TABLE 1: CO_2 EMISSIONS FROM ENERGY CONSUMPTION BY SECTOR AND FUEL TYPE, 2005 (MILLION METRIC TONS)[1]

Sector	Coal	Oil	Natural Gas	Total (Share of Total)[2]	Indirect Emissions from Electricity Use	Total Including Indirect Electricity Emissions (Share of Total)
Residential	1	105	262	368 (6.2%)	886	1,254 (21.1%)
Commercial	8	55	166	230 (3.9%)	821	1,051 (17.7%)
Transportation	0	1,922	32	1,953 (32.9%)	5	1,959 (32.9%)
Industrial	185	431	400	1,020 (17.1%)	663	1,682 (28.3%)
Electricity	1,944	100	319	2,375 (39.9%)	N/A	N/A
Total (Share of Total)	2,138 (36.0%)	2,614 (44.0%)	1,178 (19.8%)	5,945 (100.0%)	___	5,945 (100.0%)

[1] U.S. ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2005, at 13-28 (2006).

[2] *Id.* at 25-26.

TABLE 2: ALTERNATIVE POINTS OF REGULATION FOR A U.S. CAP-AND-TRADE SYSTEM[3]

Point of Regulation	**COAL**	**OIL**	**NATURAL GAS**
Upstream	Mining & Imports (500 companies)	Production Wells & Imports (750 companies)	Production Wells & Imports (750 companies)
Midstream	Rail, Barge, & Trucking (not addressed)	Refining (200 refineries)	Pipelines & Processing (200 pipelines or 1,250 LDCs and 500 NGL plants)[4]
Downstream	Power Plants (500 plants)	Mobile Sources, Industrial Boilers, and Power Plants (millions of sources)	Industrial Boilers, Commercial and Residential Furnaces, and Power Plants (millions of sources)

[3] CAMBRIDGE ENERGY RES. ASSOCS., DESIGN ISSUES FOR MARKET-BASED GREENHOUSE GAS REDUCTION STRATEGIES 8 (2006).

[4] "LDCs" are local distribution companies, and "NGL plants" are operations that produce natural gas liquids.

TABLE 3: BAU EMISSIONS AND TWO ILLUSTRATIVE CAP TRAJECTORIES (CO_2-EQUIVALENT MILLION METRIC TONS)[5]

	Scenario	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
GHG Emissions	BAU	7092	7680	8202	8596	9219	9884	10711	11507	12433	13283
	Stabilize	7092	7680	7383	7382	7382	7381	7378	7376	7374	7369
	Aggressive	7092	7680	7226	6629	6032	5434	4836	4236	3636	3041
CO_2 Emissions	BAU	5984	6517	6995	7357	7915	8518	9283	10013	10871	11656
	Stabilize	5984	6517	6710	6740	6759	6782	6804	6806	6793	6762
	Aggressive	5984	6517	6570	6036	5481	4896	4310	3702	3086	2504
CH_4 Emissions	BAU	583	602	612	617	631	643	652	664	677	683
	Stabilize	583	602	400	387	371	354	332	331	338	351
	Aggressive	583	602	389	354	322	313	302	307	317	303
N_2O Emissions	BAU	385	388	381	372	366	365	372	381	391	407
	Stabilize	385	388	264	246	241	233	233	231	234	247
	Aggressive	385	388	259	232	220	217	216	219	225	227
FG Emissions[6]	BAU	140	174	214	250	308	359	404	451	496	539
	Stabilize	140	174	9	10	11	11	10	9	9	10
	Aggressive	140	174	9	8	9	9	9	9	9	9

[5] *See* Sergey Paltsev et al., *Assessment of U.S. Cap-and-Trade Proposals* 9 (Nat'l Bureau of Econ. Research, Working Paper No. 13176, 2007) [hereinafter *Assessment*]; Sergey Paltsev et al., *Assessment of U.S. Cap-and-Trade Proposals: Appendix C* 1, 5, 6 (Nat'l Bureau of Econ. Research, Working Paper No. 13176, 2007), http://mit.edu/globalchange/www/MITJPSPGC_Rpt146_AppendixC.pdf [hereinafter *Assessment Appendix C*]. In this table and subsequent tables, "BAU" is the reference case used by Paltsev et al.; "Stabilize" is based on the 287 cumulative CO_2-e bmt case used by Paltsev et al.; "Aggressive" refers to 2050 emissions capped at 50% below the 1990 level and is based on the 203 cumulative CO_2-e bmt case used by Paltsev et al.

[6] In this table and subsequent tables, "FG" refers to three groups of fluorinated gases: sulfur hexafluoride ("SF_6"), HFCs, and PFCs.

TABLE 4: BAU AND TWO PREDICTED EMISSIONS PATHS (CO_2-EQUIVALENT MILLION METRIC TONS)[7]

	Scenario	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
GHG Emissions	BAU	7092	7680	8202	8596	9219	9884	10711	11507	12433	13283
	Stabilize	7092	7680	6962	6897	6715	6866	7867	8217	7739	7804
	Aggressive	7092	7680	6331	6004	5454	4615	5700	5288	4141	3515
CO_2 Emissions	BAU	5984	6517	6995	7357	7915	8518	9283	10013	10871	11656
	Stabilize	5984	6517	6328	6287	6132	6290	7265	7605	7126	7175
	Aggressive	5984	6517	5740	5443	4914	4085	5169	4650	3588	2945
CH_4 Emissions	BAU	583	602	612	617	631	643	652	664	677	683
	Stabilize	583	602	375	365	343	338	353	360	359	369
	Aggressive	583	602	348	331	314	307	305	310	319	328
N_2O Emissions	BAU	385	388	381	372	366	365	372	381	391	407
	Stabilize	385	388	252	237	230	228	239	241	245	252
	Aggressive	385	388	239	222	217	214	218	220	226	234
FG Emissions	BAU	140	174	214	250	308	359	404	451	496	539
	Stabilize	140	174	8	9	10	11	11	10	10	10
	Aggressive	140	174	7	8	9	9	9	9	9	9

[7] *Assessment Appendix C, supra* note 5, at 1-3.

TABLE 5: ANTICIPATED CO_2 EMISSIONS REDUCTIONS UNDER TWO ILLUSTRATIVE CAPS (MILLION METRIC TONS)[8]

Scenario		**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
BAU	Emissions	5984	6517	6995	7357	7915	8518	9283	10013	10871	11656
Stabilize	Emissions	5984	6517	6328	6287	6132	6290	7265	7605	7126	7175
	Reduction[9]	0	0	−667	−1070	−1783	−2228	−2018	−2408	−3745	−4481
	%Reduction[10]	0	0	−10%	−15%	−23%	−26%	−22%	−24%	−34%	−38%
Aggressive	Emissions	5984	6517	5740	5443	4914	4085	5169	4650	3588	2945
	Reduction	0	0	−1255	−1914	−3001	−4433	−4114	−5363	−7283	−8711
	%Reduction	0	0	−18%	−26%	−38%	−52%	−44%	−54%	−67%	−75%

[8] *Id.*
[9] Compared with business-as-usual emissions in the same year.
[10] Compared with business-as-usual emissions in the same year.

TABLE 6: PREDICTED CO_2 AND FOSSIL FUEL PRICES UNDER TWO ILLUSTRATIVE CAPS[11]

	Scenario	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
CO_2 Price[12]	BAU	0	0	0	0	0	0	0	0	0	0
	Stabilize	0	0	18	22	26	32	39	47	57	70
	Aggressive	0	0	41	50	61	74	90	109	133	161
Petroleum Product	BAU	1.0	1.2	1.3	1.5	1.7	1.9	2.0	2.1	2.2	2.3
	Stabilize	1.0	1.2	1.3	1.5	1.6	1.7	1.4	1.4	1.5	1.5
	Aggressive	1.0	1.2	1.3	1.5	1.5	1.6	1.3	1.4	1.3	1.2
Natural Gas	BAU	1.0	1.1	1.3	1.5	1.7	2.0	2.3	2.7	3.1	3.6
	Stabilize	1.0	1.1	1.2	1.5	1.9	2.4	2.5	2.8	2.8	2.8
	Aggressive	1.0	1.1	1.2	1.4	1.8	2.1	2.1	2.2	2.2	2.0
Coal	BAU	1.0	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.3	1.3
	Stabilize	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2
	Aggressive	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.2

[11] *Assessment Appendix C*, *supra* note 5, at 1-4. All fossil fuel prices are price indexes, with 2005 prices set equal to 1.00. Note that the price indexes do not include the cost of allowances, but they do include the effects of changes in fossil-fuel supply and demand (induced by impacts of allowance prices on downstream users of respective fossil fuels).

[12] Year 2005 dollars per ton of CO_2-equivalent.

TABLE 7: ELECTRICITY PRODUCTION UNDER TWO ILLUSTRATIVE CAPS[13]

	Scenario	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Coal (w/o CCS)	BAU	7	8	8	9	10	12	13	15	17	19
	Stabilize	7	8	7	6	4	3	6	7	4	4
	Aggressive	7	8	6	4	3	1	.4	0	0	0
Oil (w/o CCS)	BAU	.3	.3	.3	.2	.4	.4	.4	.5	.5	.6
	Stabilize	.3	.3	.2	.2	.1	.1	.2	.3	.2	.2
	Aggressive	.3	.3	.2	.2	.1	.1	0	0	0	0
Natural Gas (w/o CCS)	BAU	2	3	3	4	3	3	3	3	2	2
	Stabilize	2	3	3	5	9	10	8	6	4	2
	Aggressive	2	3	3	5	8	9	6	4	3	1
Nuclear	BAU	3	3	3	3	3	3	3	3	3	3
	Stabilize	3	3	3	3	3	3	3	3	3	3
	Aggressive	3	3	3	3	3	3	3	3	3	3
Hydro	BAU	1	1	1	1	1	1	1	1	1	1
	Stabilize	1	1	1	1	1	1	1	1	1	1
	Aggressive	1	1	1	1	1	1	1	1	1	1
Other Renewables	BAU	.2	.2	.2	.3	.3	.3	.4	.5	.6	.6
	Stabilize	.2	.2	.3	.4	.3	.5	,4	.6	.6	.6
	Aggressive	.2	.2	.1	.6	.3	.5	.4	.5	.6	.6
Natural Gas w/CCS	BAU	0	0	0	0	0	0	0	0	0	0
	Stabilize	0	0	0	0	0	0	0	0	0	0
	Aggressive	0	0	0	.2	.1	.4	.8	.5	.3	.2
Coal w/CCS	BAU	0	0	0	0	0	0	0	0	0	0
	Stabilize	0	0	0	.1	.1	.3	1	2	9	13
	Aggressive	0	0	0	.2	.6	2	7	11	15	18
Total Electricity Production	BAU	13	15	16	17	18	20	21	23	25	26
	Stabilize	13	15	15	16	17	18	19	21	22	25
	Aggressive	13	15	14	15	16	17	19	21	22	24

[13] *Assessment Appendix C*, *supra* note 5, at 1-4. "CCS" is carbon capture and storage. Electricity production is measured in exajoules (EJ); 1 EJ = 10^{18} joules. *See id.* at 1-3.

TABLE 8: RELATIONSHIP BETWEEN CO_2 ALLOWANCE PRICES AND RECENT FUEL PRICES[14]

Fuel	Average Base Price[15] 2002-2006	Added Fuel Cost for Various Allowance Prices[16]		
		$25	**$50**	**$100**
Crude Oil ($/bbl)	$40.00	$11.30 28%	$22.60 57%	$45.20 113%
Gasoline ($/gallon)	$1.82	$0.24 13%	$0.48 26%	$0.96 53%
Heating Oil ($/gallon)	$1.35	$0.27 20%	$0.54 40%	$1.08 80%
Wellhead Natural Gas ($/mcf)	$5.40	$1.38 26%	$2.76 51%	$5.52 102%
Residential Natural Gas ($/mcf)	$11.05	$1.39 13%	$2.78 25%	$5.56 50%
Utility Coal ($/short ton)	$26.70	$51.20 192%	$102.40 384%	$204.80 767%

[14] For base prices, *see Assessment*, *supra* note 5, at 53. Added fuel costs are from the author's calculations, drawing upon *id.* at 53, tbl. 5.

[15] In 2005 dollars.

[16] Added cost does not include adjustment for the effects of respective cap-and-trade policies on producer prices; *see supra* Table 6.

TABLE 9: PREDICTED AGGREGATE COSTS IN TERMS OF GDP AND WELFARE IMPACTS UNDER TWO ILLUSTRATIVE CAPS[17]

	Scenario	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
BAU[18]	GDP	11,981	14,339	16,921	19,773	22,846	26,459	30,534	34,929	39,530	44,210
	Welfare	9,656	11,773	13,933	16,342	18,948	22,016	25,414	29,032	32,780	36,553
% Change GDP from BAU	Stabilize	0	0	–0.22	–0.38	–0.55	–0.68	–0.33	–0.29	–0.36	–0.28
	Aggressive	0	0	–0.51	–0.79	–0.67	–0.56	–1.18	–1.00	–0.61	–0.48
% Change Welfare from BAU	Stabilize	0	0	–0.01	–0.13	–0.36	–0.45	–0.19	–0.12	–0.24	–0.18
	Aggressive	0	0	–0.04	–0.32	–0.69	–1.08	–0.77	–0.92	–1.28	–1.45

[17] *Assessment Appendix C*, *supra* note 5, at 1-3.
[18] Numbers are in billions of 2005 dollars.

TABLE 10: POTENTIAL REVENUE FROM CO_2 ALLOWANCE AUCTIONS UNDER TWO ILLUSTRATIVE CAPS[19]

Scenario		2015	2020	2025	2030	2035	2040	2045	2050
Stabilize	Total Potential CO_2 Allowance Auction Revenue (billions of dollars per year)	119	145	177	216	264	322	390	473
	Potential Tax Reduction per Family of Four (dollars per year)	1,490	1,730	2,050	2,410	2,860	3,400	4,020	4,770
	Potential Allowance Revenue as a Share of Non-CO_2 Federal Tax Revenue (%)	6	6	6	7	7	8	8	9
Aggressive	Total Potential CO_2 Allowance Auction Revenue (billions of dollars per year)	269	301	332	361	386	404	410	404
	Potential Tax Reduction per Family of Four (dollars per year)	3,360	3,610	3,820	4,030	4,180	4,260	4,230	4,060
	Potential Allowance Revenue as a Share of Non-CO_2 Federal Tax Revenue (%)	14	13	13	12	11	10	9	8

[19] Calculations by author, based on *Assessment Appendix C*, *supra* note 5, at 1-3, 5, 6.

TABLE 11: ILLUSTRATIVE DISTRIBUTION OF PRIVATE COSTS OF A CAP-AND-TRADE SYSTEM, WITHOUT OFFSETTING GAINS FROM ALLOCATION OF ALLOWANCES.[20]

Sector	**Energy Category**	**Share of Total Private Costs**	
Cost to Fossil Fuel Producers (Coal, Oil, Natural Gas)			3.6%
Increase in Business/Industry Expenditures	for Primary Energy	28.8%	54.7%
	for Electricity	25.9%	
Cost to Fossil-Fuel Fired Electric Generators			6.9%
Increase in Household Expenditures	for Primary Energy	21.5%	34.7%
	for Electricity	13.1%	
Total			100.0%[21]

[20] These illustrative results, adopted from the first proposal from the National Commission on Energy Policy, refer to the theoretical distribution of net private costs if all allowances were auctioned and none of the revenues were recycled. In other words, the potential offsetting effects of free distribution of allowances and/or using revenues to cut taxes or otherwise return revenues to businesses or individuals are not included. *See* NAT'L COMM'N ON ENERGY POL'Y, ALLOCATING ALLOWANCES IN A GREENHOUSE GAS TRADING SYSTEM 21 (2007).

[21] Some columns do not add up because of rounding error.

TABLE 12: AGGREGATE COSTS AND VALUE OF CO_2 ALLOWANCES UNDER TWO ILLUSTRATIVE CAPS (BILLIONS OF DOLLARS PER YEAR)[22]

Scenario		**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Stabilize	Total Potential CO_2 Allowance Auction Revenue	119	145	177	216	264	322	390	473
	Total Economic Cost - GDP Impact	37	75	126	180	101	101	142	124
Aggressive	Total Potential CO_2 Allowance Auction Revenue	269	301	332	361	386	404	410	404
	Total Economic Cost - GDP Impact	86	156	153	148	360	349	241	212

[22] *See supra* Tables 9, 10.

TABLE 13: PREVIOUS USES OF TRADABLE PERMIT MECHANISMS*

Country	Program	Traded Commodity	Period of Operation	Environmental and Economic Effects
Canada	*ODS Allowance Trading**	*CFCs and Methyl Chloroform* *HCFCs* *Methyl Bromide*	*1993-1996* *1996-Present* *1995-Present*	*Low trading volume, except among large methyl bromide allowance holders*
	PERT GERT	NO_x, VOCs, CO, CO_2, SO_2 CO_2	1996-Present 1997-Present	Pilot program Pilot program
Chile	*Santiago Air Emissions Trading**	*Total suspended particulates emission rights trading among stationary sources*	*1995-Present*	*Low trading volume; decrease in emissions since 1997 not definitively tied to TP system*
European Union	*ODS Quota Trading**	*ODS production quotas under Montreal Protocol*	*1991-1994*	*More rapid phaseout of ODS*
Singapore	*ODS Permit Trading**	*Permits for use and distribution of ODS*	*1991-Present*	*Increase in permit prices; environmental benefits unknown*
United States	Emissions Trading Program	Criteria air pollutants under the Clean Air Act	1974-Present	Performance unaffected; savings = $5-12 billion
	Leaded Gasoline Phasedown	Rights for lead in gasoline among refineries	1982-1987	More rapid phaseout of leaded gasoline; $250 million annual savings
	Water Quality Trading	Point-nonpoint sources of nitrogen & phosphorous	1984-1986	No trading occurred, because ambient standards not binding
	*CFC Trades for Ozone Protection**	*Production rights for some CFCs, based on depletion potential*	*1987-Present*	*Environmental targets achieved ahead of schedule; effect of TP system unclear*
	Heavy Duty Engine Trading	Averaging, banking, and trading of credits for NO_x and particulate emissions	1992-Present	Standards achieved; cost savings unknown
	*Acid Rain Reduction**	*SO_2 emission reduction credits; mainly among electric utilities*	*1995-Present*	*SO_2 reductions achieved ahead of schedule; savings of $1 billion/year*
	*RECLAIM Program**	*SO_2 and NO_x emissions among stationary sources*	*1994-Present*	*Emission reductions over 50%; 40% cost savings, or $58 million annually*
	*N.E. Ozone Transport**	*Primarily NO_x emissions by large stationary sources*	*1999-Present*	*Emission reductions of 40%; compliance cost savings of 44%*

* *See* Robert Hahn & Gordon Hester, *Marketable Permits: Lessons for Theory and Practice*, 16 ECOLOGY L.Q. 361 (1989). *See* Robert Hahn, *Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders*, 3 J. ECON. PERSP. 95 (1989). *See* Richard Schmalensee et al., *An Interim Evaluation of Sulfur Dioxide Emissions Trading*, 12 J. ECON. PERSP. 53 (1998). *See* Juan-Pablo Montero & Jose Miguel Sánchez, *A Market-Based Environmental Policy Experiment in Chile*, 45 J. L. & ECON. 267 (2002). *See* Ger Klaassen, *Emissions Trading in the European Union: Practice and Prospects*, *in* POLLUTION FOR SALE 83 (Steve Sorrell & Jim Skea eds., 1999). Erik Haites & Tallat Hussain, *The Changing Climate for Emissions Trading in Canada*, 9 REV. EUR. CMTY. & INT'L ENVTL. L. 264 (2000). TP refers to tradable permits; ODS, ozone-depleting substances; CFCs, chlorofluorocarbons; and CA, State of California. Cap-and-trade systems are in italics; other instruments are credit-based tradable permit systems.