

Analysis of S.139, the Climate Stewardship Act of 2003

Table B.1. Incremental Planned Net Summer Capacity Since Completion of AEO2003* (megawatts)

North American Electric Reliability Council Region	2002	2003	2004	Total
East Central Area Reliability Coordination Agreement.....	888	1,137	528	2,553
Electric Reliability Council of Texas	371	922		1,293
Mid-Atlantic Area Council.....	2,221	739	149	3,109
Mid-America Interconnected Network	1,511	150		1,661
Mid-Continent Area Power Pool.....	302	38	38	378
New York	76	1,038		1,114
New England.....	703			703
Florida Reliability Coordinating Council	592	543		1,135
Southeastern Electric Reliability Council.....	637	5,114		5,751
Southwest Power Pool.....				0
Northwest Power Pool	438		1	438
Rocky Mountain Power Area	298	2,723		3,021
California.....	454	1,895	479	2,827
Total	8,490	14,299	1,195	23,984

*As of March 2003.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report," (2002 preliminary) and NewGen Data and Analysis, Platts Database (Boulder, CO, November 2002).

Table B.2. Total Planned Additions of Net Summer Capacity Included In NEMS Through 2005* (gigawatts)

North American Electric Reliability Council Region	2002	2003	2004	2005	Total
East Central Area Reliability Coordination Agreement.....	9,606	4,685	994		15,285
Electric Reliability Council of Texas.....	5,772	2,517	688	121	9,099
Mid-Atlantic Area Council.....	4,826	3,339	874	48	9,087
Mid-America Interconnected Network	6,012	218			6,230
Mid-Continent Area Power Pool.....	841	580	110	48	1,578
New York.....	634	1,569			2,203
New England.....	3,680	253	0		3,934
Florida Reliability Coordinating Council.....	4,856	1,805	1,832		8,492
Southeastern Electric Reliability Council.....	16,462	13,607	519		30,587
Southwest Power Pool	7,158	2,012			9,171
Northwest Power Pool.....	2,721	953	71	168	3,914
Rocky Mountain Power Area.....	5,008	6,845	1,112	45	13,008
California	2,722	3,846	1,126	857	8,550
Alaska	752				752
Hawaii	60				60
Total.....	71,110	42,230	7,325	1,286	121,951

*As of March 2003.

Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report," (2002 preliminary) and NewGen Data and Analysis, Platts Database (Boulder, CO, March 2003).

Table B.3. Domestic Marginal Abatement Costs for Non-CO₂ Covered Gases (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2005	2010	2015	2020	2025
BAU Emissions					
\$0	206	233	269	314	373
Emission Reductions					
\$1	11.1	12.2	14.6	17.9	21.3
\$10	27.2	30.6	37.5	47.4	60.6
\$20	38.2	43.4	54.2	70.0	91.9
\$30	39.7	44.9	55.4	70.8	92.8
\$40	43.4	49.0	61.1	78.9	103.9
\$50	44.9	51.0	63.5	81.9	107.8
\$75	47.1	53.4	66.6	86.1	113.5
\$100	47.3	53.6	66.7	86.2	113.6
\$125	47.8	54.2	67.7	87.5	115.4
\$150	49.0	55.7	69.7	90.3	119.3
\$175	50.2	57.2	71.6	92.9	123.0
\$200	50.3	57.2	71.7	93.0	123.1

Sources: U.S. Environmental Protection Agency, Office of Air and Radiation, *U.S. Methane Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions*, EPA_30-R-99-013 (September 1999), <http://www.epa.gov/ghginfopdfs/07-complete.pdf>; *Addendum to the U.S. Methane Emissions 1990-2020: Update for Inventories, Projections, and Opportunities for Reductions* (December 2001), http://www.epa.gov/ghginfopdfs/final_addendum2.pdf; *U.S. High GWP Gas Emissions 1990-2010: Inventories, Projections, and Opportunities for Reductions* (June 2001), EPA 000-F-97-000, http://www.epa.gov/ghginfopdfs/gwp_gas_emissions_6_01.pdf; and *U.S. Adipic Acid and Nitric Acid N₂O Emissions 1990-2020: Inventories, Projections and Opportunities for Reductions* (December 2001), <http://www.epa.gov/ghginfopdfs/adipic.pdf>.

Table B.4. Marginal Abatement Costs for Domestic Non-CO₂ Offsets in Noncovered Sectors (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2005	2010	2015	2020	2025
BAU Emissions					
\$0	154	155	155	153	151
Emission Reductions					
\$1	14.7	18.6	19.9	21.2	21.2
\$10	24.5	24.3	24.3	24.3	24.2
\$20	31.3	29.5	29.1	28.6	28.4
\$30	38.8	35.9	34.4	32.9	32.8
\$40	42.3	40.0	38.1	36.2	36.0
\$50	44.9	43.4	41.3	39.2	38.9
\$75	49.8	49.9	47.5	45.2	44.9
\$100	50.2	50.6	48.4	46.2	45.8
\$125	51.2	51.6	49.6	47.5	47.2
\$150	51.4	51.8	49.8	47.8	47.5
\$175	51.5	51.9	50.0	48.1	47.8
\$200	51.6	52.0	50.1	48.3	47.9

Sources: U.S. Environmental Protection Agency, Office of Air and Radiation, *U.S. Methane Emissions 1990-2020: Inventories, Projections, and Opportunities for Reductions*, EPA_30-R-99-013 (September 1999), <http://www.epa.gov/ghginfopdfs/07-complete.pdf>; *Addendum to the U.S. Methane Emissions 1990-2020: Update for Inventories, Projections, and Opportunities for Reductions* (December 2001), http://www.epa.gov/ghginfopdfs/final_addendum2.pdf; *U.S. High GWP Gas Emissions 1990-2010: Inventories, Projections, and Opportunities for Reductions* (June 2001), EPA 000-F-97-000, http://www.epa.gov/ghginfopdfs/gwp_gas_emissions_6_01.pdf; and *U.S. Adipic Acid and Nitric Acid N₂O Emissions 1990-2020: Inventories, Projections and Opportunities for Reductions* (December 2001), <http://www.epa.gov/ghginfopdfs/adipic.pdf>.

Table B.5. Marginal Abatement Costs for Carbon Sequestration in Domestic Agriculture and Forestry (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2005	2010	2015	2020	2025
\$1	0	0	0	0	0
\$10	0	57	58	59	48
\$20	0	73	74	76	62
\$30	0	84	86	88	72
\$40	0	94	96	98	80
\$50	0	101	104	106	86
\$100	0	130	133	136	111
\$150	0	151	154	157	128
\$200	0	167	171	174	142
\$225	0	174	178	182	149
\$250	0	181	185	189	154

Notes: The reductions shown are relative to a case with no carbon allowance value. Offset curves exclude biofuels, which are represented endogenously in NEMS.

Source: U.S. Environmental Protection Agency, FASOM Reduced Form Model, excluding biofuels use.

Table B.6. Marginal Abatement Costs for International Offsets (reductions in million metric tons carbon equivalent)

Offset Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$10	0	0	0	0
\$15	0	0	0	0
\$20	0	0	0	0
\$30	13	0	0	0
\$40	31	0	0	0
\$50	45	3	0	0
\$75	81	48	23	3
\$100	115	90	71	54
\$125	146	129	116	102
\$150	170	158	151	138
\$175	193	186	183	171
\$200	217	214	216	205
\$225	263	266	275	265

Source: Communication with Ron Sands, who operates the SGM model for EPA, and adjustments made by EIA as described below.

Table B.7. Baseline Carbon Dioxide Emissions for EEU and FSU Countries from SGM (million metric tons carbon equivalent)

Year	Baseline Emissions	Annual growth Rate (percent)
1990	1,319	
1995	894	-7.5
2000	815	-1.8
2005	979	3.7
2010	1,079	2.0
2015	1,167	1.6
2020	1,250	1.4
2025	1,285	0.6

Source: Historical data and projections from Ron Sands, PNNL, obtained using the SGM model.

Table B.8. Baseline Greenhouse Gas Emissions for Lithuania, Slovenia, Croatia, and Ukraine Using SGM Growth Rates (million metric ton carbon equivalent)

Year	Lithuania	Slovenia	Croatia	Ukraine	Total
1990	14	5	9	251	279
1995	9	4	6	147	166
2000	9	3	5	134	151
2005	10	4	7	161	182
2010	12	4	7	177	200
2015	12	5	8	192	217
2020	13	5	9	205	232
2025	14	5	9	211	239

Source: Historical data from "National Communications From Parties Included in Annex I to the Convention: Report on National Greenhouse Gas Inventory Data from Annex I Parties for 1990 to 2000", United Nations, October 11 2002, FCCC/SB/2002/INF.2, available at <http://unfccc.int/program/mis/ghg/index.html> (Table 4, page 10). Projections calculated using methodology described in this appendix.

Table B.9: Kyoto Protocol 2010 National Emissions Targets (percent of 1990 emissions)

Annex B Country	Target	Annex B Country	Target
Australia	108	Lichtenstein	92
Austria	92	Lithuania	92
Belgium	92	Luxembourg.....	92
Bulgaria	92	Monaco.....	92
Canada.....	94	Netherlands	92
Croatia.....	95	New Zealand	100
Czech Republic	92	Norway	101
Denmark.....	92	Poland	94
Estonia	92	Portugal	92
Finland	92	Romania	92
France	92	Russian Federation.....	100
Germany	92	Slovakia	92
Greece	92	Slovenia.....	92
Hungary.....	94	Spain	92
Iceland.....	110	Sweden.....	92
Ireland	92	Switzerland	92
Italy.....	92	Ukraine	100
Japan	94	United Kingdom and Northern Ireland	92
Latvia.....	92	United States	93

Source: "Kyoto Protocol of the United Nations Framework Convention on Climate Change", available at <http://unfccc.int/resource/docs/convkp/kpeng.pdf>, Annex B, page 23.

Table B.10. Annex I Countries' Baseline Greenhouse Gas Emissions, Excluding the United States, Historical and Forecast (million metric tons carbon equivalent)

Year	Baseline Emissions	Kyoto Protocol Target	Reductions from Baseline Needed To Meet Kyoto Protocol Target
1990	3,188		
1995	2,906		
2000	2,875		
2005	3,109		
2010	3,299	2,898	401
2015	3,462	2,898	564
2020	3,605	2,898	707
2025	3,688	2,898	790

Sources: Energy Information Administration, Office of Integrated Analysis and Forecasting; Ron Sands, PNL; and The Energy Modeling Forum (EMF), sponsored by Stanford University. EMF is a series of periodic seminars that examine important energy issues. EMF21 concentrated on greenhouse gas abatement strategies. See <http://www.stanford.edu/group/EMF/group21/index.htm>.

Table B.11. Annex I Countries' Baseline Greenhouse Gas Emissions, Excluding the United States (million metric tons carbon equivalent)

GHG Gas	1990	1995	2000	2005	2010	2015	2020	2025
CO ₂ (annex B).....	2,745	2,399	2,386	2,623	2,806	2,957	3,086	3,145
CH ₄	472	437	402	405	407	419	431	443
N ₂ O.....	216	198	191	204	216	227	242	256
HGWP.....	34	39	47	59	71	75	79	82
Lithuania, Slovenia, Croatia, Ukraine.....	-279	-166	-151	-182	-200	-217	-232	-239
Total Annex I Baseline.....	3,188	2,906	2,875	3,109	3,299	3,461	3,605	3,688

Note: Total greenhouse gas emissions from Annex I, excluding the United States, are the sum of emissions of carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and non-CO₂ gases with high global warming potential (HGWP) minus emissions from Lithuania, Slovenia, Croatia, and the Ukraine. As noted, this sum understates Annex I baseline GHG emissions by the amount of non-CO₂ emissions from the four countries.

Sources: Ron Sands email to Joseph Beamon, March 27, 2003, for Annex I carbon emission projections and marginal abatement cost curves; EMF 21 assumptions for all other gases in Annex I. Note that since we were only interested in greenhouse gas emissions in Annex I excluding the United States, we used SGM results for all countries in Annex I to be consistent.

Table B.12. Carbon Dioxide Marginal Abatement Costs for Annex I Counties, Excluding the United States (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$0	0	0	0	0
\$10	44	64	84	95
\$15	62	89	117	130
\$20	80	115	149	166
\$30	114	162	210	232
\$40	145	205	265	290
\$50	174	244	314	342
\$75	236	326	413	447
\$100	295	400	499	539
\$125	354	474	584	630
\$150	400	529	649	696
\$175	445	583	711	759
\$200	490	637	774	823
\$225	535	690	837	887

Source: Ron Sands, PNNL use of the Second Generation Model, provided to EIA staff via email.

Table B.13. Methane Marginal Abatement Costs for Annex I Counties, Excluding the United States (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$0	27	27	27	27
\$10	42	42	43	43
\$15	54	54	55	56
\$20	65	66	67	68
\$30	78	79	79	80
\$40	81	82	83	84
\$50	82	83	84	84
\$75	90	91	92	94
\$100	98	100	101	102
\$125	100	102	103	105
\$150	102	103	105	106
\$175	102	104	106	107
\$200	105	107	108	110
\$225	148	151	154	157

Source: Energy Modeling Forum, EMF21. The Energy Modeling Forum, sponsored by Stanford University, is a series of periodic seminars that examine important energy issues. EMF21 concentrated on greenhouse gas abatement strategies. See <http://www.stanford.edu/group/EMF/group21/index.htm>.

Table B.14. Nitrous Oxide Marginal Abatement Costs for Annex I Counties, Excluding the United States (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$0	0	0	0	0
\$10	19	19	20	20
\$15	19	19	20	20
\$20	19	19	20	20
\$30	19	19	20	20
\$40	19	19	20	20
\$50	19	19	20	20
\$75	19	19	20	20
\$100	19	19	20	20
\$125	19	19	20	20
\$150	19	19	20	20
\$175	19	19	20	20
\$200	19	19	20	20
\$225	19	19	20	20

Source: Energy Modeling Forum, EMF21. The Energy Modeling Forum, sponsored by Stanford University, is a series of periodic seminars that examine important energy issues. EMF21 concentrated on greenhouse gas abatement strategies. See <http://www.stanford.edu/group/EMF/group21/index.htm>.

Table B.15. Marginal Abatement Costs for Non-CO₂ Gases with High Global Warming Potential for Annex I Countries, Excluding the United States (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$0	5	7	9	11
\$10	11	12	13	14
\$15	13	16	18	21
\$20	15	20	24	28
\$30	16	21	26	31
\$40	17	22	28	33
\$50	17	23	28	33
\$75	18	23	29	34
\$100	18	24	30	36
\$125	19	26	33	39
\$150	21	28	36	43
\$175	21	29	37	45
\$200	22	30	38	46
\$225	25	35	45	56

Source: Energy Modeling Forum, EMF21. The Energy Modeling Forum, sponsored by Stanford University, is a series of periodic seminars that examine important energy issues. EMF21 concentrated on greenhouse gas abatement strategies. See <http://www.stanford.edu/group/EMF/group21/index.htm>.

Table B.16. Aggregate Greenhouse Gas Marginal Abatement Costs for Annex I Countries, Excluding the United States and Adjusted for Agriculture and Forestry Sinks and CDM (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$0	32	34	36	39
\$10	116	137	159	172
\$15	348	379	410	427
\$20	380	420	460	482
\$30	427	481	535	563
\$40	462	529	595	627
\$50	492	569	645	680
\$75	562	660	754	795
\$100	630	743	850	898
\$125	693	821	940	995
\$150	742	880	1,009	1,066
\$175	788	935	1,074	1,132
\$200	835	992	1,140	1,199
\$225	927	1,096	1,256	1,320

Source: Energy Information Administration, Office of Integrated Analysis and Forecasting. The results are the sum of the results from Tables B.11-B.14.

Table B.17. Aggregate Greenhouse Gas Marginal Abatement Costs for Annex I Counties, Excluding the United States and Adjusted for Agriculture and Forestry Sinks, CDM, Kyoto Protocol Targets, and a 50-Percent Reduction Factor (reductions in million metric tons carbon equivalent)

Allowance Price (2001 dollars per metric ton carbon equivalent)	2010	2015	2020	2025
\$0	0	0	0	0
\$10	0	0	0	0
\$15	0	0	0	0
\$20	0	0	0	0
\$30	13	0	0	0
\$40	31	0	0	0
\$50	45	3	0	0
\$75	81	48	23	3
\$100	115	90	71	54
\$125	146	129	116	102
\$150	170	158	151	138
\$175	193	186	183	171
\$200	217	214	216	205
\$225	263	266	274	265

Source: Energy Information Administration, Office of Integrated Analysis and Forecasting, using methodology described above.