ANNEX S

Global Warming Potential Values

Global Warming Potentials (GWPs) are intended as a quantified measure of the globally averaged relative radiative forcing impacts of a particular greenhouse gas. It is defined as the cumulative radiative forcing—both direct and indirect effects—integrated over a period of time from the emission of a unit mass of gas relative to some reference gas (IPCC 1996). Carbon dioxide (CO_2) was chosen as this reference gas. Direct effects occur when the gas itself is a greenhouse gas. Indirect radiative forcing occurs when chemical transformations involving the original gas produce a gas or gases that are greenhouse gases, or when a gas influences other radiatively important processes such as the atmospheric lifetimes of other gases. The relationship between gigagrams (Gg) of a gas and Tg CO_2 Eq. can be expressed as follows:

$$\text{Tg CO}_2\ \text{Eq} = (\text{Gg of gas}) \times (\text{GWP}) \times \left(\frac{\text{Tg}}{1{,}000\ \text{Gg}}\right)$$

Where:

Tg CO_2 Eq. = Teragrams of Carbon Dioxide Equivalents

Gg = Gigagrams (equivalent to a thousand metric tons)

GWP = Global Warming Potential

Tg = Teragrams

GWP values allow policy makers to compare the impacts of emissions and reductions of different gases. According to the IPCC, GWPs typically have an uncertainty of roughly ±35 percent, though some GWPs have larger uncertainty than others, especially those in which lifetimes have not yet been ascertained. In the following decision, the parties to the UNFCCC have agreed to use consistent GWPs from the IPCC Second Assessment Report (SAR), based upon a 100 year time horizon, although other time horizon values are available (see Table S-1).

> *In addition to communicating emissions in units of mass, Parties may choose also to use global warming potentials (GWPs) to reflect their inventories and projections in carbon dioxide-equivalent terms, using information provided by the Intergovernmental Panel on Climate Change (IPCC) in its Second Assessment Report. Any use of GWPs should be based on the effects of the greenhouse gases over a 100-year time horizon. In addition, Parties may also use other time horizons.*[1]

Greenhouse gases with relatively long atmospheric lifetimes (e.g., CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) tend to be evenly distributed throughout the atmosphere, and consequently global average concentrations can be determined. The short-lived gases such as water vapor, carbon monoxide, tropospheric ozone, other ambient air pollutants (e.g., NO_x, and NMVOCs), and tropospheric aerosols (e.g., SO_2 products and black carbon), however, vary spatially, and consequently it is difficult to quantify their global radiative forcing impacts. GWP values are generally not attributed to these gases that are short-lived and spatially inhomogeneous in the atmosphere.

Table S-1: Global Warming Potentials (GWP) and Atmospheric Lifetimes (Years) of Gases Used in this Report

Gas	Atmospheric Lifetime	100-year GWP[a]	20-year GWP	500-year GWP
Carbon dioxide (CO_2)	50-200	1	1	1
Methane (CH_4)[b]	12±3	21	56	6.5
Nitrous oxide (N_2O)	120	310	280	170
HFC-23	264	11,700	9,100	9,800

[1] Framework Convention on Climate Change; FCCC/CP/1996/15/Add.1; 29 October 1996; Report of the Conference of the Parties at its second session; held at Geneva from 8 to 19 July 1996; Addendum; Part Two: Action taken by the Conference of the Parties at its second session; Decision 9/CP.2; Communications from Parties included in Annex I to the Convention: guidelines, schedule and process for consideration; Annex: Revised Guidelines for the Preparation of National Communications by Parties Included in Annex I to the Convention; p. 18. FCCC (1996)

HFC-125	32.6	2,800	4,600	920
HFC-134a	14.6	1,300	3,400	420
HFC-143a	48.3	3,800	5,000	1,400
HFC-152a	1.5	140	460	42
HFC-227ea	36.5	2,900	4,300	950
HFC-236fa	209	6,300	5,100	4,700
HFC-4310mee	17.1	1,300	3,000	400
CF_4	50,000	6,500	4,400	10,000
C_2F_6	10,000	9,200	6,200	14,000
C_4F_{10}	2,600	7,000	4,800	10,100
C_6F_{14}	3,200	7,400	5,000	10,700
SF_6	3,200	23,900	16,300	34,900

Source: IPCC (1996)

[a] GWPs used in this report are calculated over 100 year time horizon

[b] The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.

Table S-2 presents direct and net (i.e., direct and indirect) GWPs for ozone-depleting substances (ODSs). Ozone-depleting substances directly absorb infrared radiation and contribute to positive radiative forcing; however, their effect as ozone-depleters also leads to a negative radiative forcing because ozone itself is a potent greenhouse gas. There is considerable uncertainty regarding this indirect effect; therefore, a range of net GWPs is provided for ozone depleting substances.

Table S-2: Net 100-year Global Warming Potentials for Select Ozone Depleting Substances*

Gas	Direct	Net_{min}	Net_{max}
CFC-11	4,600	(600)	3,600
CFC-12	10,600	7,300	9,900
CFC-113	6,000	2,200	5,200
HCFC-22	1,700	1,400	1,700
HCFC-123	120	20	100
HCFC-124	620	480	590
HCFC-141b	700	(5)	570
HCFC-142b	2,400	1,900	2,300
$CHCl_3$	140	(560)	0
CCl_4	1,800	(3,900)	660
CH_3Br	5	(2,600)	(500)
Halon-1211	1,300	(24,000)	(3,600)
Halon-1301	6,900	(76,000)	(9,300)

Source: IPCC (2001)

* Because these compounds have been shown to deplete stratospheric ozone, they are typically referred to as ozone depleting substances (ODSs). However, they are also potent greenhouse gases. Recognizing the harmful effects of these compounds on the ozone layer, in 1987 many governments signed the *Montreal Protocol on Substances that Deplete the Ozone Layer* to limit the production and importation of a number of CFCs and other halogenated compounds. The United States furthered its commitment to phase-out ODSs by signing and ratifying the Copenhagen Amendments to the *Montreal Protocol* in 1992. Under these amendments, the United States committed to ending the production and importation of halons by 1994, and CFCs by 1996. The IPCC Guidelines and the UNFCCC do not include reporting instructions for estimating emissions of ODSs because their use is being phased-out under the *Montreal Protocol*. The effects of these compounds on radiative forcing are not addressed in this report.

The IPCC recently published its Third Assessment Report (TAR), providing the most current and comprehensive scientific assessment of climate change (IPCC 2001). Within this report, the GWPs of several gases were revised relative to the IPCC's Second Assessment Report (SAR) (IPCC 1996), and new GWPs have been calculated for an expanded set of gases. Since the SAR, the IPCC has applied an improved calculation of CO_2 radiative forcing and an improved CO_2 response function (presented in WMO 1999). The GWPs are drawn from WMO (1999) and the SAR, with updates for those cases where new laboratory or radiative transfer results have been published. Additionally, the atmospheric lifetimes of some gases have been recalculated. Because the revised radiative forcing of CO_2 is about 12 percent lower than that in the SAR, the GWPs of the other gases relative to CO_2 tend to be larger, taking into account revisions in lifetimes. However, there were some instances in which other variables, such as the radiative efficiency or the chemical lifetime, were altered that resulted in further increases or decreases in particular GWP values. In addition, the values for radiative forcing and lifetimes have been calculated for a variety of halocarbons, which were not presented in the SAR. The changes are described in the TAR as follows:

> *New categories of gases include fluorinated organic molecules, many of which are ethers that are proposed as halocarbon substitutes. Some of the GWPs have larger uncertainties than that of others, particularly for those gases where detailed laboratory data on lifetimes are not yet available. The direct GWPs have been calculated relative to CO_2 using an improved calculation of the CO_2 radiative forcing, the SAR response function for a CO_2 pulse, and new values for the radiative forcing and lifetimes for a number of halocarbons.*

Table S-3 compares the lifetimes and GWPs for the SAR and TAR. As can be seen in Table S-3, GWPs changed anywhere from a decrease of 35 percent to an increase of 49 percent.

Table S-3: Comparison of GWPs and lifetimes used in the SAR and the TAR

	Lifetime (years)		GWP (100 year)			
Gas	**SAR**	**TAR**	**SAR**	**TAR**	**Difference**	
Carbon dioxide (CO_2)	50-200	5-200[a]	1	1	NC	NC
Methane (CH_4)[b]	12±3	8.4/12[c]	21	23	2	10%
Nitrous oxide (N_2O)	120	120/114[c]	310	296	(14)	-5%
Hydrofluorocarbons						
HFC-23	264	260	11,700	12,000	300	3%
HFC-32	5.6	5.0	650	550	(100)	-15%
HFC-41	3.7	2.6	150	97	(53)	-35%
HFC-125	32.6	29	2,800	3,400	600	21%
HFC-134	10.6	9.6	1,000	1,100	100	10%
HFC-134a	14.6	13.8	1,300	1,300	NC	NC
HFC-143	3.8	3.4	300	330	30	10%
HFC-143a	48.3	52	3,800	4,300	500	13%
HFC-152	NA	0.5	NA	43	NA	NA
HFC-152a	1.5	1.4	140	120	(20)	-14%
HFC-161	NA	0.3	NA	12	NA	NA
HFC-227ea	36.5	33.0	2,900	3,500	600	21%
HFC-236cb	NA	13.2	NA	1,300	NA	NA
HFC-236ea	NA	10	NA	1,200	NA	NA
HFC-236fa	209	220	6,300	9,400	3,100	49%
HFC-245ca	6.6	5.9	560	640	80	14%
HFC-245fa	NA	7.2	NA	950	NA	NA
HFC-365mfc	NA	9.9	NA	890	NA	NA
HFC-4310mee	17.1	15	1,300	1,500	200	15%
Iodocarbons						
FIC-1311	<0.005	0.005	<1	1	NC	NC
Fully Fluorinated Species						
SF_6	3,200	3,200	23,900	22,200	(1,900)	-7%
CF_4	50,000	50,000	6,500	5,700	(800)	-12%
C_2F_6	10,000	10,000	9,200	11,900	2,700	29%
C_3F_8	2,600	2,600	7,000	8,600	1,600	23%
C_4F_{10}	2,600	2,600	7,000	8,600	1,600	23%
c-C_4F_8	3,200	3,200	8,700	10,000	1,300	15%
C_5F_{12}	4,100	4,100	7,500	8,900	1,400	19%
C_6F_{14}	3,200	3,200	7,400	9,000	1,600	22%
Ethers and Halogenated Ethers						
CH_3OCH_3	NA	0.015	NA	1	NA	NA
$(CF_3)_2CFOCH_3$	NA	3.4	NA	330	NA	NA
$(CF_3)CH_2OH$	NA	0.5	NA	57	NA	NA
$CF_3CF_2CH_2OH$	NA	0.4	NA	40	NA	NA
$(CF_3)_2CHOH$	NA	1.8	NA	190	NA	NA
HFE-125	NA	150	NA	14,900	NA	NA
HFE-134	NA	26.2	NA	6,100	NA	NA
HFE-143a	NA	4.4	NA	750	NA	NA
HCFE-235da2	NA	2.6	NA	340	NA	NA
HFE-245cb2	NA	4.3	NA	580	NA	NA

HFE-245fa2	NA	4.4	NA	570	NA	NA
HFE-254cb2	NA	0.22	NA	30	NA	NA
HFE-347mcc3	NA	4.5	NA	480	NA	NA
HFE-356pcf3	NA	3.2	NA	430	NA	NA
HFE-374pcf2	NA	5.0	NA	540	NA	NA
HFE-7100	NA	5.0	NA	390	NA	NA
HFE-7200	NA	0.77	NA	55	NA	NA
H-Galden 1040x	NA	6.3	NA	1,800	NA	NA
HG-10	NA	12.1	NA	2,700	NA	NA
HG-01	NA	6.2	NA	1,500	NA	NA
Others[d]						
NF_3	NA	740	NA	10,800	NA	NA
SF_5CF_3	NA	>1,000	NA	>17,500	NA	NA
$c\text{-}C_3F_6$	NA	>1,000	NA	>16,800	NA	NA
HFE-227ea	NA	11	NA	1,500	NA	NA
HFE-236ea2	NA	5.8	NA	960	NA	NA
HFE-236fa	NA	3.7	NA	470	NA	NA
HFE-245fa1	NA	2.2	NA	280	NA	NA
HFE-263fb2	NA	0.1	NA	11	NA	NA
HFE-329mcc2	NA	6.8	NA	890	NA	NA
HFE-338mcf2	NA	4.3	NA	540	NA	NA
HFE-347-mcf2	NA	2.8	NA	360	NA	NA
HFE-356mec3	NA	0.94	NA	98	NA	NA
HFE-356pcc3	NA	0.93	NA	110	NA	NA
HFE-356pcf2	NA	2.0	NA	260	NA	NA
HFE-365mcf3	NA	0.11	NA	11	NA	NA
$(CF_3)_2CHOCHF_2$	NA	3.1	NA	370	NA	NA
$(CF_3)_2CHOCH_3$	NA	0.25	NA	26	NA	NA
$-(CF_2)_4CH(OH)-$	NA	0.85	NA	70	NA	NA

[a] No single lifetime can be determined for carbon dioxide. (See IPCC 2001)
[b] The methane GWP includes the direct effects and those indirect effects due to the production of tropospheric ozone and stratospheric water vapor. The indirect effect due to the production of CO_2 is not included.
[c] Methane and nitrous oxide have chemical feedback systems that can alter the length of the atmospheric response, in these cases, global mean atmospheric lifetime (LT) is given first, followed by perturbation time (PT).
[d] Gases whose lifetime has been determined only via indirect means or for whom there is uncertainty over the loss process.
Source: IPCC (2001)
NC (No Change)
NA (Not Applicable)

When the GWPs from the TAR are applied to the emission estimates presented in this report, total emissions for the year 2001 are 6,965.5 Tg CO_2 Eq., as compared to 6936.2 Tg CO_2 Eq. when the GWPs from the SAR are used (a 0.4 percent difference). Table S-4 provides a detailed summary of U.S. greenhouse gas emissions and sinks for 1990 through 2001, using the GWPs from the TAR. The adjusted greenhouse gas emissions are shown for each gas in units of Tg CO_2 Eq. in Table S-5. The correlating percent change in emissions of each gas is shown in Table S-6. The percent change in emissions is equal to the percent change in the GWP, however, in cases where multiple gases are emitted in varying amounts the percent change is variable over the years, such as with substitutes for ozone depleting substances. Table S-7 summarizes the emissions and resulting change in emissions using GWPs from the SAR or the TAR for 1990 and 2001.

Table S-4: Recent Trends in U.S. Greenhouse Gas Emissions and Sinks using the TAR GWPs (Tg CO_2 Eq.)

Gas/Source	1990	1995	1996	1997	1998	1999	2000	2001
CO_2	**5,003.7**	**5,334.4**	**5,514.8**	**5,595.4**	**5,614.2**	**5,680.7**	**5,883.1**	**5,794.8**
Fossil Fuel Combustion	4,814.8	5,141.5	5,325.8	5,400.0	5,420.5	5,488.8	5,692.2	5,614.9
Natural Gas Flaring	5.5	8.7	8.2	7.6	6.3	6.7	5.5	5.2
Cement Manufacture	33.3	36.8	37.1	38.3	39.2	40.0	41.2	41.4
Lime Manufacture	11.2	12.8	13.5	13.7	13.9	13.5	13.3	12.9
Limestone and Dolomite Use	5.5	7.0	7.6	7.1	7.3	7.7	5.8	5.3
Soda Ash Manufacture and Consumption	4.1	4.3	4.2	4.4	4.3	4.2	4.2	4.1
Carbon Dioxide Consumption	0.9	1.1	1.1	1.2	1.2	1.2	1.2	1.3
Waste Combustion	14.1	18.5	19.4	21.2	22.5	23.9	25.4	26.9

Titanium Dioxide Production	1.3	1.7	1.7	1.8	1.8	1.9	1.9	1.9
Aluminum Production	6.3	5.3	5.6	5.6	5.8	5.9	5.4	4.1
Iron and Steel Production	85.4	74.4	68.3	71.9	67.4	64.4	65.8	59.1
Ferroalloys	2.0	1.9	2.0	2.0	2.0	2.0	1.7	1.3
Ammonia Production and Urea Application	19.3	20.5	20.3	20.7	21.9	20.6	19.6	16.6
Land-Use Change and Forestry (Sink)[a]	(1,072.8)	(1,064.2)	(1,061.0)	(840.6)	(830.5)	(841.1)	(834.6)	(838.1)
International Bunker Fuels[b]	113.9	101.0	102.3	109.9	112.9	105.3	99.3	97.3
CH_4	**705.3**	**711.9**	**697.5**	**689.5**	**682.0**	**674.2**	**671.8**	**663.6**
Stationary Sources	8.9	9.3	9.6	8.2	7.9	8.1	8.4	8.1
Mobile Sources	5.4	5.3	5.2	5.1	5.0	4.9	4.9	4.7
Coal Mining	95.4	80.5	74.9	74.6	74.4	69.8	66.8	66.5
Natural Gas Systems	133.6	139.4	139.6	138.0	135.8	131.7	132.7	128.5
Petroleum Systems	30.1	26.5	26.2	25.8	25.1	23.7	23.2	23.3
Petrochemical Production	1.3	1.7	1.7	1.8	1.8	1.8	1.8	1.6
Silicon Carbide Production	+	+	+	+	+	+	+	+
Enteric Fermentation	129.1	134.7	131.9	129.6	127.8	127.7	126.7	125.8
Manure Management	34.3	39.6	38.2	40.0	42.7	42.6	41.9	42.6
Rice Cultivation	7.8	8.3	7.6	8.2	8.7	9.1	8.2	8.4
Field Burning of Agricultural Residues	0.7	0.7	0.8	0.8	0.9	0.8	0.9	0.8
Landfills	232.3	236.7	232.3	227.2	221.7	223.1	225.4	222.3
Wastewater Treatment	26.4	29.1	29.4	29.9	30.3	30.8	31.0	31.0
International Bunker Fuels[b]	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.1
N_2O	**379.6**	**411.5**	**421.8**	**421.0**	**417.1**	**413.4**	**410.5**	**405.4**
Stationary Source	12.0	12.6	13.2	13.1	13.1	13.1	13.6	13.5
Mobile Sources	48.3	58.2	58.0	57.6	57.0	56.1	54.9	52.3
Adipic Acid	14.5	16.4	16.3	9.8	5.7	5.2	5.8	4.7
Nitric Acid	17.0	19.0	19.8	20.3	19.9	19.2	18.2	16.8
Manure Management	15.4	15.8	16.2	16.5	16.5	16.6	17.1	17.2
Agricultural Soil Management	255.5	271.2	279.9	284.7	285.6	283.6	281.3	281.0
Field Burning of Agricultural Residues	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Human Sewage	12.1	13.3	13.5	13.8	14.0	14.4	14.5	14.6
N_2O Product Usage	4.1	4.3	4.3	4.6	4.6	4.6	4.6	4.6
Waste Combustion	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
International Bunker Fuels[b]	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.8
HFCs, PFCs, and SF_6	**91.7**	**95.2**	**106.6**	**109.8**	**120.5**	**112.3**	**112.5**	**101.7**
Substitution of Ozone Depleting Substances	0.9	19.0	25.1	32.0	37.8	43.1	48.8	54.5
Aluminum Production	16.8	10.9	11.5	10.1	8.3	8.2	7.3	3.9
HCFC-22 Production[c]	35.9	27.7	31.9	30.8	41.2	31.2	30.6	20.3
Semiconductor Manufacture[d]	3.3	6.8	6.3	7.6	8.4	9.0	8.5	6.5
Electrical Transmission and Distribution[e]	29.8	25.5	25.7	23.4	19.4	15.2	14.3	14.2
Magnesium Production and Processing[e]	5.0	5.2	6.1	5.9	5.4	5.6	2.9	2.3
Total	**6,180.4**	**6,553.1**	**6,740.6**	**6,815.6**	**6,833.7**	**6,880.6**	**7,077.9**	**6,965.5**

+ Does not exceed 0.05 Tg CO_2 Eq.

[a] Sinks are only included in net emissions total, and are based partially on projected activity data. Parentheses indicate negative values (or sequestration).

[b] Emissions from International Bunker Fuels are not included in totals.

[c] HFC-23 emitted

[d] Emissions from HFC-23, CF_4, C_2F_6,C_3F_8 SF_6, and the addition of NF_3

[e] SF_6 emitted

Note: Totals may not sum due to independent rounding.

Table S-5: Change in U.S. Greenhouse Gas Emissions and Sinks Using TAR vs SAR GWPs (Tg CO_2 Eq.)

Gas	1990	1995	1996	1997	1998	1999	2000	2001
CO_2	NC	NC	NC	NC	NC	NC	NC	NC
CH_4	61.3	61.9	60.6	60.0	59.3	58.6	58.4	57.7
N_2O	(18.0)	(19.5)	(19.9)	(19.9)	(19.7)	(19.6)	(19.4)	(19.2)
HFCs, PFCs, and SF_6*	(2.6)	(4.3)	(7.1)	(7.1)	(7.2)	(8.0)	(8.5)	(9.2)
Total	**40.8**	**38.2**	**33.6**	**33.0**	**32.4**	**31.1**	**30.5**	**29.3**

NC (No change)

*Includes NF_3

Note: Totals may not sum due to independent rounding.

Table S-6: Change in U.S. Greenhouse Gas Emissions Using TAR vs. SAR GWPs (Percent)

Gas/Source	1990	1995	1996	1997	1998	1999	2000	2001
CO_2	NC	NC	NC	NC	NC	NC	NC	NC
CH_4	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
N_2O	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)
HFCs, PFCs, and SF_6	(2.8)	(4.3)	(6.2)	(6.0)	(5.6)	(6.7)	(7.0)	(8.3)
Substitution of Ozone Depleting Substances	(3.2)	(12.2)	(17.5)	(15.3)	(15.2)	(15.2)	(14.8)	(14.4)
Aluminum Production[a]	(7.0)	(7.7)	(7.8)	(7.9)	(7.9)	(7.9)	(8.0)	(6.8)
HCFC-22 Production[b]	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Semiconductor Manufacture[c]	15.9	15.9	15.9	15.9	15.9	15.9	15.9	17.2
Electrical Transmission and Distribution[d]	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)
Magnesium Production and Processing[d]	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)	(7.1)
Total	**0.7**	**0.6**	**0.5**	**0.5**	**0.5**	**0.5**	**0.4**	**0.4**

NC (No change)
[a] PFC emissions from CF_4 and C_2F_6
[b] HFC-23 emitted
[c] Emissions from HFC-23, CF_4, C_2F_6,C_3F_8 SF_6, and the addition of NF_3
[d] SF_6 emitted
Note: Excludes Sinks.

Table S-7: Effects on U.S. Greenhouse Gas Emissions Using TAR vs. SAR GWPs (Tg CO_2 Eq.)

Gas	Trend from 1990 to 2001		Revisions to Annual Estimates	
	SAR	TAR	1990	2001
CO_2	791.1	791.1	NC	NC
CH_4	(38.12)	(41.75)	61.3	57.7
N_2O	27.0	25.8	(18.0)	(19.2)
HFCs, PFCs, and SF_6*	16.6	10.0	(2.6)	(9.2)
Total	**796.6**	**785.1**	**40.8**	**29.3**
Percent Change	**13.0%**	**12.7%**	**0.7%**	**0.4%**

NC (No Change)
*Includes NF_3
Note: Totals may not sum due to independent rounding. Excludes Sinks.

Overall, these revisions to GWP values do not have a significant effect on U.S. emission trends, as shown in Table S-5 and Table S-6. Table S-8 below shows a comparison of total emissions estimates by sector using both the IPCC SAR and TAR GWP values. For most sectors, the change in emissions was minimal. The effect on emissions from waste was by far the greatest (8.7 percent), due the predominance of CH_4 emissions in this sector. Emissions from all other sectors were comprised of mainly CO_2 or a mix of gases, which moderated the effect of the changes.

Table S-8: Comparison of Emissions by Sector using IPCC SAR and TAR GWP Values (Tg CO_2 Eq.)

Sector	1990	1995	1996	1997	1998	1999	2000	2001
Energy								
SAR GWP (Used in Inventory)	5,147.5	5,481.6	5,661.4	5,733.0	5,749.4	5,809.5	6,010.4	5,927.1
TAR GWP	5,168.4	5,500.9	5,680.3	5,751.5	5,767.6	5,826.9	6,027.7	5,944.1
Difference (%)	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Industrial Processes								
SAR GWP (Used in Inventory)	302.2	308.3	318.8	321.4	325.9	313.7	312.6	287.6
TAR GWP	298.1	302.3	310.0	312.8	317.5	304.5	302.9	277.3
Difference (%)	-1.4%	-1.9%	-2.8%	-2.7%	-2.6%	-2.9%	-3.1%	-3.6%
Agriculture								
SAR GWP (Used in Inventory)	441.0	468.4	473.7	479.0	481.3	479.3	475.1	474.9
TAR GWP	443.1	470.8	475.2	480.3	482.7	480.8	476.4	476.2
Difference (%)	0.5%	0.5%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%
Land-Use Change and Forestry								
SAR GWP (Used in Inventory)	(1,072.81)	(1,064.17)	(1,061.02)	(840.62)	(830.48)	(841.05)	(834.64)	(838.14)
TAR GWP	(1,072.81)	(1,064.17)	(1,061.02)	(840.62)	(830.48)	(841.05)	(834.64)	(838.14)

Difference (%)	NC		NC	NC	NC	NC	NC	NC	NC
Waste									
SAR GWP (Used in Inventory)	248.9		256.6	253.1	249.2	244.7	247.0	249.2	246.6
TAR GWP	270.8		279.1	275.2	270.9	266.0	268.4	270.8	267.9
Difference (%)	8.8%		8.8%	8.7%	8.7%	8.7%	8.7%	8.7%	8.7%
Net Emisions (Sources and Sinks)									
SAR GWP (Used in Inventory)	**5,066.8**		**5,450.7**	**5,646.0**	**5,942.0**	**5,970.9**	**6,008.5**	**6,212.7**	**6,098.1**
TAR GWP	**5,107.6**		**5,488.9**	**5,679.6**	**5,974.9**	**6,003.3**	**6,039.6**	**6,243.2**	**6,127.4**
Difference (%)	**0.8%**		**0.7%**	**0.6%**	**0.6%**	**0.5%**	**0.5%**	**0.5%**	**0.5%**

NC (No change)

Note: Totals may not sum due to independent rounding.