

**CARBON SEQUESTRATION:  
Resource Management Through The Storage  
Of Carbon Dioxide in Geologic Structures**

***LOUISIANA'S PROACTIVE APPROACH  
(La. R.S. 30:1101, et seq.)***

On July 10, 2009, Louisiana Governor Bobby Jindal signed into law the Louisiana Geologic **Sequestration of Carbon Dioxide Act** (La. R.S. 30:1101, et seq.). Joining seven other states that passed similar legislation in 2009, Louisiana took its place on the vanguard in providing a legal and regulatory framework for the geologic storage of carbon dioxide.

# States With Carbon Sequestration Statutes

State	Bill and year	What it cover
Montana	SB 498 (2009)	Liability, Pore space, Storage fund, Unitization, Primacy, CO <sub>2</sub> ownership
Wyoming	HB 57 (2009)	Primacy
-	HB 17 (2010)	Storage fund
-	HB 58 (2009)	CO <sub>2</sub> ownership
-	HB 80 (2009)	Unitization
-	HB 89 (2008)	Pore space, Primacy
Texas (offshore)	HB 1796 (2009)	Storage fund, Liability
Texas (onshore)	SB 1387 (2009)	Storage fund, Primacy, CO <sub>2</sub> ownership,
Oklahoma	SB 610 (2009)	Primacy, CO <sub>2</sub> ownership
Kansas	HB 2419 (2007)	Storage fund
-	HB 2418 (2010)	Liability
North Dakota	SB 2095 (2009)	Liability, Storage fund, CO <sub>2</sub> ownership, Unitization,
-	SB 2139 (2009)	Pore space
Illinois	SB 1704 (2007)	Liability (FutureGen)
West Virginia	HB 2860 (2009)	Primacy, inter-state boundary
Louisiana	HB 661 (2009)	Liability, CO <sub>2</sub> ownership, Storage fund
-	HB 1220 (2008)	Liability

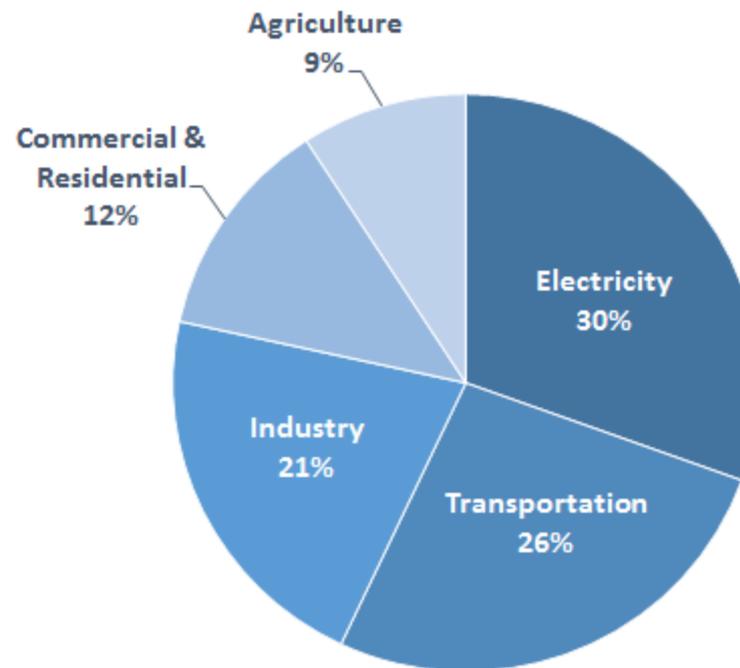
Lost in a fiscal session and passed unanimously by both houses of the legislature with little fanfare, many representatives of industry believe that Act 517 may be the most important piece of legislation coming out of Louisiana's 2009 Legislative Session. In an era where hardly a day passes without some comment or article touting the federal regulation of greenhouse gas emissions, Louisiana proactively showed the way on how states can protect both economic viability by easing the way for industry to deal with this coming regulation, while also protecting the environment.

From the pre-industrial era (i.e., ending about 1750) to 2014, concentrations of greenhouse gases (e.g., carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O)) increased globally by **43, 160, and 21** percent, respectively.

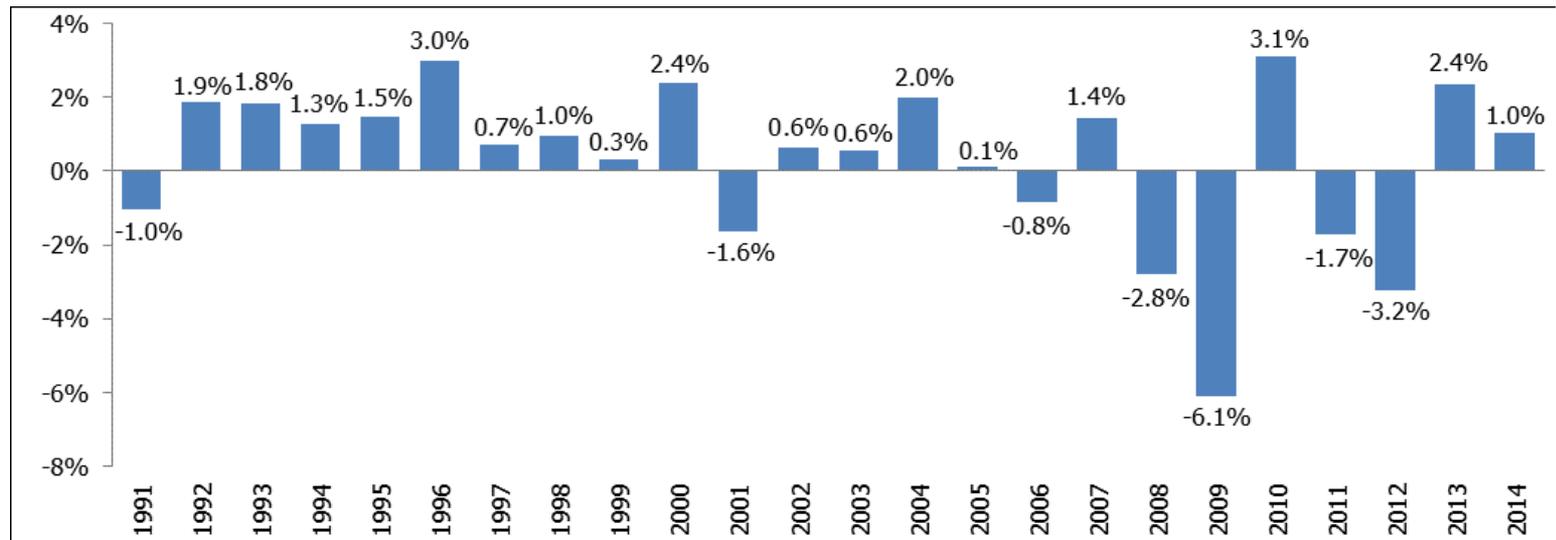
The latest greenhouse gas inventory released by the Environmental Protection Agency on **April 15, 2016**, reported that emissions of heat-trapping gases grew 1.0 percent from 2013 to 2014. In 2014, total U.S. greenhouse gas emissions were **6,870.5 MMT** or million metric tons CO<sub>2</sub> Eq. The bulk of that increase was carbon dioxide from the burning of fossil fuels (e.g., coal, oil, gas) to meet a greater demand for electricity. Total U.S. emissions have increased by **7.4 percent** from 1990 to 2014.

# Total U.S. Greenhouse Gas Emissions by Economic Sector in 2014

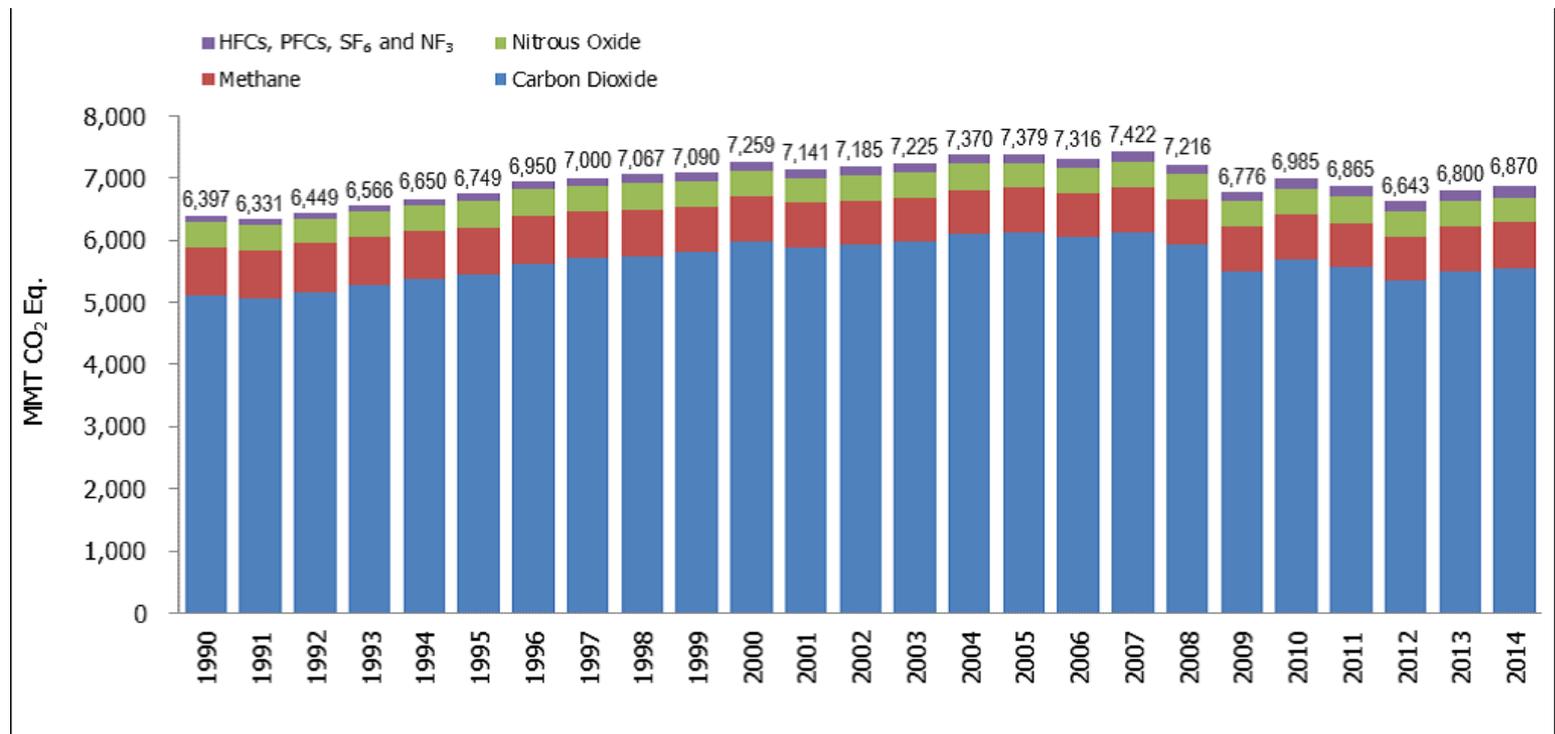
Total U.S. Greenhouse Gas Emissions  
by Economic Sector in 2014



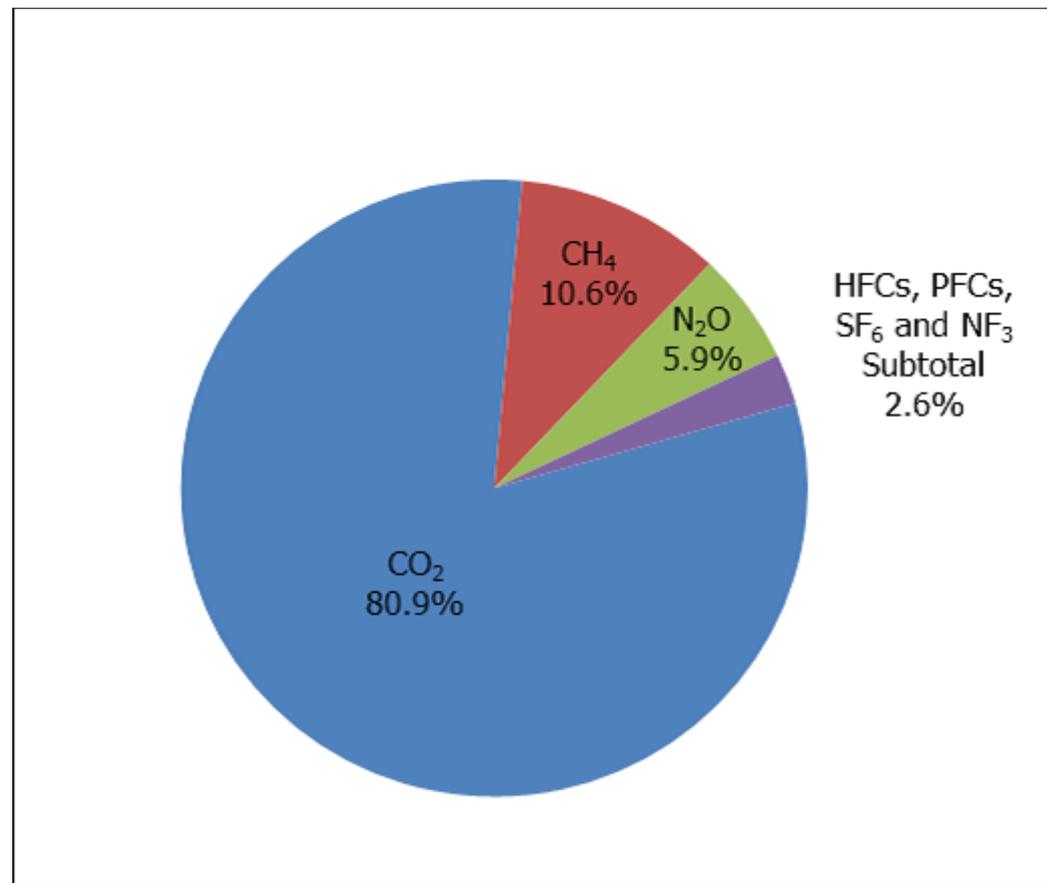
## Annual Percent Change in U.S. Greenhouse Gas Emissions Relative to the Previous Year



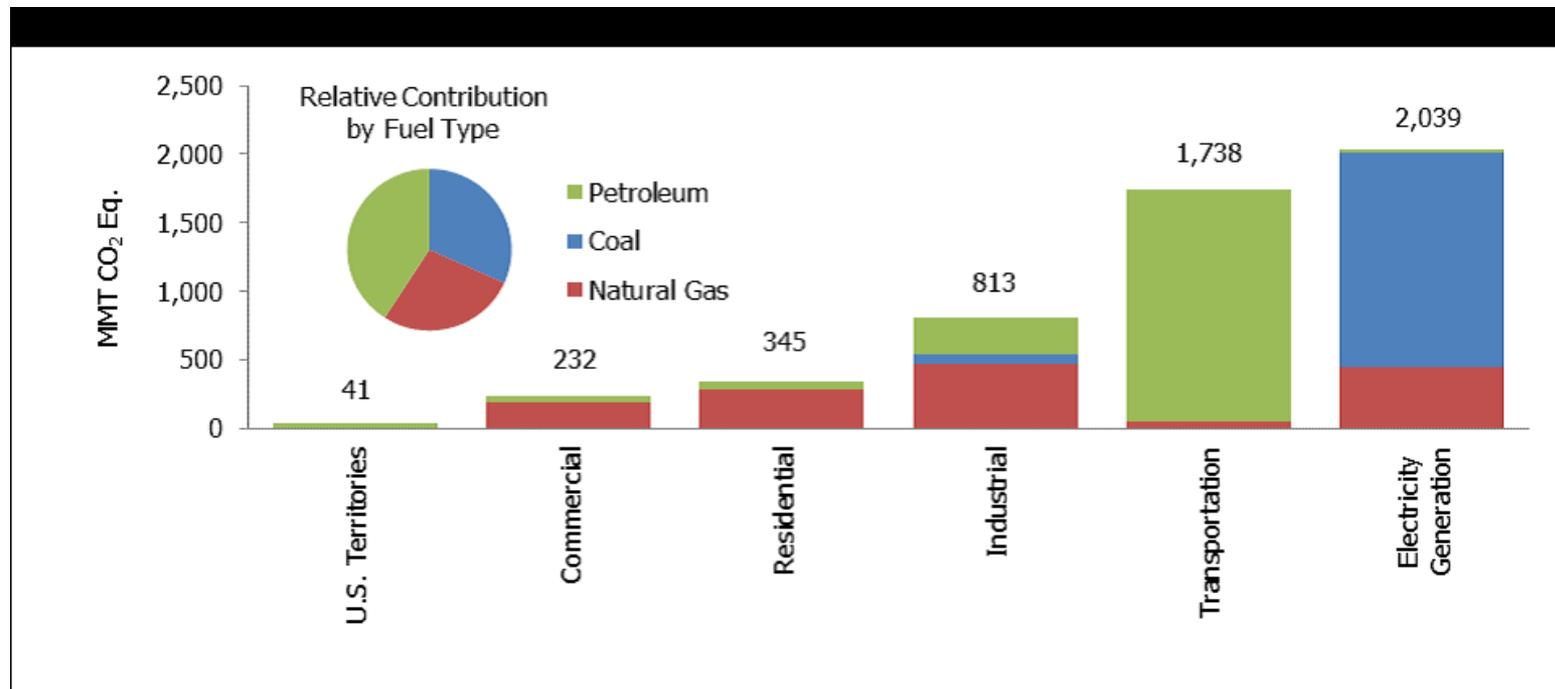
# U.S. Greenhous Gas Emissions by Gas



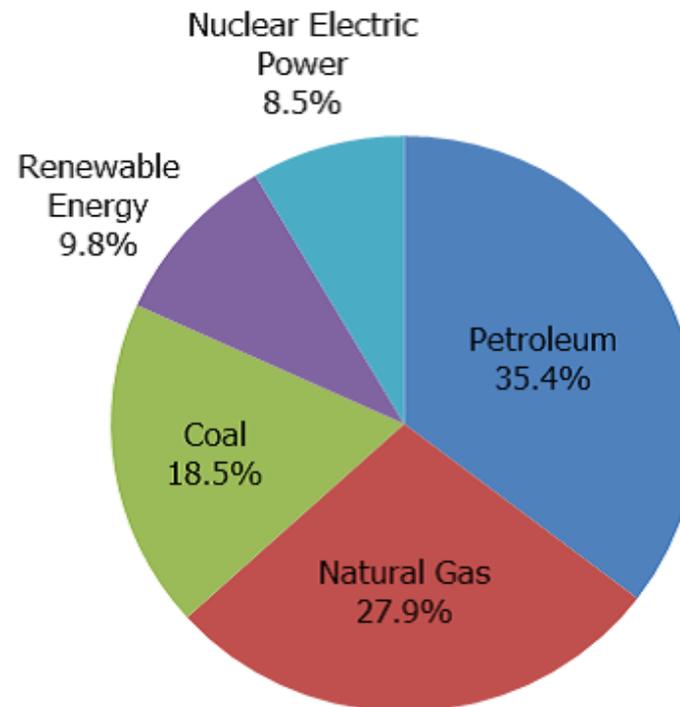
## 2014 U.S. Greenhouse Gas Emissions by Gas (Percentages based on MMT CO<sub>2</sub> Eq.)



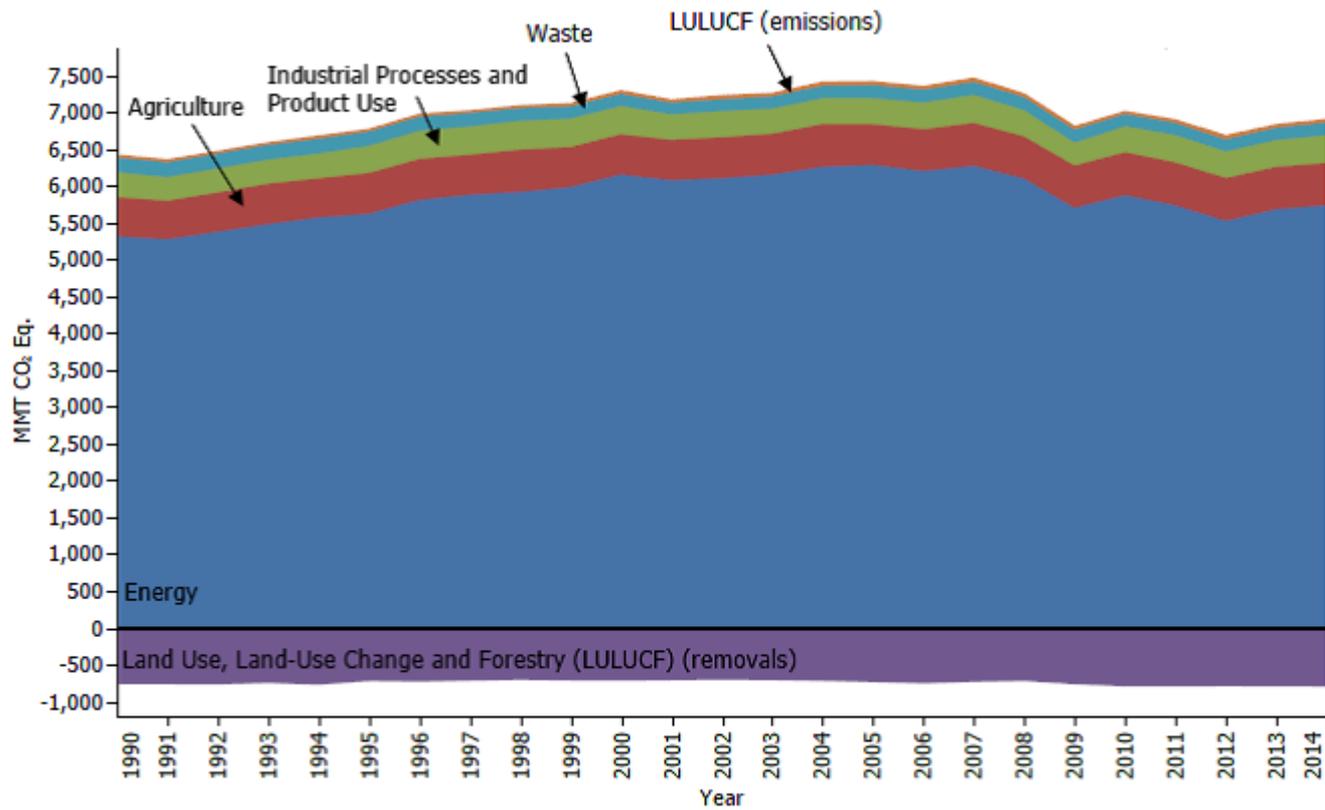
## 2014 CO<sub>2</sub> Emissions from Fossil Fuel Combustion by Sector and Fuel Type (MMT CO<sub>2</sub> Eq.)



## 2014 U.S. Energy Consumption by Energy Source (Percent)



# U.S. Greenhouse Gas Emissions and Sinks by Chapter/IPCC Sector (MMT CO<sub>2</sub> Eq.)



In 2013 (the most recent year for which data was reported by EPA), Louisiana carbon dioxide emissions totaled **194.5 million metric tons** of CO<sub>2</sub>, compared to Texas with 641 MMT of CO<sub>2</sub>, and Mississippi with 60.1 MMT. Louisiana's overall carbon dioxide production **ranks No. 8** in the nation, behind Texas, California, Pennsylvania, Illinois, Ohio, Florida, and Indiana. This despite Louisiana's comparatively low population, which supports the conclusion that Louisiana's ranking is due to the high level of influence of industry.

According to the *Carbon Storage Atlas*, Louisiana (including GOM) leads the nation in CO<sub>2</sub> storage potential. Identified as one of the leading ways for reducing concentrations of anthropogenic greenhouse gases, carbon capture and geological storage is a process whereby CO<sub>2</sub> is captured and stored in geologic formations through underground injection (instead of being released into the atmosphere). To give a sense of scale, the estimated geological storage capacity in the Lower 48 states is equivalent to over 450 years at recent U.S. greenhouse gas emissions rates. Louisiana, both onshore and offshore, leads the way with a combined storage capacity of over **8,556.43 billion metric tons** of sequestration potential – i.e., roughly **40%** of the Lower 48 states' total potential geologic storage capacity.

# CO<sub>2</sub> Stationary Source Emissions and CO<sub>2</sub> Storage Resource Estimates Summary

CO<sub>2</sub> Stationary Source Emissions and CO<sub>2</sub> Storage Resource Estimates Summary\*

State/ Province	CO <sub>2</sub> Emissions		Oil and Natural Gas Reservoirs Storage Resource			Unmineable Coal Storage Resource			Saline Formation Storage Resource			Total Storage Resource		
	Million Metric Tons Per Year	Number of Sources	Billion Metric Tons			Billion Metric Tons			Billion Metric Tons			Billion Metric Tons		
			Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate
Alabama	91	134	0.06	.09	0.12	1.92	2.98	4.37	120.22	307.34	689.67	122.20	310.41	694.16
Alaska	18	63				8.64	13.44	19.75				8.64	13.44	19.75
Alberta	137	182	0.60	1.49	3.57	0.03	0.03	0.03	38.17	76.74	140.30	38.80	78.26	143.90
Arizona	57	67	0.00	0.00	0.01	0.00	0.00	0.00	0.11	0.42	1.14	0.11	0.42	1.15
Arkansas	44	120	0.11	0.18	0.25	1.58	2.46	3.61	4.38	21.20	59.84	6.07	23.84	63.70
British Columbia	17	71	0.00	0.00	0.00				0.88	1.87	3.58	0.88	1.87	3.58
California	106	374	3.56	4.85	6.63				30.33	147.55	417.07	33.89	152.40	423.70
Canadian Federal Offshore									0.96	4.65	13.15	0.96	4.65	13.15
Colorado	49	142	1.31	2.35	2.66	0.49	0.65	0.86	33.48	131.11	353.82	35.28	134.11	357.34
Connecticut	8	47												
Delaware	9	18							0.04	0.04	0.04	0.04	0.04	0.04
District of Columbia	0	6												
Florida	120	142	0.02	0.03	0.05	1.26	1.95	2.85	101.37	246.45	552.05	102.65	248.43	554.95
Georgia	69	120				0.01	0.02	0.03	145.33	148.70	159.02	145.34	148.72	159.05
Hawaii	8	23												
Idaho	3	39							0.04	0.15	0.39	0.04	0.15	0.39
Illinois	120	231	0.10	0.20	0.34	1.45	2.38	2.87	19.68	80.75	213.07	21.23	83.33	216.28
Indiana	149	180	0.02	0.04	0.07	0.09	0.14	0.17	38.14	66.67	128.52	38.25	66.85	128.76
Iowa	68	143				0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01
Kansas	42	116	1.25	1.25	1.25	0.00	0.00	0.01	9.63	34.40	85.08	10.88	35.65	86.34
Kentucky	99	122	1.05	1.75	3.21	0.14	0.18	0.20	14.72	46.43	110.20	15.91	48.36	113.61
Louisiana	126	282	3.12	5.70	8.29	8.30	12.89	18.91	151.36	734.55	2075.23	162.78	753.14	2102.43
Maine	4	28										0.00	0.00	0.00
Manitoba	2	11	0.01	0.03	0.07				6.95	13.14	22.53	6.96	13.17	22.60
Maryland	24	52	0.00	0.00	0.00	0.00	0.00	0.00	1.86	1.88	1.93	1.86	1.88	1.93
Massachusetts	15	76										0.00	0.00	0.00
Michigan	87	208	0.17	0.26	0.32	0.00	0.00	0.00	31.55	45.56	66.20	31.72	45.82	66.52
Minnesota	46	130							0.00	0.00	0.00	0.00	0.00	0.00
Mississippi	34	91	0.28	0.45	0.62	5.44	8.46	12.45	139.02	459.15	1172.03	144.74	468.06	1185.10
Missouri	95	104	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.10	0.29	0.02	0.11	0.30
Montana	21	31	0.15	0.38	0.90	0.33	0.33	0.33	98.21	335.74	856.92	98.69	336.45	858.15
Nebraska	37	72	0.01	0.03	0.07	0.00	0.00	0.00	23.65	54.47	111.91	23.66	54.50	111.98

\* States/Provinces with a "zero" value represent estimates of minimal CO<sub>2</sub> storage resource, while States/Provinces with a blank represent areas that have not yet been assessed by the RCPs. Medium = p50. (ATLAS V1.1 DATA)

State/ Province	CO <sub>2</sub> Emissions		Oil and Natural Gas Reservoirs Storage Resource			Unminesible Coal Storage Resource			Saline Formation Storage Resource			Total Storage Resource		
	Million Metric Tons Per Year	Number of Sources	Billion Metric Tons			Billion Metric Tons			Billion Metric Tons			Billion Metric Tons		
			Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate	Low Estimate	Medium Estimate	High Estimate
Nevada	18	37												
New Brunswick	0	0												
New Hampshire	4	16												
New Jersey	22	96							0.00	0.00	0.00	0.00	0.00	0.00
New Mexico	37	84	9.71	9.71	9.71	0.08	0.16	0.30	32.97	129.29	349.08	42.76	139.16	359.09
New York	43	203	0.05	0.08	0.15				4.37	4.37	4.37	4.42	4.45	4.52
Newfoundland & Labrador	0	0												
North Carolina	62	99							1.34	6.51	18.39	1.34	6.51	18.39
North Dakota	39	48	0.37	0.91	2.19	0.54	0.54	0.54	71.94	136.50	234.71	72.85	137.95	237.44
Northwest Territories	0	0												
Nova Scotia	0	0												
Ohio	126	231	0.65	1.08	1.97	0.12	0.12	0.12	9.91	9.91	9.91	10.68	11.11	12.00
Oklahoma	67	151	3.48	4.40	4.40	0.00	0.00	0.01	19.64	76.87	207.24	23.12	81.27	211.65
Ontario	0	0							0.01	0.01	0.01	0.01	0.01	0.01
Oregon	9	47							6.81	33.15	93.70	6.81	33.15	93.70
Pennsylvania	132	281	0.80	1.34	2.45	0.27	0.27	0.27	17.34	17.34	17.34	18.41	18.95	20.06
Puerto Rico	17	23												
Quebec	0	0												
Rhode Island	4	12												
Saskatchewan	24	41	0.38	0.96	2.31				149.72	285.22	492.63	150.10	286.18	494.94
South Carolina	41	77							30.10	31.07	34.18	30.10	31.07	34.18
South Dakota	9	33	0.00	0.00	0.01				3.70	7.04	12.15	3.70	7.04	12.16
Tennessee	50	90	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.85	4.63	0.50	1.85	4.63
Texas	376	677	133.72	137.60	141.48	14.02	21.80	32.03	331.62	1505.79	4199.74	479.36	1665.19	4373.25
U.S. Federal Offshore	5	87	17.18	17.18	17.18	1.69	2.63	3.86	472.06	2277.24	6432.96	490.93	2297.05	6454.00
Utah	38	73	1.31	2.39	2.66	0.03	0.07	0.12	22.61	88.65	239.35	23.95	91.11	242.13
Vermont	0	6												
Virginia	35	111	0.00	0.01	0.01	0.16	0.37	0.69	0.27	0.86	2.21	0.43	1.24	2.91
Washington	17	74				0.59	0.92	1.35	36.03	175.26	495.39	36.62	176.18	496.74
West Virginia	71	84	5.93	9.84	18.05	0.37	0.37	0.37	11.19	11.19	11.19	17.49	21.40	29.61
Wisconsin	54	134							0.00	0.00	0.00	0.00	0.00	0.00
Wyoming	66	118	0.23	0.59	1.41	6.55	6.64	6.78	146.34	570.92	1539.56	153.12	578.15	1547.75
North America Total	3,071	6,358	186	205	232	54	80	113	2,379	8,328	21,633	2,618	8,613	21,978

\* States/Provinces with a "zero" value represent estimates of minimal CO<sub>2</sub> storage resource, while States/Provinces with a blank represent areas that have not yet been assessed by the RCPs. Medium = p50. (ATLAS V1.1 DATA)

Recent **government policy** has focused on sequestration as a means of lowering the atmospheric concentration of greenhouse gases, including carbon dioxide. The future of sequestration in the United States is closely tied to **political policies**.

The three steps in carbon capture and geologic storage are:

1. CO<sub>2</sub> capture and compression,
2. pipeline transportation, and
3. underground storage.

While many of the underlying technologies involved in CO<sub>2</sub> capture are mature, their use in the circumstances and scale needed for CCGS carries considerable technological and commercial risks.

**Federal Legal and Regulatory Regime for Geologic Storage:** There is no definitive federal legal and regulatory framework set up for CCGS regulation. There is no economic regulation of CO<sub>2</sub> pipelines since the Surface Transportation Board (STB) and the Federal Energy Regulatory Commission (FERC), assert they lack jurisdiction.

## Louisiana's Regime for Geologic Storage of CO<sub>2</sub>

Act 517 was based on model legislation proposed by the **Interstate Oil and Gas Compact Commission** (“IOGCC”), as modified to fit Louisiana’s regulatory structure and other existing legislation. The important facets of the law are:

The Act treats CO<sub>2</sub> not as a waste, but as a **commodity**. It regulates CO<sub>2</sub> under a resource management framework, taking into account the legal complexities of CO<sub>2</sub> storage, including environmental protection, ownership of pore space, long term liability, and maximization of storage capacity.

The Act was drafted in broad terms and grants the **Commissioner of Conservation** jurisdiction over “all persons and property necessary to administer and enforce effectively the provisions concerning geologic storage of carbon dioxide.” The Statute grants permitting authority to the Commissioner of Conservation for the purpose of regulating the facility and protecting against CO<sub>2</sub> pollution or migration.

The regulatory program authorizes the Commissioner of Conservation to **adopt rules** for injection and storage of carbon dioxide, consistent with the anticipated U. S. Environmental Protection Agency rules for Class VI injection wells under the Safe Drinking Water Act. It also extends the Commissioner’s authority over use of carbon dioxide for enhanced oil recovery. The rules are to prevent the escape of carbon dioxide to fresh water and to protect oil, gas, and other mineral resources. The Commissioner is given authority to issue **compliance orders and civil penalties** of up to \$5,000 per day of violation.

The Statute also empowers a storage operator, after obtaining approval from the Commissioner of Conservation, to exercise the right of **eminent domain** in order to acquire all surface and subsurface rights necessary for the operation of the storage facility.

The law allows property to be expropriated by private entities for the underground storage of carbon dioxide, “including but not limited to surface and subsurface rights, mineral rights, and other property interests necessary or useful for the purpose of constructing, operating, or modifying a carbon dioxide facility.” However, before any expropriation, the Conservation Commissioner must issue a **certificate of public convenience and necessity** after a public hearing in the parish where storage operations are located. As a condition precedent, the Commissioner, must have determined that the reservoir sought to be used is suitable and feasible for such use and meets all regulatory requirements. The eminent domain authority is to be exercised pursuant to the procedures found in existing law regarding expropriation, La. R.S. 19:2.

The Act establishes **liability limits** for operators with transfer of liability for storage operations to the Geologic Storage Trust Fund (run by the state) after a specified time.

In any civil liability action against the owner or operator of a storage facility, carbon dioxide transmission pipeline, or the generator of the carbon dioxide being handled by either the facility or pipeline, the maximum amount recoverable as compensatory damages for noneconomic loss shall not exceed **two hundred fifty thousand dollars** per occurrence.

The legislation **transfers liability** for long term storage (with a few exceptions) to the State ten years after the completion of injection, thus providing more certainty to encourage storage of carbon dioxide that will in turn assist in combating global warming. The ten year period can be altered by rule. To fund this potential liability, the law creates a **Geologic Storage Trust Fund** that will be funded by fees to be paid by the injection well operator. Until liability transfers to the state, the operator of the injection well, and only the operator, will be liable for compliance with injection and storage requirements.

## **Site-specific trust accounts**

The law provides that the injected carbon dioxide will “at all times be deemed the property of the **party that owns such carbon dioxide**, whether at the time of injection, or pursuant to a change of ownership by agreement while the carbon dioxide is located in the storage facility...and in no event shall such carbon dioxide be subject to the right of the owner of the surface of the lands or of any mineral interest therein...” After the cessation of injection operations, the Commissioner may issue a **certificate of completion** of injection operations upon a showing by the storage operator that the reservoir is reasonably expected to retain mechanical integrity and the carbon dioxide will reasonably remain emplaced. Upon issuance of the certificate, both liability for, and ownership of, the remaining project, including the stored carbon dioxide, **transfers to the state**. The liability release does not apply if the owner, operator, or generator intentionally and knowingly concealed or intentionally and knowingly misrepresented material facts related to the mechanical integrity of the storage facility or the chemical composition of any injected carbon dioxide.

No sequestration operation can adversely affect any reservoir which is producing or is **capable of producing oil, gas, condensate**, or other commercial minerals in paying quantities, unless all owners in such reservoir have agreed thereto or, if all owners do not agree, then at least three-fourths of the owners must agree and the Commissioner must find that the minerals capable of production in paying quantities have been produced or the reservoir has a **greater value** as a reservoir for carbon dioxide storage than for the production of the remaining volumes of original oil, gas, condensate, or other commercial minerals.