

Analysis of S.139, the Climate Stewardship Act of 2003: Highlights and Summary

Table S.1. Summary of Greenhouse Gas Emission Results, Reference and S.139 Cases, 2010, 2016, and 2025 (million metric tons carbon equivalent)

	2001	2010		2016		2025	
		Refer- ence	S.139	Refer- ence	S.139	Refer- ence	S.139
Greenhouse Gas Emissions							
Energy-Related Carbon Dioxide.....	1,559	1,802	1,710	1,968	1,656	2,234	1,482
Non-Energy Carbon Dioxide	36	40	40	42	42	46	46
Methane	175	178	115	176	127	172	120
Nitrous Oxide.....	119	127	121	133	127	143	137
High-GWP Gases (HFCs, PFCs, and SF ₆).....	39	84	50	123	71	209	106
Total.....	1,928	2,230	2,036	2,442	2,023	2,806	1,891
S.139 Compliance Summary							
Covered Energy-Related Carbon Dioxide.....	1,379	1,605	1,513	1,763	1,452	2,014	1,257
Other Covered Emissions	75	124	70	163	91	251	128
Total Covered Emissions	1,454	1,729	1,583	1,926	1,544	2,265	1,385
Offset Reductions Purchased							
Noncovered Greenhouse Gases.....	—	—	49	—	36	—	39
Increases in Biological Carbon Sequestration	—	—	113	—	90	—	87
International Offsets	—	—	73	—	0	—	0
Total Offset Reductions	—	—	235	—	126	—	126
Covered Emissions, less Offsets.....	1,454	1,729	1,349	1,926	1,418	2,265	1,259
Emission Allowances Issued	—	—	1,465	—	1,258	—	1,258
Net Allowance Bank Change (+, deposit; -, withdrawal).....	—	—	+117	—	-160	—	-1
Greenhouse Gas Emission Allowance Price							
(2001 dollars per metric ton carbon equivalent).....	—	—	79	—	129	—	221
(2001 dollars per metric ton carbon dioxide equivalent)	—	—	22	—	35	—	60
Offset Trading Price							
(2001 dollars per metric ton carbon equivalent).....	—	—	71	—	35	—	52
(2001 dollars per metric ton carbon dioxide equivalent)	—	—	19	—	9	—	14

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A and MLBILL.D050503A. Data on greenhouse gas emissions for 2001 from Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2001*. Forecasts of reference case greenhouse gas emissions other than carbon dioxide from reference materials provided by the U.S. Environmental Protection Agency for a business-as-usual case, developed in preparing the *Climate Change Action Report 2001* and extrapolated to 2025. Chapters 2 and 3 discuss related issues and data sources in more detail.

Table S.2. Summary of Energy Sector Results, Reference and S.139 Cases, 2010, 2016, and 2025

Summary Indicators	2000	2001	2010		2016		2025	
			Refer- ence	S.139	Refer- ence	S.139	Refer- ence	S.139
Greenhouse Gas Allowance Cost (2001 dollars per metric ton).....	—	—	—	79	—	129	—	221
Effective Delivered Energy Prices (2001 dollars per million Btu)								
Coal	1.24	1.26	1.18	3.18	1.16	4.34	1.12	6.44
Natural Gas.....	5.59	6.40	5.15	5.96	5.40	6.80	5.64	8.22
Motor Gasoline.....	12.42	11.57	11.45	12.98	11.33	13.70	12.07	15.31
Jet Fuel	7.26	6.20	5.66	7.10	6.03	8.24	6.72	10.35
Distillate Fuel	10.05	9.16	9.15	10.45	9.33	11.29	9.90	13.17
Electricity	20.18	21.34	18.76	20.40	19.28	23.28	19.66	28.70
Primary Energy Use (quadrillion Btu)								
Natural Gas.....	24.07	23.26	27.35	28.12	30.53	32.42	35.55	39.54
Petroleum	38.53	38.46	44.45	43.74	49.20	47.02	56.11	50.76
Coal	22.64	22.02	25.47	22.00	26.94	15.86	29.86	6.74
Nuclear	7.87	8.03	8.25	8.37	8.28	8.80	8.28	12.39
Renewable.....	5.95	5.32	7.30	9.03	7.94	12.76	8.77	16.22
Other.....	0.31	0.21	0.31	0.43	0.24	0.49	0.06	0.32
Total	99.37	97.29	113.13	111.67	123.12	117.35	138.63	125.97
Electricity Sales (quadrillion Btu).....	11.73	11.65	14.00	13.82	15.53	14.75	17.90	15.87
Carbon Dioxide Emissions by Fuel (million metric tons carbon equivalent)								
Natural Gas.....	341	329	391	402	437	452	509	493
Petroleum	659	668	761	748	843	806	963	870
Coal	579	561	650	560	688	398	763	119
Total	1,578	1,559	1,802	1,710	1,968	1,656	2,234	1,482
Carbon Dioxide Emissions by Sector (million metric tons carbon equivalent)								
Residential	317	314	355	326	372	275	406	181
Commercial.....	274	279	320	291	352	251	411	166
Industrial	477	451	500	472	534	448	592	391
Transportation.....	510	514	628	622	709	681	826	744
Total	1,578	1,559	1,802	1,710	1,968	1,656	2,234	1,482
Electricity Generation.....	621	612	697	615	759	485	868	205
Carbon Dioxide Reductions by Sector (million metric tons carbon equivalent)								
Residential	—	—	—	29	—	97	—	225
Commercial.....	—	—	—	29	—	101	—	245
Industrial	—	—	—	28	—	86	—	201
Transportation.....	—	—	—	6	—	28	—	82
Total	—	—	—	92	—	312	—	752
Electricity Generation Component	—	—	—	82	—	274	—	663

Notes: "Other" includes net electricity imports, methanol, and liquid hydrogen. "Effective Delivered Energy Prices" include cost of greenhouse gas allowances.

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A and MLBILL.D050503A.

Table S.3. Economic Impacts of S.139 (billion 1996 dollars and percent change relative to the reference case)

	Actual GDP	Potential GDP
Cumulative GDP Loss, 2004-2025 (billion 1996 dollars)		
Undiscounted	-1,354	-559
Discounted at 7 Percent per Year	-507	-165
Percent Change from Reference Case		
Undiscounted	-0.4%	-0.2%
Discounted at 7 Percent per Year	-0.3%	-0.1%
Economic Impact, 2025		
GDP Loss (billion 1996 dollars).....	-106	-90
Percent Change from Reference Case	-0.6%	-0.5%

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A and MLBILL.D050503A.

Table S.4. Comparison of Key Results in the Reference and High Technology Sensitivity Cases, 2010 and 2025

	2010				2025			
	Reference	High Technology Reference	S.139	S.139 High Technology	Reference	High Technology Reference	S.139	S.139 High Technology
Greenhouse Gas Emission Allowance Price (2001 dollars per metric ton carbon equivalent).....	—	—	79	59	—	—	221	158
Electricity Price (2001 cents per kilowatthour)	6.40	6.29	6.96	6.71	6.71	6.25	9.79	8.57
Electricity Sales (billion kilowatthours).....	4,104	4,020	4,050	3,965	5,246	4,997	4,653	4,481
Cumulative Incremental^a Capacity Additions (gigawatts)								
Coal.....	12	9	0	0	81	60	38	18
Natural Gas Combined Cycle.....	32	30	60	51	162	183	260	262
Combustion Turbine/Diesel.....	9	4	4	1	52	17	4	1
Nuclear Power.....	0	0	0	0	0	0	49	41
Renewables.....	1	3	33	25	5	11	148	110
Distributed Generation	2	1	2	1	18	8	5	2
Total Additions	57	47	98	77	318	280	503	433
Energy Consumption (quadrillion Btu)								
Coal.....	25.47	24.85	22.00	22.47	29.86	26.89	6.74	8.00
Natural Gas	27.35	26.62	28.12	26.82	35.55	32.35	39.54	36.44
Petroleum.....	44.45	43.82	43.74	43.30	56.11	53.29	50.76	49.41
Nuclear.....	8.25	8.17	8.37	8.37	8.28	8.05	12.39	11.76
Renewable	7.30	7.71	9.03	9.03	8.77	10.28	16.22	15.60
Electricity Imports.....	0.31	0.27	0.43	0.41	0.06	0.05	0.32	0.11
Total.....	113.13	111.44	111.67	110.39	138.63	130.90	125.97	121.31
Carbon Dioxide Emissions by Fuel								
Coal.....	650	634	560	573	763	687	119	182
Natural Gas	391	381	402	383	509	463	493	451
Petroleum.....	761	750	748	740	963	911	870	844
Total.....	1,802	1,764	1,710	1,696	2,234	2,060	1,482	1,477

^a Excludes plants under construction.

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A, MLBASE_HT.D052003C, MLBILL.D050503A, ML_HT.D050503A.

Table S.5. Comparison of Key Results in the Reference, S.139, and No New Nuclear/No Sequestration Cases, 2025

	2025		
	Reference	S.139	No New Nuclear / No Sequestration
Cumulative Incremental^a Capacity Additions (gigawatts)			
Coal.....	81	38	0
Natural Gas Combined Cycle.....	162	260	249
Combustion Turbine/Diesel.....	52	4	3
Nuclear Power.....	0	49	0
Renewables.....	5	148	206
Distributed Generation.....	18	5	6
Total Additions.....	318	503	464
Greenhouse Gas Emission Allowance Price			
(2001 dollars per metric ton carbon equivalent).....	—	221	297
(2001 dollars per ton metric carbon dioxide equivalent).....	—	60	81
Electricity Price (2001 cents per kilowatthour).....	6.71	9.79	10.68
Electricity Sales (billion kilowatthours).....	5,246	4,653	4,573
Carbon Dioxide Emissions by Fuel			
(million metric tons carbon equivalent)			
Coal.....	763	119	93
Natural Gas.....	509	493	582
Petroleum.....	963	870	859
Total.....	2,234	1,482	1,534^b

^a Excludes plants under construction.

^b Total emissions are higher in this case than in the S.139 case, because previously banked allowances are still available to be used in 2025. In the S.139 case, the bank of allowances is depleted in 2023.

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A, MLBILL.D050503A, and ML0NUCSEQ.D050403A.

Table S.6. Comparison of Key Results in the Reference, S.139, and High Natural Gas Price Sensitivity Cases, 2010 and 2025

	2010				2025			
	Refer- ence	S.139	High Natural Gas Price Refer- ence	S.139 High Natural Gas Price	Refer- ence	S.139	High Natural Gas Price Refer- ence	S.139 High Natural Gas Price
Greenhouse Gas Emission								
Allowance Price (2001 dollars per metric ton carbon equivalent)	—	79	—	83	—	221	—	214
Natural Gas Wellhead Price (2001 dollars per thousand cubic feet)	3.39	3.51	3.81	3.86	3.95	4.36	5.55	5.70
Electricity Price (2001 cents per kilowatthour)	6.40	6.96	6.55	7.12	6.71	9.79	7.18	10.28
Electricity Sales (billion kilowatthours)	4,104	4,050	4,089	4,032	5,246	4,653	5,202	4,617
Cumulative Incremental^a Capacity Additions (gigawatts) ..								
Coal	12	0	13	0	81	38	144	81
Natural Gas Combined Cycle	32	60	28	47	162	260	108	177
Combustion Turbine/Diesel	9	4	10	3	52	4	45	4
Nuclear Power	0	0	0	0	0	49	0	65
Renewables	1	33	2	41	5	148	7	178
Distributed Generation	2	2	2	1	18	5	16	4
Total Additions	57	98	54	93	318	503	321	509
Energy Consumption (quadrillion Btu)								
Coal	25.5	22.0	25.6	22.6	29.9	6.7	33.1	11.9
Natural Gas	27.3	28.1	26.6	27.0	35.5	39.5	30.1	30.5
Petroleum	44.4	43.7	44.5	43.7	56.1	50.8	57.1	51.3
Nuclear	8.2	8.4	8.2	8.4	8.3	12.4	8.3	13.7
Renewable	7.3	9.0	7.3	9.3	8.8	16.2	8.8	18.0
Electricity Imports	0.3	0.4	0.3	0.5	0.1	0.3	0.1	0.4
Total	113.1	111.7	112.6	111.4	138.6	126.0	137.5	125.8
Carbon Dioxide Emissions by Fuel (million metric tons carbon equivalent)								
Coal	650	560	652	577	763	119	846	192
Natural Gas	391	402	381	385	509	493	430	403
Petroleum	761	748	763	747	963	870	984	879
Total	1,802	1,710	1,796	1,709	2,234	1,482	2,260	1,474

^a Excludes plants under construction.

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A, MLBILL.D050503A, MLBASE_HGP.D052103A, and MLBILL_HGP.D052303A.

Table S.7. Comparison of Compliance Results in the S.139 and Offset Sensitivity Cases, 2010 and 2025 (million metric tons carbon equivalent)

	2010				2025			
	S.139	OFFSET 50	INTL 100	INTL 0	S.139	OFFSET 50	INTL 100	INTL 0
Greenhouse Gas Emissions								
Energy-Related Carbon Dioxide.....	1,710	1,737	1,710	1,704	1,482	1,697	1,482	1,482
Non-Energy Carbon Dioxide	40	40	40	40	46	46	46	46
Methane	115	117	120	114	120	111	120	120
Nitrous Oxide.....	121	121	121	121	137	137	137	137
High GWP Gases (HFCs, PFCs, and SF ₆).....	50	51	50	50	106	106	106	106
Total.....	2,036	2,066	2,041	2,028	1,891	2,098	1,891	1,891
S.139 Compliance Summary								
Covered Energy-Related CO ₂	1,513	1,540	1,513	1,507	1,257	1,475	1,256	1,256
Other Covered GHG Emissions	70	71	70	70	128	128	128	128
Total Covered Emissions	1,583	1,611	1,583	1,577	1,385	1,603	1,384	1,384
Offset Reductions Purchased								
Noncovered Greenhouse Gases.....	49	47	43	50	39	48	39	39
Increases in Biological Carbon Sequestration	113	108	101	120	87	134	87	87
International Offsets	73	63	90	0	0	165	0	0
Total Offset Reductions.....	235	218	234	170	126	346	126	126
Covered Emissions, Less Offsets.....	1,349	1,393	1,349	1,407	1,259	1,256	1,258	1,258
Emission Allowances Issued	1,465	1,465	1,465	1,465	1,258	1,258	1,258	1,258
Allowance Bank Change (+, deposit; -, withdrawal)	+117	+72	+116	+58	-1	+1	0	0
Greenhouse Gas Emission Allowance Price								
(2001 dollars per metric ton carbon equivalent).....	79	64	79	84	221	174	222	223
(2001 dollars per metric ton carbon dioxide equivalent)	22	17	22	23	60	48	60	61
Offset Trading Price								
(2001 dollars per metric ton carbon equivalent).....	71	64	51	84	52	174	52	52
(2001 dollars per metric ton carbon dioxide equivalent)	19	17	14	23	14	48	14	14

Source: Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBILL.D050503A, OFFSET50.D052303A, ML_INTL100.D052703A, and ML_INTL0.D051903A.

Table S.8. Comparison of Key Results from the EIA and MIT Analyses of S.139

	2000 ^a	2010	2015	2020	2025
Greenhouse Gas Emission Allowance Price (2001 dollars per metric ton carbon equivalent)					
MIT, McL Case	—	78	102	134	NA
EIA, S.139 Case.....	—	79	119	178	221
EIA, High Technology S.139 Case.....	—	59	88	133	158
Fossil Fuel Use (quadrillion Btu)					
MIT, Base Case					
Coal.....	22.75	26.54	28.43	32.23	NA
Oil.....	36.96	41.70	45.49	47.39	NA
Natural Gas	20.85	22.75	24.64	25.59	NA
EIA, Reference Case					
Coal.....	22.58	25.47	26.68	27.88	29.86
Oil.....	38.40	44.45	48.47	52.15	56.11
Natural Gas	24.06	27.35	30.07	32.95	35.55
EIA, High Technology Reference Case					
Coal.....	22.58	24.85	25.56	26.05	26.89
Oil.....	38.40	43.82	47.09	49.95	53.29
Natural Gas	24.06	26.62	28.45	30.33	32.35
Petroleum Use (quadrillion Btu, unless otherwise noted)					
MIT, Base Case.....	—	41.70	45.49	47.39	NA
MIT, McL Case.....	—	36.96	38.86	39.81	NA
Percent Change from Base Case.....	—	-11.4%	-14.6%	-16.0%	NA
MIT, McL Case Emissions Allowance Price for Motor Gasoline (2001 cents per gallon)					
	—	18.55	24.14	31.77	NA
EIA, Reference Case.....					
	—	44.45	48.47	52.15	56.11
EIA, S.139 Case.....					
	—	43.74	46.62	48.65	50.76
Percent Change from Reference Case	—	-1.6%	-3.8%	-6.7%	-9.5%
EIA, S.139 Case Emissions Allowance Price for Motor Gasoline (2001 cent per gallon).....					
	—	18.68	28.08	42.23	52.26
EIA, High Technology Reference Case.....					
	—	43.82	47.09	49.95	53.29
EIA, High Technology S.139 Case.....					
	—	43.30	45.79	47.45	49.41
Percent Change from High Technology Reference	—	-1.2%	-2.8%	-5.0%	-7.3%
EIA, High Technology S.139 Case Emissions Allowance Price for Motor Gasoline (2001 cents per gallon).....					
	—	13.91	20.91	31.45	37.53

^aMIT estimates for 2000 oil use are from 1.0 to 3.8 quadrillion Btu below EIA data for 2000; MIT estimates for 2000 natural gas use are from 2.7 to 3.7 quadrillion Btu below EIA data for 2000.

NA = not available.

Sources: **MIT:** S. Palstev, J.M. Reilly, H.D. Jacoby, A.D. Ellerman, and K.H. Tay, *Emissions Trading to Reduce Greenhouse Gas Emissions in the United States: The McCain-Lieberman Proposal*, Report No. 97 (Cambridge, MA: MIT Joint Program on the Science and Policy of Global Change, June 2003 [revised June 17]), Base Case and Case 7 (0-cost credits to 15 and 10 percent limits), Tables 5 and 7. **EIA:** Projections—Office of Integrated Analysis and Forecasting, National Energy Modeling System runs MLBASE.D050303A, MLBILL.D050503A, MLBASE_HT.D052003C, and ML_HT.D050503A; 2000 Fossil Fuel Use—Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(2003/04) (Washington, DC, April 2003), Table 1.3, web site <http://tonto.eia.doe.gov/FTP/ROOT/multifuel/mer/00350304.pdf>.