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Carbon Sequestration: A Pipedream or the Solution to Global Warming?

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INTRODUCTION

While the Earth's climate has changed throughout history, the planet is currently warming at an unprecedented rate, one that has not been seen in the past 10,000 years.[1] Scientists predict that this warming will have disastrous effects for the planet.[2] Ice caps will melt, which will increase sea levels throughout the world, flood coastal communities, and force these communities to relocate further inland.[3] Areas accustomed to large amounts of rainfall will experience intense droughts and fires.[4] Regions that typically have dry climates will experience severe storms and dangerous flooding.[5]

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1. Earth Sci. Commc'ns Team at NASA's Jet Propulsion Lab'y, *How Do We Know Climate Change is Real?*, NASA (Oct. 5, 2022), https://climate.nasa.gov/evidence/ [https://perma.cc/7F59-D883].

2. Jasmine Abdel-khalik, *Prescriptive Treaties in Global Warming: Applying the Factors Leading to the Montreal Protocol*, 22 MICH. J. INT'L L. 489, 520 (2001).

3. *Id.*

4. *Id.*

5. *Id.*

The greenhouse gases[6] emitted from burning fossil fuels[7] are a major cause of the planet's warming.[8] The most prominent of these greenhouse gases is carbon dioxide, which accounted for nearly 80% of greenhouse gas emissions in 2020.[9] However, fossil fuels power modern society and likely will for the next several decades.[10] Thus, many government officials and carbon-producing industries face the challenge of how to utilize fossil fuels while also reducing greenhouse gas emissions.[11] The energy industry, which is often blamed for global warming, provides an innovative solution to this problem: geologic carbon sequestration.[12] Geologic carbon sequestration is the injection of carbon dioxide into deep geologic formations, which prevents the carbon dioxide from escaping into the atmosphere and contributing to global warming.[13] Many proponents of geologic carbon sequestration believe that it, along with the use of renewable fuels and energy, is the most promising solution to global warming.[14]

The energy industry is responsible for almost a quarter of the United States' greenhouse gas emissions.[15] Thus, society is strongly pressuring

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6. *Greenhouse gases* are gases that trap heat in the atmosphere. *Overview of Greenhouse Gases*, U.S. ENV'T PROT. AGENCY (May 16, 2022), https://www.epa.gov/ghgemissions/overview-greenhouse-gases [https://perma.cc/K4WZ-J6QW].

7. Fossil energy sources, including oil, coal, and natural gas, are non-renewable resources that formed when prehistoric plants and animals died and were gradually buried by layers of rock. *Fossil*, U.S. DEP'T OF ENERGY, https://www.energy.gov/science-innovation/energy-sources/fossil [https://perma.cc/4R3D-HDSY].

8. Sam Meredith, *'Turn the valve off': Climate activists push for an abrupt end to the fossil fuel era*, CNBC (Dec. 29, 2021), https://www.cnbc.com/2021/12/29/climate-activists-push-for-an-abrupt-end-to-global-fossil-fuel-use.html [https://perma.cc/Q8CP-96PF].

9. *Overview of Greenhouse Gases*, *supra* note 6.

10. Meredith, *supra* note 8.

11. Owen Anderson, *Geologic CO2 Sequestration: Who Owns the Pore Space*, 9 WYO. L. REV. 97, 98 (2009).

12. *Id.*

13. *Id.*

14. *Global Energy Transformation: A Roadmap to 2050*, INT'L RENEWABLE ENERGY AGENCY (2018), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2018/Apr/IRENA_Report_GET_2018.pdf [https://perma.cc/6LQH-D8B4].

15. *Energy and the environment explained, Where greenhouse gases come from*, U.S. ENERGY INFO. ADMIN. (June 24, 2022), https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php [https://perma.cc/DK38-5P5D].

the government to regulate the industry and reduce its environmental impact.[16] Specifically in Louisiana, the legislature responded to these pressures by enacting the Louisiana Geologic Sequestration of Carbon Dioxide Act (LGSCDA).[17] LGSCDA attempts to promote carbon sequestration by claiming that this emissions-reducing method is in the interest of the state of Louisiana.[18] LGSCDA further promotes carbon sequestration by allowing carbon sequestration project operators[19] to exercise the right of eminent domain[20] to take any private property that is needed to create these expansive projects.[21] Despite the fact that project operators may exercise these expropriation rights, § 1108 of LGSCDA still permits mineral right owners[22] to drill through any carbon storage facilities located beneath their land.[23] Act 163, a recent amendment to LGSCDA, changes this rule for Caldwell Parish.[24] Act 163 expands the expropriation rights of project operators in this Parish, allowing them to exercise the right of eminent domain to prohibit Caldwell Parish mineral right owners from drilling through the carbon storage reservoirs if: (1) five years have passed since any well has been drilled in the area; and (2) any well below the storage reservoir is no longer capable of producing minerals in paying quantities.[25]

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16. Alec Tyson et al., *Americans Largely Favor U.S. Taking Steps To Become Carbon Neutral by 2050*, PEW RSCH. CTR. (Mar. 1, 2022), https://www.pewresearch.org/science/2022/03/01/americans-largely-favor-u-s-taking-steps-to-become-carbon-neutral-by-2050/ [https://perma.cc/7DTZ-5UGM].

17. LA. REV. STAT. § 30:1101 (2023).

18. *Id.* § 30:1102.

19. A *carbon sequestration project operator* is "the person authorized by the commissioner to operate a [carbon sequestration] storage facility. A storage operator can, but need not be, the owner of carbon dioxide injected into a storage facility." *Id.* § 30:1103.

20. *Eminent domain* is the right of the government, or an actor under the government's authority, to take private property for public use. *Eminent domain*, LEGAL INFO. INST., https://www.law.cornell.edu/wex/eminent_domain [https://perma.cc/48JK-LKDP].

21. LA. REV. STAT. § 30:1108.

22. Mineral right owners have the right to explore and develop a tract of land for production of minerals and reduce them to possession. *Id.* § 31:15.

23. *Id.* § 30:1108.

24. Act No. 163, 2022 La. Acts 267.

25. *Id. Paying quantities* means production in quantities sufficient to yield a return in excess of operating costs. *Paying quantities definition*, L. INSIDER https://www.lawinsider.com/dictionary/paying-quantities [https://perma.cc/2A27-FHFF].

This amendment poses an important question for Louisiana: should Louisiana be moving towards carbon sequestration and amend LGSCDA to expand project operators' expropriation rights in every parish? In LGSCDA, the Louisiana legislature made its position clear that carbon sequestration is "in the public interest for a public purpose."[26] The legislature promoted the implementation of carbon sequestration projects by expanding Caldwell Parish project operators' expropriation rights under Act 163.[27] By expanding project operators' expropriation rights and allowing them to prohibit mineral right owners from drilling through carbon storage facilities, Act 163 helps ensure that carbon captured from the atmosphere is stored securely underground.[28] With that security, Act 163 allows Caldwell Parish energy companies to participate in California's Low Carbon Fuel Standard program and to receive valuable federal income tax credits while also significantly lowering their carbon footprint.[29] However, these incentives must be viewed in light of the extensive costs of carbon sequestration, the need for widespread implementation of the projects, and the restrictions that will be imposed on valuable mineral rights of the land owner.[30]

Part I of this Comment will first provide background and history of Louisiana's movement toward carbon sequestration, including the enactment of LGSCDA. Part I will then provide background on Act 163, California's Low Standard Fuel program, the § 45Q tax credit, and other prominent policy considerations. Part I will conclude by addressing property issues regarding carbon sequestration. Part II of this Comment will balance the environmental and economic motives behind carbon sequestration against Louisiana's strong stance on drilling for minerals. Part III of this Comment will propose an amendment to § 45Q and LGSCDA that considers both the environmental and economic incentives

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26. LA. REV. STAT. § 30:1102.

27. Act No. 163, 2022 La. Acts 267.

28. *See* LA. REV. STAT. § 30:1102; Act No. 163, 2022 La. Acts 267; *see also* Geoffrey Ozin, *A Fossil Fuel-Free Industrial Revolution*, ADVANCED SCI. NEWS (Dec. 20, 2019), https://www.advancedsciencenews.com/would-a-fossil-fuel-free-industrial-revolution-have-been-possible/ [https://perma.cc/HY3C-EAFY]; *The Warming Effects of the Industrial Revolution*, CLIMATE POL'Y WATCHER (May 12, 2023), https://www.climate-policy-watcher.org/global-temperatures/the -warming-effects-of-the-industrial-revolution.html [https://perma.cc/VT9W-2HHZ].

29. *See* 26 U.S.C. § 45Q (2023); *see also* CAL. CODE REGS. tit. 17, § 95490(a) (2023).

30. *See* Act No. 163, 2022 La. Acts 267; *See generally* DAVID E. DISMUKES ET AL., INTEGRATED CARBON CAPTURE AND STORAGE IN THE LOUISIANA CHEMICAL CORRIDOR (2019).

for carbon sequestration and the importance of Louisiana's energy industry.

I. LOUISIANA'S MOVEMENT TOWARD CARBON SEQUESTRATION

Until the middle of the 18th century, humans did not significantly impact the environmental balances of the planet.[31] However, in 1776, James Watt invented the coal powered steam engine, which triggered the industrial revolution in Great Britain and catalyzed the fossil fuel movement that changed the world.[32] From this fossil fuel movement, society advanced exponentially because it had access to electricity, heat, transportation, steel, plastics, and other products derived from fossil fuels.[33] Unfortunately, this advancement came at a cost: it caused the world to become unsustainably dependent on fossil fuels.[34] It is unsustainable for society to depend on fossil fuels because the planet has a limited supply of these resources as it takes hundreds of thousands of years for fossil fuels to develop.[35] Moreover, this dependence is unsustainable because the combustion of fossil fuels emits harmful greenhouse gases such as carbon dioxide.[36]

A. The Energy Industry in Louisiana

The past 100 years of Louisiana history are intimately tied to one of these fossil fuels: crude oil.[37] Louisiana has an abundance of crude oil due

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31. Ozin, *supra* note 28; *The Warming Effects of the Industrial Revolution*, *supra* note 28.

32. Ozin, *supra* note 28.

33. Christina Nunez, *Fossil fuels, explained*, NAT'L GEOGRAPHIC (Apr. 9, 2019), https://www.nationalgeographic.com/environment/article/fossil-fuels [https://perma.cc/H8JN-BTES].

34. *Id.*

35. *Non-Renewable Energy*, NAT'L GEOGRAPHIC, https://education.nationalgeographic.org/resource/non-renewable-energy [https://perma.cc/X92A-XADU].

36. Ozin, *supra* note 28.

37. *Crude oil* is the oil that comes out of the ground before it is processed; it is a mixture of compounds, mainly consisting of thousands of hydrocarbon compounds. Kimberly Amadeo, *What is Crude Oil?*, THE BALANCE (June 6, 2022), https://www.thebalancemoney.com/crude-oil-prices-trends-and-impact-on-the-economy-and-you-3305738 [https://perma.cc/55DH-AL2S]; *History of Oil & Gas in Louisiana and the Gulf Coast Region*, LA. DEP'T OF NAT. RES., http://www.dnr.louisiana.gov/assets/TAD/education/BGBB/6/la_oil.html [https://perma.cc/PH84-CRWY].

to the state's geological history.[38] Louisiana is situated within the Gulf Coast Continental Margin basin, which extends throughout the Gulf of Mexico.[39] This area has an abundance of crude oil because over thousands of years, organic, oceanic materials sunk to the seafloor of the Gulf of Mexico, where it was subject to extremely warm temperatures and high pressures, forcing the organic material to undergo chemical reactions that transformed it into crude oil.[40] A portion of the crude oil that was created in the Gulf of Mexico can be found in salt domes located throughout Louisiana's vast coastal plains and offshore regions.[41]

Louisiana's portion of this crude oil remained untouched until 1901, when the Heywood brothers created the first successful oil well in Jennings, Louisiana.[42] The Heywood brothers, two veterans of the Texas oil boom, traveled to Jennings to drill this well after hearing that Jules Clements, a local farmer, owned a rice field that was seeping gas.[43] Knowing that seeping gas was a sign of oil, the brothers drilled a well in the rice field, but it came up short, producing nothing.[44] However, they made the risky decision to drill deeper, and once they did, they created a "gusher" that uncontrollably blew crude oil out of the top of the drilling structure.[45] The brothers called the well the "Heywood #1 Jules Clement well" and ultimately drilled 1,700 feet below the surface.[46] This successful discovery triggered an oil rush in Louisiana, with wells springing up one after the other.[47] By the end of 1905, the state produced upwards of six million barrels of oil, which generated approximately $4.3 million in revenue.[48]

Following this oil rush, the demand for oil increased as people started to grow accustomed to the luxuries that oil could provide.[49] The energy industry responded to this demand by utilizing new exploration techniques and technology, which allowed for drilling companies to more accurately

38. *History of Oil & Gas in Louisiana and the Gulf Coast Region*, *supra* note 37.
39. *Id.*
40. *Id.*
41. Jason P. Theriot, *Oil and Gas Industry in Louisiana*, 64 PARS., https://64parishes.org/entry/oil-and-gas-industry-in-louisiana [https://perma.cc/59TV-C8VH].
42. *History of Oil & Gas in Louisiana and the Gulf Coast Region*, *supra* note 37.
43. Theriot, *supra* note 41.
44. *Id.*
45. *Id.*
46. *History of Oil & Gas in Louisiana and the Gulf Coast Region*, *supra* note 37.
47. *Id.*
48. *Id.*
49. *Id.*

find and drill for oil all over the state.[50] However, once drilling companies fully explored and utilized the land in Louisiana, many companies began experimenting with offshore drilling.[51] The first successful offshore well was drilled one mile off the shoreline of Louisiana in 1934.[52] In the years following, thousands of oil rigs sprung up along the coast of Louisiana.[53]

Ever since Louisiana struck oil in 1901, its energy industry has skyrocketed, becoming a major economic and industrial force.[54] Drilling companies have touched all 64 parishes in the state, drilling over a million wells and producing around 25 billion barrels of oil.[55] Thus, Louisiana is one of the top states in the country for crude oil production.[56] Once the crude oil is taken from the ground, pipelines transport the oil to one of the state's 14 refineries to be turned into petroleum products, which are used as fuels, heating, or electricity.[57] Louisiana's 14 refineries account for nearly one-fifth of the country's refining capacity.[58] Additionally, Louisiana's oil industry produces nearly a quarter of the state's income and provides over 300,000 jobs to the state's citizens.[59] The energy industry is so intimately connected to the state of Louisiana that it has molded the social, political, and economic climate of the state for decades.[60]

While the economic and industrial benefits of Louisiana's energy industry are extremely prevalent, the environmental costs associated with the industry are coming to a brutal head.[61] As a whole, the United States produces massive amounts of carbon dioxide emissions, with approximately one-half of those emissions coming from the combustion of petroleum.[62] Due to the state's massive energy industry, Louisiana is

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50. *Id.*
51. *Id.*
52. *Id.*
53. *Id.*
54. *Id.*
55. *Id.*
56. 10/12 Indus. Rep. Staff, *API report: Nearly one quarter of Louisiana's GDP is tied to oil and gas*, 10/12 INDUS. SUPPORT (July 27, 2021), https://www.1012industryreport.com/energy/api-report-nearly-one-quarter-of-louisianas-gdp-is-tied-to-oil-and-gas/ [https://perma.cc/9HPL-6BNJ].
57. *Louisiana State Energy Profile*, U.S. ENERGY INFO. ADMIN. (May 19, 2022) https://www.eia.gov/state/print.php?sid=LA [https://perma.cc/RMP7-RXEB].
58. *Id.*
59. *Id.*
60. Theriot, *supra* note 41.
61. *Id.*
62. *Energy and the environment explained, Where greenhouse gases come from*, *supra* note 15.

one of the leading states in petroleum production.[63] Because petroleum is the refined version of crude oil,[64] it is also a fossil fuel that consists of organic material; thus, it is comprised of carbon and hydrogen atoms.[65] When petroleum is burned, oxygen from the atmosphere reacts with the carbon atoms in the petroleum and creates heat and carbon dioxide.[66] The heat from this reaction is used to run vehicles, heat buildings, and produce electricity, while the carbon dioxide—a greenhouse gas—is emitted into the atmosphere.[67] Many scientists believe that this unnatural addition of carbon dioxide into the atmosphere has enhanced the earth's natural greenhouse effect,[68] causing global warming.[69] Therefore, Louisiana, along with other large oil producing states and countries, is under pressure to reduce its carbon dioxide emissions in hopes of slowing global warming.[70]

B. The Process of Carbon Sequestration

The energy industry has begun offering an innovative potential solution to global warming: carbon-dioxide sequestration.[71] Commonly referred to as carbon sequestration, this technique involves capturing carbon dioxide and storing it in a contained area before it is ever released

63. 10/12 Indus. Rep. Staff, *supra* note 56.

64. Once crude oil is taken from the ground, it is sent to a refinery where it is processed and cleaned. This refined product is petroleum, which is used for fuel, plastics, transportation, and heating. *Louisiana State Energy Profile*, *supra* note 57.

65. *Oil and petroleum products explained*, U.S. ENERGY INFO. ADMIN. (Apr. 13, 2023), https://www.eia.gov/energyexplained/oil-and-petroleum-products/ [https://perma.cc/3ZBH-9U6J].

66. *Hydrocarbon combustion*, ENERGY EDUC., https://energyeducation.ca/encyclopedia/Hydrocarbon_combustion [https://perma.cc/X9XM-RL7E].

67. *Oil and petroleum products explained*, *supra* note 65.

68. The *greenhouse gas effect* is a naturally occurring process that traps greenhouse gases such as carbon dioxide and methane in the atmosphere, acting like a blanket or a cap that traps warmth in the Earth's atmosphere. Sarah Fecht, *How Exactly Does Carbon Dioxide Cause Global Warming?*, COLUM. CLIMATE SCH. (Feb. 25, 2021), https://news.climate.columbia.edu/2021/02/25/carbon-dioxide-cause-global-warming [https://perma.cc/HQZ7-67Y8].

69. Earth Sci. Commc'ns Team at NASA's Jet Propulsion Lab'y, *Global Climate Change: The Causes of Climate Change*, NASA (Sept. 19, 2022), https://climate.nasa.gov/causes/ [https://perma.cc/C7U9-YBXX].

70. Tyson et al., *supra* note 16.

71. Anderson, *supra* note 11, at 98.

into the atmosphere.[72] While society views carbon capture as a new and advanced technology, it actually mimics a portion of the carbon cycle.[73] The carbon cycle is one of the planet's naturally occurring, self-regulating processes that controls the temperature of the planet.[74] As a part of the carbon cycle, massive "carbon sinks,"[75] such as soils, wetlands, forests, and oceans, absorb large amounts of carbon dioxide from the atmosphere and store it for long periods of time.[76] However, there is more carbon dioxide in the atmosphere than ever before.[77] These natural carbon sinks are overwhelmed and cannot absorb the amount of carbon dioxide that large transportation sectors and energy industries are pumping into the atmosphere.[78] Thus, scientists continue to seek out other creative methods of storing this excess carbon dioxide, focusing primarily on carbon sequestration.[79]

There are three subsectors of carbon sequestration: biologic carbon sequestration, geologic carbon sequestration, and technological carbon sequestration.[80] The most promising of these subsectors is geologic carbon sequestration.[81] Geologic carbon sequestration is a process by which carbon dioxide is captured and secured underground to prevent its release into the atmosphere and contribution to global warming.[82] The goal of geologic carbon sequestration is to keep the captured carbon dioxide deep

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72. Stephanie M. Haggerty, *Legal Requirements for Widespread Implementation of CO2 Sequestration in Depleted Oil Reservoirs*, 21 PACE ENV'T L. REV. 197, 198 (2004).

73. Petya Trendafilova, *What is Carbon Sequestration And What Are Its Benefits?*, CARBON HERALD (Nov. 19, 2022), https://carbonherald.com/what-is-carbon-sequestration/ [https://perma.cc/KB9B-2MN9].

74. *Id.*

75. Nature created the process of sequestering carbon either through photosynthesis (of forests, wetlands, etc.) or oceanic sinks to stabilize the levels of carbon dioxide as excess amounts warm up the atmosphere. *Id.*

76. *Id.*

77. *Id.*

78. *Id.*

79. *Id.*

80. *What is Carbon Sequestration and How Does it Work?*, CLARITY & LEADERSHIP FOR ENV'T AWARENESS RSCH. UC DAVIS (Sept. 20, 2019), https://clear.ucdavis.edu/explainers/what-carbon-sequestration [https://perma.cc/5UDM-Y5LM].

81. Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change, Carbon Sequestration, and Property Rights*, 2010 U. ILL. L. REV. 363, 364 (2010), available at https://scholarship.law.umn.edu/faculty_articles/171 [https://perma.cc/YXQ5-YCBD].

82. *Id.*

underground for hundreds of thousands of years, by storing it in a storage reservoir.[83]

The first step in the geologic carbon sequestration process is capturing the carbon dioxide from power plants, large industrial sources, and other fixed-point emitters.[84] Capturing carbon dioxide involves separating the carbon dioxide molecules from their counterparts either before or after the fossil fuel has been combusted.[85] Pre-combustion carbon capture is a process that removes carbon dioxide from fossil fuels before the fuels are ever burned.[86] Under this technique, the fossil fuel is exposed to a combination of oxygen, high temperatures, and intense pressures, which transforms the fuel into a synthesized gas.[87] This gas is then run through a filter where a physical solvent[88] absorbs the carbon dioxide particles in the gas, physically separating them from the hydrogen particles in the gas.[89] This separation prevents the carbon dioxide from ever being emitted because only the hydrogen gas is used to actually combust the fossil fuel.[90]

Post-combustion carbon capture is an alternative process that captures the carbon dioxide after the fossil fuel has already been combusted.[91] As an industrial source emits combustion gases, a pipe redirects the gases into a chamber where a chemical solvent[92] forces the gases to undergo a

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83. *See id.*

84. A fixed-point CO2 emitter is restricted to one location, such as a power plant or factory. A non-fixed-point emitter emits CO2 but is not restricted to one location. Non-fixed-point emitters include cars, trucks, and other means of transportation. Christopher Bidlack, *Regulating the Inevitable: Understanding the Legal Consequences of and Providing for the Regulation of the Geologic Sequestration of Carbon Dioxide*, 30 J. LAND RES. & ENV'T L. 199, 202 (2010).

85. *Carbon Capture*, CTR. FOR CLIMATE ENERGY SOLS., https://www.c2es.org/content/carbon-capture/ [https://perma.cc/THS8-A4D9].

86. *Id.*

87. *Id.*

88. A physical solvent is a substance that physically absorbs the carbon dioxide from the fossil-fuel-created gas without ever undergoing a chemical reaction. FERNANDO VEGA ET AL., CARBON DIOXIDE CHEMISTRY, CAPTURE AND OIL RECOVERY 154 (2018).

89. *Carbon Capture*, *supra* note 85.

90. *Id.*

91. *Id.*

92. Chemical solvents are specifically formulated chemical mixtures that are used to absorb carbon dioxide from the other gases emitted during the combustion of fossil fuels. These chemical solvents normally contain an amine which reacts selectively with the carbon dioxide. *The Role of Solvents in Carbon Capture*, CARBON CLEAN (Aug. 17, 2021), https://www.carbonclean.com/blog/solvent-based-carbon-capture [https://perma.cc/M66W-BCRC].

chemical reaction that separates the carbon dioxide from the rest of the combustion gases.[93] The remaining combustion gases are released into the atmosphere while the carbon dioxide is redirected, thereby preventing the carbon dioxide from being released into the atmosphere.[94]

Once the carbon dioxide is captured using one of these methods, it is then purified, compressed, and transported through a carbon dioxide pipeline to a site where it can be injected into the ground.[95] At this injection site, the carbon dioxide is injected into deep permeable[96] geologic formations below the surface.[97] These geologic formations are typically deep saline formations,[98] unmineable coal seams, oil and gas reservoirs, or basalt formations.[99] Once injected, the carbon dioxide flows into the geologic formation and fills the permeable rocks' pore spaces, which are the areas where oil and gas used to be in the rock.[100] The carbon dioxide is then held inside the pore spaces of the rock until it undergoes a chemical reaction with the minerals in the surrounding rock.[101] The reaction between the carbon dioxide and the minerals creates a new solid, chalky mineral that becomes a part of the surrounding rock.[102] This process is called *mineral storage* because the carbon dioxide is essentially locked into the surrounding layers of rock once the new chalky mineral is created.[103]

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93. *Carbon Capture*, *supra* note 85.

94. *Id.*

95. Bidlack, *supra* note 84, at 202.

96. The underground geologic formations need to be permeable, meaning the rock formation has sockets of air in it, because the carbon dioxide flows throughout the air pockets inside the rock and the pockets store the carbon dioxide. *Carbon Storage FAQS*, NAT'L ENERGY TECH. LAB'Y, https://netl.doe.gov/carbon-management/carbon-storage/faqs/carbon-storage-faqs [https://perma.cc/4DNZ-3W56].

97. Bidlack, *supra* note 84, at 203.

98. Saline formations are porous formations deep underground that are filled with brine, or salty water. Captured carbon dioxide could be stored in these saline formations once the brine has been removed, and the carbon dioxide can fill into the pore spaces. *See* Klass & Wilson, *supra* note 81, at 364.

99. Bidlack, *supra* note 84, at 203.

100. Klass & Wilson, *supra* note 81, at 364.

101. *How do you store CO2 and what happens to it when you do?*, DRAX (Apr. 22, 2020), https://www.drax.com/carbon-capture/how-do-you-store-co2-and-what-happens-to-it-when-you-do [https://perma.cc/RW2P-577F].

102. *Id.*

103. *Id.*

Although carbon sequestration technology has been around for decades, its implementation has been extremely limited.[104] This is mainly due to the costs of the projects.[105] As of October 2022, there are 16 operational carbon sequestration projects[106] in North America, none of which are in Louisiana.[107] Globally, there are only around 30 carbon sequestration projects, including the 16 projects in North America.[108] The International Energy Agency estimates that the global carbon capture industry will need to grow to over 2,000 facilities capturing 2.8 gigatons of carbon dioxide per year to have a substantial effect on global warming.[109]

Many proponents of geologic carbon sequestration believe that Louisiana is "an emerging hub of carbon capture."[110] Due to the state's extensive history with the energy industry, Louisiana maintains an abundance of saline formations and abandoned oil and gas reservoirs where the captured carbon dioxide can be stored.[111] Additionally, the state has countless pre-existing industrial facilities where carbon dioxide can be captured.[112] These industrial facilities are located relatively close to pre-existing carbon dioxide pipeline infrastructure that can transfer the carbon

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104. Nicola Jones, *Solution or Band-Aid? Carbon Capture Projects Are Moving Ahead*, YALE ENV'T 360 (June 7, 2022), https://e360.yale.edu/features/solution-or-band-aid-carbon-capture-projects-are-moving-ahead [https://perma.cc/N3ZA-UPDR].

105. *Id.*

106. These carbon sequestrations projects are located in Port Arthur, Texas; Estevan, Saskatchewan, Canada; Pecos County, Texas; Beulah, North Dakota; Lost Cabin Gas Plant in Wyoming; Alberta, Canada; Shute Creek near LaBarge, Wyoming; Weyburn and Midale oilfields in Saskatchewan, Canada; Borger, Texas; "Valleyfield" near Montreal, Quebec, Canada; Belton, West Virginia; Sugar creek oil field in Kentucky; Bois Blanc formations in Michigan; West Pearl Queen oil field in New Mexico; Plant Barry Power Station in Alabama; and Middle East Key, Connecticut. GLOBAL CCS INST., https://co2re.co/FacilityData [https://perma.cc/3EH8-H65M].

107. *Id.*

108. Jones, *supra* note 104.

109. *Carbon Capture Jobs and Project Development Status*, CARBON CAPTURE COAL., https://carboncapturecoalition.org/wp-content/uploads/2020/06/Carbon-Capture-Jobs-and-Projects.pdf [https://perma.cc/XRF2-GUGJ].

110. Dane McFarlane, *Louisiana Carbon Capture Opportunities*, GREAT PLAINS INST., https://carboncaptureready.betterenergy.org/louisiana [https://perma.cc/L67H-A9XJ].

111. *Id.*

112. *Id.*

dioxide to its injection site.[113] The fact that Louisiana has a pre-existing carbon dioxide pipeline infrastructure is significant because carbon sequestration projects can be implemented without having to undergo the extensive costs and time needed to create a wholly new pipeline system.[114] Louisiana also has a highly skilled energy workforce and a pre-existing statutory framework that can help to ease this transition.[115] Therefore, many hopeful environmentalists look to Louisiana to be the spark that helps transition the United States into the practice of carbon sequestration.[116]

C. The Louisiana Geologic Sequestration of Carbon Dioxide Act and Act 163: Why Just Caldwell Parish?

In hopes of combatting global warming, the Louisiana legislature enacted the 2009 Louisiana Geologic Sequestration of Carbon Dioxide Act, which encompasses Louisiana Revised Statutes §§ 30:1101–1111.[117] The LGSCDA explicitly details Louisiana's support for carbon sequestration and serves as the cornerstone legislation for carbon sequestration projects in the state of Louisiana.[118] Specifically, the LGSCDA states that geologic storage of carbon dioxide is "in the public interest [and] for a public purpose" because it "will benefit the citizens of the state and the state's environment by reducing greenhouse gas emissions."[119] The LGSCDA further demonstrates the legislature's support of carbon capture by stating that stored "[c]arbon dioxide is a valuable commodity to the citizens of [Louisiana]" as it can be used for "commercial, industrial, or other [purposes], including the use of carbon dioxide for enhanced recovery of oil and gas."[120] In sum, the LGSCDA aims to promote carbon sequestration projects and lay down the necessary structure and regulation needed to create a strong carbon sequestration industry within Louisiana.[121]

The LGSCDA has three major components.[122] First, it establishes a regulatory framework for the entire process of carbon sequestration, from

113. *Id.*
114. *Id.*
115. *Id.*
116. *Id.*
117. LA. REV. STAT. § 30:1101 (2023).
118. *Id.*
119. *Id.* § 30:1102(A)(1).
120. *Id.* § 30:1102(A)(2)–(3).
121. *Id.*
122. *See id.* § 30:1101.

injection and storage to future use of carbon dioxide.[123] Second, it ensures that Louisiana will assume liability for any captured carbon dioxide after ten years, provided that certain conditions are met.[124] Third, it gives carbon sequestration project operators the right to exercise eminent domain, meaning that the operators can seize any private land, servitude, facility, or structure necessary for the construction, operation, or modification of their carbon sequestration project.[125]

One of the first steps in creating a carbon sequestration project is determining where to store the captured carbon dioxide.[126] Under the LGSCDA, project operators have to receive approval from the office of conservation to use a proposed carbon reservoir for carbon storage.[127] The office of conservation will approve the storage reservoir if it finds any one of three things.[128] First, the office can find that the reservoir is suitable for storage and that it is not capable of producing oil, gas, or other minerals in

123. *Id.* § 30:1104(A)(1) ("The commissioner shall have authority to . . . [r]egulate the development and operation of storage facilities and pipelines transmitting carbon dioxide to storage facilities, including in accordance with the provisions of R.S. 30:1107, the issuance of certificates of public convenience and necessity for storage facilities and pipelines serving such projects approved hereunder.").

124. *Id.* § 30:1109(A)(1) ("Ten years, or any other time frame established by rule, after cessation of injection into a storage facility, the commissioner shall issue a certificate of completion of injection operations . . . [u]pon the issuance of the certificate of completion of injection operations, the storage operator, all generators of any injected carbon dioxide, all owners of carbon dioxide stored in the storage facility, and all owners otherwise having any interest in the storage facility, shall be released from any and all duties or obligations under this Chapter and any and all liability associated with or related to that storage facility which arises after the issuance of the certificate of completion of injection operations.").

125. *Id.* § 30:1108(A)(1) ("Any storage operator is hereby authorized, after obtaining any permit and any certificate of public convenience and necessity from the commissioner required by this Chapter, to exercise the power of eminent domain and expropriate needed property to acquire surface and subsurface rights and property interests necessary or useful for the purpose of constructing, operating, or modifying a storage facility and the necessary infrastructure . . .").

126. *Id.* § 30:1104(C).

127. *Id.*

128. *Id.* ("Prior to the use of any reservoir for the storage of carbon dioxide and prior to the exercise of eminent domain by any person, firm, or corporation having such right under laws of the state of Louisiana, and as a condition precedent to such use or to the exercise of such rights of eminent domain, the commissioner, after public hearing pursuant to the provisions of R.S. 30:6, held in the parish where the storage facility is to be located, shall have found at least one of the following . . .").

paying quantities.[129] However, one of these producing reservoirs may still be utilized if the land and mineral right owners consent to its use, if the volumes of oil have been significantly depleted, or if the reservoir would be more valuable for carbon dioxide storage.[130] Second, the office can find that the use of the reservoir for the storage of carbon dioxide would not contaminate the groundwater.[131] Third, the office can find that the storage site will not endanger human lives or cause hazardous conditions.[132] As a result, project operators have a wide range of flexibility in deciding where they will store the captured carbon dioxide.[133]

Once the project operator determines where to store the carbon dioxide, the operator must acquire the rights over the area where the carbon sequestration project will be.[134] Ideally, the project operator obtains the consent of all of the parties with interests[135] in the surface of the land

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129. *Id.* § 30:1104(C)(1) ("That the reservoir sought to be used for the injection, storage, and withdrawal of carbon dioxide is suitable and feasible for such use, provided no reservoir, any part of which is producing or is capable of producing oil, gas, condensate, or other commercial mineral in paying quantities, shall be subject to such use, unless any of the following applies . . .").

130. *Id.* § 30:1104(C)(1)(a)–(c) ("That the reservoir sought to be used for the injection, storage, and withdrawal of carbon dioxide is suitable and feasible for such use, provided no reservoir, any part of which is producing or is capable of producing oil, gas, condensate, or other commercial mineral in paying quantities, shall be subject to such use, unless any of the following applies: (a) The reservoir or any part thereof sought to be used for storage under this Chapter is producing or is capable of producing oil, gas, condensate, or other commercial mineral in paying quantities, and all owners in such reservoir or relevant part thereof have agreed to such use[;] (b) The volumes of original reservoir, oil, gas, condensate, salt, or other commercial mineral therein which are capable of being produced in paying quantities have all been produced[;] (c) Such reservoir has a greater value or utility as a reservoir for carbon dioxide storage than for the production of the remaining volumes of original reservoir oil, gas, condensate, or other commercial mineral, and at least three-fourths of the owners, in interest, exclusive of any 'lessor' defined in R.S. 30:148.1, have consented to such use in writing.").

131. *Id.* § 30:1104(C)(2).

132. *Id.* § 30:1104(C)(3).

133. *See id.* § 30:1104(C).

134. *Id.* § 30:1108(A)(1).

135. "'Interested person' means any person who presently owns an interest within the area of, or proximate to, the tracts directly affected by the storage facility." *Id.* § 30:1103(6). Owning an interest within the area means that the individual has certain rights over the area, such as the right to use and produce from his or her land. *See* LA. CIV. CODE art. 477 (2023). There can be multiple individuals who have interests in a tract of land and its subsurface; thus, the

and the subsurface[136] of the land where the project will be located and compensates them accordingly.[137] However, if that is not possible, the project operator can exercise his or her right of eminent domain and take any private property, surface or subsurface, that is needed to construct, operate, or modify a carbon storage facility and all of its necessary infrastructure.[138] This includes the land where the storage facility itself will be located and also the land where all of the necessary carbon dioxide pipelines will run.[139] Even though a project operator may exercise his or her right of eminent domain and take the subsurface rights over the property where the carbon reservoir is located, § 1108 of the LGSCDA explicitly allows for a mineral right owner to drill through the reservoir to access the minerals below the reservoir.[140] However, a recent amendment to the LGSCDA changes this rule for Caldwell Parish.[141]

Under Act 163, Caldwell Parish project operators may still take any land that is necessary or useful in constructing, operating, or modifying a carbon storage facility.[142] However, Act 163 expands carbon sequestration project operators' expropriation rights, allowing operators to use eminent domain to prohibit mineral right owners in Caldwell Parish from drilling through the carbon reservoirs used for carbon sequestration.[143] If the operator exercises these expropriation rights, the affected Caldwell Parish mineral right owners would only be allowed to drill through carbon

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project operator must obtain the consent of all of these parties. LA. REV. STAT. § 30:1103.

136. The surface of a tract of land is everything above the surface of the ground. The owner of the surface generally owns the structures, buildings, trees, water access rights, etc. that come with the land. The subsurface of a tract of land refers to the ownership of the land below the property's surface. The owner of the subsurface generally has the right to explore for and produce minerals, to store gas, etc. *Subsurface Rights: What Exactly Do I Own?*, RANGER LAND & MINS. (June 22, 2020), https://www.rangerminerals.com/subsurface-rights/ [https://perma.cc/B99M-BU5Z].

137. LA. REV. STAT. § 30:1108(A)(1).

138. *Id.*

139. *Id.*

140. *Id.* § 30:1108(B)(1) ("[t]he exercise of the right of eminent domain granted in this Chapter shall not prevent persons having the right to do so from drilling through the storage facility in such manner as shall comply with the rules of the commissioner issued for the purpose of protecting the storage facility against pollution or invasion and against the escape or migration of carbon dioxide.").

141. Act No. 163, 2022 La. Acts 267.

142. *Id.*

143. *Id.*

reservoirs when: (1) five years have passed "from the actual drilling or operation of any oil or gas well within the boundaries of the storage facility" to depths below the base of the storage facility; and (2) all reservoirs below the storage facility are no longer capable of producing minerals in paying quantities.[144]

Act 163 was a targeted change that was intended to provide carbon reservoir storage security for projects in Caldwell Parish because of a specific and large project on the horizon.[145] In 2021, Strategic Biofuels, a team of engineers and renewable technology leaders, announced that it was creating the Louisiana Green Fuels Project in Caldwell Parish.[146] This project is a $700-million negative-carbon-footprint[147] renewable diesel refinery, which will convert forestry waste materials into renewable diesel fuel[148] while also utilizing an integrated carbon sequestration well.[149] Strategic Biofuels worked with the state of Louisiana and Governor John Bel Edwards to amend the LGSCDA, ensuring that its carbon storage facilities were safe from third-party drilling.[150] Proponents of carbon sequestration believe that Act 163 substantially reduces the risk of stored

144. LA. REV. STAT. § 1108(B)(2) ("The exercise of the right of eminent domain granted in this Section may prohibit persons having the right to do so from drilling through the storage facility located in Caldwell Parish only when the following requirements are satisfied:(a) [a] period of five years has elapsed from the actual drilling or operation of any oil or gas well within the boundaries of the storage facility to depths below the base of the underground reservoir component of the storage facility as determined by the commissioner of conservation[; and] (b) [a]ll reservoirs below the underground reservoir component of the storage facility that were drilled to and produced in any oil or gas well located within the boundaries of the storage facility are no longer capable of producing minerals in paying quantities as determined by the commissioner of conservation.").

145. Tina Olivero, *State of Louisiana Passes Parish Specific Law*, OUR GREAT MINDS, https://theogm.com/2022/07/28/state-of-louisiana-passes-parish-specific-law/ [https://perma.cc/BX3D-HJS9].

146. *Id.*

147. This project has a negative carbon footprint because it uses forestry materials, rather than fossil fuels, to produce fuel. Burning forestry materials, as opposed to fossil fuels, means that there is substantially less carbon dioxide emitted once the forestry materials are burned. Any carbon dioxide that is emitted is sequestered underground. Thus, the refinery can operate without releasing any carbon dioxide into the atmosphere. *Id.*

148. The refinery will convert things like logging residues, shavings, sawdust, and woodchips into fuel; the fact that this fuel is being created from waste makes its carbon footprint lower because the refinery is not burning fossil fuels to create it. *Id.*

149. *Id.*

150. *Id.*

carbon dioxide leaking out of the reservoir and ensures that the negative-carbon-footprint plant reap all of its intended benefits.[151] While Act 163 only affects Caldwell Parish, its impact may be much broader.[152]

D. Why does it matter if the carbon reservoir is secure?

Act 163 is important not only because it gives project operators the opportunity to involuntarily restrict the rights of mineral right owners, but also because it exemplifies the Louisiana legislature's shifting ideology regarding the energy industry.[153] Historically, the energy industry in Louisiana is one of the leading industries for economic impact, taxes paid, and people employed. However, despite the industry's historic impact, the Louisiana legislature aimed to promote the creation of high-functioning carbon sequestration projects within the state when it enacted the LGSCDA.[154] There are various economic and environmental incentives for creating carbon sequestration projects and providing secure storage for the carbon dioxide that is captured from the atmosphere.[155] For instance, giving project operators the ability to prohibit drilling through storage reservoirs allows for these projects to easily generate revenue from California's Low Carbon Fuel Standard program and to collect federal income tax credits, which can help offset the cost-intensive carbon sequestration projects.[156] Moreover, Louisiana could significantly decrease its greenhouse gas emissions while continuing to sustain its energy industry.[157]

1. Louisiana project operators could generate revenue from California's Low Carbon Fuel Standard program.

One of the economic incentives for providing secure storage for carbon sequestration projects is the ability to generate revenue from

151. *Id.*
152. Act No. 163, 2022 La. Acts 267.
153. *Id.*
154. *See generally* LA. REV. STAT. § 30:1101 (2023); *see also* Theriot, *supra* note 41.
155. LA. REV. STAT. § 30:1101; *see* 26 U.S.C. § 45Q (2023); *see also* CAL. CODE REGS. tit. 17, § 95490(a) (2023).
156. *See* 26 U.S.C. § 45Q; *see also* CAL. CODE REGS. tit. 17, § 95490(a).
157. *See generally* DISMUKES ET AL., *supra* note 30.

California's Low Carbon Fuel Standard program.[158] In 2006, the California legislature enacted the Global Warming Solutions Act, which established a comprehensive, state-wide program aimed at reducing greenhouse gas emissions.[159] One element of this comprehensive program is California's Low Carbon Fuel Standard.[160] The California legislature designed the Low Carbon Fuel Standard specifically to reduce the amount of greenhouse gases emitted from California's transportation sector while also lessening the state's dependency on petroleum.[161]

The Low Carbon Fuel Standard is a market-based policy that sets an annual carbon intensity[162] benchmark for transportation fuels that are sold, supplied, or offered for sale in the state of California.[163] All companies that produce and distribute petroleum fuel within California are required to participate and adhere to the Low Carbon Fuel Standard.[164] However, companies that produce or distribute lower carbon fuel[165] within the state can voluntarily opt into the Low Carbon Fuel Standard as well.[166] In this market-based system, any participating company that produces or distributes fuel with a carbon intensity below the set annual standard will receive compliance credits.[167] Alternatively, a participating company that produces or distributes fuel with a carbon intensity that surpasses the set annual standard will generate compliance deficits.[168] At the end of each calendar quarter, all participating companies must have more compliance credits than they do compliance deficits to satisfy the Low Carbon Fuel

158. *See generally* ALEX TOWNSEND & IAN HAVERCROFT, THE LCFS AND CCS PROTOCOL: AN OVERVIEW FOR POLICYMAKERS AND PROJECT DEVELOPERS (2019).

159. CAL. CODE REGS. tit. 17, § 95490(a).

160. TOWNSEND & HAVERCROFT, *supra* note 158, at 4.

161. *Id.*

162. Project operators can decrease the carbon intensity of their fuel by creating it from industrial, forestry, or geologic waste rather than burning fossil fuels. *Id.*

163. *Id.* at 7.

164. *Id.*

165. Fuels that produce lower greenhouse gas emissions than traditional petroleum-based fuels are considered "clean fuels." Clean fuels are things such as biofuels, renewable diesel, synthetic fuels and sustainable aviation fuel, and fuels produced from feedstock, waste materials, and forest biomass. *See generally What are low-carbon liquid fuels?*, CLEAN FUELS FOR ALL, https://www.cleanfuelsforall.eu/low-carbon-liquid-fuels/ [https://perma.cc/JHZ7-9JUW].

166. TOWNSEND & HAVERCROFT, *supra* note 158, at 7.

167. *See id.*

168. *See id.*

Standard.[169] If a participating company is in an overall compliance deficit, then that company must purchase compliance credits from another participating company that is in an overall compliance surplus.[170] The actual price of the compliance credit is very volatile, fluctuating with the demand of the credits.[171] Nevertheless, companies that are either required to adhere to the Low Carbon Fuel Standard or that opt in voluntarily can typically generate revenue off of providing low carbon intensity fuel to the state of California, thereby producing compliance credits and selling those compliance credits to companies that are in an overall compliance deficit.[172]

As carbon sequestration grows in popularity, the Low Carbon Fuel Standard was amended to allow carbon capture projects to also generate these valuable compliance credits.[173] Now, carbon capture projects that either directly capture carbon dioxide from the atmosphere or reduce emissions associated with the production of transportation fuels sold in California may be eligible for these credits.[174] Minimum eligibility requires that the carbon dioxide is captured onshore and then placed in a secure reservoir.[175] Provided that the project meets these qualifications, project operators may generate these credits through one of two methods.[176] Under the first method, project operators may opt in to receive project-based credits where they will receive the number of credits equal to the emissions reductions that the project achieves.[177] However, under the second method, operators may opt in to receive fuel pathway credits, where they will earn credits based on how low their fuel's carbon intensity is in comparison to the standard set forth by the Low Carbon Fuel Standard.[178] Accordingly, Louisiana project operators can benefit from California's Low Carbon Fuel Standard program by either practicing carbon sequestration at an oil and gas production facility or refinery and

169. The calendar quarters for the Low Carbon Fuel Standard are January through March, April through June, July through September, and October through December. *Id* at 8.
170. *Id.*
171. *Id.*
172. *Id.*
173. *Id.*
174. *Id.* at 9.
175. *Id.* at 10.
176. *Id.* at 9.
177. *Id.*
178. *Id.*

selling fuel within the state of California or directly capturing carbon dioxide from the atmosphere, regardless of the connection with the state.[179]

Because California's Low Carbon Fuel Standard program requires secure storage for the sequestered carbon dioxide, Louisiana project operators can attempt to provide secure storage, and thus qualify for these credits, by either obtaining a binding agreement that prohibits any party from drilling through the carbon storage facility or exercising eminent domain to take private land needed to construct the carbon sequestration project.[180] However, as it stands, § 1108 of the LGSCDA permits mineral right owners to drill through the storage facility, regardless of the fact that the project operator has exercised his or her right of eminent domain.[181] The possibility that a mineral right owner may drill through the carbon reservoir decreases the chance that the storage facility remains secured, which makes it difficult for project operators in Louisiana to qualify for the Low Carbon Fuel Standard credits.[182] Act 163 solves this issue for project operators in Caldwell Parish by allowing project operators to acquire a no-drill-through right using eminent domain. The amendment allows project operators in Caldwell Parish to guarantee a secure storage reservoir and generate revenue from California's Low Carbon Fuel Standard program.[183] By giving Caldwell Parish project operators this luxury, the Louisiana legislature leaves carbon sequestration project operators in different parishes subject to different opportunities.

2. Louisiana project operators could also be eligible for federal tax incentives.

While Louisiana project operators can generate revenue from California's Low Carbon Fuel Standard program, they can also qualify for § 45Q federal tax credits under the Internal Revenue Code.[184] The Internal Revenue Code is a body of law that codifies all federal tax laws including income, estate, gift, excise, alcohol, tobacco, and employment taxes.[185] In response to the growing pressures caused by global warming, Congress

179. *See id.*

180. *See* CAL. CODE REGS. tit. 17, § 95490(h)(1) (2023); *see also* LA REV. STAT. § 30:1108(A) (2023).

181. LA. REV. STAT. § 30:1108(A).

182. *See generally* Act No. 163, 2022 La. Acts 267.

183. *Id.*

184. *See* 26 U.S.C. § 45Q (2023).

185. *Tax Code, Regulations and Official Guidance*, INTERNAL REVENUE SERV. (Jan. 18, 2023), https://www.irs.gov/privacy-disclosure/tax-code-regulations-and-official-guidance [https://perma.cc/8GH7-NDVG].

passed the Energy Improvement and Extension Act of 2008, which created § 45Q of the Internal Revenue Code.[186] Section 45Q provides a performance-based federal tax credit for carbon sequestration projects that either: (1) securely store captured carbon dioxide in geologic formations, such as depleted oil fields or saline formations; or (2) use captured carbon dioxide to create fuels, chemicals, and other products, effectively recycling the carbon dioxide.[187] Section 45Q originally provided a credit of $20 per metric ton of carbon dioxide that was permanently stored, and $10 per metric ton of carbon dioxide that was permanently stored and used as a tertiary injectant.[188] Section 45Q also originally limited the tax credit to the first 75 million tons of carbon dioxide stored by all projects and was not available to facilities that captured less than 500,000 metric tons of carbon dioxide per year.[189]

In 2018, Congress enacted the Bipartisan Budget Act, which substantially expanded the pre-existing credit for carbon dioxide sequestration under § 45Q in three ways.[190] First, rather than restricting the credit to the first 75 million tons of carbon stored in the world, the Bipartisan Budget Act made the enhanced tax credit available for every metric ton of carbon dioxide that was stored over a 12-year period.[191] This 12-year period begins on the date the carbon capture equipment starts operating.[192] Second, the Bipartisan Budget Act mandated that the enhanced tax credit will be based on the method of disposal.[193] The amendment recognized various methods of disposal including but not limited to: (1) disposal in secure geologic storage; (2) physically or contractually insuring disposal by using the carbon as a tertiary injectant in connection with an enhanced oil recovery project; (3) disposal by fixation through photosynthesis or chemosynthesis; and (4) disposal by

186. Shannon Zaret, *Can the Expansion of 45Q Effectively Spur Investment in Carbon Capture?*, 19 SUSTAINABLE DEV. L. & POL'Y 14, 14 (2019).

187. *Id.*

188. A *tertiary injectant*, which is likely natural gas, nitrogen, or carbon dioxide, is pumped into an oil reservoir to extract the crude oil that cannot otherwise be extracted. *Secondary-Tertiary Recovery Methods*, GEOART, https://www.geoart.com/2021/04/16/secondary-tertiary-recovery-methods/ [https://perma.cc/5VTZ-EB6H]; *see generally* Zaret, *supra* note 186.

189. Zaret, *supra* note 186, at 14.

190. 26 U.S.C. § 45Q (2023) (as amended in 2018 by Pub. L. No. 115-123, 132 Stat. 64 (2018)).

191. *Id.*

192. *Id.*

193. *Id.*

chemically converting the carbon into a material or chemical compound.[194] The last expansion of the Bipartisan Budget Act made the enhanced credits available to a wide array of facilities that capture less than 500,000 metric tons per year.[195]

In an effort to promote the growth of the carbon sequestration industry even further, Congress again expanded the § 45Q tax credit through the Inflation Reduction Act in 2022.[196] This amendment did not change the foundation of the Bipartisan Budget Act, but it increased the amount of tax credits that project operators may earn by practicing carbon sequestration.[197] Now, project operators may earn $85 per metric ton of carbon dioxide that they capture from an industrial source and store in geologic formations, as opposed to the previous $50 per ton.[198] Additionally, project operators may now earn $130 per ton of carbon dioxide that they directly capture from the air, as opposed to the previous $50 per ton.[199]

Similar to California's Low Carbon Fuel Standard program, § 45Q(f)(2) of the Internal Revenue Code requires that carbon sequestration projects provide secure geological storage for the captured carbon dioxide so that it does not escape into the atmosphere.[200] Under this section, "[s]ecure geological storage" includes, but is not limited to, "storage at deep saline formations, oil and gas reservoirs, and unminable coal seams."[201] In order to prove that the storage facility is secure, project operators must calculate and report the amount of carbon dioxide: (1) initially received; (2) injected into the subsurface; (3) produced; (4) emitted by surface leakage; (5) emitted by equipment leakage; (6) sequestered into subsurface geologic formations; and (7) remaining in the secured geologic formation since the start of required reporting.[202] After calculating and reporting these statistics, the facilities must formulate a plan to ensure safe, secure geological storage that must be approved by the Environmental Protection Agency.[203]

194. *Id.*
195. *Id.*
196. *Id.* (as amended in 2022 by Pub. L. No. 117-169, 136 Stat. 1818 (2022)).
197. *Id.*
198. *Id.*
199. *Id.*
200. *Id.* § 45Q(f)(2).
201. *Id.*
202. *Id.* § 98.440.
203. *Id.* § 45Q.

Louisiana taxpayers seeking to take advantage of the § 45Q federal income tax credits, again, run into the issue of carbon reservoir security.[204] Ideally, project operators must obtain contractual consent that prohibits any party from drilling through the geological storage.[205] However, in the instance that this cannot be done, the LGSCDA allows for project operators in Louisiana to exercise eminent domain and take the private property needed to construct the carbon sequestration project.[206] Despite this, § 1108 of the LGSCDA still allows for mineral right owners to drill through the storage facility.[207] While a mineral right owner can use the correct technology and techniques to safely and effectively drill through a carbon storage facility, there are still prevalent risks.[208] When a mineral right owner drills through a storage facility, equipment can malfunction, which opens the door for potential leaks that can re-release carbon dioxide into the atmosphere and obstruct the security of the storage facility.[209] If a mineral right owner obstructs the security of the carbon storage facility in this manner, the project operator is required to pay back the portion of § 45Q tax credits that correlates to the amount of carbon dioxide re-released into the atmosphere.[210] Thus, in the event that the project operator cannot obtain the consent of all parties with an interest in the land, this provision makes it difficult for project operators in Louisiana, except those in Caldwell Parish, to qualify for the federal income tax credits, which is the same issue these operators have with possibly not benefitting from California's Low Carbon Fuel Standard program.[211]

204. *See generally* LA. REV. STAT. § 30:1108(A) (2023).

205. *Id.* § 30:1102(A).

206. *Id.* § 30:1108(A).

207. *Id.*

208. IEA Greenhouse Gas R&D Programme, *Remediation of Leakage From CO2 Storage Reservoirs* (Sept. 2007) (unpublished technical study made by the IEA Greenhouse Gas R&D Programme on behalf of the Executive Committee of the IEA GHG Programme).

209. *Id.*

210. If the mineral rights owners used the correct equipment and techniques to drill through the storage facility and there were no leaks as a result, then the project operator would not be required to pay back any portion of § 45Q tax credits. 26 U.S.C. § 45Q (2023).

211. *See* Act No. 163, 2022 La. Acts 267.

a. Why do Louisiana project operators care about qualifying for these fiscal benefits?

Many proponents of carbon sequestration believe that it is imperative for project operators to qualify for the § 45Q federal income tax credit and California's Low Carbon Fuel Standard program.[212] Industrial carbon sequestration projects are extremely expensive, potentially the most expensive solution to global warming due to the extreme costs of actually capturing and storing carbon dioxide and the fact that carbon sequestration projects must be implemented on a wide scale in order to be effective.[213] Nationally, it costs anywhere from $120 to $140 to capture one ton of carbon, with many projects capturing hundreds of thousands of tons of carbon dioxide.[214] This could potentially cost a single project operator millions or even billions of dollars.[215] Act 163 allows Caldwell Parish project operators to qualify for the § 45Q federal income tax credit and California's Low Carbon Fuel Standard program, which can help offset the intense costs of carbon sequestration.[216] However, the LGSCDA does not provide operators in all other Louisiana parishes this luxury.

3. Carbon sequestration can help decarbonize the energy industry while still allowing society to utilize fossil fuels.

While tax credits and revenue from California's Low Carbon Fuel Standard are valuable economic incentives for carbon sequestration, there is a much broader incentive as well.[217] Society today is dependent on the combustion of fossil fuels and will likely be dependent on these fuels for decades to come.[218] Fossil fuels give society heat, transportation, electricity, plastic, fertilizers, pharmaceuticals, and many other essential commodities.[219] However, the combustion of these fuels is causing global

212. Michael Barnard, *Carbon Capture is Expensive Because Physics*, CLEAN TECHNICA (Jan. 19, 2016), https://cleantechnica.com/2016/01/19/carbon-capture-expensive-physics/ [https://perma.cc/TKC5-SWBR].

213. Aylin Woodward, *The world's biggest carbon-removal plant just opened. In a year, it'll negate just 3 seconds' worth of global emissions*, INSIDER (Sept. 25, 2021), https://www.businessinsider.com/carbon-capture-storage-expensive-climate-change-2021-9 [https://perma.cc/R2ZW-DMSK].

214. Barnard, *supra* note 212.

215. *Id.*

216. *See* Act No. 163, 2022 La. Acts 267.

217. Meredith, *supra* note 8.

218. *Id.*

219. *Fossil Fuels*, ENV'T ENERGY STUDY INST. (July 22, 2021), https://www.eesi.org/topics/fossil-fuels/description [https://perma.cc/H8U5-C7EN].

warming, and many believe that the only way to combat this phenomenon is to utilize low-carbon fuels and implement large scale carbon sequestration projects.[220] A single carbon sequestration project has the potential to capture over 90% of the carbon dioxide that a power plant or industrial facility emits.[221] While a single carbon sequestration project will not have a large impact on the atmospheric concentration of carbon dioxide or global warming, a large scale implementation of these projects will.[222] If carbon sequestration projects were implemented on a national and international level, power plants and industrial plants could continue to burn fossil fuels at the same rate, keeping up with societal needs while reducing carbon dioxide emissions by 90%.[223] This large reduction in carbon dioxide emissions will reduce the amount of greenhouse gases in the atmosphere, slowing the process of global warming.[224] Carbon capture is thought to be one of the only practical ways to decarbonize the energy industry while still allowing society to utilize fossil fuels, and benefit from the jobs that they create and the revenue that they produce.[225] Nonetheless, the only way carbon sequestration will be the solution to global warming is if it is implemented on a global scale.[226]

E. While there are incentives for providing secure storage for captured carbon dioxide, the costs of carbon sequestration are extremely high.

The combination of reducing greenhouse gases, receiving federal income tax credits, and generating revenue from California's Low Carbon Fuel Standard program is likely enticing for Louisiana's energy industry.[227] However, these incentives may not be enough to make carbon sequestration a viable option for fighting global warming.[228] The hefty

220. *Global Energy Transformation: A Roadmap to 2050*, *supra* note 14.

221. *What is carbon capture and storage and what role can it play in tackling climate change?*, LONDON SCH. OF ECON. & POL. SCI. (Mar. 13, 2023), https://www.lse.ac.uk/granthaminstitute/explainers/what-is-carbon-capture-and-storage-and-what-role-can-it-play-in-tackling-climate-change/ [https://perma.cc/ NDF5-JYCW].

222. *See generally Carbon Capture Jobs and Project Development Status*, *supra* note 109.

223. *What is carbon capture and storage and what role can it play in tackling climate change?*, *supra* note 221.

224. Trendafilova, *supra* note 73.

225. *Id.*

226. *See generally Carbon Capture Jobs and Project Development Status*, *supra* note 109.

227. *See generally* DISMUKES ET AL., *supra* note 30.

228. *Id.*

investment on the front end by the project operator and the costs of actually operating the projects are some of the largest drawbacks of carbon sequestration.[229] Carbon sequestration projects are not traditionally created to turn a profit.[230] Additionally, the costs associated with capturing, transporting, and storing carbon dioxide are both expensive and extensive.[231] Therefore, while the Louisiana legislature is attempting to provide Caldwell Parish project operators an avenue to obtain the secure storage needed to qualify for California's valuable Low Carbon Fuel Standard program and federal income tax credits, these fiscal benefits may not be sufficient to offset the extreme costs of moving the state towards carbon sequestration.[232]

1. The cost of capturing the carbon dioxide is high.

The actual act of capturing carbon dioxide is often the largest cost component in a carbon sequestration project because of the energy and equipment requirements of separating the carbon dioxide from the other components of the gas being emitting from the plant.[233] The cost of capturing carbon dioxide is heavily dependent upon where the carbon is being captured from.[234] It will be cheaper to capture carbon dioxide from sources with a higher concentration of carbon dioxide, as opposed to sources with a lower concentration of carbon dioxide.[235] For example, it is more cost effective to capture carbon dioxide from industrial sources and power plants, as opposed to directly from the air, because the carbon dioxide is being emitted from a more potent source.[236] Regardless of how the carbon dioxide is captured, the cost of capturing carbon dioxide is still extremely expensive, which has the potential to deter future projects.[237]

A study from the National Energy Technology Laboratory (NETL) on the high costs of carbon sequestration sheds light on this situation.[238] NETL provides estimated costs of carbon sequestration based on a standard plant design that can be thought of as a typical facility suited for

229. *Id.*
230. *Id.*
231. *Id.*
232. *See* Act No. 163, 2022 La. Acts 267.
233. DISMUKES ET AL., *supra* note 30, at 93.
234. *Id.*
235. *Id.*
236. *Id.*
237. *Id.*
238. *Id.*

carbon sequestration.[239] In regard to capturing carbon dioxide, the study specifically looks to the cost of the carbon dioxide piping, carbon dioxide compression machines, cooling water chilling units, and instruments needed for capturing carbon dioxide and separating it from the other components of the gas.[240] The study shows that a project operator in Louisiana would pay approximately $73.88 per every metric ton of carbon dioxide that the project captures, which would approximately total $363.6 million.[241] This estimate simply refers to the cost of maintaining the carbon dioxide project and does not include the costs it would take to actually implement the project itself.[242]

2. The cost of transporting the carbon dioxide is high.

In addition to the costs of capturing the carbon dioxide, one must also consider the cost of transporting the carbon dioxide to the injection site.[243] According to NETL, the costs of transporting carbon dioxide varies depending on the diameter of the pipeline, the length of the pipeline, and the need for any booster pumps to pump the carbon dioxide over longer distances.[244] The NETL study shows that a carbon sequestration project in Louisiana could anticipate paying approximately $5.57 per every metric ton of carbon dioxide that the project transports, which would approximately total $27.4 million.[245] Many proponents of carbon capture believe that Louisiana's pre-existing pipeline infrastructure could help mitigate this cost; however, the exact figures are unknown.[246]

3. The cost of injecting the carbon dioxide is high.

Finally, a potential project operator must consider the costs of injecting and storing the carbon dioxide.[247] Once carbon dioxide is captured from an industrial source, it is transported via a carbon dioxide pipeline to an injection site.[248] At this injection site, an injection well will

239. *Id.*
240. *Id.*
241. According to this study, the project would be capturing approximately 4,921,494 metric tons of carbon dioxide. *Id.* at 96.
242. *Id.* at 97.
243. *Id.*
244. *Id.*
245. *Id.* at 98.
246. *Id.*
247. *Id.*
248. *Id.*

pump the carbon dioxide deep underground into the geologic formation.[249] The NETL study estimates the costs of injecting and storing carbon dioxide in accordance with the Environmental Protection Agency's Underground Injection Program.[250] This program regulates the construction, operation, permitting, and closure of these injection wells.[251] The program requires injection wells to meet certain construction standards based on the type of well being used and the depth of the fluid injected.[252] Specifically, geologic sequestration wells are subject to the Underground Injection Program's Class VI construction rules.[253]

Class VI geologic sequestration injection wells are required to meet a heightened standard of construction due to the nature of the well.[254] Geologic sequestration wells carry a harmful greenhouse gas and run directly through underground sources of drinking water.[255] Therefore, Class VI well requirements are designed to prevent leakage and protect this groundwater from carbon dioxide contamination.[256] For example, geologic sequestration wells are required to be made of certain construction materials that have sufficient structural strength and are designed for the life of the geologic sequestration project.[257] These materials must be carbon-dioxide resistant and must be compatible with fluids that they are expected to come into contact with.[258] These heightened construction standards contribute to the high costs of injecting carbon dioxide underground.[259] The study shows that the cost of injecting and storing carbon dioxide for the average project in Louisiana is approximately $9.56 per every metric ton of carbon dioxide injected and stored, which would be a total of about $47 million.[260]

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249. *Id.*
250. *Id.*
251. *Class VI – Wells used for Geologic Sequestration of Caron Dioxide*, U.S. ENV'T PROT. AGENCY (Sept. 27, 2022), https://www.epa.gov/uic/class-vi-wells-used-geologic-sequestration-carbon-dioxide [https://perma.cc/UD6Y-G7G3].
252. *Id.*
253. *Id.*
254. *Id.*
255. *Id.*
256. *Id.*
257. *Id.*
258. *Id.*
259. *Id.*
260. DISMUKES ET AL., *supra* note 30, at 99.

4. The High Cost of Carbon Sequestration vs. Fiscal Incentives

In sum, the NETL study shows that the average industrial facility in Louisiana can expect to pay around $89.01 per every metric ton of carbon dioxide that it captures, transports, and injects underground, which would approximately total $438.1 million.[261] California's Low Carbon Fuel Standard program and § 45Q tax credits are meant to reduce this financial burden.[262] The § 45Q federal tax credit is worth $85 per metric ton of carbon dioxide that is captured and sequestered, but it can only be collected for a 12-year period.[263] The revenue generated from California's Low Carbon Fuel Standard program is dependent on the amount of emissions actually reduced and whether any compliance credits are actually sold, so the profits for every project can vary substantially.[264] Some projects may generate revenue beyond the costs of operating the carbon sequestration project, while others can actually lose money by selling fuel with a carbon intensity higher than permitted under the Low Carbon Fuel Standard.[265] Additionally, California's Low Carbon Fuel Standard program requires a portion of this revenue to be saved in a Buffer Account.[266] This Buffer Account provides a reserve that can be drawn on in the event that a carbon sequestration project operator is required to pay back a portion of the revenue that he or she generated under the Low Carbon Fuel Standard.[267] A project operator is required to pay back his or her earned revenue if the stored carbon dioxide migrates outside of the storage facility or is rereleased into the atmosphere.[268] The fact that project operators are required to save a portion of their revenue into a Buffer Account prevents the project operators from utilizing the full amount of revenue that their projects generated.[269] As a result, the revenue generated from California's Low Carbon Fuel Standard program and § 45Q federal income tax credits may not be enough to overcome the financial burden of developing a carbon sequestration project.[270]

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261. *Id.* at 100.
262. *See generally* TOWNSEND & HAVERCROFT, *supra* note 158.
263. 26 U.S.C. § 45Q (2023).
264. *See* TOWNSEND & HAVERCROFT, *supra* note 158, at 9.
265. *See id.*
266. *Id.* at 13.
267. *Id.*
268. *Id.*
269. *See id.*
270. *See generally id. See also* DISMUKES ET AL., *supra* note 30, at 100.

5. The Property Right Considerations of Act 163

While the costs associated with carbon sequestration projects are considerable, Act 163 also brings a prominent property issue to the forefront.[271] Taking a tract of land and its associated mineral rights via eminent domain to create a carbon sequestration project should be an option of last resort because it strips the land and mineral right owners of their rights involuntarily.[272] Ideally, the land and mineral right owners should consent to their land being used for the project and should be compensated accordingly.[273] Act 163 not only allows for project operators to involuntarily take private land to create carbon sequestration projects, but it also allows the project operator to involuntarily strip the mineral right owner of their right to drill through the carbon reservoir if five years have passed since minerals have been produced from under the reservoir and any minerals left under the reservoir could not be produced in paying quantities.[274] Act 163 seemingly does not harm the mineral right owner because the mineral right owner would likely not drill in an area where there is no substantial mineral production.[275] However, a mineral right owner has the right to place a well on his or her own property and directionally drill to find oil and other minerals.[276] This means that the mineral right owner can drill a well and angle it in such a way that it taps into the liquid and gaseous mineral reservoirs located beneath surrounding properties.[277] Pressure will then force the liquid and gaseous minerals located beneath these surrounding properties to come to the surface of the mineral right owner's land, and at that moment, the mineral right owner will become the owner of the liquid or gaseous minerals that he or she took

271. *See generally* Act No. 163, 2022 La. Acts 267; *see also* DeMoss v. Sample, 78 So. 482, 484 (La. 1918) (the Louisiana Supreme Court referred to mineral rights as "the most valuable property in the state.").

272. *See generally* LA. REV. STAT. § 30:1108(A) (2023).

273. *Id.* § 30:1108(A).

274. Act No. 163, 2022 La. Acts 267.

275. *Id.*

276. Jason Lavis, *Directional Drilling: Everything You Ever Wanted to Know*, DRILLERS.COM (Aug. 14, 2018), https://drillers.com/directional-drilling-everything-you-ever-wanted-to-know/ [https://perma.cc/E2GJ-UT48].

277. LA. REV. STAT. § 31:8 (2023) ("A landowner . . . may reduce to possession and ownership all of the minerals occurring naturally in a liquid or gaseous state that can be obtained by operations on or beneath his land even though his operations may cause their migration from beneath the land of another."); Lavis, *supra* note 276.

from underneath his or her neighbor's property.[278] Therefore, Act 163 could prevent the mineral right owner from producing oil if he or she cannot safely directionally drill through the carbon storage reservoir to access other producing beds.[279]

The Louisiana legislature enacted Act 163 to allow for project operators in Caldwell Parish to utilize both California's Low Carbon Fuel Standard program and § 45Q federal income tax credits.[280] These fiscal benefits help offset the extreme costs associated with carbon sequestration projects, although they may not be entirely sufficient to support the projects.[281] However, in its attempt to meet the security requirements of these fiscal benefits and make these projects more feasible, the Louisiana legislature restricted the mineral rights of citizens in Caldwell Parish, which is at odds with the law that governs the other parishes in the state.[282] While Act 163 benefits project operators in Caldwell Parish, it leaves the rest of the state in a sense of confusion regarding the balance between carbon sequestration and individual mineral rights.[283] As a state with a massive energy industry, Louisiana considers mineral rights to be one of the most valuable property rights in the state.[284] Consequently, the Louisiana legislature must consider whether the implementation of these financially risky carbon sequestration projects is worth restricting one of the most valuable rights in the state of Louisiana.

II. WEIGHING THE ENVIRONMENTAL AND ECONOMIC MOTIVES BEHIND CARBON SEQUESTRATION AGAINST LOUISIANA'S STRONG STANCE ON DRILLING FOR MINERALS

The Louisiana Geologic Sequestration of Carbon Dioxide Act and its most recent amendment Act 163 are primary evidence of Louisiana's movement towards carbon sequestration.[285] However, Act 163 leaves the

278. LA. REV. STAT. § 31:8 ("A landowner . . . may reduce to possession and ownership all of the minerals occurring naturally in a liquid or gaseous state that can be obtained by operations on or beneath his land even though his operations may cause their migration from beneath the land of another.").

279. Act No. 163, 2022 La. Acts 267.

280. Olivero, *supra* note 145.

281. Barnard, *supra* note 212.

282. Act No. 163, 2022 La. Acts 267.

283. *Id.*

284. DeMoss v. Sample, 78 So. 482, 484 (La. 1918) (the Louisiana Supreme Court referred to mineral rights as "the most valuable property in the state.").

285. *See* LA. REV. STAT. § 30:1101 (2023); *see also* Act No. 163, 2022 La. Acts 267.

state's stance on carbon sequestration and the future of mineral drilling at odds.[286] On the one hand, the Louisiana legislature, in enacting the LGSCDA, is clearly promoting the creation of high-functioning carbon sequestration projects that have secure storage in hopes of substantially reducing the state's greenhouse gas emissions.[287] On the other hand, the legislature, in enacting Act 163, is giving project operators in Caldwell Parish the right to involuntarily restrict the mineral right owner's right to drill, one of the most valuable rights in the state.[288] The Louisiana legislature's restriction of mineral rights only in Caldwell Parish leaves the rest of the state in a sense of confusion regarding the balance between carbon sequestration and individual mineral rights. Therefore, the legislature must consider whether moving towards carbon sequestration and amending the LGSCDA to expand project operators' expropriation rights in every parish, at this time, is worth potentially stripping a mineral right owner of his or her valuable property rights.

In determining whether Louisiana should be moving towards carbon sequestration at the cost of placing restrictions on valuable mineral rights of the landowner, there are four factors to consider. First, the Louisiana legislature must consider whether carbon sequestration is the key to balancing the state's need to maintain its prominent energy industry while also reducing its greenhouse gas emissions. Second, if the legislature determines that carbon sequestration is the key to maintaining this balance, then it must consider the financial implications of actually executing these projects. Specifically, the legislature must weigh the costs associated with carbon sequestration against the fiscal benefits offered by California's Low Carbon Fuel Standard and the § 45Q federal income tax credits. Third, the legislature must consider whether implementing carbon dioxide projects within the state will actually affect global warming. Finally, considering the financial implications and the need for widespread implementation of carbon sequestration projects, the legislature must consider whether expanding project operators' expropriation rights is worth restricting Louisiana citizens' valuable property rights.

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286. *See* LA. REV. STAT. § 30:1102(A); *see also* Act No. 163, 2022 La. Acts 267.

287. *See* LA. REV. STAT. § 30:1102(A); *see also* Act No. 163, 2022 La. Acts 267.

288. Act No. 163, 2022 La. Acts 267.

A. Carbon sequestration may be the key to balancing Louisiana's need to maintain its prominent energy industry while also reducing greenhouse gas emissions.

In determining whether the LGSCDA should be amended to expand project operators' expropriation rights in every parish, the Louisiana legislature must first consider whether carbon sequestration is the key to balancing Louisiana's need to maintain its prominent energy industry with its need to reduce its greenhouse gas emissions. As an initial matter, if Louisiana's energy industry were to come to a sudden halt for environmental purposes, the state would lose significant revenue, large amounts of citizens would be unemployed, and the state would have to look elsewhere for valuable products that could be produced at home.[289] However, the negative environmental impact of Louisiana's energy industry is undeniable.[290] Global warming is at an all-time high, and its effects are thought to be close to irreversible.[291] Currently, Louisiana is emitting greenhouse gases at an unsustainable rate.[292] These intense emissions play a role in the effects of global warming, causing Louisiana and the rest of the world to suffer from increased temperatures and rising sea levels.[293] This is a particularly important issue for Louisiana because it is uniquely vulnerable to rising sea levels given the facts that the state lies below sea level and is home to large coastal populations.[294] If Louisiana wants to continue emitting massive amounts of carbon dioxide into the atmosphere, then the state must find some way to counteract these emissions. The state must find a balance between the energy industry and its environmental footprint to help curb the effects of global warming.

Carbon sequestration is thought to be one of the only practical ways to decarbonize the energy industry while still allowing society to utilize fossil fuels.[295] As Louisiana's industrial plants burn crude oil, carbon capture technologies can capture approximately 90% of the carbon dioxide

289. 10/12 Indus. Rep. Staff, *supra* note 56.

290. Theriot, *supra* note 41.

291. *Energy and the environment explained, Where greenhouse gases come from*, *supra* note 15.

292. Theriot, *supra* note 41.

293. *What Climate Change Means for Louisiana,* U.S. ENV'T PROT. AGENCY (Aug. 2016), https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/climate-change-la.pdf [https://perma.cc/4EEW-9WR2].

294. *Id.*

295. Trendafilova, *supra* note 73.

before it ever reaches the atmosphere.[296] That carbon dioxide can then be transferred via one of Louisiana's many pre-existing carbon dioxide pipelines to one of Louisiana's thousands of depleted oil reservoirs or saline formations where it would be stored indefinitely.[297] Louisiana already has a large industrial sector, pipeline infrastructure, and highly skilled work force necessary for carbon sequestration to succeed.[298] Therefore, it is one of the most ideal locations to implement large scale carbon sequestration projects.[299] As a result, carbon sequestration seems to be an extremely promising solution to Louisiana's environmental struggles.[300] The state's energy industry could continue to burn fossil fuels at the same rate, keeping up with the state's societal needs and interests while simultaneously reducing carbon dioxide emissions by 90%.[301]

B. The extensive financial implications of carbon sequestration projects may be a large barrier to their implementation.

Carbon sequestration may be the answer to Louisiana's struggle to reduce greenhouse gas emissions and continue to maintain its prevalent energy industry. However, in deciding whether to amend the LGSCDA to expand project operators' expropriation rights in every parish, the Louisiana legislature must consider the financial implications of carbon sequestration projects. Specifically, the Louisiana legislature must weigh the extreme costs of implementing and maintaining carbon sequestration projects against the fiscal benefits that project operators may earn by running a carbon sequestration project. While carbon capture is thought to be one of the only practical ways to decarbonize the energy industry, the high cost of implementing the projects is a major obstacle that has not yet been overcome.[302] On average, a United States industrial facility pays anywhere from $120 to $140 to capture and sequester one ton of carbon dioxide, with projects capturing hundreds of thousands of tons of carbon dioxide.[303] While Louisiana is fortunate to have an extensive pre-existing foundation on which the carbon sequestration industry may grow, its

296. *What is carbon capture and storage and what role can it play in tackling climate change?*, *supra* note 221.
297. McFarlane, *supra* note 110.
298. *Id.*
299. *Id.*
300. *Id.*
301. *Id.*
302. *See* DISMUKES ET AL., *supra* note 30, at 100.
303. Barnard, *supra* note 212.

expected price of $89.01 per metric ton of carbon dioxide to adequately run a project is still exorbitant as it could total $431.8 million.[304]

Many proponents of carbon sequestration encourage project operators to lean on California's Low Carbon Fuel Standard program and the § 45Q federal income tax credit to lessen this financial burden.[305] The Louisiana legislature even enacted Act 163 to ensure that the Louisiana Green Fuel diesel refinery plant in Caldwell Parish could qualify for these fiscal benefits.[306] However, even these benefits do not offset the hefty costs of implementing and maintaining a carbon sequestration project.[307] Geologic sequestration projects, alone, do not turn a profit.[308] Therefore, § 45Q's $85 credit per metric ton of carbon dioxide, which expires after 12 years, and the unpredictable income from California's Low Carbon Fuel Standard program likely do not counteract the long-term and extreme costs of geologic carbon sequestration.[309] These carbon sequestration projects may be able to support themselves in the short term, but, after the 12-year term on the § 45Q tax credits expires, the project operators will be forced to carry a large portion of their project's financial burden.[310] For these reasons, geologic carbon sequestration projects, as is, are not financially practical in Louisiana, and they are especially not practical in any other part of the United States.[311] If a single carbon sequestration project is not financially practical, then the Louisiana legislature must seriously consider whether it should further restrict the rights of mineral owners throughout the state in an effort to promote carbon sequestration.

304. DISMUKES ET AL., *supra* note 30, at 100.

305. *See generally* TOWNSEND & HAVERCROFT, *supra* note 158.

306. Olivero, *supra* note 145.

307. *See generally* TOWNSEND & HAVERCROFT, *supra* note 158; *see generally also* DISMUKES ET AL., *supra* note 30.

308. *See generally* DISMUKES ET AL., *supra* note 30.

309. The income from California's Low Carbon Fuel Standard is unpredictable because it depends upon how carbon intense the fuel created is. If the fuel's carbon intensity is lower than the standard set forth by the state, then the fuel producer will receive compliance credits. However, if the fuel's carbon intensity is higher than that standard, the fuel producer will lose money. TOWNSEND & HAVERCROFT, *supra* note 158, at 7.

310. Zaret, *supra* note 186, at 14.

311. *See generally* DISMUKES ET AL., *supra* note 30.

C. Carbon sequestration projects must be implemented on an intranational scale to actually curb the effects of global warming.

The fact that the revenue generated from California's Low Carbon Fuel Standard program and § 45Q federal income tax credits is not sufficient to support even a single carbon sequestration project presents an even larger issue for the Louisiana legislature to consider. Carbon sequestration projects must be implemented on an international scale to actually have an effect on the atmospheric concentration of greenhouse gases.[312] While one carbon sequestration project can take millions of tons of carbon dioxide out of the atmosphere each year, this is not enough to combat the pre-existing amount of carbon dioxide in the atmosphere in combination with the amount that continues to be emitted.[313] As of October 2022, there are 16 operational carbon sequestration projects in North America—none of which are in Louisiana—and 80 projects currently in development, including Caldwell Parish's Louisiana Green Fuel diesel refinery.[314] Globally, there are only around 30 carbon sequestration projects.[315] However, the International Energy Agency estimates that the global carbon capture industry will need to grow to over 2,000 facilities, capturing 2.8 gigatons of carbon dioxide per year, to have a substantial effect on global warming.[316] Thus, in order to reach its intended effect, there must be some force that promotes an accelerated, economy-wide implementation of carbon sequestration projects.[317] Without that force, Louisiana companies will be implementing financially risky carbon sequestration projects, and restricting mineral rights in the process, but the state would not actually be achieving its goal of curbing global warming.

D. Louisiana's most valuable right should not be restricted over a non-feasible pipedream.

While carbon sequestration seems like the current solution to global warming, it is likely impracticable at this time. The costs of operating and maintaining a carbon sequestration project are extensive and likely not offset by § 45Q tax credits or the revenue generated from California's Low Carbon Fuel Standard program. Additionally, carbon sequestration

312. *Carbon Capture Jobs and Project Development Status*, *supra* note 109.
313. *Id.*
314. *Id.*
315. Jones, *supra* note 104.
316. *Id.*
317. *Id.*

projects need to be implemented on a global scale to be effective. In light of these drawbacks, the Louisiana legislature must consider whether project operators throughout the state should have the right to restrict one of Louisiana's most valuable rights to construct a carbon sequestration project.

Property rights—specifically mineral rights—in the state of Louisiana are an extremely valuable asset for Louisiana citizens because these rights allow Louisiana citizens to drill on their property for minerals, earning revenues through royalties and other profiting avenues.[318] If project operators exercise their power of eminent domain to prohibit Caldwell Parish mineral right owners from drilling through a carbon storage reservoir to reach the minerals underneath, the mineral right owners will be forced to directionally drill if they wish to find oil. This will significantly increase the cost of drilling.[319] Additionally, mineral right owners may be prohibited from drilling a well on their property at all if the carbon storage reservoir covers the entire length of the property.[320] Regardless, mineral right owners will be prohibited from drilling directly through the carbon storage facility, even if they were to use the proper technique and technology to help ensure that stored carbon dioxide will not leak out of the storage reservoir.[321] Therefore, the mineral right owners could completely lose the ability to drill on their land completely or face significantly higher costs for doing so. Moreover, if the Louisiana legislature expands project operators' expropriation rights throughout the entire state, Louisiana could eventually lose onshore drilling altogether.

Given that carbon sequestration is likely not a viable solution for global warming at this time, it is not worth giving project operators the right to restrict "the most valuable right in the state."[322] Proponents of carbon sequestration will argue that it is necessary to restrict these mineral rights because it allows for project operators to qualify for the valuable California Low Carbon Fuel Standard program and § 45Q tax credits. However, these tax credits are not sufficient to support carbon sequestration in the large-scale manner needed for these projects to

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318. DeMoss v. Sample, 78 So. 482, 484 (La. 1918) (the Louisiana Supreme Court referred to mineral rights as "the most valuable property in the state.").

319. Tarrant Cnty. Water Improvement Dist. No. One v. Haupt, Inc., 854 S.W.2d 909, 912 (Tex. 1993).

320. If the carbon storage reservoir covers the entire property, then no matter where the mineral right owner drills, he or she will have to drill through the carbon reservoir.

321. *See generally* LA. REV. STAT. § 30:1108(A) (2023).

322. *DeMoss*, 78 So. at 484 (the Louisiana Supreme Court referred to mineral rights as "the most valuable property in the state.").

achieve the ultimate goal of curbing global warming. Restricting rights via eminent domain is supposed to be an option of last resort.[323] Despite this, the Louisiana legislature is restricting mineral rights through eminent domain at the cost of promoting a solution that is not yet feasible.

III. THE LOUISIANA LEGISLATURE MUST AMEND LGSCDA ONLY AFTER CONGRESS EXPANDS THE § 45Q TAX CREDIT

Modern society is extremely dependent on fossil fuels and will be for the next several decades.[324] However, burning fossil fuels contributes to global warming and the degradation of the planet.[325] As a state with a massive energy industry, Louisiana significantly contributes to this problem.[326] As such, Louisiana must move towards carbon sequestration since carbon sequestration will allow the state to reduce its greenhouse gas emissions while also continuing to burn fossil fuels to support modern society.[327] However, the fact that carbon sequestration projects are extremely cost-intensive is a burden that has not yet been overcome by California's Low Carbon Fuel Standard program and § 45Q federal tax credits.[328] Additionally, carbon sequestration projects will have to be implemented on a massive scale to actually curb the effects of global warming.[329] Consequently, there must be some force that promotes an accelerated, economy-wide implementation of carbon sequestration projects in order for these projects to reach their intended effect.[330]

If this force is not a regulation requiring the widespread use of carbon sequestration, the technology needs to become more affordable for carbon sequestration projects to be widely implemented within the United States.[331] Carbon sequestration technology can become more affordable by decreasing the costs of carbon capture and storage through innovating

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323. *See generally* LA. REV. STAT. § 30:1108(A).

324. Meredith, *supra* note 8.

325. *Energy and the environment explained, Where greenhouse gases come from*, *supra* note 15.

326. 10/12 Indus. Rep. Staff, *supra* note 56.

327. *See generally* DISMUKES ET AL., *supra* note 30.

328. *See generally* DISMUKES ET AL., *supra* note 30; *see generally also* TOWNSEND & HAVERCROFT, *supra* note 158.

329. *Carbon Capture Jobs and Project Development Status*, *supra* note 109.

330. *Id.*

331. Jonathan M. Moch et al., *Carbon Capture, Utilization, and Storage: Technologies and Costs in the U.S. Context*, HARV. KENNEDY SCH. BELFER CTR. (Jan. 2022), https://www.belfercenter.org/publication/carbon-capture-utilization-and-storage-technologies-and-costs-us-context [https://perma.cc/BH8K-DHTE].

technology, developing new high-value ways to use sequestered carbon dioxide, or increasing government incentives.[332] While technological innovation and the development of new ways to use sequestered carbon dioxide are likely to happen as society progresses, they are difficult to control or incentivize and have yet to occur.[333] As a result, revenue needs to be generated through increased government incentives until carbon capture technology becomes more affordable and sequestered carbon dioxide can be used in a productive way.[334]

A. Section 45Q of the Internal Revenue Code must be expanded even further.

Specifically, in order to make carbon sequestration a more feasible solution to global warming, § 45Q of the Internal Revenue Code must be expanded even further. While Congress recently amended § 45Q to broaden the scope of projects eligible for federal income tax credits and increase the amount of tax credits a carbon sequestration project can receive,[335] this increase is still not enough to counteract the extreme costs of carbon sequestration.[336] Project operators may now receive $85 per metric ton of carbon dioxide captured and sequestered,[337] but in reality, it could still cost a carbon sequestration project up to $140 per ton to capture and store carbon dioxide while capturing hundreds of thousands of tons.[338] Global warming is a global issue. Hence, the federal government should expand § 45Q of the Internal Revenue Code to encourage the implementation and effective use of carbon sequestration facilities.

Congress should expand § 45Q of the Internal Revenue Code to grant carbon sequestration projects $140 per metric ton of carbon dioxide that is captured and sequestered, as opposed to the current $85 per metric ton. In Louisiana, project operators can expect to pay approximately $89.01 to capture and sequester a single ton of carbon dioxide.[339] This price of capturing and sequestering carbon dioxide is lower in Louisiana because the state has an extensive pre-existing foundation on which the carbon sequestration industry may grow.[340] However, nationally, it costs

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332. *Id.*
333. *Id.*
334. *Id.*
335. *Id.*
336. *See generally* DISMUKES ET AL., *supra* note 30.
337. 26 U.S.C. § 45Q (2023).
338. Barnard, *supra* note 212.
339. DISMUKES ET AL., *supra* note 30, at 100.
340. *See id.*

anywhere from $120 to $140 to capture one ton of carbon.[341] The current $85 tax credit is not sufficient to support a single carbon sequestration project in Louisiana, let alone the rest of the country, which will have to kickstart their carbon sequestration industries nearly from scratch. If project operators are able to collect $140 per every metric ton of carbon dioxide that they capture and sequester, then they can minimize the extreme costs of implementing a single carbon sequestration project. Project operators throughout the country would then be able to consider carbon sequestration projects as practical investments.

Additionally, carbon sequestration projects should be eligible for § 45Q tax credits for 20 years as opposed to 12. As society progresses, technological innovation and the development of new ways to use sequestered carbon dioxide are likely to decrease the costs of implementing carbon sequestration projects.[342] However, it is difficult to control or incentivize the rate at which technological innovation happens, and it has yet to occur.[343] Consequently, carbon sequestration project operators will need financial help from the federal government for the foreseeable future.[344] If Congress allowed project operators to collect § 45Q credits for 20 years as opposed to 12 years, then there would be more time for this technological innovation to occur. Once this innovation occurs, carbon sequestration projects will become more economically feasible, which means that project operators likely will not need such extensive financial help from the federal government.[345] However, while society waits on this innovation, the § 45Q tax credits should subsidize the costs of operating a carbon sequestration project.

If Congress expands the § 45Q tax credit to $140 per metric ton and increases the duration that operators will be able to receive the § 45Q tax credits to 20 years, then carbon sequestration projects will become much more feasible to implement. With that feasibility, it will be easier for carbon sequestration projects to be implemented on a broader scale. This widespread implementation will substantially reduce the amount of greenhouse gases in the air and ultimately help curb the effects of global warming.

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341. Barnard, *supra* note 212.
342. Moch et al., *supra* note 331.
343. *Id.*
344. *See generally id.*
345. *See generally id.*

B. Once § 45Q is expanded, the Louisiana legislature must amend the Louisiana Geologic Sequestration of Carbon Dioxide Act.

Congress must expand the § 45Q tax credits to grant carbon sequestration projects $140 per every metric ton of carbon dioxide that is captured and sequestered for a period of 20 years. These increased financial incentives will catalyze the widescale implementation of carbon sequestration projects that is necessary to put a dent in the amount of carbon dioxide that is currently in the atmosphere. Once carbon sequestration projects become more economically feasible, the private property rights of citizens will be outweighed because carbon sequestration would be working at the scale necessary to actually curb the effects of global warming. While citizens' private property rights and especially mineral rights are extremely valuable in Louisiana, the need to curb the effects of global warming is so immense that it requires global cooperation, and therefore, it is one of the only situations where the "most valuable . . . [right] in the state" should be restricted.[346]

Therefore, only after Congress expands the § 45Q tax credit should the Louisiana legislature amend § 1108 of the LGSCDA to allow project operators to exercise the right of eminent domain to prohibit mineral right owners in every parish from drilling through carbon storage reservoirs. In amending § 1108 of the LGSCDA, the legislature should adopt the language from Act 163 and explicitly state that "the exercise of the right of eminent domain granted in this Section may prohibit persons having the right to do so from drilling through the storage facility located in [*all*] parish[es]."[347] The legislature should go on to state that project operators can only prohibit a mineral right owner from drilling when either "a period of five years has elapsed from the actual drilling or operation of any oil or gas well within the boundaries of the storage facility to depths below the base of the storage facility" or when "all reservoirs below the underground reservoir component of the storage facility that were drilled to and produced in any oil or gas well located within the boundaries of the storage facility are no longer capable of producing minerals in paying quantities."[348] This amendment would promote the security of the reservoir and allow for project operators to qualify for California's Low Carbon Fuel Standard program and the valuable § 45Q tax credits that could further help subsidize the carbon sequestration project. Doing so

346. DeMoss v. Sample, 78 So. 482, 484 (La. 1918) (the Louisiana Supreme Court referred to mineral rights as "the most valuable property in the state.").

347. *See generally* Act No. 163, 2022 La. Acts 267.

348. *Id.*

puts Louisiana in a position where it is on the forefront of promoting a greener footprint.

CONCLUSION

The need to lessen the amount of carbon dioxide in the atmosphere is undeniable. If society wishes to prevent the ice caps from melting, the sea levels from rising, and the climate from changing, something must be done to curb greenhouse gas emissions.[349] The ideal solution to this problem is carbon sequestration. However, given the extreme costs of carbon sequestration projects, industries throughout the world must be heavily incentivized to create these projects. Given that global warming is a global and national problem, the federal government must be the one to provide this incentivization, making carbon sequestration a more realistic solution rather than a far-off dream.

To do so, § 45Q must be expanded. Section 45Q must provide carbon sequestration project operators with a federal tax incentive of $140 per ton of carbon dioxide that is captured and sequestered for a period of 20 years. These financial incentives will catalyze the widescale implementation of carbon sequestration projects that is necessary to put a dent in the amount of carbon dioxide that is currently in the atmosphere. Once the projects become economically feasible, the public's interest in reducing the effects of global warming will outweigh the private property rights of citizens. Only once carbon sequestration is economically feasible should the Louisiana legislature amend the Louisiana Geologic Sequestration of Carbon Dioxide Act to prohibit mineral right owners in all parishes from drilling through carbon storage reservoirs. The amendment will ensure that project operators throughout Louisiana have the ability to qualify for the state and federal tax credits that make carbon sequestration projects feasible. More importantly, it will help lower the overall concentration of carbon dioxide in the atmosphere leading to a healthier, greener planet.

349. Abdel-khalik, *supra* note 2.