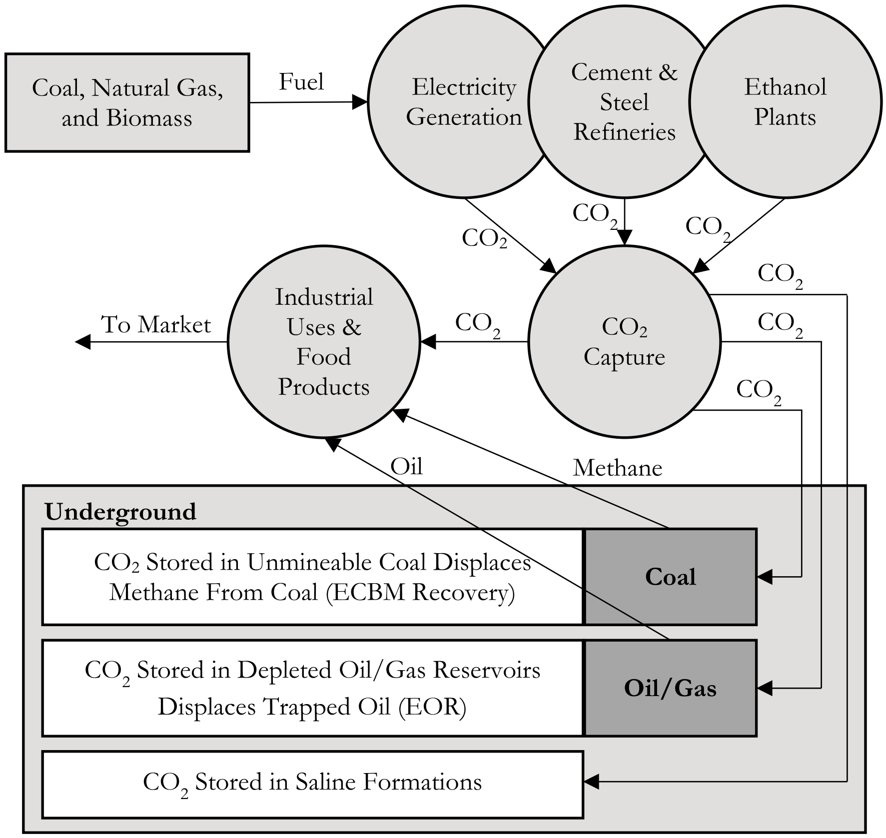
An integrated CCUS project involves capturing, utilizing, and injecting CO_2 into underground reservoirs for permanent sequestration. There are different interdependent segments and economic actors involved in executing the project when considered as a whole. Thus, the challenge of guaranteeing risks and contractual obligations for the actual offtake and transportation of captured CO_2 increases accordingly. The correlated risks and costs vary depending on factors such as the location of the point sources, volume and value of the CO_2 stream, and risks attributable to storage or sequestration requirements. There are about three or four principal participants in a typical project who will execute the commercial arrangements that tie together the various processes and segments. The participants include some variations of the following: (i) an emitter of CO_x, (ii) a capturer of CO_x, (iii) a transporter of CO_x, and (iv) the user or storer

93 The IRS Transferability Guidance clarifies that the eligibility for the transfer of credit is based on the eligibility of the transferor (which would be an entity that owns the capture equipment and physically or contractually ensures the disposal, utilization, or use as a tertiary injectant of the CO_2). In contrast, the ability to use that tax credit against taxable income is based on the attributes of the transferee. *See Elective Pay and Transferability Frequently Asked Questions: Overview*, *supra* note 87.

94 Transfer of Certain Credits, 89 Fed. Reg. 34770, 34770 (Apr. 30, 2024) (creating 'Rules for Partnerships and S Corporations' effective July 1, 2024).

of CO_x. In most cases, emitters are the owners of industrial facilities that emit CO_x as externalities in their primary business operations.

Figure 1: CCUS Project Options and Integration [95]



Project sponsors, investors, and service providers are expected to create a commercially viable structure connecting the different aspects of capturing CO_2, conveying it in its supercritical form, storing it permanently, or supplying it to other users as depicted in Figure 1 above. The required offtake and transportation arrangements may take either of the following two possible approaches or a variation depending on the peculiarities of the project and the facilities involved. The first approach is for the parties to execute separate agreements for(i) the purchase of CO_2 from the emitter in the form of a CPSA and (ii) transportation and sequestration services, respectively. Thus, the capturer could engage a carrier for transportation services using a CO_2 Transportation Contract

[95] Figure 1 is adapted from OFF. OF FOSSIL ENERGY, U.S. DEP'T OF ENERGY, UNITED STATES CARBON UTILIZATION AND STORAGE ATLAS 4 (4th ed. 2012) (available for download at https://edx.netl.doe.gov/dataset/the-united-states-2012-carbon-utilization-and-storage-atlas).

similar to a Gas Transportation Agreement; while also contracting with an underground storage site operator (possibly an affiliate of the carrier) for sequestration services. The second possible approach to structuring an offtake and transportation arrangement is to negotiate a CSSA through which the emitter or a group of emitters executes a single agreement with the capturer who is providing transportation and sequestration services. If the single agreement approach is adopted, the emitter engages a service provider whose business plan is to own, lease, construct, operate, or maintain a carbon capture system. Under such CSSA, the emitter or cluster of emitters would agree to engage the service provider exclusively to carry out sequestration services as defined under the contract.

In practice, parties and advisers may adopt hybrid or bespoke arrangements that are most efficient within the peculiar circumstances of the CCUS venture. For instance, depending on the technical and financial resources available to a typical transportation and sequestration services provider, the arrangement may provide the designated services directly or through subcontractors. Likewise, the service provider may also provide capture services in addition to transportation and sequestration. The relevant services and the conditions the parties operate under should be clearly stated under the applicable agreement. As an example of the highlighted concepts and the typical parties in CCUS arrangements, it was reported on March 4, 2024, that Valero Energy Corp, a major petroleum refiner and ethanol producer, recently agreed to participate in a proposed project led by Iowa-based Summit Carbon Solutions. Under the arrangement, Valero agrees to transport CO_2 from eight of its ethanol plants using Summit's proposed pipeline. The multi-state pipeline and CCUS project spanning the U.S. Midwest region also involves another ethanol producer.[96]

A. Tax Equity Arrangements

In deciding what commercial structure the offtake and transportation arrangements will take, it is essential to consider the main source(s) of financing (i.e., the form of corporate or project financing) and the role of equity investors vis-à-vis project developers in meeting the upfront capital requirements, allocating revenues and risks as well as managing the project itself. Figure 2 below illustrates how the financing aspects of a typical CCS investment arrangement are structured. In most cases, the project developers constitute the parent companies of the joint venture or special

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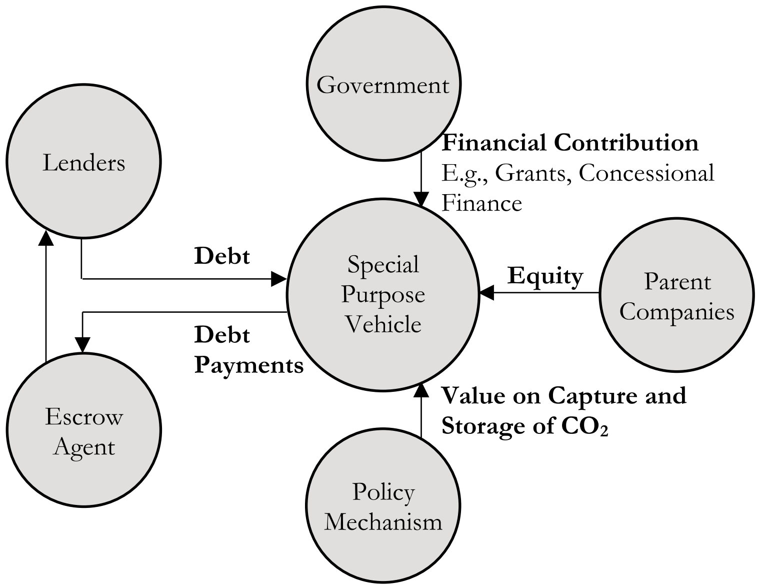
[96] Mrinalika Roy, *Valero Joins Summit's Carbon Capture Project*, REUTERS (Mar. 4, 2024) www.reuters.com/sustainability/climate-energy/valero-joins-summits-carbon-capture-project-2024-03-04/.

purpose vehicle and the tax credits attributable to captured CO_2 are a key element in accessing the value of the captured and stored carbon.

Figure 2: Project Financing for CCS Investment [97]



Before the IRA was enacted, project developers were forced to take on tax equity partnerships, thereby selling the right to use what ordinarily would be their tax credits.[98] Generally, a tax equity investment refers to arrangements that pair the tax credits or other tax benefits generated by a qualifying physical investment with the capital financing associated with that investment. These transactions involve one party agreeing to assign the rights to claim the tax credits to another party in exchange for an equity investment (i.e., cash financing) in the project or venture that generates the tax credit. The exchange is sometimes referred to as "monetizing," "selling," or "trading" the tax credits. The monetization of federal tax credits usually occurs within a partnership structure or contractual agreement. Either form should legally bind the relevant parties and satisfy federal tax requirements that the tax credit claimant has an ownership

97 Figure 2 is adapted from RASSOOL, *supra* note 5, at 13.

98 See Bright, *supra* note 74. The IRA now permits interested developers to choose an "elective payment" or "direct pay" that works like a tax refund. This is considered "one of the most impactful amendments" of the law. With elective pay, an eligible entity that qualifies for an applicable tax credit can notify the IRS of its intent to claim the credit and file an annual tax return to claim elective pay for the full value of the credit.

interest in the underlying physical investment that generates the tax credit.[99]

Under the partnership structure, there is usually the possibility for income (or losses), deductions, and other tax item allocations for the individual partners. In some cases, non-profit entities can form a partnership with taxable investors with enough tax liabilities, thus, the non-profit can indirectly benefit through the partnership.[100] In a partnership flip structure, the owner of the industrial facility forms a partnership with a tax-equity investor to own the capture equipment. Tax credits must be shared by partners in the same ratio they share in income or loss, depending on whether the partnership is expected to generate cash flow.[101] If the partnership activities will generate gross receipts, then the credits must be shared by partners in the same ratio that partnership income is allocated. Otherwise, they are shared in the same ratio as losses.[102]

The tax equity arrangement can also be structured as a sale-leaseback where the capture equipment is sold to a tax equity investor and leased back. The lease would have to require the lessee to dispose of the captured CO_2. Other possible structures are an outright sale of the carbon capture equipment to the tax equity investor or a disposal contract where the tax equity investor agrees to be responsible for disposing the CO_2 but subcontracts the actual physical disposal to someone else. Thus, in most tax equity transactions, the tax-credit-eligible assets (i.e., the qualified equipment with the capacity to capture and treat CO_x at the specified capture threshold level and built within the timeline envisaged under the 45Q provisions, etc.) are sold to a joint venture or special purpose vehicle. As depicted in Figure 1 above, the special purpose joint venture will ideally be between the developer and the tax equity investor, while the tax-eligible assets would be sold at a fair market value. A major issue in all the arrangements is that the transaction should allow the joint venture or special purpose vehicle to be eligible to claim the credit, thus, parties must carefully consider the arrangement's compliance with extant 45Q eligibility requirements as well as arrangements with the lenders who will be

99 MARK P. KEIGHTLEY, DONALD J. MARPLES & MOLLY F. SHERLOCK, TAX EQUITY FINANCING: AN INTRODUCTION AND POLICY CONSIDERATIONS 1–2 (2019), https://sgp.fas.org/crs/misc/R45693.pdf [https://perma.cc/5B3N-7KSG]; Keith Martin, *Tax Credits for Carbon Capture*, NORTON ROSE FULBRIGHT: PROJECT FIN. NEWS (Feb. 18, 2021), www.projectfinance.law/publications/2021/february/tax-credits-for-carbon-capture/ [https://perma.cc/WBM8-QBBW].

100 KEIGHTLEY, MARPLES & SHERLOCK, *supra* note 99.

101 Martin, *supra* note 99. The U.S. Internal Revenue Service (IRS) issued guidelines for carbon capture tax equity transactions that are structured as partnership flips. These guidelines can be found in Rev. Proc. 2020-12, https://www.irs.gov/pub/irs-drop/rp-20-12.pdf [https://perma.cc/3TJL-2Q2L].

102 Martin, *supra* note 99.

providing project financing vis-à-vis the tax-eligible assets of the joint venture company.

A tax equity investor's return depends on the price paid per credit and associated benefits the investor secures in exchange. In an ideal scenario, the main benefit the investor receives from the credits is the ability to reduce their tax liability. For example, consider a project that will cost $1.5 million to complete and that will generate $1 million in federal tax credits that its owner is seeking to sell to finance the upfront cost of the project. An outside investor has agreed to contribute 90 cents in equity financing in exchange for each $1.00 of tax credit. Thus, the investor pays (contributes capital) $900,000 in exchange for $1 million in tax credits. The net return to the investor is $100,000 (in reduced taxes) or 11.1% ($100,000 divided by $900,000).[103] The price investors are willing to pay for tax credits depends not only on the benefits attached to the credits but also on the risks associated with the underlying project. These include risks associated with the project such as recapture risks and long-term liability issues. Other issues include how the project is financed and the period over which benefits accrue, which under the 45Q is twelve years after the capture facility is placed in service.

Tax credits mainly go to offset and reduce tax liabilities; thus, potential developers or investors may be dissuaded if they do not have enough tax liabilities to justify the equity investment in the venture. Therefore, it may be a challenging option for potential project developers because they would only have their taxes offset if they had sufficiently large enough tax liabilities, and to the extent of their investments in the joint venture or special purpose company.[104] Further, such transactions have the adverse impact of creating structural and transactional costs which effectively chip away at the cash value of the credits. Despite the drawbacks, these equity investment arrangements are common and useful in boosting investments in capital-intensive projects that are largely driven by government subsidies and tax credits.

In addition to providing a source of upfront financing, tax equity investors can play a crucial role in evaluating the quality of projects before investing as well as providing continuing oversight and compliance monitoring. The tax equity mechanism outsources a portion of the oversight and compliance monitoring to investors in exchange for a financial return. On the one hand, there may be value to the federal government in being able to rely on outside investors to provide oversight and monitoring. On the other hand, for some tax equity programs that

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103 KEIGHTLEY, MARPLES & SHERLOCK, *supra* note 99, at 3.

104 Oyewunmi & Talus, *supra* note 18.

have a government entity overseeing participant compliance, the monitor role of investors may be redundant.[105]

B. *Conceptualizing Risk Management*

The notion of risk aversion in finance and economics signifies a rational individual's or corporation's general attitude toward avoiding risk or uncertain welfare outcomes of major investment decisions. Hence, a rational investor, financier, or private corporation involved in a capital-intensive venture involving a significant level of risk, such as CCUS projects, can reasonably be expected to be risk-averse. Finance and risk management pundits opine that a risk-averse agent who typically invests with caution may like risky lotteries if the expected payoffs are large enough or the expected gains come with a reasonable level of certainty.[106] In other words, a rational investor may engage in seemingly risky ventures if the returns on the investments are dependable (perhaps due to government policy backing and contractual mechanisms embedded in the financing structure and offtake arrangement) and sufficient in its welfare implications. A commercially-minded investor may want to purchase risky assets if their expected returns exceed the risk-free rate.[107] Thus, it is important to determine the optimal trade-off between the expected gain and the degree of risk by assessing the effect of risk on welfare (i.e., the benefit or utility gained) and the implications of the investment decision.

When faced with two investment opportunities and limited financial resources, the risk-neutral investor would ordinarily consider the potential gains of each investment and ignore the potential downside risk, while a risk-averse investor would pass up the opportunity for a large gain in favor of safety. Such concepts are useful in understanding a party's disposition while negotiating carbon offtake and transportation agreements under the current U.S. investment, legal, and policy environment. Corporate economic actors like lenders, tax-equity investors, or project developers, that are risk-averse would prefer investments that offer a guaranteed, or

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105 KEIGHTLEY, MARPLES & SHERLOCK, *supra* note 99, at 10.

106 EECKHOUDT, GOLLIER & SCHLESINGER, *supra* note 4, at 9–10; *Risk Aversion*, *supra* note 3; Almeida, Hankins & Williams, *supra* note 3, at 4179–4215. In Froot, Scharfstein & Stein, *supra* note 3, the authors consider risk management as a means of coordinating corporate investments and financing policies and observe that- if external sources of finance are more costly to a corporation than internally generated funds, there will typically be a benefit to hedging since it will help to ensure that a corporation has sufficient internal funds available to take advantage of attractive investment opportunities. In this context, if the firm does not hedge, there will be some variability in the cash flows generated by assets in place. Such variability in internal cash flow and the firm's investments will generally be undesirable to the extent it leads to diminishing marginal returns overall. *See id.* at 1629–31.

107 EECKHOUDT, GOLLIER & SCHLESINGER, *supra* note 4, at 9–10.

"risk-free" return.[108] Such economic actors with a higher risk tolerance or lower levels of risk aversion are willing to accept greater levels of risk in exchange for the opportunity to earn higher returns on investment or at least a certain level of returns.[109] Arguably, the increasing value of captured CO_2 under the IRA, improvements in the eligibility and transferability of 45Q credits, the possibility of twelve years to claim credits after a capture facility is placed in service, and the IIJA funding for demonstration and pilot projects, alleviate some of the critical risk factors that previously distorted commercially viable CCUS projects.

In a 2021 report on "unlocking private finance to support CCS" the Global CCS Institute notes that investment risks for CCS can be broadly categorized into general project or mitigable risks, and hard-to-reduce risks. Examples of the latter category include revenue risk arising from an insufficient value on CO_2 emissions, risks arising from the interdependency of segments in the CCS value chain, and long-term storage liability risks.[110] The measures to address general project risks are developed and implemented by the project sponsors and contracting parties as CCS projects evolve. Hard-to-reduce risks usually require input and measures from private project sponsors, public stakeholders, and government policymakers. If not effectively addressed, the hard-to-reduce category could lead to lack of project feasibility and the inability of sponsoring parties to reach a FID.[111]

For a potential capturer or project developer, the main impediment to investment is often the absence of an adequate carbon price that places a compelling value on emissions reductions.[112] Without this, there is usually little or no incentive to incur the costs of constructing and operating a capture facility or retrofitting an existing industrial facility. As noted by the Global CCS Institute regarding the risks arising from the interdependency of segments in the CCS value chain and long-term storage liability issues:

> CCS projects require the coordination of several activities, often with multiple investment decisions, and each with long lead times. Taking decisions to develop each element of the CCS value chain exposes various risks associated with relative timing and capacity management. This interdependency continues during the operational phase.

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108 *Risk Aversion*, *supra* note 3.

109 *Id.*

110 RASSOOL, *supra* note 5, at 8–9; *see* DOMINIC RASSOOL & IAN HAVERCROFT, FINANCING CCS IN DEVELOPING COUNTRIES 8–11, 19 (2021), www.globalccsinstitute.com/wp-content/uploads/2021/04/Financing-CCS-In-Developing-Countries-V2-1.pdf [https://perma.cc/AK8S-JKW4].

111 RASSOOL, *supra* note 5, at 8–11.

112 *See* FATTOUH, MUSLEMANI & JEWAD, *supra* note 47, at 8–10.

> One component of the CCS value chain's failure may affect others' costs and revenues and prevent the value chain from performing as a whole . . . . While the risk of leakage from geological storage is diminishingly small, it is not zero. This presents a significant risk to CCS project owners if they remain liable for the risk of leakage over an indefinite period since the value of this contingent liability is very likely to increase with time (e.g. as carbon prices rise). For CCS projects to become investible, public policy plays an essential role in managing hard-to-reduce risks.[113]

From the above discussion on the disposition of an ideal and rational investor interested in risky ventures that require considerable upfront capital investment, such as CCUS, policy-support through incentive-based instruments like tax credits, promotion of research and developments, and contractual tools that make projects more feasible and bankable are essential.

As of 2022, most of the investments in CCS facilities currently operating at a commercial-scale worldwide have been made by large corporations and state-owned enterprises. These first-generation CCS project sponsors had to rely significantly on government policy and corporate financing (i.e., funding projects directly by relying on the corporation's balance sheet) rather than project financing through commercial banks.[114] These corporate emitters tend to have deep knowledge of the technologies and practices that underpin CCS such as gas processing, pipelines, subsurface characterization, and underground geologic storage and injection.[115] Corporations operating in such sectors are more comfortable with CCS project risks than other emitters and are large enough to absorb the costs of these risks if they materialize. Thus, the combination of low-cost opportunities to capture CO_x, enabling policy measures, and emerging opportunities to sell the captured CO_x has led to an increase in CCS projects.[116]

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113 RASSOOL, *supra* note 5, at 8.

114 *Id.* at 12–16.

115 *See* OFF. OF FOSSIL ENERGY, U.S. DEP'T OF ENERGY, UNITED STATES CARBON UTILIZATION AND STORAGE ATLAS 12–14 (5th ed. 2015) www.netl.doe.gov/sites/default/files/2018-10/ATLAS-V-2015.pdf. For instance, CO2 storage methodologies and approaches are similar and get significant expertise and know-how from existing knowledge about subsurface oil and gas reservoirs, and geological interactions. Most energy companies are also very familiar with pipelines and gas processing which is necessary for carbon capture and transportation.

116 RASSOOL, *supra* note 5, at 12–16.

Deploying carbon capture systems at the necessary scale and pace to contribute meaningfully to climate change mitigation and decarbonization goals requires robust public policy support, incentives, and financial derisking. The corporate finance model involves a single corporation that develops the project and finances all its costs. The corporation may choose to implement the project through a subsidiary, which would then be consolidated into the corporation's financial accounts. However, not all companies are large enough to develop projects in this manner. Thus, while corporate finance is generally considered efficient, it is often unable to deliver the volume of investments required to meet the number of CCS projects envisaged under projections such as the IEA SDS.[117]

An alternative to the corporate financing approach is the project finance model. Project financing allows multiple equity investors to participate in a single venture and the financiers have no recourse to the assets of project owners.[118] Debt provided through project finance is referred to as non-recourse debt, which is charged at higher interest rates than corporate debt.[119] Under the project finance approach, the venture is set up through a standalone company (i.e., the joint venture or special purpose vehicle as depicted in Figure 2 above) and each investor has an equity stake.[120] Importantly, the capital for the project is raised based on future cashflows from project output or sales.[121] Securing a final investment decision through project finance entirely depends on future projected cash flows, requiring thorough scrutiny and due diligence beforehand. Usually, the strain between the interests of lenders and the interests of project sponsors and equity investors plays out during the negotiations of relevant loan and project structuring agreements such as the CPSA and CSSA.

The eventual terms and conditions agreed to, and the project structure adopted to mitigate risks will often depend on the creditworthiness of the sponsors, the location and economics of the project, and the risks inherent in the project itself.[122] For instance, in July 2020, after capturing an estimated 3.9 million tons of CO_2, the operator of the Petra Nova project announced it planned to cease its capture operations at its plant until

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117 *Id.*

118 *Id.*

119 Nonrecourse refers to a type of debt where the creditor may only look to the collateral to satisfy the unpaid loan, and not the debtor's personal assets (as with a recourse loan). *See Recourse*, CORNELL L. SCH., LEGAL INFO. INST., https://www.law.cornell.edu/wex/nonrecourse [https://perma.cc/8PAU-FT45] (last visited Aug. 7, 2024).

120 *Infra* Figure 2.

121 *Id.*

122 David Blumental, *Sources of Funds and Risk Management for International Energy Projects*, 16 BERKELEY J. INT'L L. 267, 275 (1998).

economics improve.[123] The Texas-based project was designed to capture CO_2 from a 240 Megawatt flue gas slipstream from a coal-fired unit, and the captured CO_2 was supposed to be transported and injected into an oil field to increase crude oil production.[124] A major reason for the 2020 shutdown was the historic drop in oil prices brought on by the COVID-19 demand shock, coupled with increases in the OPEC+ nations. Plus, the Petra Nova plant struggled to maintain profitability, which was primarily hinged on capturing CO_2 for EOR and thus suffered from the price and market of oil as well. The Petro Nova project sponsors and owners reported restarting it in 2023.[125] Given this experience, it is noted that CCUS-EOR projects may be impacted by external commodity price exposures and other project-specific operational challenges worth addressing while negotiating and developing future projects.[126]

C. *Securing Project Viability*

Developing large-scale infrastructural projects typically require significant upfront capital investments and firm commitments from participants. In commercially risky ventures involving different interdependent aspects such as CCUS, the sponsors, investors, and lenders would need to carefully determine whether the project is technically and financially feasible. In this regard, financial feasibility implies that the project company or special purpose vehicle can recoup the costs of developing, building, and operating the scheme, and earn a reasonable return following the sale of its output. In a CCUS context, the main revenue earner is the captured CO_x stream, or the services performed to transport and sequester such molecules. The relevant parties must ensure the necessary conditions and obligations and maintain a feasible and viable venture as agreed under the relevant offtake arrangement. Currently, most commercial-scale CCUS deployment has occurred across low-cost capture opportunities. These are opportunities, such as natural gas processing, where the separation of CO_2 gas from methane is standard industry practice.[127] This approach reduces a project's capital requirement since the capture facility's most costly component is already in place and operational.

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123 Lee et al., *supra* note 28, at 49; *see also* Suzanne Mattei & David Schlissel, *The Ill-Fated Petra Nova CCS Project: NRG Energy Throws in The Towel*, INST. FOR ENERGY ECON. & FIN. ANALYSIS (Oct. 5, 2022), https://ieefa.org/resources/ill-fated-petra-nova-ccs-project-nrg-energy-throws-towel [https://perma.cc/38M4-2UK9].

124 Lee et al., *supra* note 28, at 49.

125 *Groundbreaking Petra Nova CCS Project Back Up and Running, Owner Says*, POWER ENG'G (Sept. 14, 2023), www.power-eng.com/emissions/groundbreaking-petra-nova-ccs-project-back-up-and-running-owner-says/ [https://perma.cc/5F5D-MZ9F].

126 *Id.*

127 RASSOOL, *supra* note 5, at 12–16.

Thus, any additional cost incurred in such a context for the CCUS project would be limited to compression, transport, and storage.

Some of the main categories of risks encountered in the process of executing offtake agreements include demand risks, revenue-related risks, and market or pricing risks. Most offtake agreements are negotiated to mitigate these risks by (i) providing the project company with a committed buyer or user for its product; (ii) establishing and, when necessary, reviewing the pricing of the product or service; and (iii) clarifying the terms and conditions under which the offtaker is required to purchase the project's output. For large-scale capital-intensive projects, most parties usually prefer a firm long-term offtake agreement with agreed-upon and reviewable prices or pricing formulae as a means of securing project viability. In cases with less secure or firm agreements, the lenders may require credit enhancement mechanisms, including additional equity contributions from the project sponsor and hedging agreements to mitigate revenue risk.[128]

D. Take-or-Pay, Minimum Volume Commitments, and Shortfalls

As already noted, carbon capture and sequestration projects are capital-intensive. Project-by-project costs may vary based upon several factors including the costs and availability of materials, equipment and skilled labor, choice of capture technology, and the density of the applicable CO_2 stream. The capital costs associated with these projects may range from $15 to $ 25 per ton of CO_2 for projects capturing high-density CO_2 streams to $40 to $120 per ton for low-density projects.[129] A project developer may primarily recoup its costs by capturing and sequestering carbon in volumes consistent with expectations at project onset. Therefore, the offtaker is exposed to project risk if the promised volumes are not delivered. To protect against such concerns, it has become popular for CO_2 offtakers to negotiate for the inclusion of a minimum volume commitment (MVC) on the part of the CO_2 emitter.

The MVC is a take-or-pay concept commonly found in similar throughput agreements in other industries such as natural gas, natural gas liquids, or crude oil production, and it typically takes the form of a contractual covenant by the emitter to provide an agreed-upon minimum volume of CO_2 periodically.[130] If the emitter fails to deliver the minimum

128 Froot, Scharfstein & Stein, *supra* note 3, at 1629–31.

129 Adam Baylin-Stern & Niels Berghout, *Is Carbon Capture Too Expensive?*, INT'L ENERGY AGENCY (Feb. 17, 2021), www.iea.org/commentaries/is-carbon-capture-too-expensive [https://perma.cc/3VUT-TYLV].

130 Elizabeth L. McGinley et al., *Critical Issues for Carbon Capture Projects: Tax, Environmental, Land Rights, and Commercial Issues*, 68 NAT. RES. & ENERGY L. INST. 7-1 (2022).

committed volume during an applicable period, it will be obligated to pay the offtaker a deficiency payment equal to the amount of the volume shortfall multiplied by the per-unit contract price. Many agreements will provide for an exception to the MVC if a shortfall falls within an agreed *de minimis* event or interruption of the offtaker's services.[131]

An author's copy of a CPSA designed to take carbon from a fertilizer plant defines the "Minimum Volume" under the agreement as (i) for the first Contract Year, 500,000 Short Tons of CO_2 and (ii) for the remainder of the contractual term, 750,000 Short Tons of CO_2 per contract year, minus any permanently released volumes that is permitted under the agreement. The agreement also includes definitions for shortfall volumes and monthly minimum volumes. Arguably, this definition for minimum volumes bears in mind the offtaker's reliance on being qualified to claim tax credits under the 45Q provisions. As noted earlier, before the passage of the IRA, project developers were ineligible for the tax credit without meeting a requirement of 500,000 tons of CO_2 for power generation and 100,000 tons for all other projects. This high capture threshold stipulated before the IRA's 2022 amendments posed a significant barrier to financing. However, the current lower capture threshold under the IRA now allows operators capable of capturing lesser amounts of carbon to enter into CPSAs knowing they can qualify to earn tax credit and secure necessary backup financial guarantees to support the MVC.[132]

Offtake agreements with MVCs may also contain a "banking" provision, where the CO_2 emitter can roll forward or credit volumes of CO_2 exceeding the MVC toward future MVC obligations. Such banking may be made available on a rolling basis with respect to all excess volumes during the preceding term of the offtake agreement, or may be limited to, for example, only the preceding contract month. Often, the MVC is given in exchange for a firm service commitment by the offtaker. A provision for "firm service" is a qualified guarantee by the offtaker to make available a certain amount of contracted capacity for the emitter's CO_2,[133] or compensate the emitter for losses arising from its failure provide the firm capacity.[134] While often desirable to the CO_2 emitter, for projects which fundamentally rely on the removal of CO_2, such as blue hydrogen

131 Arthur J. Wright, Anna R. Irion & Laranne A. Breagy, *You Found It, Now What Do You Do With It? Gas and Oil Gathering in New Shale Plays*, 58 ROCKY MTN. MIN. L. INST. 5-1 (2012).

132 As stated in Table 1 above, to qualify for 45Q tax credits, the IRA provides for a lower yearly carbon capture threshold, i.e., 18.750 metric tons for power plants (with a carbon capture capacity of 75% of baseline CO_2 production), 12,500 metric tons for industrial facilities, and 1,000 metric tons for DAC.

133 Wright, Irion & Breagy, *supra* note 131.

134 *Id.*

production via steam methane reformation or projects with utilization components, firm service may be a requirement.[135] Thus, the firm service volume is a commercial point to be negotiated by the parties, but absent other factors should equal or exceed the applicable MVC, if any.

Offtake agreements may also contain provisions authorizing the offtaker to accept volumes exceeding the firm service commitment volume on an interruptible basis. The provision for "interruptible service" relates to a service that can be interrupted any time there is insufficient capacity after giving priority to the firm service customers.[136] Normally, if there is an interruption or capacity shortfall, the offtake agreement may authorize the offtaker to limit service relating to interruptible volumes on a pro-rata basis. However, it may be advisable for offtakers to negotiate for the right to give priority to higher-value CO_2 volumes. If such an interruptible service provision is included, the parties may wish to establish whether interruptible volumes offered by the emitter, but not accepted by the offtaker, may be credited toward future MVCs under the banking provision.

E. *Fee Structure, Tax Credits, and CCUS*

The party claiming Section 45Q tax credits and other environmental attributes would ideally drive the fee and payment structure for the offtake and transportation arrangement. To claim Section 45Q tax credits, a party must own at least one component of the capture equipment and contract for disposal, EOR, enhanced gas recovery (EGR), or utilization of the CO_2.[137] If the capturer claims the Section 45Q tax credits, it will typically pay a service fee to the service provider for each ton of CO_2 that is transported and sequestered.[138] The service fee may be accompanied by a

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135 *Id.*

136 In the gas supply industry, pipeline companies and operators ideally schedule their capacity based on a system of nominations, and, when necessary, restrict service based on the type of service contracted. These pipelines and/or storage operators could offer to their customers: (1) firm service, whereby a shipper chooses to pay a monthly reservation charge to the pipeline that entitles it to transport or store a certain quantity of gas each day, assuming the shipper nominates the quantity and delivers to the pipeline the equivalent amount of natural gas at the receipt points specified in the contract; and (2) interruptible service in which a gas supplier or pipeline operator has the option of interrupting the fuel supply for contractually stipulated reasons. *See Natural Gas Power Plants Purchase Fuel Using Different Types* of *Contracts*, U.S. ENERGY INFO. ADMIN. (Feb. 27, 2018), https://www.eia.gov/todayinenergy/detail.php?id=35112 [https://perma.cc/KUB7-G484] (explaining the role of firm and interruptible contracts in the context of gas offtake arrangements between gas-fired power plant operators, producers, and pipeline companies).

137 *See supra* Table 1.

138 *See* ASS'N OF INT'L ENERGY NEGOTS., WHITE PAPER CARBON CAPTURE, USE AND STORAGE (CCUS) 8 (2023), https://www.aien.org/wp-

separate capital recovery fee for the service provider to recoup capital outlay in constructing transportation and/or sequestration facilities, or capital recovery may be blended with the base service fee and assessed as a single charge. Such fees are typically subject to automatic escalation in proportion with increases, if any, in the value of Section 45Q tax credits, including via inflation adjustment. If the service provider is the capturer and claims the Section 45Q tax credits, it may: (i) purchase the CO_2 from the emitter and therefore bear all development costs related to the capture, transport, and sequester facilities; (ii) pay to the emitter an amount equal to a portion of the value it derives from the Section 45Q credits; or (iii) some hybrid of the above to achieve the expected value-sharing percentage.

Examples of common CO_2 emitters include ethanol producers, gas- and coal-fired power generators, gas processing plants, ammonia facilities, and other industrial facilities. In most cases, CO_2 capturers are also the main sponsors of the CCUS project.[139] They own or lease the carbon capture equipment that attaches to the emitter's facilities and will be the party that earns the available tax credits under Section 45Q. Transporters of CO_2 are necessary to ensure the delivery of captured volumes to the ultimate end-user, the storage facility where those volumes are sequestered, or both. The most common method of CO_2 transportation is through a pipeline.[140] In a sequestration project such as those executed under a CSSA, the storage site operator will generally own or have the rights to use and maintain the underground storage site for sequestration purposes. One entity could take on multiple roles as part of a CCUS project. For example, an industrial facility operator may function as both an emitter and capturer of CO_2 if it desires to invest in the carbon capture equipment needed to remove CO_2 from its primary operations.[141] Likewise, the party contracting as a capturer, user, or storer could take on the role of transporter for all or a portion of the project and build out the applicable pipeline network as part of its primary role in the project.[142]

content/uploads/2024/03/AIEN-CCUS-Whitepaper.pdf [https://perma.cc/AT6F-M2CG]; Deanne Barrow & Keith Martin, *Carbon Capture Terms*, *in* TARIFFS, INFLATION AND OTHER CHALLENGES, June 2022, at 20, 20–21, https://www.projectfinance.law/media/5762/pfn_0622a.pdf [https://perma.cc/Y79E-WPMQ].

139 Lee et al., *supra* note 28.

140 *Id.*

141 *Id.*

142 *Id.*

At the moment, tax credits under Section 45Q are the main economic driver of CCUS projects in the United States.[143] For utilization projects, there could also be a revenue stream generated from the sale of CO_2 to the user that will contribute to the economics of the project. A key transactional objective of parties will be backstopping the main economic drivers usually by guaranteeing the ability of the project to be financed by third-party investors and capital providers. A recent report by the Global CCS Institute reviewing the Midwest CCS CO_2 Hubs project noted that the lack of firm CO_2 volume guarantees by investment grade emitters added considerable risks to the project overall.[144] Furthermore, financial risk increases with the size of the pipeline and dependency on time-sensitive federal subsidies.[145] The project was designed to leverage ethanol as a low-cost CCS application and aim to decarbonize a hub of Midwest industrial and power plants.[146] It is important to ensure that the processes and facilities utilized by the project meet the requirements of Section 45Q so that tax credits can be earned. Additionally, the risk of recaptured tax credits due to leakage of CO_2 during use or sequestration should be addressed in the CPSA. Finally, the parties should attempt to secure the availability of a minimum level of CO_2 as necessary to meet the anticipated economic assumptions underlying the business case for the project.[147]

Globally, there were about thirty operational and seventy CCUS projects in advanced developmental phases as of 2022.[148] For instance, the Boundary Dam project in Canada is the first commercial-scale power plant with CCS and began operations in 2014. The operators capture, transport by pipeline, and sell most of the CO_2 for EOR; while the remaining is stored in a deep saline aquifer at a nearby experimental injection site.[149]

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143 Tade Oyewunmi, *Offtake and Transportation Agreements for U.S. Carbon Capture Projects*, KLEINMAN CTR. FOR ENERGY POL'Y INSIGHTS NEWSL. (July 17, 2024), https://kleinmanenergy.upenn.edu/news-insights/offtake-and-transportation-agreements-for-u-s-carbon-capture-projects/ [https://perma.cc/3P85-ZSEL].

144 SELIM CEVIKEL & JERRAD THOMAS, THE INVESTMENT CASE FOR CCS: POLICY DRIVE AND CASE STUDIES 17–23 (2023), https://www.globalccsinstitute.com/wp-content/uploads/2023/11/The-Investment-Case-for-CCS-Policy-Drive-Case-Studies.pdf [https://perma.cc/AV8K-RXPF].

145 *Id.*

146 *Id.*

147 Lee et al., *supra* note 28, at 68.

148 MATT STEYN ET AL., GLOBAL STATUS OF CCS 2022 7 (2023), https://status22.globalccsinstitute.com/wp-content/uploads/2023/03/GCCSI_Global-Report-2022_PDF_FINAL-01-03-23.pdf [https://perma.cc/528M-7ZYF]; Oyewunmi, *supra* note 1.

149 *Boundary Dam Fact Sheet: Carbon Capture and Storage Project*, MASS. INST. TECH.: CARBON CAPTURE & SEQUESTRATION TECHS., http://sequestration.mit.edu/tools/projects/boundary_dam.html (last visited Aug. 7., 2024). By March 2022, the plant had captured over 4.3 million metric tons of CO_2 since full-time operations began in October 2014. The project injected 370,000 metric tons of CO_2 for geologic sequestration as of 2021. *See* JONES & LAWSON, *supra* note 37.

Examples from the U.S. include (i) the Bell Creek Project in Montana, which is one of the first projects developed to demonstrate that commercial EOR operations can safely and cost-effectively store significant amounts of CO_2;[150] (ii) the Red Trail Energy CCS Project in North Dakota, which began assessing the technical and economic feasibility of integrating CCS with ethanol production to reduce net CO_2 emissions in 2016;[151] and (iii) the Wyoming CarbonSAFE project.[152] Notably, Shell's CANSOLV CO_2 capture system is expected to capture CO_2 emissions from processed flue gas and a combined cycle gas turbine (CCGT) power plant.[153] Examples of widely deployed CCUS applications include the chemical absorption of CO_2 from ammonia production and natural gas processing, CO_2 use in the production of fertilizer (urea), and long-distance pipeline transport and injection of CO_2 for EOR.[154] Examples of applications in demonstration phases and early adoption stages include the chemical absorption from coal-fired power generation and hydrogen production from natural gas, the Allam Cycle power plant that uses supercritical CO_2 to drive an electricity-generating turbine, compression of CO_2 from bioethanol production and coal-to-chemicals plants, and CO_2 storage in saline aquifers.[155]

V. OWNERSHIP INTERESTS AND ENVIRONMENTAL ATTRIBUTES OF CAPTURED CO_2

Absent an agreement to the contrary, the carbon emitter is the owner of the carbon emissions it generates, together with any related environmental attributes (subject to applicable law). As discussed in Part III, the emitter physically ensures the sequestration or utilization of COx and can claim Section 45Q credits. The taxpayer that owns the carbon capture equipment may elect to allow the disposer or end user of the

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150 *Bell Creek Project Fact Sheet: Carbon Capture and Storage Project*, MASS. INST. TECH., CARBON CAPTURE & SEQUESTRATION TECHS., http://sequestration.mit.edu/tools/projects/bell_creek.html (last visited Aug. 7., 2024); *Projects*, PLAINS CO_2 REDUCTION P'SHIP, https://pcor.undeerc.org/Projects.aspx [https://perma.cc/ZH4X-J6T3] (last visited Aug. 7, 2024).

151 *Projects*, *supra* note 146.

152 STEYN ET AL., *supra* note 148, at 18.

153 *Shell Catalysts & Technologies, Technip Energies and Zachry Group Selected for Calpine's Carbon Capture Unit Project in Texas*, SHELL (Mar. 14, 2023), www.shell.com/business-customers/catalysts-technologies/resources-library/catalysts-technologies-technip-energies-zachry-group-calpine-carbon-capture-unit.html [https://perma.cc/BN9M-TBZM].

154 NAIMOLI STEPHEN & SARAH LADISLAW, CLIMATE SOLUTIONS SERIES: DECARBONIZING HEAVY INDUSTRY 2 (2020), https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/201005_Naimoli_Ladislaw_Climate_Solutions_Decarbonizing_Heavy_Industry.pdf [https://perma.cc/A5G4-954X].

155 *Id.* Applications such as DAC and CO_2 capture from cement, iron, and steel making are still at the demonstration or prototype stage. *See* JONES & LAWSON, *supra* note 37.

qualified CO_x to claim the credit. The owner of the capture equipment may or may not be the emitter or the offtaker who is buying the captured carbon molecules.[156] As such, it is necessary for offtake agreements to include an express transfer of title to, and liability for, the captured carbon from the emitter to the offtaker. The consideration for such transfer may vary depending on several factors, including the allocation of capital costs between the parties, emission volumes, transportation and sequestration costs, and the emitter's commercial objectives in pursuing the project.

Because the utility and qualification for carbon attributes (credits, allowances, offsets, etc.) are continually evolving in the United States and elsewhere, it may be advisable for parties to a carbon offtake and transportation agreement to expressly establish whether the right to claim such attributes, including any prospective future attributes and title to the physical CO_2, is retained by the emitter or transferred to the offtaker or sequestration service provider, as applicable. Note that in a typical CSSA, the term "sequestration" is regarded as the storage, injection, sequestration, and monitoring of CO_2 at the sequestration site, while "sequestration services" would ordinarily include the receipt of all flue gas available at the receipt point, capture of CO_2, transportation of CO_2 to the delivery points, and sequestration of the CO_2. Thus, a service provider in such a context would be keen to expressly agree to which party takes the essential and valued attributes and property rights of the project's output.

The main driver of project feasibility for CCUS has been the environmental and ownership attributes of the captured CO_2 and the eligibility to claim tax credits under Section 45Q. As a form of incentive-based regulatory mechanism, tax credits typically amount to a subsidy designed to allow a taxpayer to avoid taxation on developments or revenue that was otherwise taxable. It could be a useful means of boosting investments in high-risk emerging industries or systems, like CCUS applications in industrial settings. However, subsidies can create a "perverse incentive" and profit-minded operators could increase externalities, pollution, or wrong activities to attract more subsidies without necessarily providing the goods and services or meeting the objectives for which the subsidies and credits were granted. The objectives, in this case, include delivering and securing decarbonization via investments in CCUS. In this vein, it is noted that Section 6418(g)(1) of the IRC provides that as a condition of, and before, any transfer of any portion of an eligible credit under section 6418 (discussed above), the Secretary of the Treasury may require registration and details of appropriate or necessary information to prevent duplication, fraud, improper payments, or excessive payments of the applicable credits.

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[156] 26 U.S.C. § 45Q(f)(3)(A).

During the hearing of the proposed rule on transferability of credits, stakeholders requested additional information about this provision and requested that the regulations balance the need to prevent fraud and abuse with the burden on taxpayers.[157] Stakeholders therefore recommended a registration system that assigns a transfer number to an eligible taxpayer that can be used by taxpayers to claim transferred credits and allows the IRS to track transfers of eligible credits.[158] Going forward, this would be an important obligation to monitor and assign while negotiating offtake and transportation agreements that have some risk of recapture and loss of the underlying environmental attributes or change of ownership through the transfer of the tax credits.

VI. TRANSACTIONAL RISKS, CONDITIONS, AND VALUE RECAPTURE ISSUES

Generally, indemnities, warranties, conditions precedent, and *force majeure* provisions are important tools for allocating risks and qualifying liabilities in a contract. They may be used to indicate a party's ability and acceptance to insure against (or bear) certain project risks. A warranty is a statement or promise, either express or implied, made about certain facts whereby the warrantor ensures that those facts are as stated.[159] Additionally, a representation is a statement of presently existing facts, made either by words or by conduct, and intended to induce reliance and action by a party.[160] Statements about future conditions do not qualify as representations because there is incomplete information, and no one can know the future. The breach of a covenant, which is essentially a promise to act or not to act in the future, will typically support an action for damages or specific performance of contractual obligations.

An indemnity provision, commonly used in contracts for capital-intensive and high-risk offtake or infrastructural arrangements, is essentially a collateral contractual obligation where one party, the indemnitor, engages to hold another, the indemnitee, harmless from loss, damage, or liability to third parties.[161] Thus, the concept of indemnification is a promise to reimburse another for a loss, damage, or liability suffered because of a third party's or one's own act or default. It essentially shifts financial risks and burdens from one party to another. A conventional indemnity clause covers any losses from a breach or inaccuracy of any representation or warranty in the agreement. Like guarantees, indemnities

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157 Section 6418 Transfer of Certain Credits, 88 Fed. Reg. at 40507.

158 *Id.*

159 *See Warranty*, BLACK'S LAW DICTIONARY (11th ed. 2019).

160 *See Representation*, BLACK'S LAW DICTIONARY (11th ed. 2019).

161 GEORGE W. KUNEY, THE ELEMENTS OF CONTRACT DRAFTING 121–22, 377 (5th ed., 2020).

are only as good as the net worth or liquidity of the indemnitor. Under an ideal CSSA for instance, the emitter and service provider's indemnity provision would read as follows:

> EMITTER Indemnity. Other than to the extent of the gross negligence, fraud, willful misconduct or material breach of this Agreement by service provider, the EMITTER hereby agrees to release, indemnify, defend, and hold harmless each service provider Indemnitee from and against any Liabilities suffered by any service provider Indemnitee or any Third-Party claim against any service provider Indemnitee, in each case to the extent arising out of, caused by, or resulting from (in whole or in part), (a) any EMITTER Indemnitee accessing the CCS Facilities in a manner that is not explicitly authorized under this Agreement; (b) material breach of this Agreement by EMITTER; or (c) gross negligence, willful misconduct, or fraud by EMITTER . . . .
>
> Service Provider Indemnity. Other than to the extent of the gross negligence, fraud, willful misconduct or material breach of this Agreement by the EMITTER, the service provider hereby agrees to release, indemnify, defend, and hold harmless each EMITTER Indemnitee from and against any and all Liabilities suffered by any EMITTER Indemnitee or any Third-Party claim against any EMITTER Indemnitee, in each case to the extent arising out of, caused by, or resulting from (in whole or in part), (a) the activities of or on behalf of service provider or any service provider Indemnitee while accessing the Plant, or other damage to the Plant as a result of service provider operation of the CCS Facilities; (b) compliance with applicable Law in connection with, and the provision of, the Pre-Sequestration Work, the Sequestration Services, the completion of Service Provider's work . . . , and completion of the Post-Injection Obligations; (c) material breach of this Agreement; (d) the ownership or operation of the CCS Facilities or the Flue Gas following its delivery to the Receipt Point, or any other Capture Facility System CO_2; (e) compliance, reporting, recapture, or otherwise with respect to Section 45Q of the Code or . . . ; (e) any use of or reliance on the records of EMITTER provided . . . ; and (f) the activities of or on behalf of EMITTER.

Note that if the emitter is claiming the Section 45Q credits or other relevant environmental attributes, the service provider may provide an indemnity for (i) the value or replacement cost of any lost environmental attributes (subject to deductibles and caps) and (ii) the recapture of Section 45Q tax credits. Furthermore, if the emitter is claiming Section 45Q credits, it may seek full indemnity from the service provider for the loss of Section 45Q tax credits, other relevant environmental attributes, or their recapture. Third party insurers currently offer insurance policies covering Section 45Q credit recapture, but pricing on premiums for those policies remains high.

In negotiating CCUS contracts, the sequesterer's indemnity for breach of contract is one of the most heavily negotiated provisions in the contract.[162] Some of the main issues that come up include the measure of recoverable damages; liability for environmental damage, covering both direct and third-party claims; and defining the indemnity trigger events such as leakage, failure to transport, or planned outages and maintenance of the relevant facilities. Some pipeline and sequestration companies may be willing to provide an availability or uptime guarantee. In cases where *force majeure* is not applicable or an excused event, the pipeline company and party responsible for sequestration can seek insurance to help cover the risk.[163]

In infrastructural development projects such as CCUS, there is often a risk relating to change of law or regulations. For instance, governmental institutions such as the IRS may issue new regulations, or there may be a new interpretation of existing regulations. In such a case, the affected party may resort to applying the provisions relating to "material-adverse-change" due to a change of law. The usual threshold is if there is an impact or a percentage change in net profits or the expected economic return of one or more of the parties. In negotiating the offtake agreement, it is worth considering whether the party claiming tax credits should have the ability to walk away from the deal if there is an unfavorable change in tax law or action by the IRS that lowers (i.e., indirectly expropriates) the value of tax credits it has claimed.

A. Security Interests and Bankruptcy Protection

An offtake agreement for CCUS should be an instrument for ensuring that the project's output is firmly acquired, and the designated party can take possession of the project's output securely. It should also stipulate terms and conditions that include how the project's benefits, risks,

162 Barrow & Martin, *supra* note 138.
163 *Id.*

revenue, and liabilities are allocated between the parties. Hence, as part of the feasibility and bankability analysis of a project, lenders and project sponsors will scrutinize offtake agreements to ensure they can generate sufficient revenue to (i) service the project debt; (ii) pay the project's operation, maintenance, and administrative costs and expenses; and (iii) earn a reasonable return for the project sponsor.

Offtake agreements in certain sectors involving minerals in place, including natural gas, crude oil, and helium, are typically secured by an acreage dedication or covenant running with the land. These security measures, if employed correctly, may protect the offtaker from discharge risk in the event that the producer files for protection under the bankruptcy code and seeks to discharge executory contracts. However, because as-produced CO_2 emissions do not constitute an interest in real property, such risk mitigation measures may not be available in the CO_2 offtake agreement context. This exposes the offtaker to the possibility that an emitter-debtor may exercise its rights under the bankruptcy code to deem its CO_2 offtake agreement an executory contract and thus discharge its delivery obligations thereunder, leaving the offtaker with little recourse except recovering anything available to it as a member of the unsecured class of creditors. In the absence of such protective measures, it may be advisable that offtakers confer with bankruptcy counsel to determine the best alternative security options, including obtaining a security interest in the emitter facility.

B. Conditions Precedent

In the law of contracts, the term "condition" is ordinarily used to describe acts or events that must occur before a party is obliged to perform a promise made in an existing contract.[164] The condition is an act or event, other than a lapse of time, that unless excused, must occur before a duty to perform a contractual promise arises (i.e., condition precedent), or discharges a duty of performance that has already arisen (i.e., condition subsequent). Generally, express conditions are the mechanisms that control how a transaction progresses. When the condition relates to the occurrence of an event outside the control of the parties (e.g., death, calamity, effectiveness of a government regulation, etc.), the condition should adjust the transaction accordingly.[165] Conditions generally trigger duties (shall clauses) or rights (may clauses); thus, they must be carefully and explicitly drafted and integrated into the rest of the contract, especially when dealing with multi-faceted capital-intensive ventures like CCUS.

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164 JOSEPH M. PERILLO, CONTRACTS 377 (7th ed., 2014).

165 KUNEY, *supra* note 161, at 87.

After a CO_2 offtake agreement is signed, it may be months or years before the actual capture, transportation, and injection operations commence. In recognition of this and the many variables that could impact project viability during interim periods, contingencies based on satisfaction of certain pre-defined conditions precedent have become common. Usual conditions precedent include: (i) the achievement of project FID sanctioning, often following the satisfactory completion of a front-end engineering design study to quantify estimated project costs; (ii) acquisition of adequate pore space and right of way; and (iii) the satisfaction of certain development milestones, including receipt of a Class VI well permit.

In an ideal CSSA, the obligations of the service provider to provide sequestration services as defined under the contract are subject to the satisfaction or waiver of identified conditions precedent. Likewise, the obligations of the emitter to deliver flue gas to the service provider as envisaged under the contract at the receiving point and to pay the service provider are subject to specified conditions precedent. Generally, if the conditions precedent are not satisfied or waived, the non-defaulting party will have the right (but not the obligation) to terminate the agreement. The parties may wish to negotiate for express remedies if the agreement is terminated. Such remedies may be limited to the reimbursement of costs incurred during the post-signing interim period or may be more punitive, including break fees, other liquidated damages, or the right to sue for equitable remedies such as specific performance.

C. Permits and Risks for Transportation and Storage

The Pipeline and Hazardous Materials Safety Administration (PHMSA) at the U.S. Department of Transportation is responsible for the safety regulation and oversight of over 2.8 million miles of gas and hazardous liquids pipeline systems among other facilities.[166] The PHMSA does not, however, have statutory authority to regulate the placement or permitting of pipelines. Rather, the Federal Energy Regulatory Commission (FERC) is responsible for approving the siting of interstate natural gas pipelines, as well as natural gas transportation in interstate commerce.[167] The Departments of the Interior and Agriculture oversee siting on the Outer Continental Shelf and federal lands within their

166 EXEC. OFF. OF THE PRESIDENT OF THE U.S., *supra* note 19, at 25; PAUL W. PARFOMAK, DOT'S FEDERAL PIPELINE SAFETY PROGRAM: BACKGROUND AND ISSUES FOR CONGRESS 1–2 (2023), https://crsreports.congress.gov/product/pdf/R/R44201.

167 PAUL W. PARFOMAK, INTERSTATE NATURAL GAS PIPELINES: PROCESS AND TIMING OF FERC PERMIT APPLICATION REVIEW 1–2 (2015), https://crsreports.congress.gov/product/pdf/R/R43138; Tade Oyewunmi, *Examining the Role of Regulation in Restructuring and Development of Gas Supply Markets in the United States and the European Union*, 40 HOUS. J. INT'L L. 191, 242–54 (2017).

jurisdictions. Regarding intrastate pipelines, the respective states have the authority to regulate intrastate pipeline development within the boundaries of the state.[168] Currently, no Federal entity is responsible for permitting the placement of interstate CO_2 pipelines across federal and non-federal lands.[169] Thus, until Congress enacts a federal institution, each state can assume the powers to establish appropriate regulatory frameworks and institutions to play the role. Such a framework would specify responsibility for the placement, safety, and permitting of intrastate CO_2 pipelines as well as segments of interstate hazardous liquids pipelines within the state boundary.[170]

The contracting parties must consider relevant state law because of a drastic split between jurisdictions. While some states like Illinois and Texas have created a regulatory framework dealing with CO_2 pipelines, others like California have maintained that no agency within the state has clear authority to exercise jurisdiction over pipelines designed to carry CO_2, except for maintaining public health and safety. Thus, in executing an offtake agreement and determining what permits and regulatory issues apply for a planned CCUS project, the contracting parties would need to carefully consider the relevant state law and policy. If a proposed CO_2 pipeline will cross federal land, the Bureau of Land Management has authority to grant the applicable rights-of-way.[171]

Despite having about 5,000 miles of existing CO_2 pipeline networks operating in the U.S., there is still a need for additional pipelines, especially interstate, to facilitate efficient shipping of captured CO_x to the ideal storage or utilization sites. Recent proposals for new CO_2 pipelines in the Midwest, for instance, have faced public opposition and regulatory challenges.[172] Project sponsors may need to proactively engage with public

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168 For a discussion on the regulation of interstate and intrastate pipelines *see* Alexandra B. Klass & Danielle Meinhardt, *Transporting Oil and Gas: U.S. Infrastructure Challenges*, 100 IOWA L. REV. 947, 980–90 (2015); FED. ENERGY REGUL. COMM'N, U.S. DEP'T OF ENERGY, ENERGY PRIMER: A HANDBOOK FOR ENERGY MARKET BASICS 2–3 (2023), https://www.ferc.gov/media/energy-primer-handbook-energy-market-basics [https://perma.cc/ESA5-CERY].

169 Tara Righetti, *Siting Carbon Dioxide Pipelines*, 3 OIL & GAS, NAT. RESOURCES & ENERGY J. 907, 927–31 (2017).

170 *See* MARTIN LOCKMAN, PERMITTING CO_2 PIPELINES (2023), https://scholarship.law.columbia.edu/cgi/viewcontent.cgi?article=1208&context=sabin_climate_change; PAUL W. PARFOMAK, SITING CHALLENGES FOR CARBON DIOXIDE (CO_2) PIPELINES (2023), https://crsreports.congress.gov/product/pdf/IN/IN12269; *see also Cortez Pipeline Co.*, 7 F.E.R.C. ¶ 61024, 61040 (1979).

171 Righetti, *supra* note 169; at 930. *See* Exxon Corp. v. Lujan, 970 F.2d 757, 761 (10th Cir. 1992); EXEC. OFF. OF THE PRESIDENT OF THE U.S., *supra* note 19, at 30–32, for an overview of the types of permits and permissions needed for CCUS projects, including the state and federal institutions involved. For Tribal lands/sovereign nations, the Tribal government will have oversight.

172 PARFOMAK, *supra* note 170, at 1–3.

stakeholders during the permitting process to correct any misinformation or informational gaps that fuel such opposition. As of 2019, when PHMSA last published its annual report data, there were approximately thirty-two liquid CO_2 pipeline operators under the Department of Transportation's regulatory authority in the United States, transporting supercritical fluid CO_2. A significantly smaller amount (about sixty miles) of gaseous CO_2 pipelines exists as of 2019.[173] Captured CO_2 and CO_x must be transported safely and securely in their supercritical or compressed gaseous state from point sources to a predetermined geologic storage site or utilization facility. A secure network of pipelines is therefore essential, although truck, train, and ship transportation could also be used when necessary.[174]

The developers of new CO_2 pipelines should devise contractual and operational measures to address the related challenges and hurdles. Additionally, existing easements may not contemplate the transportation of CO_2.[175] Thus, private landowner concerns about CO_2 pipelines may arise and would need to be addressed. Other considerations for permitting CCUS projects include obtaining the Underground Injection Control (UIC) Class VI or Class II permits and whether the state has the primacy to authorize the underground sequestration of the CO_2 accordingly.[176] In states like Texas and North Dakota, the law recognizes a split estate between a mineral estate owner and surface landowner, which means the

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173 EXEC. OFF. OF THE PRESIDENT OF THE U.S., *supra* note 19, at 25–27; Righetti, *supra* note 169, at 920–22. Transportation of CO_2 by pipeline requires unique design and construction to address the pressure and temperature requirements for transport in a supercritical phase. Unlike natural gas, CO_2 is transported in a supercritical dense-phase state at pressures ranging from 1,200 to 2,700 psi and therefore has gaseous and liquid attributes.

174 Righetti, *supra* note 169, at 920–21.

175 EXEC. OFF. OF THE PRESIDENT OF THE U.S., *supra* note 19 at 24–25; Jared Strong & Paul Hammel, *Landowner Battles Against Pipelines Vary by State*, IOWA CAP. DISPATCH (May 12, 2023), https://iowacapitaldispatch.com/2023/05/12/landowner-battles-against-pipelines-vary-by-state/ [https://perma.cc/Q88X-RC3T].

176 EXEC. OFF. OF THE PRESIDENT OF THE U.S., *supra* note 19, at 38–40, 52; *Primary Enforcement Authority for the Underground Injection Control Program*, U.S. ENV'T PROT. AGENCY, www.epa.gov/uic/primary-enforcement-authority-underground-injection-control-program-0 [https://perma.cc/6BFV-44X9] (last visited Jan. 25, 2024). The U.S. Environmental Protection Agency (EPA) developed the UIC Class VI geologic sequestration well regulations under the Safe Drinking Water Act. The aim is to facilitate the proper injection of CO_2 for geologic sequestration while protecting human health by ensuring the protection of underground sources of drinking water. In addition, the EPA and states also have UIC experience with the Class II program, which provides a regulatory framework for the protection of underground sources of drinking water for CO_2 injected for purposes of EOR. The EPA implements the UIC program unless the EPA has authorized primacy enforcement responsibility for a state (e.g., North Dakota, Wyoming, and Louisiana), territory, or Tribe. Therefore, permitting responsibility for certain well classes may be shared with EPA or divided between two different state, territory, or Tribal authorities.

owner of the title to property in subsurface minerals such as oil and gas is often distinct from the owner of the land.[177] To avoid controversies, it is important for the relevant party to an offtake agreement such as a CSSA to clarify and secure access rights to subsurface pore space for CO_2 sequestration. In Texas, a CO_2 storage facility permit may be issued if the applicant has demonstrated, among other things, that CO_2 injection and storage will not endanger or injure any existing or prospective oil, gas, geothermal, or other mineral resource, or cause waste.[178] An applicant must also demonstrate that with the proper safeguards, underground drinking water and surface water sources can be adequately protected from CO_2 migration or displaced formation fluids.[179]

State law establishes whether and for what purposes CO_2 pipeline developers may utilize eminent domain (i.e., the power to take private property for public use) to acquire property along the pipeline route.[180] Another contractual issue to consider is how parties treat *force majeure* and planned outages, which vary by project. Typically, the emitter is relieved of any dedication or MVC in the event of a service provider *force majeure* incident. The emitter may also receive credit for the volumes of CO_2 it was ready to deliver.

Generally, the commercial arrangements among the participants in the project will force each party to internalize these industry-specific and business-specific risks. For example, consider the risk of outages at an emitter's facilities. While it is normal to relieve the facility owner from complying with certain obligations for necessary planned (for facility maintenance) and unplanned outages due to events beyond its reasonable control (e.g., *force majeure* events), unplanned curtailments in production and facility shutdowns should be treated differently. Events such as unplanned shutdowns of facilities or curtailments in production that persist for prolonged periods will often trigger termination rights, make-whole payment obligations, and other specific remedies for the other party.[181]

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177 Owen L. Anderson, *Geologic CO_2 Sequestration: Who Owns the Pore Space?*, 9 WYO. L. REV. 97, 99–102 (2009); Joseph A. Schremmer, *Pore Space Property*, 2021 UTAH L. REV. 1, 56–58 (2021); Tade Oyewunmi, *Ownership and Utilization of Subsurface Pore Spaces in North Dakota: A Comment on Recent Legal Developments*, FOUND. FOR NAT. RES. & ENERGY L. (Dec. 2022), https://www.fnrel.org/-/media/files/natural-resources-law-network/december-2022/ownership-and-utilization-of-subsurface-pore-spaces-in-north-dakota.pdf?la=en [https://perma.cc/T6CJ-8EWG].

178 S.B. 1387, 81st Leg., Leg. Sess. (Tex. 2009) (relating to the implementation of projects involving the capture, injection, sequestration, or geologic storage of carbon dioxide in Texas).

179 *Id.*

180 Righetti, *supra* note 169, at 937–41.

181 Lee et al., *supra* note 28, at 71.

D. *The Right to Operate and Maintain Storage*

The Environmental Protection Agency's UIC program consists of six classes of injection wells. Each well class is based on the type and depth of the injection activity, and the potential for that injection activity to endanger underground sources of drinking water (USDW). Class VI wells are wells used for injection of CO_2 into underground subsurface rock formations for long-term storage, or geologic sequestration.[182] The UIC regulations mandate the consideration of a variety of measures to assure that injection activities will not endanger USDW. The UIC program may be implemented by the Environmental Protection Agency (EPA) or by states, territories, or tribes with EPA-approved primacy for permitting and enforcement authority. Activities performed by the UIC program include maintaining well inventory, permitting injection wells, performing inspections, and ensuring compliance with permit requirements. When operators do not meet the applicable UIC requirements when managing their wells, the program alerts operators to issues and may assist operators in returning the wells to compliance or take enforcement action.[183] The final EPA rule[184] identifies the qualifying financial instruments for Class VI wells, all of which must sufficiently address USDW endangerment.

In North Dakota, geologic storage is permitted by the state's Industrial Commission (NDIC).[185] If the commission consents, the permit may also be transferred to another. Before issuing a permit, the NDIC must find that (i) the storage operator has complied with all requirements set by the commission; (ii) the storage facility is suitable and feasible for carbon dioxide injection and storage; and (iii) the carbon dioxide is of a quality that allows it to be safely and efficiently stored in the storage reservoir.[186] Furthermore, the storage operator has title to the injected and stored CO_2 and holds title until the NDIC issues a certificate of project completion. While the storage operator holds title, the operator is liable for any damage the CO_2 may cause, including damage caused by CO_2 that escapes from the storage facility.[187] A certificate of project completion may only be issued after public notice and hearing and in consultation with the Department of Environmental Quality.[188] The certificate cannot be issued until at least ten years after CO_2 injection ends. Once issued, the title to the

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182 *Class VI - Wells used for Geologic Sequestration of Carbon Dioxide*, U.S. ENV'T PROT. AGENCY (May 21, 2024), https://www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-carbon-dioxide [https://perma.cc/G4PR-USVT].

183 *Id.*

184 40 C.F.R. § 146.85.

185 *See* N.D. CENT. CODE §§ 38-22-01 to -23.

186 *Id.*

187 *Id.*

188 *Id.*

storage facility and the stored CO_2 transfers, without payment of any compensation, to the state. In this regard, the title acquired by the state includes all rights and interests in and all responsibilities associated with the stored CO_2.

The Texas Railroad Commission is empowered to write regulations for CO_2 geologic storage and clarify regulatory issues such as CO_2 ownership and property rights.[189] The law empowering the commission also creates a CO_2 storage trust fund to cover the costs associated with long-term storage facility monitoring. Each year until the facility has reached the end of the post-injection storage facility care period, CO_2 storage facility permit holders are required to provide evidence demonstrating the permit holder's financial responsibility and resources for: (i) corrective action; (ii) injection well plugging; (iii) post-injection storage facility care and storage facility closure; and (iv) emergency and remedial responses each year until the facility has reached the end of the post-injection storage care period. Storage facilities must not receive CO_2 until the operator has obtained a bond or letter of credit for the facility in an amount equal to or greater than the maximum amount estimated to perform corrective action, emergency response, remedial action, post-injection monitoring and site care, and closure of the geologic storage facility. This financial security must also be approved by the Director of the Oil and Gas Division of the Texas Railroad Commission. Additionally, operators must notify the Commission of, among other things, any adverse financial conditions that may affect an operator's ability to carry out injection, well plugging, and post-injection storage facility care and closure.

E. Recapture Issues

The tax credits claimed will be recaptured to the extent the CO_2 leaks from underground storage, including after use as a tertiary injectant for enhanced oil or gas recovery. Any tax credits recaptured must be repaid to the U.S. Treasury. The IRS will look back three years. It assumes that once CO_2 has remained underground for at least that period, it is likely to remain underground. Thus, the total period when the tax equity investor claiming tax credits is exposed to some level of recapture runs potentially for fifteen years (the twelve year tax credit period plus three years thereafter). Only the net leak in a year is recaptured, meaning the leak after offsetting the CO_2 injections that year.[190] If multiple taxpayers are storing in the same underground reservoir, then they will have to come up with a method to allocate the leaked CO_2 among them. Leaks triggered by a volcano,

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[189] 16 TEX. ADMIN. CODE §§ 5.101–.308. Texas Act S.B. 1387 relates to the implementation of projects involving the capture, injection, sequestration, or geologic storage of carbon dioxide. S.B. 1387, 81st Leg., Leg. Sess. (Tex. 2009).

[190] Martin, *supra* note 99.

earthquake (but not seismic activity caused by CO_2 injection), pandemic, war, terrorist attack, or government action do not trigger recapture.

The Secretary of the Treasury (in consultation with the EPA, the Secretary of Energy, and the Secretary of the Interior) is required to establish regulations for geological storage to ensure that qualified CO_x do not escape into the atmosphere.[191] The proposed regulations provide that the taxpayer can store captured qualified CO_x in secure geological storage if such storage complies with the EPA's rules for monitoring, reporting, and verifying (MRV) sequestration.[192] Accordingly, storers of CO_2 under the offtake agreement must be able to prevent captured CO_2 from escaping from their facilities or processes, especially if the project is designed for permanent sequestration. Otherwise, there is a risk of recapture regarding the 45Q credits already earned. Thus, the applicable offtake agreements should obligate such storage operators to conduct their operations to minimize the risk of leakage from their facilities.

In any arrangement where captured CO_2 is utilized for EOR operations or sequestered in underground storage reservoirs, the user or storer of such CO_2 should be responsible for obtaining and maintaining the necessary real property rights in the applicable reservoirs where the CO_2 is injected. Addressing these recapture and compliance risks will require the participants to make representations and warranties about themselves, their facilities, and their processes that confirm that the applicable qualifications and requirements are met. To the extent compliance with Section 45Q and other regulatory requirements is dependent on a participant taking future actions (such as the buildout or maintenance of its facilities), the participant must expressly obligate itself to meet those specific requirements.[193]

Pursuant to the Clean Air Act, the EPA has promulgated regulations for mandatory reporting of greenhouse gases (GHGs) and administers the Greenhouse Gas Reporting Program. The Greenhouse Gas Reporting Program (GHGRP) regulations require reporting large-source GHG emissions. The facilities injecting CO_2 for geologic sequestration must report the amount of CO_2 injected and sequestered to the EPA annually

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191 26 U.S.C. § 45Q(f)(4) ("The Secretary shall, by regulations, provide for recapturing the benefit of any credit allowable under subsection (a) with respect to any qualified carbon oxide which ceases to be captured, disposed of, or used as a tertiary injectant in a manner consistent with the requirements of [attributing tax credit to a taxpayer under the] section.").

192 40 C.F.R. §§ 98.440–.449.

193 *Id.*

and have an approved MRV plan, among other requirements.[194] The facilities injecting CO_2 for purposes other than sequestration, such as EOR, are required to report the amount of CO_2 injected for EOR and the amount of CO_2 received annually.[195] The Subpart RR regulations allow owners and operators to satisfy certain requirements with a UIC Class VI permit.

Operators of all other facilities that inject CO_2 underground, for EOR or any other purpose, are required to report basic information on carbon dioxide received for injection.[196] Facilities that conduct EOR are not required to report under Subpart RR unless the owner or operator chooses to opt into Subpart RR or the facility holds a UIC Class VI permit for the EOR operation wells. Annual reports submitted under 40 C.F.R. Part 98 to the EPA's GHGRP undergo verification by the EPA, and non-confidential data from these reports are published on the EPA's website.[197] The 2021 Section 45Q rule adds a new Section 1-45Q-3 to 29 C.F.R. Part 1, which calls for geologic sequestration facilities' compliance with GHGRP Subpart RR reporting requirements to meet the conditions of secure geological storage.[198] As explained earlier, Subpart RR requirements include reporting the mass of CO_2 injected (calculated using a mass balance equation) and having an approved MRV plan. By comparison, for EOR operations, taxpayers can meet the requirements by either (i) storing CO_x in compliance with Subpart RR requirements or (ii) storing CO_x in compliance with the EOR standard adopted by the International Organization for Standardization and endorsed by the American National Standards Institute.[199]

VII. CONCLUSION

The recent developments regarding policy and fiscal provisions for CCS projects have been unprecedented. Arguably, it exemplifies how governmental policy can provide necessary incentives to boost private-

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194 ANGELA C. JONES, REPORTING CARBON DIOXIDE INJECTION AND STORAGE: FEDERAL AUTHORITIES AND PROGRAMS 4 (2021) https://sgp.fas.org/crs/misc/R46757.pdf. Under 40 CFR part 98 subpart RR (Geologic Sequestration of Carbon Dioxide source category, referred to as subpart RR), certain facilities, including UIC Class VI wells, are required to report basic information on carbon dioxide received for injection, develop and implement EPA-approved site-specific Monitoring, Reporting, and Verification Plan (MRV Plan), and report the amount of carbon dioxide geologically sequestered using a mass balance approach and annual monitoring activities. 40 C.F.R. §§ 98.440–.449.

195 JONES, *supra* note 194, at 11-12; 40 C.F.R. §§ 98.470–.478.

196 40 C.F.R. §§ 98.470–.478 (Injection of Carbon Dioxide source category, referred to as subpart UU).

197 JONES, *supra* note 194, at 4.

198 *Id.*

199 *Id.*

sector investment in capital-intensive and risky ventures. Assuming the current global macro-trend of strengthening policy drivers for climate mitigation continues, offtake and financing arrangements for CCS projects are expected to increase as the investors and project sponsors seeking to decarbonize their operations gain the technical and transactional experience necessary to derisk CCUS projects. Securing investments and bankable projects in this context hinges on clarifying how the project company will generate revenue to repay loans from developing and constructing projects. Consequently, project participants should have a clear understanding of the underlying arrangements for (i) selling the captured CO_x as the primary project output; (ii) the market into which the project's output will be sold; (iii) the parties to whom the project's output will be sold and the price the project company will receive for the output, and (iv) how any long-term risks, such as recapture risks, can be effectively addressed in this context. The emerging trends discussed in this Article highlight how offtake and transportation agreements such as a CPSA or CSSA serve as transactional tools to identify these issues and mitigate the risks. The set of project agreements helps to ensure that the project company has a contractually committed buyer or user for the captured CO_x; confirms the sales price or formula for determining the price in case of a long-term arrangement; and sets out the terms under which the offtaker is required to purchase, take, transport, use, or sequester the captured CO_x as the final project output.