

**COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY**

**INVENTORY OF GREENHOUSE GAS EMISSIONS
(1990 – 1999)**



Prepared By
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In support to the deliberations of Virginia Governor's Commission on Climate Change, this inventory of greenhouse gasses in Virginia for the years 1990 to 1999 is prepared as a backward extension of the earlier inventory for the years 2000 – 2025 prepared for the same purpose. The methodology used in preparing this inventory is very similar to the one employed in preparation of the earlier inventory.

Tables 1.1, 1.2, 8.1 & 8.2 of the earlier inventory as well as Figures 1.1 & 1.2 are recast below to include the data for the years 1990 and 1995. Appendix A gives the details of data used in generating the inventory for the years 1990 to 1999 and Appendix B gives the details of estimated greenhouse gas emissions.

Table 1.1: Emissions of Greenhouse Gases (1990 – 2025)

Emission Source	1990	1995	2000	2025
Million Metric Tons of CO₂ Equivalent				
1. Energy				
1.1 Fossil Fuel Combustion	97.82	106.25	122.86	169.74
1.2 Coal Mining	18.74	9.18	6.04	5.78
1.3 Oil & Natural Gas	0.07	0.14	0.31	0.43
Energy Total	116.64	115.57	129.21	175.95
2. Industrial Processes	2.11	3.15	4.15	4.33
3. Waste Management				
3.1 Solid Wastes	5.04	5.21	4.28	5.54
3.2 Wastewater	0.61	0.65	0.93	1.27
Waste Management Total	5.65	5.86	5.21	6.81
4. Agriculture				
4.1 Livestock Rearing	2.90	2.95	2.52	2.62
4.2 Crops Harvest	0.01	0.01	3.58	3.50
Agriculture total	2.90	2.96	6.10	6.12
Total Emission (Production)	127.30	127.53	144.66	193.20
Emissions (Imported Power)	16.24	18.04	17.97	36.64
Total Emission (Consumption)	143.55	145.57	162.63	229.84

Table 1.2: Emissions from Energy Consuming Sectors

Energy Consuming Sectors	1990	1995	2000	2025
Million Metric Tons of CO₂ Equivalent				
1. Residential	6.61	7.34	8.40	8.83
2. Commercial	4.36	5.24	5.82	8.11
3. Industrial	20.16	18.22	17.86	22.25
4. Transportation	43.49	44.92	48.27	78.29
5. Generated Power	23.20	30.52	42.51	52.26
6. Imported Power	16.24	18.04	17.97	36.64
Energy Consuming Sectors Total	114.07	124.28	140.83	206.38

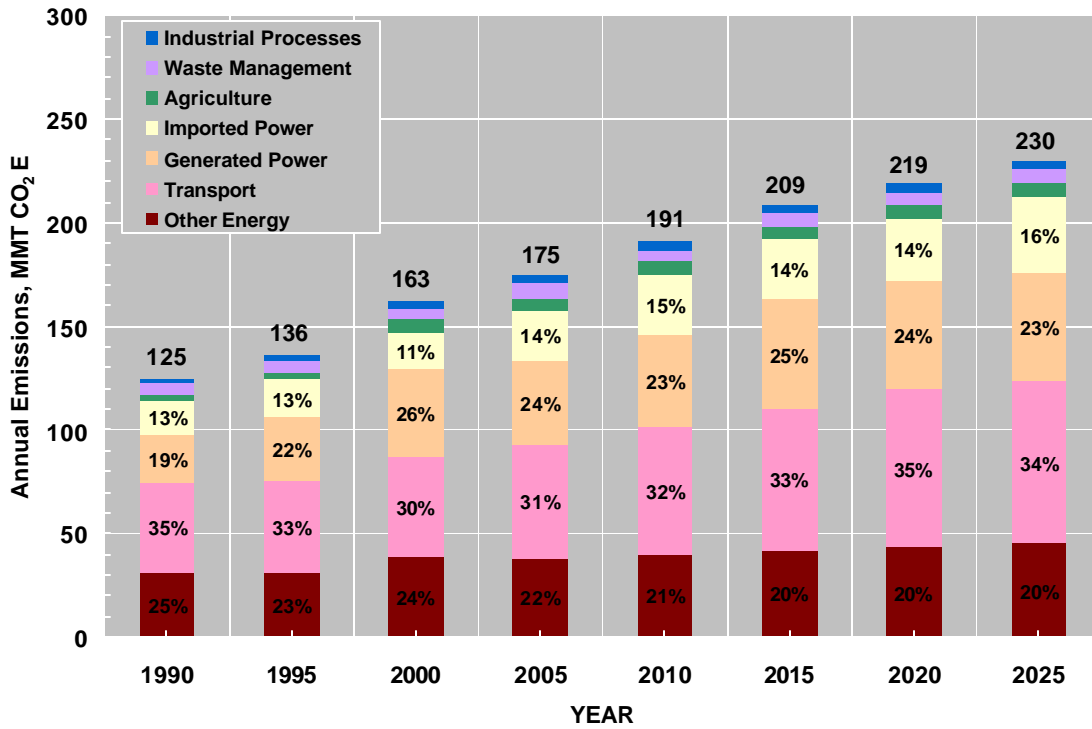


Figure 1.1: Emissions Distribution from Different Sources

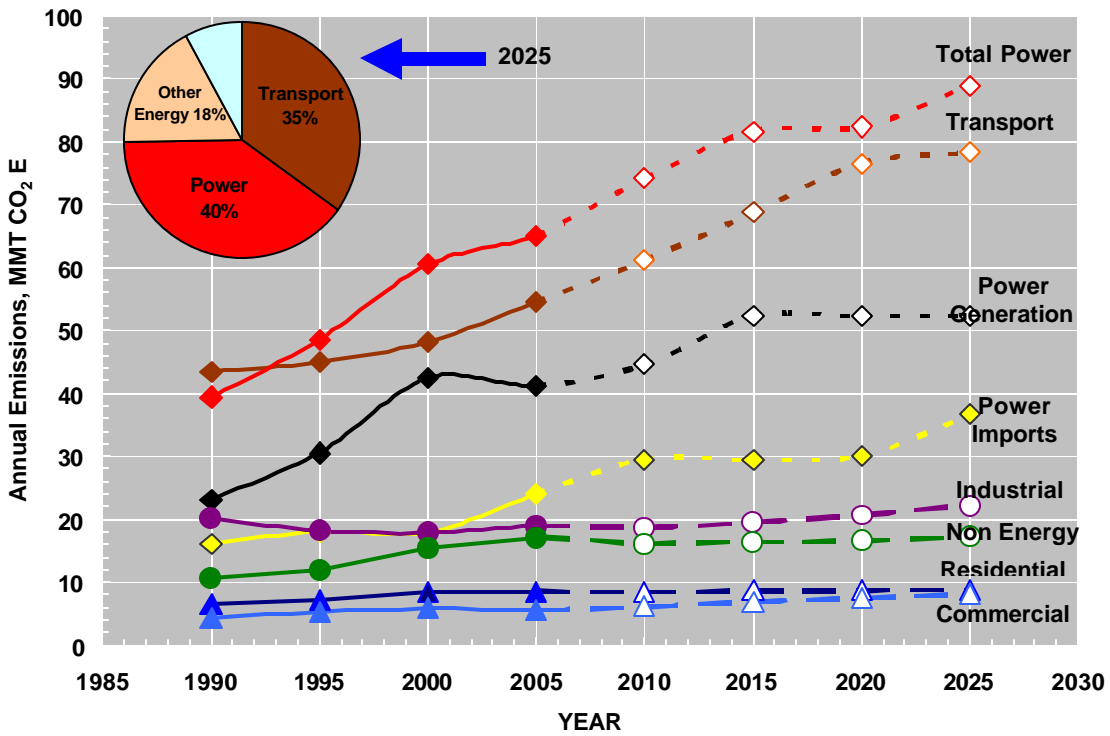


Figure 1.2: Emissions Trend from Energy Consuming Sectors

Table 8.1: Emission Summary by Source Category

Source/Sector	1990	1995	2000	2005	2010	2015	2020	2025
	Million Metric tons of Carbon Dioxide							
1. Energy								
1.1 Combustion								
1.1.1 Residential	6.61	7.34	8.40	8.59	8.40	8.64	8.68	8.83
1.1.2 Commercial	4.36	5.24	5.82	5.60	6.10	6.91	7.47	8.11
1.1.3 Industrial	20.16	18.22	17.86	18.93	18.70	19.51	20.69	22.25
1.1.4 Power (Generation)	23.20	30.52	42.51	41.24	44.55	52.26	52.26	52.26
1.1.5 Transportation	43.49	44.92	48.27	54.52	61.14	68.75	76.59	78.29
Combustion Total	97.82	106.24	122.86	128.88	138.89	156.07	165.69	169.74
1.2 Energy Production								
1.2.1 Coal Mining	18.74	9.18	6.04	4.47	6.39	6.30	6.04	5.78
1.2.1 Oil & Gas	0.07	0.14	0.31	0.43	0.39	0.40	0.41	0.43
Energy Total	18.81	9.32	129.21	133.78	145.67	162.77	172.14	175.95
2. Industrial Processes								
Industrial Processes Total	2.11	3.15	4.15	4.33	4.42	4.23	4.06	4.33
3. Waste Management								
Solid Wastes	5.04	5.21	4.28	5.93	4.49	4.89	5.22	5.54
Wastewater	0.61	0.65	0.93	1.07	1.05	1.12	1.20	1.27
4. Agriculture								
Live Stock	2.90	2.95	2.52	2.44	2.60	2.62	2.62	2.62
Crops Harvest	0.01	0.01	3.58	3.39	3.54	3.52	3.51	3.50
All Emission (Production)	127.30	127.53	144.66	150.93	161.76	179.15	188.73	193.20
Power (Imported)	16.24	18.04	17.97	23.93	29.54	29.43	30.10	36.64
All Emission (Consumption)	143.55	145.47	162.63	174.86	191.30	208.58	218.83	229.84

Table 8.2: Emissions Summary by Gases

Source/Sector	1990	1995	2000	2005	2010	2015	2020	2025
	Million Metric tons of Carbon Dioxide							
Carbon Dioxide								
Residential	6.50	7.20	8.28	8.50	8.27	8.51	8.54	8.69
Commercial	4.34	5.20	5.73	5.49	5.97	6.75	7.29	7.91
Industrial	19.95	18.02	17.66	18.74	18.47	19.27	20.44	21.98
Power	23.08	30.36	42.30	41.03	44.34	52.02	52.02	52.02
Transportation	41.50	42.54	46.92	53.51	60.83	68.46	76.34	78.07
Industrial Processes	1.39	1.82	1.68	1.00	3.07	2.42	1.77	1.44
Solid Wastes	0.34	0.68	0.51	0.92	1.25	1.46	1.67	1.90
Carbon Dioxide Total	97.08	105.82	123.08	129.18	142.20	158.89	168.07	172.01
Methane								
Residential	0.09	0.12	0.10	0.07	0.10	0.11	0.11	0.11
Commercial	0.02	0.02	0.07	0.09	0.11	0.13	0.14	0.16
Industrial	0.07	0.07	0.07	0.07	0.08	0.08	0.09	0.09
Power	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Transportation	0.18	0.17	0.08	0.06	0.02	0.02	0.02	0.02
Coal mining	18.74	9.18	6.04	4.47	6.39	6.30	6.04	5.78
Oil & Gas	0.07	0.14	0.31	0.43	0.39	0.40	0.41	0.43
Solid Wastes	4.70	4.51	3.76	3.97	3.21	3.40	3.51	3.61
Wastewater	0.44	0.47	0.51	0.62	0.58	0.61	0.65	0.68
Livestock	2.57	2.35	2.16	1.90	2.22	2.23	2.22	2.21
Residue burning	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Methane Total	26.88	17.04	13.12	11.70	13.11	13.30	13.21	13.12
Nitrous Oxide								
Residential	0.02	0.03	0.03	0.02	0.03	0.03	0.03	0.03
Commercial	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04
Industrial	0.15	0.14	0.13	0.13	0.15	0.16	0.16	0.17
Power	0.12	0.15	0.19	0.19	0.20	0.23	0.23	0.23
Transportation	1.81	2.21	1.27	0.95	0.29	0.27	0.23	0.20
Solid Wastes	0.01	0.02	0.01	1.04	0.02	0.03	0.03	0.03
Wastewater	0.17	0.19	0.41	0.44	0.48	0.51	0.55	0.58
Live Stock	0.33	0.60	0.36	0.54	0.38	0.39	0.40	0.41
Crops Harvest	0.00	0.00	3.57	3.38	3.53	3.51	3.50	3.48
Nitrous Oxide Total	2.62	3.34	6.00	6.72	5.10	5.15	5.16	5.18
Fluorine compounds	0.73	1.33	2.47	3.32	1.35	1.81	2.29	2.89
All Gases (Production)	127.30	127.53	144.66	150.93	161.76	179.15	188.73	193.20
Imported Power (CO ₂)	16.24	18.04	17.97	23.93	29.54	29.43	30.10	36.64
All Gases (Consumption)	143.55	145.57	162.63	174.86	191.30	208.58	218.83	229.84

APPENDIX A
INPUT DATA DETAILS

Table A.1: Data on Historic Fuels Consumption

Sector/Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Billion Btu									
A. Residential										
Coal	1,184	629	869	1,395	1,181	926	1,190	499	500	394
Distillate Fuel	35,350	30,968	32,382	30,805	31,840	30,066	33,611	30,372	29,245	28,841
Kerosene	6,576	7,496	7,277	8,442	7,124	6,918	8,754	8,975	11,639	8,779
LPG	7,699	8,385	8,804	8,624	8,868	10,412	11,518	12,432	9,483	10,584
Natural Gas	53,632	56,504	64,883	68,525	67,746	70,823	79,208	77,138	65,955	71,799
Wood	10,364	10,865	11,399	16,417	15,583	15,583	16,183	12,357	10,981	11,559
B. Commercial										
Coal	4,736	2,864	3,957	6,353	6,694	6,198	8,728	4,039	4,043	2,887
Distillate Fuel	16,400	14,378	13,240	15,048	15,965	15,474	19,793	17,321	18,042	16,683
Kerosene	790	839	719	902	571	1,561	1,573	2,108	2,456	1,799
LPG	1,359	1,480	1,554	1,522	1,565	1,837	2,033	2,194	1,673	1,868
Motor Gasoline	2,510	1,791	1,810	638	718	686	678	715	644	864
Residual Fuel	1,367	718	1,394	1,129	975	1,290	1,593	802	706	1,141
Natural Gas	42,788	45,951	52,751	55,345	55,031	58,697	61,590	64,602	60,837	63,836
Wood	8,430	5,596	5,978	7,516	7,301	7,569	11,340	11,530	11,551	11,171
C. Industrial										
Other coal	117,890	134,297	116,558	97,667	97,055	90,722	91,870	88,798	86,768	83,397
Asphalt and Road Oil	31,193	24,781	24,944	24,535	26,113	24,147	23,308	23,056	25,805	31,653
Aviation Gasoline Blends	1	0	1	1	21	20	26	33	15	23
Distillate fuel	21,118	19,797	17,114	18,402	16,047	21,326	25,435	29,108	25,812	24,925
Feedstock < 401 F	2,787	3,602	4,544	4,224	4,800	4,494	6,656	7,449	8,110	6,972
Feedstock > 401 F	6,042	9,968	9,814	10,170	10,105	9,651	10,133	11,960	11,369	11,265
Kerosene	425	521	317	494	575	694	646	518	668	317
LPG	5,531	6,549	6,403	6,874	6,821	4,848	4,873	4,064	3,194	4,086
Lubricants	2,622	2,346	2,391	2,435	2,545	2,501	2,428	2,565	2,685	2,713
Motor Gasoline	3,705	3,526	3,510	3,334	3,483	3,746	3,994	4,174	4,137	2,977
Miscellaneous Oil Products	1,105	1,839	1,206	1,141	1,275	1,170	1,236	1,357	1,652	1,554
Petroleum Coke	2,932	2,970	3,365	3,236	3,100	3,365	3,262	3,448	3,079	3,172
Pentene Plus	2,006	3,543	3,886	4,004	4,081	4,072	4,930	4,568	4,083	5,068
Residual Fuel	17,936	15,568	18,312	17,035	15,475	11,170	11,252	15,167	12,648	10,712
Still Gas	5,584	5,634	5,190	5,155	5,058	5,385	5,372	5,281	5,244	5,241
Special Naphtha	2,989	1,335	1,586	1,587	1,230	1,074	1,881	1,823	2,707	3,668
Unfinished Oils	-1,399	-1,778	-1,273	-1,427	-981	-1,219	-422	-375	-1,145	-1,050
Waxes		858	910	978	991	992	1,099	988	957	845
Natural Gas	78,356	62,853	72,190	77,522	90,290	101,829	88,900	90,382	98,165	100,306
Wood & Wastes	131,193	137,078	140,632	144,611	152,560	160,740	161,469	152,234	150,257	153,756
D. Transportation										
Aviation Gasoline	351	586	510	531	511	431	401	254	457	537
Distillate Fuel	97,565	100,903	98,813	100,469	107,642	107,285	124,781	129,744	133,055	135,237
Jet Fuel, Kerosene	69,961	61,095	61,390	62,713	66,274	59,893	52,149	53,298	57,735	52,811
Jet Fuel, Naphtha	18,565	5,618	4,514	4,576	1,683	137	35	12		
LPG	230	365	371	393	660	232	204	172	128	50
Motor Gasoline	363,243	365,154	370,445	383,840	388,296	406,657	408,246	419,660	423,629	438,127
Residual Fuel	20,845	23,624	17,855	14,866	12,245	12,088	7,652	9,134	7,911	7,668
Natural Gas	7,239	6,918	6,708	6,062	6,650	6,566	8,199	7,879	7,333	8,526
Ethanol	1,347	1,292	972	182	980	3	3,378	2,609	3,256	2,786
Lubricants	3,290	2,943	3,001	3,056	3,194	3,139	3,046	3,218	3,369	3,404
E. Power										
Coal	231,257	242,145	258,159	291,855	266,794	287,262	326,915	339,445	347,179	357,864
Distillate Fuel	3,220	3,081	3,366	2,528	5,058	3,979	5,104	13,156	2,704	3,733
Residual Fuel	8,931	17,667	12,832	20,467	21,052	9,917	5,169	7,603	24,834	27,579
Natural Gas	10,068	16,493	24,671	41,520	41,890	46,418	32,685	19,936	39,251	42,864
Wood and Waste	6,880	10,357	11,338	10,356	13,345	15,218	15,194	14,222	13,692	16,269
F. International Bunker Fuels										
Distillate Fuel		37	17	17	21	18	12	13	10	8
Residual Fuel		162	138	96	134	119	87	131	121	98

Table A.2: Fuel Consumption Details of Transportation Sector

Details	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
I. Highway Usage	Vehicle Miles Traveled (VMT), Million Miles									
A. Gasoline Vehicles										
Passenger Cars (LDGV)	38,911	37,622	38,109	38,476	39,720	40,830	41,601	40,620	41,045	42,568
Light-duty Trucks (LDGT)	15,590	17,676	19,300	20,473	21,156	21,984	22,629	22,540	22,532	23,890
Heavy-duty Vehicles (HDGV)	878	934	916	897	897	902	902	863	857	867
Motorcycles (MC)	243	247	257	265	273	286	288	279	280	293
B. Diesel Vehicles										
Passenger Cars (LDDV)	380	345	343	341	334	319	307	292	273	269
Light-duty Trucks (LDDT)	448	493	549	597	622	648	671	683	680	728
Heavy-duty Vehicles (HDDV)	3,727	3,781	3,973	4,364	4,535	4,840	5,001	5,082	5,163	5,314
II. Non-highway Usage										
C. Aviation	Billion Btu									
Jet Fuel, kerosene	69,961	61,095	61,390	62,713	66,274	59,893	52,149	53,298	57,735	52,811
Jet Fuel, Naphtha	18,565	5,618	4,514	4,576	1,683	137	35	12		
Aviation Gasoline	351	586	510	531	511	431	401	254	456	537
D. Marine Vehicles	1,000 Gallons									
Residual Fuel Oil	139,253	157,820	119,283	99,313	81,802	80,750	51,120	61,017	52,851	51,228
Distillate Fuel Oil	45,075	49,915	36,074	33,704	28,121	26,260	19,574	27,047	24,960	23,791
Gasoline	27,238	36,742	28,200	19,669	20,183	23,913	22,305	22,437	22,475	24,313
E. Locomotives	1,000 Gallons									
Diesel Fuel	84,328	62,353	67,907	58,849	56,869	67,787	128,748	93,432	66,346	32,202
F. Farming	1,000 Gallons									
Gasoline Tractor	7,973	8,014	8,512	14,566	15,608	16,487	17,093	17,478	16,764	15,104
Diesel Tractor	32,765	33,132	40,005	44,832	32,107	37,501	42,435	39,248	33,880	40,034
G. Construction Equipment	1,000 Gallons									
Gasoline	8,822	7,081	7,131	6,250	6,062	6,723	8,190	8,907	6,642	4,897
Diesel	97,268	92,749	98,793	99,801	92,177	100,576	124,785	132,260	130,128	130,370
H. Miscellaneous	1,000 Gallons									
Gasoline Heavy-duty	13,453	13,530	13,132	6,221	6,736	7,082	7,157	7,541	10,213	4,376
Gasoline Small-duty	16,853	14,001	15,619	10,151	10,579	10,249	10,105	10,273	12,694	7,204
Diesel Heavy-duty	25,699	26,872	22,364	15,520	17,478	14,365	13,389	12,778	15,092	8,562
NON-HIGHWAY FUEL USE, Billion Btu										
Jet Fuel, Kerosene	69,961	61,095	61,390	62,713	66,274	59,893	52,149	53,298	57,735	52,811
Jet Fuel, Naphtha	18,565	5,618	4,514	4,576	1,683	137	35	12		
Aviation Gasoline	351	586	510	531	511	431	401	254	456	537
Gasoline	65,517	72,287	65,463	50,607	53,106	57,731	56,660	57,729	62,146	50,997
Diesel/distillate	285,134	265,021	265,144	252,705	226,751	246,489	328,931	304,765	270,406	234,960
Residual Fuel Oil	139,253	157,820	119,283	99,313	81,802	80,750	51,120	61,017	52,851	51,228

Table A.3: Details on Coal Mining, Oil and Natural Gas Sector

Details	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A. Coal Mining											
Underground Mines Production	1,000 short tons	39,071	34,034	34,607	30,166	28,054	25,372	25,568	26,929	25,212	22,562
Surface Mines Production		7,681	7,777	8,259	9,151	9,075	8,727	10,022	8,907	8,535	9,732
Measured Ventilation Emissions	Million cubic feet	20,643	N/A	N/A	18,702	17,657	14,053	14,292	11,701	9,474	9,316
Degasification Emissions		19,981	N/A	N/A	17,958	20,347	19,740	20,796	17,804	20,608	19,970
Methane Recovered for use		-	-	-	10,716	15,426	17,770	19,310	16,663	19,868	19,456
B. Natural Gas											
Total Number of Wells	Number	819	886	1,153	1,426	1,470	1,671	1,671	2,046	2,388	2,752
C. Petroleum Production											
Oil Production	1,000 barrels	16	13	12	12	11	11	13	10	5	8
Data on transmission /distribution and flaring for gas and oil systems not available											

Table A.4: Data on Industrial Processes

Details	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A. Cement Manufacture										
Tons										
Clinker	707,007	596,631	623,242	1,034,000	1,036,000	1,032,000	810,000	816,000	867,000	895,000
Masonry	88,905	66,225	68,040	66,000	190,000	176,000	125,000	127,000	114,000	123,000
B. Lime Manufacture										
High calcium Lime	626,810	612,555	625,853	591,416	662,088	705,168	672,123	627,634	606,359	605,648
Dolomite Lime	140,676	135,880	138,004	130,584	144,912	153,832	145,877	138,366	123,641	136,352
C. Limestone Use										
Limestone	-	-	-	-	202,888	277,898	284,219	235,456	280,006	297,583
Dolomite Lime	-	-	-	-	95,606	92,544	126,363	117,394	74,432	120,766
D. Soda Ash										
Consumption	162,646	156,503	158,188	157,493	157,188	163,274	160,588	162,927	164,550	162,062
E. Iron & Steel										
Electric Arc Furnace	-	-	-	-	-	-	-	-	547,588	534,992
F. Ammonia & Urea										
Ammonia Production	299,150	296,296	323,792	311,209	326,646	320,051	357,462	311,516	318,881	313,401
Urea consumption	1,863	2,112	3,290	4,438	3,218	2,790	2,783	2,984	3,448	4,206
Electricity T & D										
ODS Substitutes (CO ₂)	8,245	15,951	43,391	136,619	308,156	716,680	997,314	1,272,407	1,431,236	1,613,202
SF ₆ Consumption	30	29	30	29	27	25	23	21	18	18
Not manufactured or no data available for the production of BOF steel, aluminum, magnesium, nitric acid & adipic acid; For ODS substitutes national estimated emissions are distributed in proportion to population										

Table A.5: Data on Waste Management

Details	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A. Solid waste Treatment	Tons									
Population	6,213,526	6,283,853	6,383,315	6,464,795	6,536,771	6,601,392	6,665,491	6,732,878	6,789,225	6,872,912
Solid Wastes tons	7,200,000	7,200,000	4,408,000	4,408,000	4,320,000	4,237,520	4,065,030	4,230,000	4,200,000	4,556,160
CH4 avoided	0	8,510	15,147	24,698	26,571	19,535	25,480	38,733	46,105	62,124
CH4 Recovered	0	0	0	5,729	6,578	13,369	12,520	13,055	13,055	12,520
MSW Combusted	900,000	900,000	1,368,000	1,368,000	1,440,000	1,556,640	1,556,820	1,620,000	1,800,000	732,240
	Proportion of Discards in Wastes Incinerated									
Plastics	9.7%	10.8%	10.6%	11.4%	11.2%	11.4%	12.3%	12.7%	13.0%	13.8%
PET	1.2%	0.8%	0.8%	0.8%	0.8%	0.8%	0.9%	1.0%	1.1%	1.2%
HDPE	2.7%	1.9%	1.9%	2.0%	2.0%	2.0%	2.4%	2.6%	2.8%	2.9%
PVC	0.8%	0.9%	0.9%	1.0%	0.9%	0.9%	0.8%	0.8%	0.8%	0.9%
LDPE/LLDPE	3.4%	3.0%	3.0%	3.2%	3.1%	3.2%	3.2%	3.3%	3.2%	3.6%
PP	2.0%	1.7%	1.6%	1.8%	1.7%	1.8%	1.6%	1.7%	1.6%	1.8%
PS	1.4%	1.3%	1.3%	1.4%	1.4%	1.4%	1.3%	1.3%	1.3%	1.4%
Other	2.6%	1.2%	1.2%	1.2%	1.2%	1.2%	2.0%	2.0%	2.1%	2.1%
Synthetic Rubber in MSW	2.0%	2.1%	2.0%	2.1%	2.1%	1.9%	2.0%	2.0%	2.0%	2.0%
Durables	1.2%	1.3%	1.2%	1.3%	1.3%	1.4%	1.5%	1.5%	1.5%	1.5%
Non-Durables	0.5%	0.8%	0.8%	0.8%	0.8%	0.5%	0.5%	0.5%	0.5%	0.5%
<i>Clothing and Footwear</i>	0.6%	0.7%	0.6%	0.7%	0.6%	0.3%	0.4%	0.4%	0.4%	0.3%
<i>Other Non-Durables</i>	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	0.2%
Containers and Packaging	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Synthetic fiber	2.99%	3.37%	3.47%	3.75%	3.91%	4.12%	4.46%	4.49%	4.61%	4.72%
B. Wastewater Treatment	Tons									
Fruits & Vegetables	146	172	157	5,471	3,555	3,200	-	-	-	-
Meat	370,183	383,746	387,284	322,600	381,205	399,758	371,861	351,721	351,132	334,984
pulp & Paper Board	385,349	3,777,155	386,847	370,016	146,452	133,838	-	-	-	-
Poultry processing, Fruits & Vegetables and Pulp & Paper data not available										

Table A.6: Data on Livestock Rearing

Livestock Details	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Number of Animals ('000 head)									
Dairy Cattle										
Dairy Cows	141	141	140	135	130	129	128	125	125	122
Dairy Replacement Heifers	81	77	74	71	70	71	70	65	60	63
Replacements 0-12 mos.	0	0	0	0	0	0				
Replacements 12-24 mos.	0	0	0	0	0	0				
Beef Cattle										
Feedlot Heifers	7	10	10	12	11	11	9	7	7	7
Feedlot Steer	21	23	23	26	25	27	22	20	20	21
Bulls	40	40	41	41	40	42	43	45	42	42
Calves	400	400	405	410	415	415	420	420	405	410
Beef Cows	679	689	690	695	695	701	727	725	695	688
Beef Replacement Heifers	108	114	116	120	125	130	125	130	113	115
Steer Stockers	155	145	147	150	155	165	180	195	190	190
Heifer Stockers	42	48	52	48	48	44	54	52	49	48
Swine										
Breeding Swine	50	48	50	47	45	44	43	43	35	34
Market Under 60 lbs	135	130	140	137	135	118	117	134	116	114
Market 60-119 lbs	90	89	83	85	75	81	78	85	85	79
Market 120-179 lbs	78	80	75	75	67	70	64	73	78	74
Market over 180 lbs	77	73	72	66	68	67	58	65	76	69
Poultry										
Hens > 1 yr	3,570	3,821	4,067	3,860	3,785	3,817	3,522	3,463	3,745	3,415
Pullets	1,256	1,504	1,712	1,245	1,229	1,276	896	1,010	1,221	979
Chickens	136	258	368	278	198	292	230	187	177	247
Broilers	35,618	39,764	43,309	44,436	45,945	47,291	47,109	47,164	47,873	48,855
Turkeys	7,083	7,014	7,618	8,077	8,250	8,963	9,464	9,070	8,864	8,000
Other										
Sheep on Feed	165	157	143	122	100	90	76	75	74	65
Sheep Not on Feed	43	38	35	25	24	21	18	18	18	15
Goats	12	12	12	15	18	21	23	26	29	32
Horses	109	109	110	110	110	106	107	107	108	107

Table A.7: Data on Crop Harvest

Details	Units	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Crops		Crop Production									
Alfalfa	'000 tons	560	442	490	351	403	429	432	330	324	300
Corn for Grain	'000 bushels	36,500	28,140	41,760	17,100	34,300	30,525	39,060	30,225	25,200	21,840
All Wheat	'000 bushels	12,220	12,250	15,105	13,515	14,000	17,600	14,575	17,420	11,025	13,680
Barley	'000 bushels	5,280	5,695	7,110	5,695	6,351	6,720	5,100	4,920	4,270	4,920
Rye	'000 bushels	256	264	288	165	252	175	264	200	175	272
Soybeans	'000 bushels	16,800	14,500	15,500	10,780	16,640	11,280	16,320	11,270	11,040	11,880
Peanuts	'000 lbs	309,915	307,200	256,215	176,250	291,180	206,925	219,260	191,250	221,250	218,120
Fertilizers		Total Fertilizer Use (kg N)									
VA	Sh Tons N	82,356	89,695	107,899	98,099	91,990	88,367	93,702	88,867	93,134	110,474
Synthetic	Percent	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Dried Manure		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Activated Sewage Sludge		1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Other		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Other crops not grown or not considered: Oats, rye, millet, rice, edible beans & peas, lentils, red & white clover, birds foot trefoil, arrow leaf clover, crimson clover Other organic fertilizer not used or not considered: Dried blood, compost, other sewage sludge, tankage.											

APPENDIX B
HISTORIC EMISSIONS DETAILS

Table B.1: Carbon Dioxide Emissions from Fossil Fuels

Sector/Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Million Metric tons of Carbon Dioxide									
Residential										
Coal	0.11	0.06	0.08	0.13	0.11	0.09	0.11	0.05	0.05	0.04
Petroleum	3.54	3.33	3.45	3.41	3.40	3.35	3.82	3.65	3.58	3.41
Natural Gas	2.84	3.00	3.44	3.63	3.59	3.75	4.20	4.09	3.50	3.81
Residential Total	6.50	6.39	6.97	7.17	7.10	7.20	8.13	7.79	7.12	7.25
Commercial										
Coal	0.44	0.27	0.37	0.59	0.63	0.58	0.82	0.38	0.38	0.27
Petroleum	1.63	1.39	1.36	1.40	1.43	1.51	1.86	1.67	1.70	1.62
Natural Gas	2.27	2.44	2.80	2.93	2.92	3.11	3.26	3.42	3.22	3.38
Commercial Total	4.34	4.09	4.52	4.92	4.98	5.20	5.94	5.47	5.31	5.27
Industrial										
Coal	11.01	12.55	10.90	9.13	8.83	8.24	8.34	8.30	7.85	7.55
Petroleum	4.86	4.91	4.97	4.81	4.55	4.50	5.02	5.62	5.08	4.67
Natural Gas	4.07	3.26	3.76	4.03	4.68	5.28	4.61	4.68	5.07	5.17
Industrial Total	19.95	20.72	19.63	17.97	18.06	18.02	17.96	18.60	18.00	17.38
Transportation										
Petroleum	41.11	40.13	39.88	40.90	41.56	42.20	42.40	43.81	44.50	45.35
Natural Gas	0.38	0.37	0.36	0.32	0.35	0.35	0.43	0.42	0.39	0.45
Transportation Total	41.50	40.50	40.24	41.22	41.91	42.54	42.84	44.23	44.88	45.80
Power										
Coal	21.61	22.63	24.12	27.26	24.92	26.83	30.55	31.73	31.98	33.08
Petroleum	0.94	1.62	1.26	1.80	2.03	1.07	0.78	1.56	2.15	2.44
Natural Gas	0.53	0.87	1.31	2.20	2.22	2.46	1.73	1.06	2.08	2.27
Power Total	23.08	25.12	26.69	31.25	29.16	30.36	33.06	34.35	36.22	37.80
Bunker Fuel										
Petroleum	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Bunker Fuels Total	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
FUEL SUMMARY										
Coal	33.17	35.50	35.48	37.11	34.48	35.73	39.81	40.45	40.26	40.93
Petroleum	52.10	51.39	50.92	52.32	52.98	52.64	53.89	56.32	57.02	57.51
Natural Gas	10.10	9.94	11.66	13.12	13.76	14.96	14.24	13.67	14.26	15.08
All Fuels	95.37	96.83	98.05	102.55	101.23	103.33	107.94	110.44	111.54	113.52
SECTOR SUMMARY										
Residential	6.50	6.39	6.97	7.17	7.10	7.20	8.13	7.79	7.12	7.25
Commercial	4.34	4.09	4.52	4.92	4.98	5.20	5.94	5.47	5.31	5.27
Industrial	19.95	20.72	19.63	17.97	18.06	18.02	17.96	18.60	18.00	17.38
Power (Generated)	23.08	25.12	26.69	31.25	29.16	30.36	33.06	34.35	36.22	37.80
Power (Imported)¹	16.24	16.57	16.76	16.82	16.59	18.04	17.37	16.21	15.91	16.62
Transportation²	41.50	40.50	40.24	41.22	41.91	42.54	42.84	44.23	44.88	45.80
All Sectors	111.60	113.39	114.80	119.36	117.81	121.36	125.31	126.64	127.44	130.13
Power Imports, Mil. kWh	28,209	28,785	29,102	29,220	28,822	31,331	30,175	28,153	27,639	28,863

Table B.2: Methane Emissions from Stationary Combustion

Sector/Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Million Metric Tons of CO ₂ Equivalent									
Residential										
Coal	0.007	0.004	0.005	0.009	0.007	0.006	0.008	0.003	0.003	0.002
Petroleum	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.010
N. Gas	0.005	0.006	0.006	0.007	0.007	0.007	0.008	0.008	0.007	0.007
Wood	0.062	0.065	0.068	0.098	0.093	0.093	0.097	0.074	0.066	0.069
Residential Total	0.085	0.084	0.090	0.124	0.118	0.116	0.124	0.096	0.086	0.089
Commercial										
Coal	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Petroleum	0.005	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005
Natural Gas	0.004	0.005	0.005	0.006	0.005	0.006	0.006	0.006	0.006	0.006
Wood	0.007	0.007	0.007	0.013	0.013	0.013	0.013	0.012	0.011	0.011
Commercial Total	0.017	0.016	0.017	0.024	0.024	0.024	0.027	0.025	0.023	0.023
Industrial										
Coal	0.025	0.000	0.025	0.021	0.015	0.014	0.014	0.019	0.012	0.012
Petroleum	0.003	0.000	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003
Natural Gas	0.002	0.000	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
Wood & Wastes	0.040	0.000	0.042	0.044	0.046	0.049	0.049	0.047	0.046	0.047
Industrial Total	0.069	0.000	0.072	0.069	0.066	0.067	0.068	0.071	0.063	0.063
Power										
Coal	0.005	0.005	0.005	0.006	0.006	0.006	0.007	0.007	0.007	0.008
Petroleum	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.002
Natural Gas	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001
Wood and Waste	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Power Total	0.006	0.007	0.007	0.009	0.008	0.008	0.008	0.009	0.010	0.011
FUEL SUMMARY										
Coal	0.038	0.010	0.036	0.037	0.029	0.027	0.030	0.030	0.024	0.022
Petroleum	0.019	0.015	0.019	0.019	0.019	0.018	0.021	0.021	0.021	0.020
Natural Gas	0.011	0.011	0.014	0.015	0.015	0.016	0.016	0.016	0.015	0.016
Wood & Wood Wastes	0.108	0.072	0.118	0.155	0.152	0.155	0.160	0.133	0.122	0.127
All Total	0.177	0.108	0.187	0.226	0.216	0.216	0.227	0.200	0.182	0.186
SECTOR SUMMARY										
Residential Total	0.085	0.084	0.090	0.124	0.118	0.116	0.124	0.096	0.086	0.089
Commercial Total	0.017	0.016	0.017	0.024	0.024	0.024	0.027	0.025	0.023	0.023
Industrial Total	0.069	0.000	0.072	0.069	0.066	0.067	0.068	0.071	0.063	0.063
Power Total	0.006	0.007	0.007	0.009	0.008	0.008	0.008	0.009	0.010	0.011
All Total	0.177	0.108	0.187	0.226	0.216	0.216	0.227	0.200	0.182	0.186

Table B.3: Nitrous Oxide Emissions from Stationary Combustion

Sector/Fuel	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Million Metric Tons of CO ₂ Equivalent									
Residential										
Coal	0.001	0.000	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.000
Petroleum	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.009	0.009
N. Gas	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Wood	0.012	0.013	0.013	0.019	0.018	0.018	0.019	0.015	0.013	0.014
Residential Total	0.024	0.023	0.025	0.031	0.030	0.030	0.032	0.027	0.024	0.025
Commercial										
Coal	0.002	0.001	0.002	0.003	0.003	0.003	0.004	0.002	0.002	0.001
Petroleum	0.004	0.004	0.003	0.004	0.004	0.004	0.005	0.004	0.004	0.004
Natural Gas	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Wood	0.001	0.001	0.001	0.003	0.002	0.003	0.003	0.002	0.002	0.002
Commercial Total	0.009	0.008	0.008	0.011	0.011	0.011	0.013	0.011	0.010	0.010
Industrial										
Coal	0.055	0.055	0.054	0.046	0.033	0.030	0.031	0.041	0.027	0.026
Petroleum	0.010	0.010	0.010	0.010	0.009	0.009	0.010	0.012	0.010	0.009
Natural Gas	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003
Wood & Wastes	0.078	0.081	0.083	0.086	0.091	0.096	0.097	0.092	0.090	0.092
Industrial Total	0.145	0.147	0.150	0.143	0.136	0.138	0.140	0.147	0.130	0.130
Power										
Coal	0.108	0.113	0.120	0.136	0.124	0.134	0.152	0.158	0.162	0.167
Petroleum	0.002	0.004	0.003	0.004	0.005	0.003	0.002	0.004	0.005	0.006
Natural Gas	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Wood and Waste	0.008	0.012	0.013	0.012	0.014	0.015	0.016	0.015	0.014	0.016
Power Total	0.118	0.129	0.137	0.153	0.144	0.153	0.171	0.178	0.182	0.190
FUEL SUMMARY										
Coal	0.165	0.169	0.177	0.185	0.161	0.167	0.188	0.202	0.191	0.194
Petroleum	0.026	0.026	0.025	0.026	0.026	0.024	0.027	0.029	0.029	0.028
Natural Gas	0.005	0.006	0.006	0.007	0.007	0.008	0.008	0.007	0.008	0.008
Wood & Wood Wastes	0.099	0.107	0.111	0.120	0.126	0.132	0.134	0.124	0.119	0.124
All Total	0.296	0.308	0.320	0.338	0.321	0.332	0.356	0.362	0.347	0.355
SECTOR SUMMARY										
Residential	0.024	0.023	0.025	0.031	0.030	0.030	0.032	0.027	0.024	0.025
Commercial	0.009	0.008	0.008	0.011	0.011	0.011	0.013	0.011	0.010	0.010
Industrial	0.145	0.147	0.150	0.143	0.136	0.138	0.140	0.147	0.130	0.130
Power	0.118	0.129	0.137	0.153	0.144	0.153	0.171	0.178	0.182	0.190
All Total	0.296	0.308	0.320	0.338	0.321	0.332	0.356	0.362	0.347	0.355

Table B.4: Methane Emissions from Transportation Sector

Fuels Used/Vehicle Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Emission Source	Emissions, Million Metric Tons of CO₂ E									
Gasoline Highway										
Passenger Cars	0.106	0.098	0.096	0.094	0.092	0.089	0.083	0.075	0.070	0.068
Light-Duty Trucks	0.055	0.059	0.061	0.063	0.061	0.059	0.056	0.052	0.048	0.041
Heavy-Duty Vehicles	0.011	0.011	0.011	0.010	0.010	0.010	0.009	0.008	0.007	0.006
Motorcycles	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Gasoline Highway total	0.172	0.169	0.168	0.167	0.164	0.158	0.149	0.135	0.125	0.116
Diesel Highway										
Passenger Cars	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Light-Duty Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy-Duty Vehicles	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Diesel Highway total	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Alternative Fuel Vehicles	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001
Non-Highway										
Boats	0.003	0.004	0.003	0.003	0.002	0.002	0.001	0.002	0.002	0.002
Locomotives	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.001	0.001
Farm Equipment	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.002	0.001	0.002
Construction Equipment	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002
Aircraft	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.002	0.003	0.003
Other*	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Non-Highway total	0.012	0.012	0.011	0.010	0.010	0.010	0.010	0.010	0.009	0.008
*Other includes snowmobiles, small gasoline powered utility equipment, heavy-duty gasoline and diesel powered equipment										
EMISSION SUMMARY										
Highway CH₄	0.173	0.169	0.169	0.168	0.165	0.159	0.150	0.137	0.127	0.117
Non-Highway CH₄	0.012	0.012	0.011	0.010	0.010	0.010	0.010	0.010	0.009	0.008
Total Transport CH₄	0.185	0.181	0.180	0.178	0.174	0.169	0.161	0.147	0.136	0.126

Table B.5: Nitrous Oxide Emissions from Transportation Sector

Fuels Used/Vehicle Type	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Emission Source	Emissions, Million Metric Tons of CO₂ E									
Gasoline Highway										
Passenger Cars	1.074	1.058	1.088	1.110	1.140	1.146	1.132	1.071	1.044	1.030
Light-Duty Trucks	0.588	0.694	0.784	0.855	0.897	0.934	0.957	0.947	0.924	0.858
Heavy-Duty Vehicles	0.029	0.034	0.035	0.036	0.038	0.039	0.044	0.046	0.048	0.045
Motorcycles	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Gasoline Highway total	1.693	1.787	1.908	2.002	2.076	2.121	2.134	2.065	2.018	1.934
Diesel Highway										
Passenger Cars	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Light-Duty Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Heavy-Duty Vehicles	0.008	0.008	0.009	0.010	0.010	0.011	0.011	0.011	0.011	0.011
Diesel Highway total	0.009	0.009	0.009	0.010	0.011	0.011	0.012	0.012	0.012	0.011
Alternative Fuel Vehicles	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004
Non-Highway										
Boats	0.018	0.020	0.015	0.013	0.011	0.011	0.008	0.009	0.008	0.008
Locomotives	0.007	0.006	0.006	0.005	0.005	0.006	0.011	0.008	0.006	0.003
Farm Equipment	0.003	0.003	0.004	0.005	0.004	0.004	0.005	0.004	0.004	0.004
Construction Equipment	0.008	0.008	0.008	0.008	0.008	0.008	0.010	0.011	0.011	0.011
Aircraft	0.062	0.046	0.046	0.047	0.047	0.042	0.036	0.037	0.040	0.037
Other*	0.004	0.004	0.004	0.002	0.002	0.002	0.002	0.002	0.003	0.001
Non-Highway total	0.102	0.087	0.083	0.080	0.077	0.073	0.072	0.072	0.071	0.064
*Other includes snowmobiles, small gasoline powered utility equipment, heavy-duty gasoline and diesel powered equipment										
EMISSION SUMMARY										
Highway N₂O	1.704	1.799	1.919	2.016	2.089	2.135	2.149	2.080	2.033	1.949
Non-Highway N₂O	0.102	0.087	0.083	0.080	0.077	0.073	0.072	0.072	0.071	0.064
Total Transport N₂O	1.807	1.886	2.002	2.096	2.166	2.208	2.221	2.152	2.105	2.013

Table B.6: Emissions from Coal Mining, Natural Gas & Oil Sectors

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Coal mining	Million Metric Tons of CO₂ E									
Active Mines	18.60	16.23	16.51	12.25	10.78	7.99	7.93	6.79	5.64	5.37
Abandoned Mines	Million Metric Tons of CO₂ E									
Vented	0.06	0.05	0.04	0.04	0.04	0.13	0.20	0.19	0.19	0.17
Sealed	0.01	0.01	0.01	0.03	0.05	0.52	0.49	0.49	0.42	0.52
Flooded	0.07	0.04	0.03	0.06	0.08	0.54	0.47	0.45	0.33	0.28
Abandoned Total	0.14	0.10	0.08	0.13	0.17	1.19	1.16	1.13	0.94	0.97
Coal Mining Total	18.74	16.33	16.59	12.38	10.95	9.18	9.10	7.92	6.57	6.35
Oil & Gas	Million Metric Tons of CO₂ E									
Natural Gas	0.07	0.07	0.10	0.12	0.12	0.14	0.14	0.17	0.20	0.24
Petroleum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Oil & Gas	0.07	0.07	0.10	0.12	0.13	0.14	0.14	0.17	0.20	0.24

Table B.7: Emissions from Industrial Processes

Emissions (MTCO ₂ E)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Carbon Dioxide Emissions	Million Metric Tons of CO₂ E									
Cement Manufacture	0.37	0.31	0.32	0.54	0.54	0.54	0.42	0.42	0.45	0.47
Lime Manufacture	0.59	0.58	0.59	0.56	0.62	0.66	0.63	0.59	0.56	0.57
Limestone and Dolomite Use					0.14	0.17	0.19	0.16	0.16	0.19
Soda Ash	0.07	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Ammonia & Urea	0.36	0.36	0.39	0.37	0.39	0.38	0.43	0.37	0.38	0.38
Iron & Steel Production								0.04	0.04	0.04
Carbon Dioxide Emissions Total	1.39	1.31	1.37	1.53	1.76	1.82	1.73	1.66	1.67	1.71
HFC, PFC, and SF₆ Emissions	Million Metric Tons of CO₂ E									
ODS Substitutes	0.01	0.02	0.04	0.14	0.31	0.72	1.00	1.27	1.43	1.61
Semiconductor Manufacturing	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00
Electric Power Transmission and Distribution Systems	0.72	0.70	0.71	0.70	0.65	0.61	0.55	0.50	0.42	0.44
HFC, PFC, and SF₆ Emissions Total	0.73	0.71	0.75	0.84	0.96	1.33	1.56	1.78	1.86	2.06
Industrial Processes Total	2.11	2.02	2.12	2.38	2.72	3.15	3.29	3.44	3.53	3.77

Table B.8: Emissions from Waste Management

Source of Emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Landfills	Million Metric tons of CO₂ E									
Potential Methane Generation										
From Municipal Solid Wastes (MSW)	4.876	5.050	5.218	5.238	5.256	5.269	5.278	5.278	5.286	5.29
From Industrial Wastes	0.341	0.354	0.365	0.367	0.368	0.369	0.369	0.369	0.370	0.37
Total Potential Methane	5.217	5.404	5.583	5.604	5.624	5.638	5.648	5.647	5.656	5.66
Avoided Methane	Million Metric tons of CO₂ E									
From Flare	-	(0.162)	(0.289)	(0.471)	(0.506)	(0.372)	(0.485)	(0.738)	(0.878)	(1.184)
From Landfill Gas-to-Energy	-	-	-	(0.109)	(0.125)	(0.255)	(0.239)	(0.249)	(0.249)	(0.239)
Total Methane Avoided	-	(0.162)	(0.289)	(0.580)	(0.632)	(0.627)	(0.724)	(0.987)	(1.127)	(1.422)
Oxidation at MSW Landfills	0.488	0.489	0.493	0.466	0.462	0.464	0.455	0.429	0.416	0.38
Oxidation at Industrial Landfills	0.034	0.035	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.03
Total CH₄ Emissions	4.695	4.718	4.765	4.522	4.493	4.510	4.431	4.194	4.076	3.81
Waste Combustion	Million Metric tons of CO₂ E									
Carbon dioxide	0.336	0.372	0.556	0.597	0.625	0.682	0.734	0.782	0.885	0.37
Nitrogen Oxide	0.011	0.011	0.017	0.017	0.018	0.019	0.019	0.020	0.022	0.00
Methane from Wastewater	Million Metric tons of CO₂ E									
Domestic	0.42	0.42	0.43	0.43	0.44	0.44	0.45	0.45	0.46	0.46
Industrial	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Total Methane from Wastewater	0.44	0.44	0.45	0.45	0.46	0.47	0.47	0.47	0.48	0.48
Nitrogen Oxide from Wastewater	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.20
GASSES SUMMARY										
Carbon dioxide	0.34	0.37	0.56	0.60	0.62	0.68	0.73	0.78	0.89	0.3
Methane	5.13	5.16	5.22	4.97	4.95	4.98	4.90	4.67	4.55	4.3
Nitrous Oxide	0.18	0.18	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.2
Total Emissions from Wastes	5.65	5.72	5.97	5.77	5.78	5.86	5.84	5.66	5.65	4.8
SECTOR SUMMARY										
Source of Emissions	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	Million Metric tons of CO₂ E									
Solid Wastes	5.04	5.10	5.34	5.14	5.14	5.21	5.18	5.00	4.98	4.2
Wastewater	0.61	0.62	0.63	0.63	0.65	0.65	0.66	0.66	0.67	0.6
Total Waste Management	5.65	5.72	5.97	5.77	5.78	5.86	5.84	5.66	5.65	4.8

Table B.9: Emissions from Agriculture

Emission Source	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Million Metric Tons of CO ₂ E									
Enteric Fermentation (CH ₄)	2.293	2.313	2.321	2.270	2.256	2.284	2.290	2.301	2.204	2.194
Manure Management										
Manure Management (CH ₄)	0.273	0.286	0.307	0.304	0.298	0.070	0.298	0.304	0.310	0.299
Manure Management (N ₂ O)	0.332	0.338	0.331	0.348	0.348	0.597	0.356	0.352	0.360	0.346
Manure Management Total	0.605	0.624	0.638	0.652	0.646	0.666	0.654	0.656	0.670	0.645
Agriculture Soils (N ₂ O)	3.468	3.536	3.655	3.485	3.562	3.512	3.660	3.561	3.524	3.586
Live Stock Rearing										
Livestock (CH ₄)	2.566	2.599	2.628	2.574	2.554	2.353	2.588	2.605	2.514	2.493
Livestock (N ₂ O)	0.332	0.338	0.331	0.348	0.348	0.597	0.356	0.352	0.360	0.346
Livestock Total	2.899	2.937	2.959	2.922	2.902	2.950	2.944	2.957	2.874	2.839
Residue burning (CH ₄)	0.004	0.003	0.004	0.002	0.004	0.004	0.003	0.003	0.003	0.003
Residue burning (N ₂ O)	0.002	0.002	0.002	0.002	0.002	0.001	0.003	0.002	0.002	0.002
Residue burning Total	0.006	0.005	0.006	0.004	0.006	0.005	0.006	0.005	0.004	0.004
GASSES SUMMARY										
Total Methane	2.57	2.60	2.63	2.58	2.56	2.36	2.59	2.61	2.52	2.50
Total Nitrous Oxide	3.80	3.88	3.99	3.83	3.91	4.11	4.02	3.92	3.89	3.93
Total Emissions	6.37	6.48	6.62	6.41	6.47	6.47	6.61	6.52	6.40	6.43
SECTOR SUMMARY										
Source of Emissions	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Livestock Rearing Total	2.52	2.58	2.57	2.54	2.44	2.44	2.51	2.55	2.56	2.58
Crops Harvest Total	3.47	3.54	3.66	3.49	3.57	3.52	3.67	3.57	3.53	3.59
Total Agriculture	5.99	6.12	6.23	6.03	6.01	5.96	6.18	6.11	6.09	6.17

Table B.10: Emissions Summary by Source

Source/Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Million Metric tons of Carbon Dioxide									
1. Energy										
1.1 Combustion										
Residential (CO ₂)	6.50	6.39	6.97	7.17	7.10	7.20	8.13	7.79	7.12	7.25
Residential (CH ₄)	0.09	0.08	0.09	0.12	0.12	0.12	0.12	0.10	0.09	0.09
Residential (N ₂ O)	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.02
1.1.1 Residential	6.61	6.50	7.08	7.32	7.25	7.34	8.28	7.91	7.23	7.37
Commercial (CO ₂)	4.34	4.09	4.52	4.92	4.98	5.20	5.94	5.47	5.31	5.27
Commercial (CH ₄)	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
Commercial (N ₂ O)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1.1.2 Commercial	4.36	4.12	4.55	4.96	5.01	5.24	5.98	5.51	5.34	5.30
Industrial (CO ₂)	19.95	20.72	19.63	17.97	18.06	18.02	17.96	18.60	18.00	17.38
Industrial (CH ₄)	0.07	0.00	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06
Industrial (N ₂ O)	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.15	0.13	0.13
1.1.3 Industrial	20.16	20.87	19.85	18.18	18.26	18.22	18.17	18.81	18.20	17.58
Power (CO ₂)	23.08	25.12	26.69	31.25	29.16	30.36	33.06	34.35	36.22	37.80
Power (CH ₄)	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Power (N ₂ O)	0.12	0.13	0.14	0.15	0.14	0.15	0.17	0.18	0.18	0.19
1.1.4 Power (Generation)	23.20	25.25	26.83	31.42	29.32	30.52	33.24	34.54	36.41	38.00
Transportation (CO ₂)	41.50	40.50	40.24	41.22	41.91	42.54	42.84	44.23	44.88	45.80
Transportation (CH ₄)	0.18	0.18	0.18	0.18	0.17	0.17	0.16	0.15	0.14	0.13
Transportation (N ₂ O)	1.81	1.89	2.00	2.10	2.17	2.21	2.22	2.15	2.10	2.01
1.1.5 Transportation	43.49	42.57	42.42	43.49	44.25	44.92	45.22	46.53	47.13	47.94
Combustion Total	97.82	99.30	100.73	105.37	104.09	106.25	110.90	113.29	114.30	116.19
1.2 Energy Production										
1.2.1 Coal Mining (CH ₄)	18.74	16.33	16.59	12.38	10.95	9.18	9.10	7.92	6.57	6.35
1.2.1 Oil & Gas (CH ₄)	0.07	0.07	0.10	0.12	0.13	0.14	0.14	0.17	0.20	0.24
Energy Sector Total	116.64	115.70	117.42	117.87	115.17	115.57	120.14	121.39	121.08	122.77
2. Industrial Processes										
2.1 Industrial (CO ₂)	1.39	1.31	1.37	1.53	1.76	1.82	1.73	1.66	1.67	1.71
2.2 Industrial (F Compds.)	0.73	0.71	0.75	0.84	0.96	1.33	1.56	1.78	1.86	2.06
Industrial Processes Total	2.11	2.02	2.12	2.38	2.72	3.15	3.29	3.44	3.53	3.77
3. Waste Management										
Solid Wastes (CO ₂)	0.34	0.37	0.56	0.60	0.62	0.68	0.73	0.78	0.89	0.38
Solid Wastes (CH ₄)	4.70	4.72	4.77	4.52	4.49	4.51	4.43	4.19	4.08	3.82
Solid Wastes (N ₂ O)	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Solid Wastes Total	5.04	5.10	5.34	5.14	5.14	5.21	5.18	5.00	4.98	4.20
Wastewater (CH ₄)	0.44	0.44	0.45	0.45	0.46	0.47	0.47	0.47	0.48	0.48
Wastewater (N ₂ O)	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.20
Wastewater Total	0.61	0.62	0.63	0.63	0.65	0.65	0.66	0.66	0.67	0.68
4. Agriculture										
Livestock (CH ₄)	2.57	2.60	2.63	2.57	2.55	2.35	2.59	2.60	2.51	2.49
Live Stock (N ₂ O)	0.33	0.34	0.33	0.35	0.35	0.60	0.36	0.35	0.36	0.35
Live Stock total	2.90	2.94	2.96	2.92	2.90	2.95	2.94	2.96	2.87	2.84
Residue burning (CH ₄)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crops Harvest (N ₂ O)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crops Harvest Total	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00
All Emission (Production)	127.30	126.39	128.47	128.94	126.58	127.53	132.22	133.45	133.14	134.27
Power (Imported)	16.24	16.57	16.76	16.82	16.59	18.04	17.37	16.21	15.91	16.62
All Emissions (Consumption)	143.55	142.96	145.22	145.77	143.18	145.57	149.59	149.65	149.05	150.89

Table B. 11: Emissions Summary by Gasses

Source/Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	Million Metric tons of Carbon Dioxide									
Carbon Dioxide										
Residential	6.50	6.39	6.97	7.17	7.10	7.20	8.13	7.79	7.12	7.25
Commercial	4.34	4.09	4.52	4.92	4.98	5.20	5.94	5.47	5.31	5.27
Industrial	19.95	20.72	19.63	17.97	18.06	18.02	17.96	18.60	18.00	17.38
Power	23.08	25.12	26.69	31.25	29.16	30.36	33.06	34.35	36.22	37.80
Transport	41.50	40.50	40.24	41.22	41.91	42.54	42.84	44.23	44.88	45.80
Industrial Processes	1.39	1.31	1.37	1.53	1.76	1.82	1.73	1.66	1.67	1.71
Solid Wastes	0.34	0.37	0.56	0.60	0.62	0.68	0.73	0.78	0.89	0.38
Carbon Dioxide Total	97.08	98.50	99.97	104.66	103.60	105.82	110.40	112.87	114.08	115.60
Methane										
Residential	0.09	0.08	0.09	0.12	0.12	0.12	0.12	0.10	0.09	0.09
Commercial	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02
Industrial	0.07	0.00	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06
Power	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Transportation	0.18	0.18	0.18	0.18	0.17	0.17	0.16	0.15	0.14	0.13
Coal mining	18.74	16.33	16.59	12.38	10.95	9.18	9.10	7.92	6.57	6.35
Oil & Gas	0.07	0.07	0.10	0.12	0.13	0.14	0.14	0.17	0.20	0.24
Solid Wastes	4.70	4.72	4.77	4.52	4.49	4.51	4.43	4.19	4.08	3.82
Wastewater	0.44	0.44	0.45	0.45	0.46	0.47	0.47	0.47	0.48	0.48
Livestock	2.57	2.60	2.63	2.57	2.55	2.35	2.59	2.60	2.51	2.49
Residue burning	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane Total	26.88	24.46	24.90	20.45	18.98	17.04	17.12	15.72	14.16	13.69
Nitrous Oxide										
Residential	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.02
Commercial	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Industrial	0.15	0.15	0.15	0.14	0.14	0.14	0.14	0.15	0.13	0.13
Power	0.12	0.13	0.14	0.15	0.14	0.15	0.17	0.18	0.18	0.19
Transportation	1.81	1.89	2.00	2.10	2.17	2.21	2.22	2.15	2.10	2.01
Solid Wastes	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Wastewater	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.20
Live Stock	0.33	0.34	0.33	0.35	0.35	0.60	0.36	0.35	0.36	0.35
Crops Harvest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nitrous Oxide Total	2.62	2.72	2.85	2.98	3.04	3.34	3.14	3.08	3.03	2.92
Fluorine compounds	0.73	0.71	0.75	0.84	0.96	1.33	1.56	1.78	1.86	2.06
All Gases (Production)	127.30	126.39	128.47	128.94	126.58	127.53	132.22	133.45	133.14	134.27
Imported Power (CO₂)	16.24	16.57	16.76	16.82	16.59	18.04	17.37	16.21	15.91	16.62
All Gases (Consumption)	143.55	142.96	145.22	145.77	143.18	145.57	149.59	149.65	149.05	150.89