2014 Taiwan Greenhouse Gas Inventory

Report Summary

Executive Summary

ES.I Background Information on National Greenhouse Gas Inventory Background Information

The guidelines in Article 4 and Article 12 of the United Nation Framework Convention on Climate Change (UNFCCC) and Article 7 of Kyoto Protocol state that each party shall submit information on its progress in response to climate change to the UNFCCC Convention of the Parties for review. In particular, the National Inventory Report (NIR) is an Annex prepared in Common Reporting Format (CRF), in which the UNFCCC¹ requires each country to report on its national greenhouse gas inventory describing the procedures for greenhouse gas emission inventory preparation, information on emission trends, statistics by sectors, and a national report of re-calculation. For countries included on Annex I, UNFCCC encourages them to submit such report; nonetheless no country excluded from the country list on Annex (Developing

Countries) has voluntarily submitted a complete NIR report. Although Taiwan is not a UNFCCC party, it has long been committed to fulfill its responsibility as a member of the global village by taking initiatives to slow down global warming with arduous efforts. The establishment of a national greenhouse gas inventory report and the estimation of greenhouse gas emission and absorption is the fundamental obligation of a country to UNFCCC as well as one of the essential steps in reducing global warming. For this reason, Taiwan is preparing the NIR report for the first time in 2014 to exhibit Taiwan' s effectiveness in controlling greenhouse gas emission and absorption.

Since 1998, Taiwan has taken initiatives to prepare the GHG inventory in compliance with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 1996 IPCC Guidelines)² published by the Intergovernmental Panel on Climate Change (IPCC) in 1997. Taiwan also referred to the "Good Practice Guidance" and "Uncertainty Management" published by IPCC in 2000 and 2003 respectively^{3,4}, to prepare its national greenhouse gas inventories. Today, the country has established a greenhouse gas

I UNFCCC, FCCC/CP/2002/8, 2002.

² IPCC, Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, 1996.

³ IPCC, Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000.

⁴ IPCC, Good Practice Guidance for Land Use, Land-Use Change and Forestry in the Preparation of National Greenhouse Gas Inventories under the Convention, 2003.

inventory database from 1990 to 2012. The database aims to summarize the overview on greenhouse gas inventory statistics to explain the GHG trends in Taiwan. It is also part of the continual effort to quantify future greenhouse gas emissions, to introduce Taiwan' s greenhouse gas statistics overview, and thereby to receive comments from all fields for the continuous improvement on the quality of national greenhouse gas inventories.

ES.2 Summary of National Emission and Removal Related Trends

Taiwan' s total greenhouse gas (GHG) emissions increased from 136.681 Kilotons of carbon dioxide (excluding carbon dioxide removal) in 1990 up to 270,682 Kilotons of carbon dioxide equivalents (excluding carbon dioxide removal) in 2012, with emission increased by 98.04% at an average annual growth rate of 3.15%. The total emission in 2012 is lowered than the previous year by 2.03%. Net greenhouse gas emission increased from 117,849 Kilotons of carbon dioxide equivalents (excluding carbon dioxide removal) in 1990 up to 251,553 Kilotons of carbon dioxide equivalents (excluding carbon dioxide removal) in 2012, with emissions increased by 113.45%, at an average annual growth rate of 3.51% The total emissions in 2012 are less than

the previous year by 2.19%, as shown in Figure ES2.1. Further comparison of statistics on various greenhouse gas emissions shows that carbon dioxide accounts for the majority of greenhouse gas emissions in Taiwan in 2012, followed by nitrous oxide and then fluorinated greenhouse gas. Between 1990 and 2012, carbon dioxide emissions grew by 116.65%, increasing at an average annual growth rate of 3.58%; methane emission decreased by 76.52% with an average annual growth rate of -6.37%, as negative growth; nitrous oxide emission decreased by 2.37% with an annual growth rate of 0.11%, as shown in Table ES2.1.

Energy sector, industrial manufacturing sector and waste treatment sector are the main emission sources of carbon dioxide in Taiwan, as shown in Table ES2.2. In 1990, Taiwan had carbon dioxide emission of 120,206 Kilotons of carbon dioxide equivalents. In 2012, the figure was 260,431 Kilotons of carbon dioxide equivalent, with an increase by 116.65% and an average annual growth rate of 3.58%. In 2012 alone, energy sector accounted for 93.49%, industrial manufacturing sector 6.49% and waste sector 0.01%. The emission in 2012 compared with 2011 was decreased by 1.84%, mainly because of the reduction of emission by 1.88% in energy sector, 1.06% in industrial process sector, and 49.53% in waste sector

The main methane emission in Taiwan is from the agriculture sector, waste sector, energy sector and industrial process sector, as shown in Table ES2.3. In 1990, total methane emission in Taiwan was 12,455 Kilotons of carbon dioxide equivalents. In 2012, total methane emission was 2,924 Kilotons of carbon dioxide equivalents, down by 76.52% with an average growth rate of -6.37%. Compared to 2011, the 2012 methane emission was reduced by 1.04%. In particular, waste sector is the largest source for methane emission, responsible for 51.69%, followed by agricultural sector 37.77%, energy sector 9.26%, and industrial process sector 1.29%.

The main nitrous oxide emission in Taiwan is from the agriculture sector with minor emissions from the waste sector,

industrial process sector and energy sector, as shown in Table ES2.4. In 1990, total nitrous oxide emission in Taiwan was 4.021 Kilotons of carbon dioxide equivalents. In 2012, total nitrous oxide emission was 4.116 Kilotons of carbon dioxide equivalents, up by 2.37% with an average growth rate of -0.11%. In particular, the agriculture sector is the largest source for nitrous oxide in Taiwan in 2012, responsible for 64.61%, followed by energy sector 20.23%, waste sector 9.96%, and industrial process sector 5.20%. Compared to 2011, the 2012 nitrous oxide emission was down by 0.50%, with industrial process and product use sector down by 14.20% (most substantial decrease), waste sector dropped by 2.43%, energy sector down by 1.68%, and agriculture sector up by 1.50% on the contrary.



Figure ES2.I Taiwan Greenhouse Gas Emissions Trends from Year 1990 to 2012

Table ES2.1 Taiwan Greenhouse Gas Emission Inventories from Year 1990 to 2012 By Gas Type

(Unit: Kilotons of Carbon Dioxide Equivalents)

Year	CO ₂	CO ₂ Absorption	CH₄	N ₂ O	HFCs	PFCs	SF,	Net GHG	Total GHG
1990	120,206	-18,832	12,455	4,021	NE	NE	NE	117,849	136,681
1991	128,985	-17,372	11,750	4,095	NE	NE	NE	127,457	144,829
1992	137,107	-19,008	I 5,050	4,029	NE	NE	NE	37, 78	156,186
1993	147,836	-19,107	15,697	4,223	597	NE	NE	149,247	168,354
1994	158,019	-19,162	17,566	4,132	676	NE	NE	161,231	180,393
1995	165,010	-19,187	15,666	4,213	634	NE	NE	166,336	185,523
1996	172,661	-19,041	l 6,322	4,320	I,032	NE	NE	175,294	194,335
1997	186,658	-19,217	16,344	4,057	١,168	NE	NE	189,010	208,227
1998	195,845	-19,217	l 6,077	3,955	I,647	NE	NE	198,307	217,524
1999	203,545	-19,220	١5,328	3,915	1,272	NE	NE	204,840	224,060
2000	221,649	-19,275	11,315	4,289	I,833	NE	NE	219,811	239,086
2001	224,123	-18,692	8,893	4,451	2,08	2,939	746	224,541	243,233
2002	235,258	-19,455	6,880	4,518	2,174	4,143	3,914	237,431	256,886
2003	244,384	-19,499	6,047	4,382	1,991	4,198	4,385	245,888	265,387
2004	252,430	-18,905	5,819	4,601	2,093	4,341	5,193	255,572	274,477
2005	258,802	-18,843	4,940	4,469	I ,070	3,070	4,683	258,191	277,034
2006	266,179	-18,938	4,511	4,529	987	3,264	3,590	264,122	283,060
2007	269,095	-18,920	3,921	4,543	I ,093	2,933	3,114	265,779	284,699
2008	256,733	-19,015	3,248	4,301	I ,046	I,682	2,644	250,640	269,655
2009	242,385	-17,218	3,065	4,272	982	1,143	2,142	236,771	253,989
2010	259,935	-18,923	3,019	4,320	934	I,354	1,922	252,561	271,484
2011	265,303	-19,103	2,955	4,137	1,129	I,240	1,525	257,185	276,288
2012	260,431	-19,129	2,924	4,116	997	725	I ,490	251,553	270,682

Source: NE (not estimated), refers to the exclusion of estimation on existing emissions and removals.

Table ES2.2 Taiwan Greenhouse Gas Emission Inventories from Year 1990 to 2012 by Sector

1994 1997 I. Energy Sector 107.550 116.275 123.727 132,754 140.487 147.835 155.330 167.221 177.688 186.749 205.339 208.951 I.A.I. Energy Industry 48.544 54,748 58.080 65.384 70.078 75.982 80 669 91.330 99.730 105.983 121,041 125.268 I.A.2. Manufacturing Industry and 32.087 35 9 3 4 29.081 30.477 31.839 33.034 33,586 34.518 36.576 37.805 40.578 39.665 Construction I.A.3. Transportation 19,447 20,676 23,788 25.837 27.261 28.529 29 498 30,226 31,521 32.439 32,870 32,909 I.A.4. Others 10.478 10.375 10.019 9.446 10.114 9.738 9.731 9.861 10.521 10.849 11.108 10,645 I.A.4.a Commerce 2.984 2.916 3,580 3 4 8 8 2953 2,464 2418 3,142 2,457 3,121 3 1 87 3,526 (Service Industry) I.A.4.b Residential 4.925 3,983 4,215 4,422 4,335 4,437 4,573 4,728 4,825 5,381 5,326 5,153 I.A.4.c Aariculture. Forestry, Fishery, 2.916 2,449 2.020 2.019 2,672 2.645 2,647 2.693 2.748 2.775 2.337 2.429 and Husbandry 2. Industrial Process 12,645 12,706 13,343 15,050 17,464 16,975 17,106 19,391 18,087 16,761 16,205 14,790 4. Waste Sector П 4 36 32 69 200 225 47 70 36 105 382 5. Land use change and -19,008 -19,162 -19,217 -18,832 -17,372 -19,107 -19,187 -19,041 -19,217 -19,220 -19,275 -18,692 Forestry secto Net CO₂ Emission 101,374 111,613 118.098 128,729 138.857 145,823 153,620 167,441 176,628 184,325 202.374 205,431 Total CO₂ Emission 128,985 137,107 147,836 158,019 165,010 195,845 203,545 224,123 120,206 172,661 186,658 221,649 2011 2012 I. Energy Sector 216,725 226,110 233,928 240,590 247,214 250,903 239,841 227,737 243,246 248,142 243,484 I.A.I. Energy Industry 129,268 139,679 145,510 152,637 159,272 163,091 157,098 147,793 158,509 161,931 159,528 I.A.2. Manufacturing Industry and 42.296 40.727 40.978 39.693 40.877 42.670 39,380 36.649 40.456 41.634 40.104 Construction I.A.3. Transportation 34,191 34,159 34,936 35,496 36,471 36,396 35,056 33,055 33,370 34,472 34,153 I.A.4. Others 10,969 11,545 11,943 11,789 10,669 10,086 10,308 9,925 9,809 9,641 9,698 I.A.4.a Commerce 3,457 3,920 4,077 4,193 4,208 4,153 4,163 4,188 4,166 3,926 3,923 (Service Industry) I.A.4.b Residential 5,079 4,996 4,794 4,712 4,745 4,843 4,920 4,831 4,853 4,750 4,788 I.A.4.c Agriculture, Forestry, Fishery, 1,079 931 2,433 2,782 2,946 2,599 1,629 1,351 988 927 1,030 and Husbandry 2. Industrial Process 18,124 17,979 18,223 18,020 18,716 17,892 16,656 14,559 16,575 17,094 16,914 4. Waste Sector 409 294 280 192 249 300 236 89 114 67 34 5. Land use change and -18,938 -19,455 -19,499 -18,905 -18,843 -18,920 -19,015 -17,218 -18,923 -19,103 -19,129 Forestry secto Net CO₂ Emission 215,803 224,885 233.525 239.959 247.241 250,175 237,718 225,167 241,012 246,200 241,302 Total CO₂ Emission 256,733 242,385 259,935 235.258 244.384 252.430 258.802 266.179 269.095 265,303 260.431

(Unit: Kilotons of Carbon Dioxide Equivalents)

Table ES2.3 Methane Emission Inventories for Taiwan from Year 1990 to 2012

(Unit: Kilotons of Carbon Dioxide Equivalents)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I. Energy Sector	143	153	164	174	186	196	203	211	223	237	248	250
2. Industrial Process Sector	18	17	17	18	23	27	29	30	29	30	31	40
4. Agriculture sector	I,567	1,601	I,550	I,573	I,547	I ,578	I,564	I,467	I,383	I,400	I,379	ا 33 ا
4.A. Livestock Gastrointestinal Fermentation	576	628	633	666	677	706	705	630	581	598	596	568
4.B. Livestock waste treatment	173	199	196	202	207	217	223	184	161	172	176	169
4.C. Rice Culturing	806	763	710	693	65 I	644	625	642	631	620	590	579
4.F. Agricultural waste burning (Crop burning)	12	12	11	12	H	11	10	11	10	10	17	15
6. Waste sector	10,726	9,979	13,319	13,932	15,810	I 3,865	14,526	14,637	14,443	13,660	9,656	7,273
6.A. Garbage landfill	9,456	8,573	11,875	12,520	14,376	12,399	12,998	3, 30	12,984	12,263	8,322	5,946
6.B. Waste water treatment	1,261	I,405	1,444	1,412	1,434	I,466	١,527	I,506	I,460	1,396	1,334	١,327
6.D. Others	10	0	L	0	0	L	0	L	0	2	0	0
Total	12,455	11,750	15,050	15,697	17,566	15,666	l 6,322	l 6,344	l 6,077	15,328	11,315	8,893
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
I. Energy Sector	254	266	277	281	282	281	271	263	271	273	271	
2. Industrial Process Sector	40	41	41	43	38	46	41	39	45	41	38	
4. Agriculture sector	I,258	1,185	1,122	١,177	1,161	1,138	1,103	I ,088	I,083	1,106	1,104	
4.A. Livestock Gastrointestinal	548	520										
rennentation		227	528	535	527	523	502	491	498	507	501	
4.B. Livestock waste treatment	163	161	162	535	527	523 155	502 151	491	498	507	501	
4.B. Livestock waste treatment 4.C. Rice Culturing	163 535	161	528 162 424	535 164 471	527 163 463	523 155 456	502 151 444	491 147 446	498 148 432	507 151 442	501 144 453	
 4.B. Livestock waste treatment 4.C. Rice Culturing 4.F. Agricultural waste burning (Crop burning) 	163 535 12	161 477 9	528 162 424 7	535 164 471 8	527 163 463 8	523 155 456 4	502 151 444 6	491 147 446 5	498 148 432 5	507 151 442 5	501 144 453 5	
 4.B. Livestock waste treatment 4.C. Rice Culturing 4.F. Agricultural waste burning (Crop burning) 6. Waste sector 	163 535 12 5,327	161 477 9 4,555	528 162 424 7 4,380	535 164 471 8 3,440	527 163 463 8 3,031	523 155 456 4 2,456	502 151 444 6 1,832	491 147 446 5 1,674	498 148 432 5 1,621	507 151 442 5 1,535	501 144 453 5 1,511	
 4.B. Livestock waste treatment 4.C. Rice Culturing 4.F. Agricultural waste burning (Crop burning) 6. Waste sector 6.A. Garbage landfill 	163 535 12 5,327 4,004	161 477 9 4,555 3,149	528 162 424 7 4,380 3,043	535 164 471 8 3,440 2,061	527 163 463 8 3,031 1,669	523 155 456 4 2,456 999	502 151 444 6 1,832 433	491 147 446 5 1,674 290	498 148 432 5 1,621 304	507 151 442 5 1,535 215	501 144 453 5 1,511 143	
 4.B. Livestock waste treatment 4.C. Rice Culturing 4.F. Agricultural waste burning (Crop burning) 6. Waste sector 6.A. Garbage landfill 6.B. Waste water treatment 	163 535 12 5,327 4,004 1,323	161 477 9 4,555 3,149 1,404	528 162 424 7 4,380 3,043 1,332	535 164 471 8 3,440 2,061 1,370	527 163 463 8 3,031 1,669 1,352	523 155 456 4 2,456 999 1,445	502 151 444 6 1,832 433 1,385	491 147 446 5 1,674 290 1,369	498 148 432 5 1,621 304 1,300	507 151 442 5 1,535 215 1,298	501 144 453 5 1,511 143 1,347	
 4.B. Livestock waste treatment 4.C. Rice Culturing 4.F. Agricultural waste burning (Crop burning) 6. Waste sector 6.A. Garbage landfill 6.B. Waste water treatment 6.D. Others 	163 535 12 5,327 4,004 1,323 0	161 477 9 4,555 3,149 1,404 2	528 162 424 7 4,380 3,043 1,332 6	535 164 471 8 3,440 2,061 1,370 8	527 163 463 8 3,031 1,669 1,352 9	523 155 456 4 2,456 999 1,445 12	502 151 444 6 1,832 433 1,385 14	491 147 446 5 1,674 290 1,369 15	498 148 432 5 1,621 304 1,300 18	507 151 442 5 1,535 215 1,298 22	501 144 453 5 1,511 143 1,347 20	

In Taiwan, the majority of fluorinated greenhouse gases come from economically critical industries, including the semiconductor, optoelectronics, power facilities, and magnesium alloy, which are emission-heavy industries. The fluorinated greenhouse gas emissions are shown in Table ES2.5. In particular, the emission from Taiwan' s HFCs decreased from 597 kilotons of carbon dioxide equivalents in 1993 to 3,211 kilotons of carbon dioxide equivalents in 2012. The emission from PFCs decreased from 2,939 kilotons of carbon dioxide equivalents in 2001 to 725 kilotons of carbon dioxide equivalents in 2012; while the emission from SF₆ increased from 746 kilotons of carbon dioxide equivalents in 2001 to 1,490 kilotons of carbon dioxide equivalents in 2012. For total emission of fluorinated greenhouse gases, it decreased from 5,766 kilotons of carbon dioxide equivalents in 2001(about 2.37% of total greenhouse gas emission for 2001) to

Table ES2.4 Nitrous Oxide Emission Inventories for Taiwan from Year 1990 to 2012

(Unit: Kilotons of Carbon Dioxide Equivalents)

Yes	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I. Energy Sector	315	340	378	505	430	45 I	488	525	561	600	679	702
2. Industrial Process Sector	183	195	175	183	168	194	205	229	220	163	115	269
4. Agriculture Sector	3,167	3,216	3,112	3,156	3,148	3,139	3,193	2,892	2,780	2,751	3,085	3,027
4.B. Livestock Waste Treatment	50	52	54	56	62	64	70	73	74	75	76	73
4.D. Agricultural soil emission	3,113	3,160	3,054	3,096	3,083	3,072	3,120	2,816	2,702	2,672	3,003	2,948
4.F. Agricultural waste burning(crop burning)	4	4	4	4	4	4	3	4	3	3	6	5
6. Waste Sector	356	343	364	380	386	429	434	411	395	401	410	453
Total	4,021	4,095	4,029	4,223	4,132	4,213	4,320	4,057	3,955	3,915	4,289	4,451
Yes	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Yes I. Energy Sector	2002 735	2003 786	2004 815	2005 840	2006 869	2007 893	2008 856	2009 816	2010 839	2011 847	2012 833	
Yes I. Energy Sector 2. Industrial Process Sector	2002 735 297	2003 786 299	2004 815 303	2005 840 318	2006 869 299	2007 893 345	2008 856 319	2009 816 295	2010 839 347	2011 847 249	2012 833 214	
Yes I. Energy Sector 2. Industrial Process Sector 4. Agriculture Sector	2002 735 297 3,029	2003 786 299 2,839	2004 815 303 3,037	2005 840 318 2,851	2006 869 299 2,897	2007 893 345 2,830	2008 856 319 2,704	2009 816 295 2,758	2010 839 347 2,716	2011 847 249 2,620	2012 833 214 2,660	
Yes I. Energy Sector 2. Industrial Process Sector 4. Agriculture Sector 4.B. Livestock Waste Treatment	2002 735 297 3,029 73	2003 786 299 2,839 74	2004 815 303 3,037 72	2005 840 318 2,851 74	2006 869 299 2,897 75	2007 893 345 2,830 74	2008 856 319 2,704 75	2009 816 295 2,758 74	2010 839 347 2,716 73	2011 847 249 2,620 74	2012 833 214 2,660 74	
Yes I. Energy Sector 2. Industrial Process Sector 4. Agriculture Sector 4.B. Livestock Waste Treatment 4.D. Agricultural soil emission	2002 735 297 3,029 73 2,951	2003 786 299 2,839 74 2,762	2004 815 303 3,037 72 2,963	2005 840 318 2,851 74 2,774	2006 869 299 2,897 75 2,819	2007 893 345 2,830 74 2,755	2008 856 319 2,704 75 2,627	2009 816 2295 2,758 74 2,683	2010 839 347 2,716 73 2,641	2011 847 249 2,620 74	2012 833 214 2,660 74 2,584	
Yes I. Energy Sector 2. Industrial Process Sector 4. Agriculture Sector 4. B. Livestock Waste Treatment 4.D. Agricultural soil emission 4.F. Agricultural waste burning(crop burning)	2002 735 297 3,029 73 2,951	2003 786 299 2,839 74 2,762 3	2004 815 303 3,037 72 2,963 3	2005 840 318 2,851 74 2,774 3	2006 869 299 2,897 75 2,819	2007 893 345 2,830 74 2,755 2	2008 856 319 2,704 75 2,627 2	2009 816 295 2,758 74 2,683	2010 839 347 2,716 73 2,641	2011 847 249 2,620 74 2,545 2	2012 833 214 2,660 74 2,584 2	
Yes I. Energy Sector 2. Industrial Process Sector 4. Agriculture Sector 4.B. Livestock Waste Treatment 4.D. Agricultural soil emission 4.F. Agricultural waste burning(crop burning) 6. Waste Sector	2002 735 297 3,029 73 2,951 4	2003 786 299 2,839 74 2,762 3 3	2004 815 303 3,037 72 2,963 3 445	2005 840 318 2,851 74 2,774 3 459	2006 869 299 2,897 75 2,819 3 464	2007 893 345 2,830 74 2,755 2 2	2008 856 319 2,704 755 2,627 2 2	2009 816 2255 2,758 74 2,683 2,683	2010 839 347 2,716 73 2,641 2,641	2011 847 249 2,620 74 2,545 2 2	2012 833 214 2,660 74 2,584 2,584 2	

3,211 kilotons of carbon dioxide equivalents in 2012(about 1.19% of total greenhouse gas emission for 2012), with emissions reduced by 44.31%.

ES.3 Emission Statistics and Trends Analysis on Emission Source and Absorption Categories

The energy sector, among all segments, has long been the one accounting for the largest total greenhouse gas emissions in Taiwan over the years. The GHG emission for the energy sector was responsible for approximately 90.36% of the total emissions in 2012 (excluding land use and forestry absorption), the industrial process sector 7.53%, agriculture sector 1.39%, and the waste sector 0.72%. The GHG emission and trends for Taiwan from year 1990 to 2012 by sector

are shown in Figure ES3.1 and Table ES3.1. Between 1990 and 2012, the GHS emissions from energy sector increased by 126.45% with an average annual growth rate of 3.79%, the industrial process sector increased by 58.61% with an average growth rate of 2.12%, the agriculture sector decreased by 20.49% with an average annual growth rate of -1.04%, a negative growth. The GHG emissions from waste sector decreased by 82.37% with an average annual growth rate of -7.59%, a negative growth while the GHG emission absorption for land use and forestry sector increased by 1.58% with an average annual growth rate of 0.07%. The total greenhouse gas emission for Taiwan in 2012 was dropped by 2.03%, compared to that in 2011. In particular, the GHG emission from energy sector was down by 1.88%, industrial process sector down

								(Unit: I	Kilotons of	Carbon L)ioxide Equ	uvalents)
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total emissions from HFCs	597	676	634	I ,032	1,168	I,647	1,272	I ,833	2,081	2,174	1,991	2,093
Total emissions PFCs	NE	NE	NE	NE	NE	NE	NE	NE	2,939	4,143	4,198	4,341
Total emissions SF ₆	NE	NE	NE	NE	NE	NE	NE	NE	746	3,914	4,385	5,193
Total Emissions	597	676	634	I,032	۱,۱68	I,647	272, ا	I ,833	5,766	10,231	10,574	11,626
Year	2005	2006	2007	2008	2009	2010	2011	2012				
Total emissions from HFCs	I ,070	987	I,093	I ,046	982	934	1,129	997				
Total emissions PFCs	3,070	3,264	2,933	I,682	1,143	I,354	I,240	725				
Total emissions SF ₆	4,683	3,590	3,114	2,644	2,142	1,922	I,525	I,490				
Total Emissions	0 0 7 7	7 0/1	7140	E 272	42/0	4210	2 004	2211				

Table ES2.5 Fluorinated Greenhouse Gas Emissions for Taiwan from Year 1993 to 2012

Source: NE (not estimated), refers to the exclusion of estimation on existing emissions and removals.

by 4.24%, agriculture sector up by 1.01%, and the waste sector down by 3.31%. Additionally, the carbon dioxide absorption of land use change and forestry sector was up by 0.14%.

The total greenhouse gas emission from the energy sector in 1990 was 108,008 kilotons of carbon dioxide equivalents and increased to 244,587 kilotons of carbon dioxide equivalents in 2012 with an average growth by 126.45% and annual average growth of 3.79%, as shown in ES3.2. During this period, the greenhouse gas emission from the energy sector showed a downward trend in 2008 for the first time and declined again in 2009, followed by more reduction in 2012. The total greenhouse gas emission from the energy sector in 2012 accounted for 90.36% of total greenhouse gas emissions in Taiwan. In particular, I.A. "energy industry" was responsible for 160,185 kilotons of carbon dioxide equivalents, accounting for 64.49% of the total greenhouse gas emission from the energy sector. 2.A. "manufacturing industry and construction" was responsible for 40,261 kilotons of carbon dioxide equivalents (accounting for 16.46%). 3.A. "transportation" was responsible for 34,397 kilotons of carbon dioxide equivalents (accounting for 14.06%), and finally 4.A. "Others" was responsible for 9,743 kilotons of carbon dioxide equivalents (accounting for 3.98%).

The greenhouse gas emission from the industrial process sector in 2012 was 20,376 kilotons of carbon dioxide equivalents, which accounted approximately for 7.53% of the total



Figure ES3.I Various Greenhouse Gas Emission Trends for Taiwan from Year 1990 to 2012 by Sector

greenhouse gas emissions in Taiwan, as shown in Table ES3.3. In particular, "Mining industry (non-metal process)" was responsible for 9,110 kilotons of carbon dioxide equivalents, accounting for 44.71% of the greenhouse gas from industrial process sector, followed by 2.C. "metal process" responsible for 7,890 kilotons of carbon dioxide equivalents (accounting for 38.27%), 2.F. "Halo and SF6 use" responsible for 3,211 kilotons of carbon dioxide equivalents (accounting for 15.76%), and 2.B. "Chemical industry" responsible for 256 kilotons of carbon dioxide equivalents (accounting for 1.26%).

								(Unit: r		Carbon Di	ioxide Equ	ivalents)
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
I. Energy Sector	108,008	116,768	124,269	133,434	4 , 03	148,483	156,022	167,956	178,472	187,586	206,266	209,903
2. Industrial Process Sector	12,847	12,918	13,535	15,847	18,331	17,829	18,373	20,818	19,982	18,226	18,185	20,865
4. Agriculture Sector	4,734	4,817	4,662	4,728	4,695	4,718	4,757	4,359	4,162	4,151	4,464	4,358
5. Land use and forestry sector	-18,832	-17,372	-19,008	-19,107	-19,162	-19,187	-19,041	-19,217	-19,217	-19,220	-19,275	-18,692
6. Waste sector	11,093	10,326	13,719	14,344	16,264	14,494	15,184	15,094	14,908	14,097	10,171	8,108
Net Greenhouse Gas Emission (including land use change and forestry absorption)	7,849	27,457	37, 78	49,247	161,231	166,336	175,294	189,010	198,307	204,840	219,811	224,541
Total Greenhouse Gas Emission (excluding land use change and forestry absorption)	36,68	144,829	156,186	168,354	180,393	185,523	194,335	208,227	217,524	224,060	239,086	243,233
Year	2002											
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
I. Energy Sector	217,714	2003 227,163	2004 35,019	2005 241,711	2006 248,365	2007 252,077	2008 240,968	2009 228,816	2010 244,356	2011 249,262	2012 244,587	
I. Energy Sector 2. Industrial Process Sector	2002 217,714 28,692	2003 227,163 28,892	2004 35,019 30,193	2005 241,711 27,204	2006 248,365 26,893	2007 252,077 25,424	2008 240,968 22,389	2009 228,816 19,161	2010 244,356 21,176	2011 249,262 21,279	2012 244,587 20,376	
 I. Energy Sector Industrial Process Sector Agriculture Sector 	217,714 28,692 4,287	2003 227,163 28,892 4,024	2004 35,019 30,193 4,159	2005 241,711 27,204 4,028	2006 248,365 26,893 4,058	2007 252,077 25,424 3,968	2008 240,968 22,389 3,807	2009 228,816 19,161 3,847	2010 244,356 21,176 3,799	2011 249,262 21,279 3,726	2012 244,587 20,376 3,764	
 Energy Sector Industrial Process Sector Agriculture Sector Land use and forestry sector 	2002 217,714 28,692 4,287 -19,455	2003 227,163 28,892 4,024 -19,499	2004 35,019 30,193 4,159 -18,905	2005 241,711 27,204 4,028 -18,843	2006 248,365 26,893 4,058 -18,938	2007 252,077 25,424 3,968 -18,920	2008 240,968 22,389 3,807 -19,015	2009 228,816 19,161 3,847 -17,218	2010 244,356 21,176 3,799 -18,923	2011 249,262 21,279 3,726 -19,103	2012 244,587 20,376 3,764 -19,129	
 Energy Sector Industrial Process Sector Agriculture Sector Land use and forestry sector Waste sector 	2002 217,714 28,692 4,287 -19,455 6,193	2003 227,163 28,892 4,024 -19,499 5,308	2004 35,019 30,193 4,159 -18,905 5,105	2005 241,711 27,204 4,028 -18,843 4,091	2006 248,365 26,893 4,058 -18,938 3,744	2007 252,077 25,424 3,968 -18,920 3,230	2008 240,968 22,389 3,807 -19,015 2,490	2009 228,816 19,161 3,847 -17,218 2,166	2010 244,356 21,176 3,799 -18,923 2,153	2011 249,262 21,279 3,726 -19,103 2,022	2012 244,587 20,376 3,764 -19,129 1,955	
 Energy Sector Industrial Process Sector Agriculture Sector Land use and forestry sector Waste sector Wet Greenhouse Gas Emission (including land use change and forestry absorption) 	217,714 28,692 4,287 -19,455 6,193 237,431	2003 227,163 28,892 4,024 -19,499 5,308 245,888	2004 35,019 30,193 4,159 -18,905 5,105 255,572	2005 241,711 27,204 4,028 -18,843 4,091 258,191	2006 248,365 26,893 4,058 -18,938 3,744 264,122	2007 252,077 25,424 3,968 -18,920 3,230 265,779	2008 240,968 22,389 3,807 -19,015 2,490 250,640	2009 228,816 19,161 3,847 -17,218 2,166 236,771	2010 244,356 21,176 3,799 -18,923 2,153 252,561	2011 249,262 21,279 3,726 -19,103 2,022 257,185	2012 244,587 20,376 3,764 -19,129 1,955 251,553	

Table ES3.1Greenhouse Gas Emissions for Taiwan from Year 1990 to 2012 by Sector

Table ES3.2 Greenhouse Gas Emission from Energy Sector for Taiwan from Year 1990 to 2012

(Unit: Kilotons of Carbon Dioxide Equivalents)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total carbon dioxide emission	107,550	116,275	123,727	I 32,754	140,487	147,835	155,330	167,221	177,688	186,749	205,339	208,951
I.A.I. Energy Industry	48,544	54,748	58,080	65,384	70,078	75,982	80,669	91,330	99,730	105,983	121,041	125,268
I.A.2. Manufacturing Industry and Construction	29,081	30,477	31,839	32,087	33,034	33,586	34,518	35,934	36,576	37,805	40,578	39,665
I.A.3. Transportation	19,447	20,676	23,788	25,837	27,261	28,529	29,498	30,226	31,521	32,439	32,870	32,909
I.A.4. Others	10,478	10,375	10,019	9,446	10,114	9,738	10,645	9,731	9,861	10,521	10,849	11,108
Total methane emission	143	153	164	174	186	196	203	211	223	237	248	250
I.A.I. Energy Industry	26	26	25	23	25	24	26	24	25	27	28	28
I.A.2. Manufacturing Industry and Construction	10	10	8	7	8	7	9	7	8	9	9	10
I.A.3. Transportation	12	13	13	13	13	13	14	14	14	16	16	15
I.A.4. Others	4	4	4	4	4	4	4	3	3	3	3	3
Total Nitrous Oxide emission	315	340	378	505	430	451	488	525	561	600	679	702
I.A.I. Energy Industry	25	25	24	22	24	23	25	23	23	25	25	26
I.A.2. Manufacturing Industry and Construction	9	8	7	6	7	5	7	6	7	7	7	8
I.A.3. Transportation	9	10	10	10	10	10	11	П	П	13	12	12
I.A.4. Others	7	7	7	7	7	7	7	6	5	5	6	6
Total Emission from Energy Sector	108,008	116,768	124,269	33,434	141,103	148,483	156,022	167,956	178,472	187,586	206,266	209,903
年	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
年 Total carbon dioxide emission	2002 216,725	2003 226,110	2004 233,928	2005 240,590	2006 247,214	2007 250,903	2008 239,841	2009 227,737	2010 243,246	2011 248,142	2012 243,484	
年 Total carbon dioxide emission I.A.I. Energy Industry	2002 216,725 129,268	2003 226,110 139,679	2004 233,928 145,510	2005 240,590 152,637	2006 247,214 159,272	2007 250,903 163,091	2008 239,841 157,098	2009 227,737 147,793	2010 243,246 158,509	2011 248,142 161,931	2012 243,484 159,528	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction	2002 216,725 129,268 42,296	2003 226,110 139,679 40,727	2004 233,928 145,510 40,978	2005 240,590 152,637 39,693	2006 247,214 159,272 40,877	2007 250,903 163,091 42,670	2008 239,841 157,098 39,380	2009 227,737 147,793 36,649	2010 243,246 158,509 40,456	2011 248,142 161,931 41,634	2012 243,484 159,528 40,104	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation	2002 216,725 129,268 42,296 34,191	2003 226,110 139,679 40,727 34,159	2004 233,928 145,510 40,978 35,496	2005 240,590 152,637 39,693 36,471	2006 247,214 159,272 40,877 36,396	2007 250,903 163,091 42,670 35,056	2008 239,841 157,098 39,380 33,055	2009 227,737 147,793 36,649 33,370	2010 243,246 158,509 40,456 34,472	2011 248,142 161,931 41,634 34,936	2012 243,484 159,528 40,104 34,153	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others	2002 216,725 129,268 42,296 34,191 10,969	2003 226,110 139,679 40,727 34,159 11,545	2004 233,928 145,510 40,978 35,496 11,943	2005 240,590 152,637 39,693 36,471 11,789	2006 247,214 159,272 40,877 36,396 10,669	2007 250,903 163,091 42,670 35,056 10,086	2008 239,841 157,098 39,380 33,055 10,308	2009 227,737 147,793 36,649 33,370 9,925	2010 243,246 158,509 40,456 34,472 9,809	2011 248,142 161,931 41,634 34,936 9,641	2012 243,484 159,528 40,104 34,153 9,698	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission	2002 216,725 129,268 42,296 34,191 10,969 254	2003 226,110 139,679 40,727 34,159 11,545 266	2004 233,928 145,510 40,978 35,496 111,943 277	2005 240,590 152,637 39,693 36,471 11,789 281	2006 247,214 159,272 40,877 36,396 10,669 282	2007 250,903 163,091 42,670 35,056 10,086 281	2008 239,841 157,098 39,380 33,055 10,308 271	2009 227,737 147,793 36,649 33,370 9,925 263	2010 243,246 158,509 40,456 34,472 9,809 271	2011 248,142 161,931 41,634 34,936 9,641 273	2012 243,484 159,528 40,104 34,153 9,698 271	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.I. Energy Industry	2002 216,725 129,268 42,296 34,191 10,969 254 28	2003 226,110 139,679 40,727 34,159 11,545 266 29	2004 233,928 145,510 40,978 35,496 11,943 277 30	2005 240,590 152,637 39,693 36,471 11,789 281 30	2006 247,214 159,272 40,877 36,396 10,669 282 282	2007 250,903 163,091 42,670 35,056 10,086 281 281	2008 239,841 157,098 39,380 33,055 10,308 271 271	2009 227,737 147,793 36,649 33,370 9,925 263 263	2010 243,246 158,509 40,456 34,472 9,809 271 26	2011 248,142 161,931 41,634 34,936 9,641 273 25	2012 243,484 159,528 40,104 34,153 9,698 271 25	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction	2002 216,725 129,268 42,296 34,191 10,969 254 28 10	2003 226,110 139,679 40,727 34,159 11,545 266 29 11	2004 233,928 145,510 40,978 35,496 11,943 277 30	2005 240,590 152,637 39,693 36,471 11,789 281 30 11	2006 247,214 159,272 40,877 36,396 10,669 282 28 28	2007 250,903 163,091 42,670 35,056 10,086 281 27 11	2008 239,841 157,098 39,380 33,055 10,308 271 277 11	2009 227,737 147,793 36,649 33,370 9,925 263 26 11	2010 243,246 158,509 40,456 34,472 9,809 271 26 11	2011 248,142 161,931 41,634 34,936 9,641 273 25 10	2012 243,484 159,528 40,104 34,153 9,698 271 25 10	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation	2002 216,725 129,268 42,296 34,191 10,969 254 28 10 10	2003 226,110 139,679 40,727 34,159 111,545 266 29 111 20 11	2004 233,928 145,510 40,978 35,496 111,943 277 300 111 41	2005 240,590 152,637 39,693 36,471 11,789 281 30 11 11	2006 247,214 159,272 40,877 36,396 10,669 282 288 10,669 282 11	2007 250,903 163,091 42,670 35,056 10,086 281 281 27 11	2008 239,841 157,098 39,380 33,055 10,308 271 277 27 11	2009 227,737 147,793 36,649 33,370 9,925 263 266 11	2010 243,246 158,509 40,456 34,472 9,809 271 26 271 26 11	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10	2012 243,484 159,528 40,104 34,153 9,698 271 25 10 10	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others	2002 216,725 129,268 42,296 34,191 10,969 254 28 10 10 15 3	2003 226,110 139,679 40,727 34,159 11,545 266 29 11 20 11 11 14 4	2004 233,928 145,510 40,978 35,496 11,943 2277 30 11,943 2077 11 30	2005 240,590 152,637 39,693 36,471 11,789 281 30 30 11 11 4 4	2006 247,214 159,272 40,877 36,396 10,669 282 282 28 28 11 11 14 22	2007 250,903 163,091 42,670 35,056 10,086 281 27 11 11 14 22	2008 239,841 157,098 39,380 33,055 10,308 271 0,308 271 1,27 11 127 11	2009 227,737 147,793 36,649 33,370 9,925 263 263 264 11 11 14	2010 243,246 158,509 40,456 34,472 9,809 271 26 26 11 11 13 13	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10 14 14	2012 243,484 159,528 40,104 34,153 9,698 271 25 10 10 13 13	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total Nitrous Oxide emission	2002 216,725 129,268 42,296 34,191 10,969 254 28 28 10 10 53 3 735	2003 226,110 139,679 40,727 34,159 11,545 266 29 	2004 233,928 145,510 40,978 35,496 11,943 277 30 11,943 277 30 11 4 4 4 815	2005 240,590 152,637 39,693 36,471 11,789 281 30 11 30 11 4 4 4 840	2006 247,214 159,272 40,877 36,396 10,669 282 28 28 11 11 14 28 869	2007 250,903 163,091 42,670 35,056 10,086 281 281 27 11 11 14 28 893	2008 239,841 157,098 33,055 10,308 271 277 11 277 11 27 11 27 27 27 27 27 27 27 27 27 27 27 27 27	2009 227,737 147,793 36,649 33,370 9,925 263 263 264 11 14 14 14 816	2010 243,246 158,509 40,456 34,472 9,809 271 26 21 26 11 13 13 13 839	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10 10 14 14 847	2012 243,484 159,528 40,104 34,153 9,698 271 25 10 10 13 13 13 833	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total Nitrous Oxide emission I.A.1. Energy Industry	2002 216,725 129,268 42,296 34,191 10,969 254 254 28 10 15 3 3 735 26	2003 226,110 139,679 40,727 11,545 266 299 11,545 206 11,545 206 29 11,545 206 29 11,545 206 207	2004 233,928 145,510 40,978 35,496 11,943 277 300 11,943 207 11,943 207 300 11,943 207 201 201 201 201 201 201 201 201 201 201	2005 240,590 152,637 39,693 36,471 11,789 281 30 281 30 11 11 4 4 840 27	2006 247,214 159,272 40,877 36,396 10,669 282 28 28 11 11 14 28 69 24	2007 250,903 163,091 42,670 35,056 10,086 281 281 27 11 11 14 28 893 23	2008 239,841 157,098 33,355 10,308 271 277 11 11 14 2856 23	2009 227,737 147,793 33,370 9,925 263 264 11 11 14 14 14 14 1816 22	2010 243,246 158,509 40,456 34,472 9,809 271 26 11 13 13 13 13 13 13 13 13 21	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10 14 14 11 847 20	2012 243,484 159,528 40,104 34,153 9,698 271 25 10 10 13 13 13 13 13 20	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total Nitrous Oxide emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction	2002 216,725 129,268 42,296 34,191 10,969 254 28 0 254 28 0 10 15 3 735 26 8	2003 226,110 139,679 40,727 34,159 11,545 266 29 	2004 233,928 145,510 40,978 35,496 11,943 277 30 11,943 207 30 11,943 207 30 21,945 21	2005 240,590 152,637 39,693 36,471 11,789 281 30 11 11 4 4 840 27 27 9	2006 247,214 159,272 40,877 36,396 10,669 282 28 28 11 14 28 69 24 24	2007 250,903 163,091 42,670 35,056 10,086 281 27 11 11 14 27 11 14 28 93 23 23	2008 239,841 157,098 33,355 10,308 271 277 11 11 14 2856 23 23	2009 227,737 147,793 36,649 33,370 9,925 263 263 26 11 11 14 14 14 14 14 14 1816 222	2010 243,246 158,509 40,456 34,472 9,809 271 26 11 13 13 13 13 13 13 13 21	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10 14 14 14 1 847 20	2012 243,484 159,528 40,104 34,153 9,698 271 25 10 13 13 13 13 13 833 20 8	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total Nitrous Oxide emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation	2002 216,725 129,268 42,296 34,191 10,969 254 28 10 10 15 3 735 26 8 8	2003 226,110 139,679 40,727 34,159 111,545 266 229 	2004 233,928 145,510 40,978 35,496 111,943 277 300 111,943 207 40 41 815 28 28 28 9	2005 240,590 152,637 39,693 36,471 11,789 281 300 111 44 4840 277 9	2006 247,214 159,272 40,877 36,396 10,669 282 28 11 28 41 28 9 24 24 24 24	2007 250,903 163,091 42,670 35,056 10,086 281 281 27 11 4 2 893 23 23 9	2008 239,841 157,098 33,355 10,308 271 277 11 277 11 27 27 27 27 27 27 27 27 27 27 27 27 27	2009 227,737 147,793 33,370 9,925 263 263 264 11 14 14 14 14 11 816 222 9	2010 243,246 158,509 40,456 34,472 9,809 271 26 11 34,472 10 27 11 33 34,472 9,809 271 13 33 11 33 39 21 33 39 21	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10 14 14 14 14 10 847 200 88 7	2012 243,484 159,528 40,104 34,153 9,698 271 225 10 10 13 13 10 833 200 8 8	
年 Total carbon dioxide emission I.A.I. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total methane emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.4. Others Total Nitrous Oxide emission I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.1. Energy Industry I.A.2. Manufacturing Industry and Construction I.A.3. Transportation I.A.3. Transportation I.A.4. Others	2002 216,725 129,268 42,296 34,191 10,969 254 28 10 15 3 735 26 3 735 26 8 8 11 11	2003 226,110 139,679 40,727 34,159 11,545 266 29 11 14 786 27 4 786 27 9 9	2004 233,928 145,510 40,978 35,496 11,943 277 30 11,943 277 30 11,943 28 11,943 28 11 815 28 28 9 9 111	2005 240,590 152,637 39,693 36,471 11,789 281 30 11,789 281 30 11,789 281 30 20 11 4 840 27 9 9 111 7	2006 247,214 159,272 40,877 36,396 10,669 282 28 28 11 4 28 9 11 28 9 24 24 9 9 11	2007 250,903 163,091 42,670 35,056 10,086 281 27 11 27 11 27 11 27 28 93 23 23 23 23 23 23 23	2008 239,841 157,098 33,055 10,308 271 277 11 277 11 27 11 27 28 56 23 23 23 23 23 23 23 23 23 23 23 23 23	2009 227,737 147,793 36,649 33,370 9,925 263 263 26 11 816 14 816 222 9 9	2010 243,246 158,509 40,456 34,472 9,809 271 26 11 26 11 839 21 839 21 9 21 9	2011 248,142 161,931 41,634 34,936 9,641 273 25 10 10 14 847 20 14 847 20 8 8 7 20	2012 243,484 159,528 40,104 34,153 9,698 271 25 10 10 13 13 13 13 10 833 200 8 3 10 8 33	

Table ES3-3 Greenhouse Gas Emission from Industrial Process Sector for Taiwan from Year 1990 to 2012

							(Unit: Kilol	ons of Ca	irbon Dio	xide Equi	valents)
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total carbon dioxide emission	12,645	12,706	13,343	15,050	17,464	16,975	17,106	19,391	l 8,087	16,761	l 6,205	14,790
2.A. Mining industry (non-metal process)	8,644	8,545	9,491	10,717	I 3,240	12,638	12,642	I 3,383	I I ,548	10,727	9,540	7,805
2.B. Chemical Industry	66	61	61	65	70	62	58	62	54	49	34	26
2.C. Metal process	3,933	4,098	3,789	4,265	4,151	4,273	4,404	5,945	6,483	5,983	6,630	6,957
2.D. Other industrial production	2	2	2	2	2	2	2	2	2	2	2	2
Total methane emission	18	17	17	18	23	27	29	30	29	30	31	40
2.B. Chemical Industry	18	17	17	18	23	27	29	30	29	30	31	35
2.C. Metal process	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	4
Total nitrous dioxide emission	183	195	175	183	۱68	194	205	229	220	163	115	269
2.B. Chemical Industry	183	195	175	183	168	194	205	229	220	163	115	183
2.C. Metal process	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	86
Total Fluorinated gas emission	NE	NE	NE	597	676	634	1,032	۱,168	I ,647	272, ا	I ,833	5,766
2.E Halo and SF ₆ manufacturing	NO	NO	NO	597	676	634	I,032	1,168	I,647	I ,272	I ,833	2,030
2.F halo and SF ₆ use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	3,736
Total Industrial Process Sector and Product Use Emission	12,847	12,918	13,535	15,847	18,331	17,829	18,373	20,818	19,982	18,226	18,185	20,865
alla liodaet ose Ellission												
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Year Total carbon dioxide emission	2002 18,124	2003 17,979	2004 18,223	2005 18,020	2006 18,716	2007 17,892	2008 16,656	2009 14,559	2010 16,575	2011 17,094	2012 16,914	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process)	2002 18,124 10,709	2003 17,979 10,519	2004 18,223 10,963	2005 18,020 11,577	2006 18,716 11,270	2007 17,892 10,208	2008 16,656 9,209	2009 14,559 8,316	2010 16,575 8,340	2011 17,094 9,528	2012 16,914 9,110	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry	2002 18,124 10,709 26	2003 17,979 10,519 14	2004 18,223 10,963 NO	2005 18,020 11,577 3	2006 18,716 11,270 4	2007 17,892 10,208 5	2008 16,656 9,209 4	2009 14,559 8,316 4	2010 16,575 8,340 4	2011 17,094 9,528 4	2012 16,914 9,110 4	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process	2002 18,124 10,709 26 7,387	2003 17,979 10,519 14 7,445	2004 18,223 10,963 NO 7,258	2005 18,020 11,577 3 6,438	2006 18,716 11,270 4 7,440	2007 17,892 10,208 5 7,677	2008 16,656 9,209 4 7,442	2009 14,559 8,316 4 6,237	2010 16,575 8,340 4 8,230	2011 17,094 9,528 4 7,561	2012 16,914 9,110 4 7,798	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production	2002 18,124 10,709 26 7,387 2	2003 17,979 10,519 14 7,445 2	2004 18,223 10,963 NO 7,258 2	2005 18,020 11,577 3 6,438 2	2006 18,716 11,270 4 7,440 2	2007 17,892 10,208 5 7,677 2	2008 16,656 9,209 4 7,442 2	2009 14,559 8,316 4 6,237 2	2010 16,575 8,340 4 8,230 2	2011 17,094 9,528 4 7,561 2	2012 16,914 9,110 4 7,798 2	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission	2002 18,124 10,709 26 7,387 2 2 40	2003 17,979 10,519 14 7,445 2 2 41	2004 18,223 10,963 NO 7,258 2 2 41	2005 18,020 11,577 3 6,438 6,438 2 2	2006 18,716 11,270 4 7,440 2 38	2007 17,892 10,208 5 7,677 2 46	2008 16,656 9,209 4 7,442 2 2 41	2009 14,559 8,316 4 6,237 2 39	2010 16,575 8,340 4 8,230 8,230 2 2	2011 17,094 9,528 4 7,561 2 2 41	2012 16,914 9,110 4 7,798 2 38	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission 2.B. Chemical Industry	2002 18,124 10,709 26 7,387 2 2 40 35	2003 17,979 10,519 14 7,445 2 2 41 36	2004 18,223 10,963 NO 7,258 2 2 41 36	2005 18,020 11,577 3 6,438 2,2 43 38	2006 18,716 11,270 4 7,440 2 2 38 38	2007 17,892 10,208 5 7,677 2 2 46 42	2008 16,656 9,209 4 7,442 2 2 41 37	2009 14,559 8,316 4 6,237 2 2 39 39	2010 16,575 8,340 4 8,230 2 2 45 39	2011 17,094 9,528 4 7,561 22 41 41	2012 16,914 9,110 4 7,798 2 2 38	
YearTotal carbon dioxide emission2.A. Mining industry (non-metal process)2.B. Chemical Industry2.C. Metal process2.D. Other industrial productionTotal methane emission2.B. Chemical Industry2.C. Metal process	2002 18,124 10,709 26 7,387 2 40 35 5	2003 17,979 10,519 14 7,445 2 2 41 36 36	2004 18,223 10,963 NO 7,258 2 2 41 36	2005 18,020 11,577 3 6,438 2 2 43 38 38	2006 18,716 11,270 4 7,440 2 38 38 37	2007 17,892 10,208 5 7,677 2 46 46 42	2008 16,656 9,209 4 7,442 2 4 1 3 7 4 1 3 7	2009 14,559 8,316 4 6,237 2 39 39 36	2010 16,575 8,340 4 8,230 2 2 45 39 39	2011 17,094 9,528 4 7,561 2 2 41 40 40	2012 16,914 9,110 4 7,798 2 2 38 38 38	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission 2.B. Chemical Industry 2.C. Metal process Total nitrous dioxide emission	2002 18,124 10,709 26 7,387 2 40 35 5 297	2003 17,979 10,519 14 7,445 22 41 36 55 299	2004 18,223 10,963 NO 7,258 22 41 366 55 303	2005 18,020 11,577 3 6,438 2,2 43 38 38 43	2006 18,716 11,270 4 7,440 22 38 37 38 37 1	2007 17,892 10,208 5 7,677 2 2 46 42 5 5 345	2008 16,656 9,209 4 7,442 2 2 41 37 5 319	2009 14,559 8,316 4 6,237 2 39 39 36 36 4 225	2010 16,575 8,340 4 8,230 2 4 5 3 9 5 5 347	2011 17,094 9,528 4 7,561 2,2 41 40 1,1 2,249	2012 16,914 9,110 4 7,798 2 38 38 38 1E 214	
YearTotal carbon dioxide emission2.A. Mining industry (non-metal process)2.B. Chemical Industry2.C. Metal process2.D. Other industrial productionTotal methane emission2.B. Chemical Industry2.C. Metal process2.B. Chemical Industry2.B. Chemical Industry2.C. Metal process2.B. Chemical Industry2.C. Metal processTotal nitrous dioxide emission2.B. Chemical Industry2.C. Metal processTotal nitrous dioxide emission2.B. Chemical Industry	2002 18,124 10,709 26 7,387 2 40 35 5 297 207	2003 17,979 10,519 14 7,445 2 2 41 36 36 5 299 207	2004 18,223 10,963 NO 7,258 2 2 41 36 5 5 303 212	2005 18,020 11,577 3 6,438 2 4 3 8 4 3 8 4 3 18 232	2006 18,716 11,270 4 7,440 2 3 8 3 8 3 7 1 1 299 208	2007 17,892 10,208 5 7,677 2 46 46 42 5 5 345	2008 16,656 9,209 4 7,442 2 4 1 37 5 319 217	2009 14,559 8,316 4 6,237 2 39 39 36 36 4 4 2295 210	2010 16,575 8,340 4 8,230 2 45 39 39 5 347 227	2011 17,094 9,528 4 7,561 2 4 1 40 40 1 249 224	2012 16,914 9,110 4 7,798 2 38 38 38 38 1E 214	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission 2.B. Chemical Industry 2.C. Metal process Total nitrous dioxide emission 2.B. Chemical Industry 2.C. Metal process	2002 18,124 10,709 26 7,387 2 2 40 335 5 297 207 90	2003 17,979 10,519 14 7,445 2 4 1 36 36 299 207 207 92	2004 18,223 10,963 7,258 2 2 41 36 5 303 2,12 92	2005 18,020 11,577 3 6,438 43 43 38 43 38 43 318 232 86	2006 18,716 11,270 4 7,440 2 3 8 3 8 3 7 1 1 2,09 2,08 2,08 9,1	2007 17,892 10,208 5 7,677 2 46 42 42 5 345 345 239 107	2008 16,656 9,209 4 7,442 2 4 1 3 3 1 3 1 1 1 1 1 1 1 1 1 1 1 1 1	2009 14,559 8,316 4 6,237 2 39 36 36 4 225 210 85	2010 16,575 8,340 4 8,230 2 45 345 345 347 347 2227 119	2011 17,094 9,528 4 7,561 2 4 1 40 40 1 249 224 225	2012 16,914 9,110 4 7,798 2 38 38 38 38 1E 214 214 214	
YearTotal carbon dioxide emission2.A. Mining industry (non-metal process)2.B. Chemical Industry2.C. Metal process2.D. Other industrial productionTotal methane emission2.B. Chemical Industry2.C. Metal process2.B. Chemical Industry2.C. Metal process2.B. Chemical Industry2.C. Metal processTotal nitrous dioxide emission2.B. Chemical Industry2.C. Metal processTotal nitrous dioxide emission2.B. Chemical Industry2.C. Metal processTotal Fluorinated gas emission	2002 18,124 10,709 26 7,387 2 40 35 5 207 207 90 10,231	2003 17,979 10,519 14 7,445 2 2 4 1 3 6 5 5 299 207 207 207 207 10,574	2004 18,223 10,963 NO 7,258 2 2 4 1 3 6 3 3 3 2 12 92 11,626	2005 18,020 11,577 3 6,438 2 2 4 3 8 4 3 18 2 318 2 32 2 3 8 6 8,823	2006 18,716 11,270 4 7,440 2 3 3 3 3 1 1 2099 208 91 7,841	2007 17,892 10,208 5 7,677 2 46 42 46 42 5 345 239 107 7,140	2008 16,656 9,209 4 7,442 2 4 1 3 7 4 1 3 7 1 1 1 1 1 1 1 1 1 1 1 1 1	2009 14,559 8,316 4 6,237 2 2 39 36 36 4 2 2 10 85 85 4,268	2010 16,575 8,340 4 8,230 2 2 4 5 347 347 227 119 4,210	2011 17,094 9,528 4 7,561 22 4 1 40 1 40 1 249 224 225 3,894	2012 16,914 9,110 4 7,798 2 2 38 38 38 38 38 38 214 214 214 214 214	
YearTotal carbon dioxide emission2.A. Mining industry (non-metal process)2.B. Chemical Industry2.C. Metal process2.D. Other industrial productionTotal methane emission2.B. Chemical Industry2.C. Metal processTotal methane emission2.B. Chemical Industry2.C. Metal processTotal nitrous dioxide emission2.B. Chemical Industry2.C. Metal processTotal nitrous dioxide emission2.B. Chemical Industry2.C. Metal processTotal Fluorinated gas emission2.E Halo and SF6 manufacturing	2002 18,124 10,709 26 7,387 2 40 35 297 207 207 90 10,231 1,705	2003 17,979 10,519 14 7,445 2 2 4 1 3 6 5 299 207 207 207 92 10,574	2004 18,223 NO 7,258 2 4 1 36 5 303 212 92 11,626 1,352	2005 18,020 11,577 3 6,438 2 2 4 3 3 8 4 3 18 2 3 8 6 8,823 NO	2006 18,716 11,270 4 7,440 2 3 3 3 3 1 1 299 208 91 7,841 NO	2007 17,892 10,208 5 7,677 2 46 46 42 5 5 345 239 107 7,140 NO	2008 16,656 9,209 4 7,442 2 4 1 3 7 3 19 217 101 5,373 NO	2009 14,559 8,316 4 6,237 2 39 36 36 4 210 85 4,268 NO	2010 16,575 8,340 4 8,230 2 2 4 5 347 227 119 4,210 NO	2011 17,094 9,528 4 7,561 2 4 1 40 1 1 249 224 225 3,894 NO	2012 16,914 9,110 4 7,798 2 2 38 38 38 38 1E 214 214 214 1E 3,211 NO	
Year Total carbon dioxide emission 2.A. Mining industry (non-metal process) 2.B. Chemical Industry 2.C. Metal process 2.D. Other industrial production Total methane emission 2.B. Chemical Industry 2.C. Metal process Total nethane emission 2.B. Chemical Industry 2.C. Metal process Total nitrous dioxide emission 2.B. Chemical Industry 2.C. Metal process Total Relation of SF6 manufacturing 2.F. Halo and SF6 2.F. halo and SF6	2002 18,124 10,709 26 7,387 2 40 335 297 207 207 90 10,231 1,705 8,526	2003 17,979 10,519 14 7,445 2 4 1 36 299 207 207 207 207 10,574 1,531	2004 18,223 10,963 NO 7,258 2 4 1 36 303 2 12 11,626 1,352 10,275	2005 18,020 11,577 3 6,438 4 3 4 3 8 4 3 18 232 8 8 8 8 2 3 8 2 3 8 2 3 8 2 3 8 2 3 8 2 3 8 2 3 8 2 3 8 2 3 8 2 3 8 8 3 8 8 3 8 8 3 8 8 3 8 8 8 3 8 8 8 8 8 8 8 8 8 8 8 8 8	2006 18,716 11,270 4 7,440 2 3 3 3 3 3 3 3 3 3 3 3 3 3	2007 17,892 10,208 5 7,677 2 4 6 4 6 4 2 3 45 3 45 239 107 7,140	2008 16,656 9,209 4 7,442 2 4 1 3 1 3 1 1 1 5,373 NO 5,373	2009 14,559 8,316 4 6,237 2 3 3 3 4 2 5 2 10 4 2 5 4,268 4,268	2010 16,575 8,340 4 8,230 2 4 5 347 347 227 119 4,210 NO	2011 17,094 9,528 4 7,561 2 4 1 40 1 40 1 249 224 224 225 3,894 NO	2012 16,914 9,110 4 7,798 2 38 38 38 1E 214 214 214 1E 3,211 NO 3,211	

Note: IE (Listed under others), including estimation on greenhouse gas emission and removal, listed under 2.C. metal-process carbon dioxide emission

NE (not yet estimated), excluding estimation on existing emission sources and removal.

NO (not yet occurred), referring to phase-out production or use in Taiwan such as suspension of production.

In 2012, greenhouse gas emissions from the agricultural sector totaled 3,764 kilotons of carbon dioxide equivalents, accounting for 1.29% of total greenhouse gas emission in Taiwan, approximately down by 20.49% when compared to that in 1990, with an average annual growth rate of -1.04%, as shown in ES3.4. The greenhouse gas emission from the agriculture sector in 2012 was up by 1.01%, compared to that in 2011. In particular, 4.D. Nitrous dioxide emission from "agricultural soil" accounted for 68.66% (majority), methane emission from 4.A. "Livestock gastrointestinal fermentation" accounted for 13.32%, methane emission from 4.C. "Rice culturing" accounted for 12.04%, methane emission from 4.B. "Livestock waste treatment" accounted for 3.84%, nitrous dioxide emission from 4.B. "Livestock waste treatment" accounted for 1.95%, methane emission from 4.F. "Agricultural waste burning" accounted for 0.14%, and nitrous dioxide emission from "agricultural waste burning" accounted for 0.05%.

Table ES3.4 Greenhouse Gas Emission from Agriculture Sector for Taiwan from Year 1990 to 2012	

							()	nit: Kiloto	ons of Car	DON DIOX	ae Equiv	aients)
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total Methane Emission	I,567	1,601	I,550	I,573	I,547	I,578	I,564	I,467	I,383	I,400	۱,379	1,331
4A. Livestock Gastrointestinal Fermentation	576	628	633	666	677	706	705	630	581	598	596	568
4B. Livestock waste treatment	173	199	196	202	207	217	223	184	161	172	176	169
4C. Rice culturing	806	763	710	693	65 I	644	625	642	631	620	590	579
4F. Agricultural waste burning	12	12	11	12	11	11	10	11	10	10	17	15
Total Nitrous Dioxide Emission	3,167	3,216	3,112	3,156	3,148	3,139	3,193	2,892	2,780	2,751	3,085	3,027
4.B. Livestock waste treatment	50	52	54	56	62	64	70	73	74	75	76	73
4.D. Agricultral soil emission	3,113	3,160	3,054	3,096	3,083	3,072	3,120	2,816	2,702	2,672	3,003	2,948
4.F. Agricultural waste burning	4	4	4	4	4	4	3	4	3	3	6	5
Total Emission from Agriculture Sector	4,734	4,817	4,662	4,728	4,695	4,718	4,757	4,359	4,162	4,151	4,464	4,358
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Total Methane Emission	I,258	1,185	1,122	1,177	1,161	۱,۱38	1,103	I ,088	I,083	1,106	1,104	
4A. Livestock Gastrointestinal Fermentation	548	539	528	535	527	523	502	491	498	507	501	
4B. Livestock waste treatment	163	161	162	164	163	155	151	147	148	151	144	
4C. Rice culturing	535	477	424	471	463	456	444	446	432	442	453	
4F. Agricultural waste burning	12	9	7	8	8	4	6	5	5	5	5	
Total Nitrous Dioxide Emission	3,029	2,839	3,037	2,85 I	2,897	2,830	2,704	2,758	2,716	2,620	2,660	
4.B. Livestock waste treatment	73	74	72	74	75	74	75	74	73	74	74	
4.D. Agricultral soil emission	2,951	2,762	2,963	2,774	2,819	2,755	2,627	2,683	2,641	2,545	2,584	
4.F. Agricultural waste burning	4	3	3	3	3	2	2	2	2	2	2	
Total Emission from Agricultura												

The main source of greenhouse gas absorbed by land use and forestry sector is carbon dioxide and the annual carbon stock increase from forestry resources. The greenhouse gas emission from land use and forestry sector for Taiwan from year **1990** to **2012** (mainly consists of carbon dioxide absorption by forestry resources) is shown in ES3.5. The 2012 absorption was 19,129 kilotons of carbon dioxide equivalents, up by 26 kilotons of carbon dioxide equivalents compared to that in 2011 (0.13%). The carbon dioxide absorption between 1990 and 2012 was up 1.58%, with an average annual growth rate of 0.07%.

Year	△ C _{G-TOTAL} (Kilotons of Carbon Dioxide)	△ C _{G-AFF} (Kilotons of Carbon Dioxide)	L _{WOOD-REMOVALS} (Kilotons of Carbon Dioxide)	L _{fuelwood} (Kilotons of Carbon Dioxide)	L _{disturbance} (Kilotons of Carbon Dioxide)	△ C (Kilotons of Carbon Dioxide)	Annual Carbon Absorption Change (Unit: Kilotons of Carbon Dioxide Equivalents)
1990	5,210	18.89	78.88	12.52	1.07	5,136	18,832
1991	5,210	16.41	51.84	7.35	428.74	4,738	17,372
1992	5,210	25.68	43.45	6.95	0.81	5,184	19,008
1993	5,210	35.47	27.77	2.72	3.26	5,211	19,107
1994	5,209	45.10	23.28	1.93	3.01	5,226	19,162
1995	5,208	54.63	23.20	5.35	1.13	5,233	19,187
1996	5,207	59.18	23.98	3.06	45.95	5,193	19,041
1997	5,206	71.61	16.92	3.58	16.55	5,241	19,217
1998	5,205	79.35	17.31	4.11	22.44	5,241	19,217
1999	5,205	96.82	18.35	3.15	37.77	5,242	19,220
2000	5,204	114.35	17.01	1.62	42.68	5,257	19,275
2001	5,203	117.34	14.65	2.37	204.73	5,098	18,692
2002	5,202	129.48	21.93	2.33	1.34	5,306	19,455
2003	5,200	152.15	28.64	5.76	0.34	5,318	19,499
2004	5,023	167.62	24.07	3.81	10.46	5,152	18,905
2005	5,006	174.04	22.96	2.36	30.85	5,124	18,843
2006	4,995	176.12	29.91	3.45	1.14	5,136	18,938
2007	4,989	181.46	29.56	3.67	13.22	5,124	18,920
2008	4,979	191.30	24.25	2.31	1.46	5,142	19,015
2009	4,978	194.67	27.48	1.16	505.47	4,639	17,218
2010	4,924	206.30	26.13	0.10	I.65	5,102	18,923
2011	4,922	203.47	19.19	0.24	0.43	5,106	19,103
2012	4,913	224.21	20.33	0.89	0.30	5,115	19,129

Table ES3.5 Carbon Dioxide Absorption of Forest Resruces for Taiwan from Year 1990 to 2012

Note:

 Δ C_{G\text{-TOTAL}}: average annual carbon stock change for forestry resources

 Δ C_{G\text{-AFF}}: annual carbon stock change due to forestation

L_{WOOD-REMOVALS}: annual carbon stock decrease due to commercial logging

 $L_{\mbox{\scriptsize fuelwood}}$ annual carbon stock decrease due to firewood usage

L_{disturbance}: annual carbon stock decrease due to other factors

The greenhouse gas emission from waste sector in 2012 was 1,955 kilotons of carbon dioxide equivalents, approximately accounting for 0.72% of total greenhouse gas emission in Taiwan (as shown in Table ES3.6), down by 82.37% compared to that in 1990, with an average annual growth down by 7.59%. Among the waste sector emission in 2012, methane emission from 6.B. "waste water treatment" accounted for 68.91%, followed by nitrous oxide from 6.B. "waste water treatment" accounting for 19.34%.

Table ES3.6 Greenhouse Gas Emission from Waste Sector for Taiwan from Year 1990 o 2012

								(Unit: Ki	lotons of (Carbon Die	oxide Equ	ivalents)
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total carbon dioxide emission	П	4.0	36	32	69	200	225	47	70	36	105	382
6.C. Waste burning	11	4.0	36	32	69	200	225	47	70	36	105	382
Total methane emission	10,726	9,979	13,319	13,932	15,810	I 3,865	14,526	14,637	14,443	13,660	9,656	7,273
6.A. Garbage landfill	9,456	8,573	11,875	12,520	14,376	12,399	12,998	3, 30	12,984	12,263	8,322	5,946
6.B. Waste water treatment	1,261	I,405	I,444	1,412	I,434	I,466	I,527	1,506	1,460	1,396	I,334	I,327
6.D. Others	10	I	I	0	0	I	0	I	0	2	0	0
Total nitrous oxide emission	356	343	364	380	386	429	434	411	395	401	410	453
6.B. Waste water treatment	342	342	354	370	370	380	383	399	379	390	388	373
6.C. Waste burning	3	I	10	9	15	48	51	10	15	9	21	80
6.D. Others	11	I	I	0	0	I	0	I	0	2	0	0
Total emission from waste sector	11,093	10,326	13,719	14,344	16,264	14,494	15,184	15,094	14,908	14,097	10,171	8,108
Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	
Total carbon dioxide emission	409	294	280	192	249	300	236	89	4	67	34	
6.C. Waste burning	409	294	280	192	249	300	236	89	114	67	34	
Total methane emission	5,3279	4,555	4,380	3,440	3,031	2,456	1,832	I,674	1,621	I,535	1,511	
6.A. Garbage landfill	4,0049	3,149	3,043	2,061	I,669	999	433	290	304	215	143	
6.B. Waste water treatment	I,323	I,404	I,332	1,370	I,352	I,445	I,385	1,369	1,300	1,298	I,347	
6.D. Others	0	2	6	8	10	12	14	15	18	22	21	
Total nitrous oxide emission	457	459	445	459	465	475	423	403	418	420	410	
6.B. Waste water treatment	387	393	378	377	373	383	353	364	370	377	378	
6.C. Waste burning	70	63	61	73	81	79	55	23	29	19	9	
6.D. Others	0	2	6	9	11	14	15	17	19	24	23	
Total emission from waste sector	6,193	5,308	5,105	4,091	3,744	3,230	2,490	2,166	2,153	2,022	١,955	

Note: 6.D. Others refer to the greenhouse gas emitted from the waste sector handling other activities, including biological waste treatment.

ES.4 Other Information

According to the Durban Platform signed at "the 17th Conference of the Parties (COP 17) to the United Nations Framework Convention on Climate and 7th session of Meeting of Parties to the Kyoto Protocol (UNFCCC COP17/ CMP 7), all countries listed on Annex I shall submit the National Inventory Report, Biennial Report, and National Communications while countries not listed in Annex I shall submit Biennial Update Report and National Communications. These national reports all relate to the content of National Greenhouse Gas Inventory. Taiwan is currently taking the initiative in establishing a national system that is feasible to conform to Taiwan customs, division of labor in sectors and the hierarchical management of database. In addition to formulating regulations governing national greenhouse gas inventory review, Taiwan also established a review committee. a review on greenhouse gas inventory, and a sound management system to comply with procedures of Measurement Reporting, Verification (MRV). Moreove, in order to cooperate with UNFCCC, Taiwan shall apply 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as 2006 IPPC Guidelines) starting in 2015. We have started preparing a national greenhouse gas inventory with 2006 IPCC Guidelines based statistical foundation and framework in addition to designing and establishing a registration platform for electronic national greenhouse gas inventory starting in 2013. At the same time, the relevant departments will test run this registration platform and submit the national greenhouse gas inventory statistics online. Taiwan is scheduled to comprehensively apply (or adopt) the 2006 IPCC Guidelines in step with UNFCCC starting in 2015.





2014 Taiwan Greenhouse Gas Inventory Report Summary



Taiwan Environmental Protection Administration http://www.epa.gov.tw