

ANNEX 1 Key Category Analysis

The United States has identified national key categories based on the estimates presented in this report. The IPCC's *Good Practice Guidance* (IPCC 2000) describes a key category as a “[category] that is prioritized within the national inventory system because its estimate has a significant influence on a country’s total inventory of direct greenhouse gases in terms of the absolute level of emissions, the trend in emissions, or both.”¹ By definition, key categories are sources or sinks that have the greatest contribution to the absolute overall level of national emissions in any of the years covered by the time series. In addition, when an entire time series of emission estimates is prepared, a determination of key categories must also account for the influence of the trends of individual categories. Therefore, a trend assessment is conducted to identify source and sink categories for which significant uncertainty in the estimate would have considerable effects on overall emission trends. Finally, a qualitative evaluation of key categories should be performed, in order to capture any key categories that were not identified in either of the quantitative analyses, but can be considered key because of the unique country-specific estimation methods.

The methodology for conducting a key category analysis, as defined by IPCC’s *Good Practice Guidance* (IPCC 2000) and IPCC’s *Good Practice Guidance for Land Use, Land-Use Change, and Forestry* (IPCC 2003), includes:

- Tier 1 approach (including both level and trend assessments);
- Tier 2 approach (including both level and trend assessments, and incorporating uncertainty analysis); and
- Qualitative approach.

This Annex presents an analysis of key categories, both for sources only and also for sources and sinks (i.e., including LULUCF); discusses Tier 1, Tier 2, and qualitative approaches to identifying key categories; provides level and trend assessment equations; and provides a brief statistical evaluation of IPCC’s quantitative methodologies for defining key categories.

Table A-1 presents the key categories for the United States based on the Tier 1 approach (including and not including LULUCF categories) using emissions data in this report, and ranked according to their sector and global warming potential-weighted emissions in 2006. The table also indicates the criteria used in identifying these source and sink categories (i.e., level, trend, and/or qualitative assessments).

Table A-1: Key Source Categories for the United States (1990-2006) Based on Tier 1 Approach

IPCC Source Categories	Gas	Level	Trend	Level	Trend	Qual	2006 Emissions (Tg CO ₂ Eq.)
		Without LULUCF	Without LULUCF	With LULUCF	With LULUCF		
Energy							
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	✓	✓	✓	✓		2,065.3
Mobile Combustion: Road & Other	CO ₂	✓	✓	✓	✓		1,643.0
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	✓	✓	✓			1,121.9
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	✓	✓	✓	✓		594.3
Mobile Combustion: Aviation	CO ₂	✓	✓	✓	✓		170.6
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	✓		✓			138.0
Mobile Combustion: Marine	CO ₂	✓	✓	✓	✓		42.4
CO ₂ Emissions from Natural Gas Systems	CO ₂	✓	✓	✓	✓		28.5
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂		✓		✓		20.9
Fugitive Emissions from Natural Gas Systems	CH ₄	✓	✓	✓	✓		102.4
Fugitive Emissions from Coal Mining	CH ₄	✓	✓	✓	✓		58.5
Fugitive Emissions from Petroleum Systems	CH ₄	✓	✓	✓	✓		28.4
Mobile Combustion: Road & Other	N ₂ O	✓	✓	✓	✓		31.1
International Bunker Fuels ^b	Several					✓	128.4

IPCC Source Categories	Gas	Level	Trend	Level	Trend	Qual	2006 Emissions (Tg CO ₂ Eq.)
		Without LULUCF	Without LULUCF	With LULUCF	With LULUCF		
Industrial Processes							
CO ₂ Emissions from Iron and Steel Production	CO ₂	✓	✓	✓	✓		49.1
CO ₂ Emissions from Cement Manufacture	CO ₂	✓	✓	✓	✓		45.7
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂		✓		✓		12.4
N ₂ O Emissions from Adipic Acid Production	N ₂ O		✓		✓		5.9
Emissions from Substitutes for Ozone Depleting Substances	Several	✓	✓	✓	✓		110.4
HFC-23 Emissions from HCFC-22 Production	HFCs	✓	✓	✓	✓		13.8
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆		✓		✓		13.2
PFC Emissions from Aluminum Production	PFCs		✓		✓		2.5
Agriculture							
CH ₄ Emissions from Enteric Fermentation	CH ₄	✓	✓	✓	✓		126.2
CH ₄ Emissions from Manure Management	CH ₄	✓		✓	✓		41.4
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	✓	✓	✓	✓		214.7
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	✓	✓	✓	✓		50.3
Waste							
CH ₄ Emissions from Landfills	CH ₄	✓	✓	✓	✓		125.7
Land Use, Land Use Change, and Forestry							
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂			✓	✓		(745.1)
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂			✓	✓		(95.5)
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂			✓	✓		(33.8)
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂				✓		16.2
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂				✓		(10.5)
CO ₂ Emissions from Land Converted to Cropland	CO ₂				✓		9.4
CH ₄ Emissions from Forest Land Remaining Forest Land	CH ₄				✓		24.6
Subtotal Without LULUCF							6,807.6
Total Emissions Without LULUCF							7,017.3
Percent of Total Without LULUCF							97.0%
Subtotal With LULUCF							5,972.8
Total Emissions With LULUCF							6,170.5
Percent of Total With LULUCF							96.8%

^aQualitative criteria.

^bEmissions from this source not included in totals.

Note: The Tier 1 approach for identifying key source categories does not directly include assessment of uncertainty in emissions estimates.

Table A-2 provides a complete listing of source categories by IPCC sector, along with comments on the criteria used in identifying key categories, without LULUCF sources and sinks. Similarly, Table A-3 provides a complete listing of source and sink categories by IPCC sector, along with comments on the criteria used in identifying key categories, including LULUCF sources and sinks. The comments refer specifically to the year(s) over the course of the entire inventory time series (i.e., 1990 to 2006) in which each source category reached the threshold for being a key source based on a Tier 1 level assessment.

In addition to conducting Tier 1 level and trend assessments, a qualitative assessment of the source and sink categories, as described in the IPCC's *Good Practice Guidance* (IPCC 2000), was conducted to capture any key categories that were not identified by either quantitative method. One additional key category, international bunker fuels, was identified using this qualitative assessment. International bunker fuels are fuels consumed for aviation or marine international transport activities, and emissions from these fuels are reported separately from totals in accordance with IPCC guidelines. If these emissions were included in the totals, bunker fuels would qualify as a key category according to the Tier 1 approach. The amount of uncertainty associated with estimation of emissions from international bunker fuels also supports the qualification of this source category as key.

Following the text of this Annex, Table A-3 through Table A- 7 contain the 1990 and 2006 level assessments for both with and without LULUCF sources and sinks, and contain further detail on where each source falls within the analysis.

Table A- 8 and Table A- 9 detail the “with LULUCF” and “without LULUCF” trend assessments for 1990 through 2006.

Table A-2: U.S Greenhouse Gas Inventory Source Categories without LULUCF

IPCC Source Categories	Direct GHG	2006		Key Category	ID Criteria	Comments
		Emissions (Tg CO ₂ Eq.)				
Energy						
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	2,065.3	✓	L,T	Level 1990 and 2006	
Mobile Combustion: Road & Other	CO ₂	1,643.0	✓	L,T	Level 1990 and 2006	
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	1,121.9	✓	L,T	Level 1990 and 2006	
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	594.3	✓	L,T	Level 1990 and 2006	
Mobile Combustion: Aviation	CO ₂	170.6	✓	L,T	Level 1990 and 2006	
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	138.0	✓	L	Level 1990 and 2006	
Mobile Combustion: Marine	CO ₂	42.4	✓	L,T	Level 1990 and 2006	
CO ₂ Emissions from Natural Gas Systems	CO ₂	28.5	✓	L,T	Level 1990	
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	20.9	✓	T		
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4				
CO ₂ Emissions from Petroleum Systems	CO ₂	0.3				
Fugitive Emissions from Natural Gas Systems	CH ₄	102.4	✓	L,T	Level 1990 and 2006	
Fugitive Emissions from Coal Mining	CH ₄	58.5	✓	L,T	Level 1990 and 2006	
Fugitive Emissions from Petroleum Systems	CH ₄	28.4	✓	L,T	Level 1990	
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	6.2				
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	5.4				
Mobile Combustion: Road & Other	CH ₄	2.1				
Mobile Combustion: Aviation	CH ₄	0.1				
Mobile Combustion: Marine	CH ₄	0.1				
Mobile Combustion: Road & Other	N ₂ O	31.1	✓	L,T	Level 1990	
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	14.5				
Mobile Combustion: Aviation	N ₂ O	1.6				
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.4				
Mobile Combustion: Marine	N ₂ O	0.4				
International Bunker Fuels ^a	Several	128.4	✓	Q		
Industrial Processes						
CO ₂ Emissions from Iron and Steel Production	CO ₂	49.1	✓	L,T	Level 1990 and 2006	
CO ₂ Emissions from Cement Manufacture	CO ₂	45.7	✓	L,T	Level 2006	
CO ₂ Emissions from Lime Manufacture	CO ₂	15.8				
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	12.4	✓	T		
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	8.6				
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.2				
CO ₂ Emissions from Aluminum Production	CO ₂	3.9				
CO ₂ Emissions from Petrochemical Production	CO ₂	2.6				
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.9				
CO ₂ Emissions from CO ₂ Consumption	CO ₂	1.6				
CO ₂ Emissions from Ferroalloy Production	CO ₂	1.5				
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.2				
CO ₂ Emissions from Zinc Production	CO ₂	0.5				
CO ₂ Emissions from Lead Production	CO ₂	0.3				
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2				

IPCC Source Categories	Direct GHG	2006		Key Category	ID Criteria	Comments
		Emissions (Tg CO ₂ Eq.)				
CH ₄ Emissions from Petrochemical Production	CH ₄	1.0				
CH ₄ Emissions from Iron and Steel Production	CH ₄	0.9				
CH ₄ Emissions from Ferroalloy Production	CH ₄	+				
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+				
N ₂ O Emissions from Nitric Acid Production	N ₂ O	15.6				
N ₂ O Emissions from Adipic Acid Production	N ₂ O	5.9	✓	T		
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4				
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	110.4	✓	L,T		Level 2006
HFC-23 Emissions from HCFC-22 Production	HiGWP	13.8	✓	L,T		Level 1990
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	13.2	✓	T		
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	HiGWP	4.8				
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	3.2				
PFC Emissions from Aluminum Production	HiGWP	2.5	✓	T		
Agriculture						
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.2	✓	L,T		Level 1990 and 2006
CH ₄ Emissions from Manure Management	CH ₄	41.4	✓	L		Level 2006
CH ₄ Emissions from Rice Cultivation	CH ₄	5.9				
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.8				
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	214.7	✓	L,T		Level 1990 and 2006
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	50.3	✓	L,T		Level 1990 and 2006
N ₂ O Emissions from Manure Management	N ₂ O	14.3				
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.5				
Waste						
CH ₄ Emissions from Landfills	CH ₄	125.7	✓	L,T		Level 1990 and 2006
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.9				
CH ₄ Emissions from Composting	CH ₄	1.6				
N ₂ O Emissions from Wastewater Treatment	N ₂ O	8.1				
N ₂ O Emissions from Composting	N ₂ O	1.8				

^a Emissions from these sources not included in totals.

+ Does not exceed 0.05 Tg CO₂ Eq.

Note: LULUCF sources and sinks are not included in this analysis.

Note: The Tier 1 approach for identifying key categories does not directly include assessment of uncertainty in emission estimates.

Table A-3: U.S Greenhouse Gas Inventory Source Categories with LULUCF

IPCC Source Categories	Gas	2006		Key Category	ID Criteria	Comments
		Emissions (Tg CO ₂ Eq.)				
Energy						
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	2,065.3	✓	L,T		Level 1990 and 2006
Mobile Combustion: Road & Other	CO ₂	1,643.0	✓	L,T		Level 1990 and 2006
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	1,121.9	✓	L		Level 1990 and 2006
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	594.3	✓	L,T		Level 1990 and 2006
Mobile Combustion: Aviation	CO ₂	170.6	✓	L,T		Level 1990 and 2006
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	138.0	✓	L		Level 1990 and 2006
Mobile Combustion: Marine	CO ₂	42.4	✓	L,T		Level 1990 and 2006
CO ₂ Emissions from Natural Gas Systems	CO ₂	28.5	✓	L,T		Level 1990
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	20.9	✓	T		
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4				
CO ₂ Emissions from Petroleum Systems	CO ₂	0.3				
Fugitive Emissions from Natural Gas Systems	CH ₄	102.4	✓	L,T		Level 1990 and 2006
Fugitive Emissions from Coal Mining	CH ₄	58.5	✓	L,T		Level 1990 and 2006
Fugitive Emissions from Petroleum Systems	CH ₄	28.4	✓	L,T		Level 1990

IPCC Source Categories	Gas	2006	Key Category	ID Criteria	Comments
		Emissions (Tg CO ₂ Eq.)			
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	6.2			
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	5.4			
Mobile Combustion: Road & Other	CH ₄	2.1			
Mobile Combustion: Aviation	CH ₄	0.1			
Mobile Combustion: Marine	CH ₄	0.1			
Mobile Combustion: Road & Other	N ₂ O	31.1	✓	L,T	Level 1990 and 2006
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	14.5			
Mobile Combustion: Aviation	N ₂ O	1.6			
N ₂ O Emissions from Municipal Waste Combustion	N ₂ O	0.4			
Mobile Combustion: Marine	N ₂ O	0.4			
International Bunker Fuels ^a	Several	128.4	✓	Q	
Industrial Processes					
CO ₂ Emissions from Iron and Steel Production	CO ₂	49.1	✓	L,T	Level 1990 and 2006
CO ₂ Emissions from Cement Manufacture	CO ₂	45.7	✓	L,T	Level 1990 and 2006
CO ₂ Emissions from Lime Manufacture	CO ₂	15.8			
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	12.4	✓	T	
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	8.6			
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.2			
CO ₂ Emissions from Aluminum Production	CO ₂	3.9			
CO ₂ Emissions from Petrochemical Production	CO ₂	2.6			
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.9			
CO ₂ Emissions from CO ₂ Consumption	CO ₂	1.6			
CO ₂ Emissions from Ferroalloy Production	CO ₂	1.5			
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.2			
CO ₂ Emissions from Zinc Production	CO ₂	0.5			
CO ₂ Emissions from Lead Production	CO ₂	0.3			
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2			
CH ₄ Emissions from Petrochemical Production	CH ₄	1.0			
CH ₄ Emissions from Iron and Steel Production	CH ₄	0.9			
CH ₄ Emissions from Ferroalloy Production	CH ₄	+			
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+			
N ₂ O Emissions from Nitric Acid Production	N ₂ O	15.6			
N ₂ O Emissions from Adipic Acid Production	N ₂ O	5.9	✓	T	
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4			
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	110.4	✓	L,T	Level 2006
HFC-23 Emissions from HCFC-22 Production	HiGWP	13.8	✓	L,T	Level 1990
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	13.2	✓	T	
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	HiGWP	4.8			
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	3.2			
PFC Emissions from Aluminum Production	HiGWP	2.5	✓	T	
Agriculture					
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.2	✓	L,T	Level 1990 and 2006
CH ₄ Emissions from Manure Management	CH ₄	41.4	✓	L,T	Level 1990 and 2006
CH ₄ Emissions from Rice Cultivation	CH ₄	5.9			
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.8			
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	214.7	✓	L,T	Level 1990 and 2006
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	50.3	✓	L,T	Level 1990 and 2006
N ₂ O Emissions from Manure Management	N ₂ O	14.3			
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.5			

IPCC Source Categories	Gas	2006	Key Category	ID Criteria	Comments
		Emissions (Tg CO ₂ Eq.)			
Waste					
CH ₄ Emissions from Landfills	CH ₄	125.7	✓	L,T	Level 1990 and 2006
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.9			
CH ₄ Emissions from Composting	CH ₄	1.6			
N ₂ O Emissions from Wastewater Treatment	N ₂ O	8.1			
N ₂ O Emissions from Composting	N ₂ O	1.8			
Land Use, Land Use Change, and Forestry					
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	(745.1)	✓	L,T	Level 1990 and 2006
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	(95.5)	✓	L,T	Level 1990 and 2006
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	(33.8)	✓	L,T	Level 2006
CO ₂ Emissions from Land Converted to Grassland	CO ₂	(16.3)			
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	16.2	✓	T	
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	(10.5)	✓	T	
CO ₂ Emissions from Land Converted to Cropland	CO ₂	9.4	✓	T	
CH ₄ Emissions from Forest Land Remaining Forest Land	CH ₄	24.6	✓	T	
N ₂ O Emissions from Forest Land Remaining Forest Land	N ₂ O	2.8			
N ₂ O Emissions from Settlements Remaining Settlements	N ₂ O	1.5			

^a Emissions from these sources not included in totals.

+ Does not exceed 0.05 Tg CO₂ Eq.

Note: The Tier 1 approach for identifying key categories does not directly include assessment of uncertainty in emission estimates.

Evaluation of Tier 1 Key Categories

Level Assessment

When using a Tier 1 approach for the level assessment, a predetermined cumulative emissions threshold is used to identify key categories. When source and sink categories are sorted in order of decreasing absolute emissions, those that fall at the top of the list and cumulatively account for 95 percent of emissions are considered key categories. The 95 percent threshold in the IPCC *Good Practice Guidance* (IPCC 2000) was designed to establish a general level where the key category analysis covers approximately 75 to 92 percent of inventory uncertainty.

It is important to note that a key category analysis can be sensitive to the definitions of the source and sink categories. If a large source category is split into many subcategories, then the subcategories may have contributions to the total inventory that are too small for those source categories to be considered key. Similarly, a collection of small, non-key source categories adding up to less than 5 percent of total emissions could become key source categories if those source categories were aggregated into a single source category. The United States has attempted to define source and sink categories by the conventions which would allow comparison with other international key categories, while still maintaining the category definitions that constitute how the emissions estimates were calculated for this report. As such, some of the category names used in the key category analysis may differ from the names used in the main body of the report. Additionally, the United States accounts for some source categories, including fossil fuel feedstocks, international bunkers, and emissions from U.S. territories, that are derived from unique data sources using country-specific methodologies.

Trend Assessment

The United States is currently taking a Tier 1 approach to identify trend assessment key categories until a full and consistent inventory-wide uncertainty analysis is completed. The Tier 1 approach for trend assessment is defined as the product of the source or sink category level assessment and the absolute difference between the source or sink category trend and the total trend. In turn, the source or sink category trend is defined as the change in emissions from the base year to the current year, as a percentage of current year emissions from that source or sink category. The total trend is the percentage change in total inventory emissions from the base year to the current year.

Thus, the source or sink category trend assessment will be large if the source or sink category represents a large percentage of emissions and/or has a trend that is quite different from the overall inventory trend. To determine key categories, the trend assessments are sorted in decreasing order, so that the source or sink categories with the highest trend assessments appear first. The trend assessments are summed until the threshold of 95 percent is reached; all categories that fall within that cumulative 95 percent are considered key categories.

Tier 2 Key Category Assessment

IPCC *Good Practice Guidance* (IPCC 2000) recommends using a Tier 2 method for identifying key source categories if nationally derived source-level uncertainties are measured. The Tier 2 approach is a more detailed analysis that builds on the Tier 1 approach by multiplying the results of the Tier 1 analysis by the relative uncertainty of each source category. This method is likely to reduce the number of key source categories under consideration. As part of its multi-year uncertainty assessment effort, the United States has already developed quantitative uncertainty estimates for most source and sink categories. When quantitative estimates of uncertainty become available for all source categories, future inventories can incorporate this Tier 2 approach.

Table A- 4: 1990 Key Source Category Tier 1 Analysis—Level Assessment, without LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate	1990 Estimate	Level Assessment	Cumulative
		(Tg CO ₂ Eq.)	(Tg CO ₂ Eq.)		Total of Level Assessment
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	1698.9	1698.9	0.28	0.28
Mobile Combustion: Road & Other	CO ₂	1258.5	1258.5	0.21	0.48
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	975.4	975.4	0.16	0.64
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	564.3	564.3	0.09	0.73
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	218.3	218.3	0.04	0.77
Mobile Combustion: Aviation	CO ₂	180.0	180.0	0.03	0.80
CH ₄ Emissions from Landfills	CH ₄	149.6	149.6	0.02	0.82
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.9	126.9	0.02	0.84
Fugitive Emissions from Natural Gas Systems	CH ₄	124.7	124.7	0.02	0.86
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.2	117.2	0.02	0.88
CO ₂ Emissions from Iron and Steel Production	CO ₂	86.2	86.2	0.01	0.90
Fugitive Emissions from Coal Mining	CH ₄	84.1	84.1	0.01	0.91
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	51.1	51.1	0.01	0.92
Mobile Combustion: Marine	CO ₂	46.5	46.5	0.01	0.93
Mobile Combustion: Road & Other	N ₂ O	41.4	41.4	0.01	0.93
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	36.4	0.01	0.94
Fugitive Emissions from Petroleum Systems	CH ₄	33.9	33.9	0.01	0.94
CO ₂ Emissions from Natural Gas Systems	CO ₂	33.7	33.7	0.01	0.95
CO ₂ Emissions from Cement Manufacture	CO ₂	33.3	33.3	0.01	0.96
CH ₄ Emissions from Manure Management	CH ₄	31.0	31.0	0.01	0.96
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	26.7	<0.01	0.96
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.0	23.0	<0.01	0.97
PFC Emissions from Aluminum Production	PFCs	18.5	18.5	<0.01	0.97
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.0	17.0	<0.01	0.97
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	16.9	16.9	<0.01	0.98
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.3	15.3	<0.01	0.98
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	12.8	12.8	<0.01	0.98
N ₂ O Emissions from Manure Management	N ₂ O	12.1	12.1	<0.01	0.98
CO ₂ Emissions from Lime Manufacture	CO ₂	12.0	12.0	<0.01	0.99
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	10.9	10.9	<0.01	0.99
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	7.4	7.4	<0.01	0.99
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	7.1	<0.01	0.99
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	6.8	<0.01	0.99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	6.3	6.3	<0.01	0.99
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	6.0	<0.01	0.99
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	5.5	5.5	<0.01	0.99
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	5.4	<0.01	0.99
Mobile Combustion: Road & Other	CH ₄	4.5	4.5	<0.01	0.99

IPCC Source Categories	Direct GHG	1990 Estimate	1990 Estimate	Level	Cumulative
		(Tg CO ₂ Eq.)	(Tg CO ₂ Eq.)	Assessment	Total of Level
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4	4.4	<0.01	0.99
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.1	4.1	<0.01	0.99
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	2.9	<0.01	0.99
CO ₂ Emissions from Petrochemical Production	CO ₂	2.2	2.2	<0.01	0.99
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	2.2	<0.01	0.99
Mobile Combustion: Aviation	N ₂ O	1.7	1.7	<0.01	1.00
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.5	<0.01	1.00
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	1.4	<0.01	1.00
CH ₄ Emissions from Iron and Steel Production	CH ₄	1.3	1.3	<0.01	1.00
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.2	<0.01	1.00
CO ₂ Emissions from Zinc Production	CO ₂	0.9	0.9	<0.01	1.00
CH ₄ Emissions from Petrochemical Production	CH ₄	0.9	0.9	<0.01	1.00
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.7	0.7	<0.01	1.00
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.5	0.5	<0.01	1.00
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	1.00
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.4	<0.01	1.00
Mobile Combustion: Marine	N ₂ O	0.4	0.4	<0.01	1.00
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.4	<0.01	1.00
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.4	0.4	<0.01	1.00
N ₂ O Emission from Composting	N ₂ O	0.4	0.4	<0.01	1.00
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	0.3	<0.01	1.00
CH ₄ Emissions from Composting	CH ₄	0.3	0.3	<0.01	1.00
CO ₂ Emissions from Lead Production	CO ₂	0.3	0.3	<0.01	1.00
Mobile Combustion: Aviation	CH ₄	0.2	0.2	<0.01	1.00
Mobile Combustion: Marine	CH ₄	0.1	0.1	<0.01	1.00
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	<0.1	<0.1	<0.01	1.00
CH ₄ Emissions from Ferroalloy Production	CH ₄	<0.1	<0.1	<0.01	1.00

Note: LULUCF sources and sinks are not included in this analysis.

Table A- 5: 1990 Key Source Category Tier 1 Analysis—Level Assessment, with LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate	1990 Estimate	Level	Cumulative
		(Tg CO ₂ Eq.)	(Tg CO ₂ Eq.)	Assessment	Total of Level
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	1698.9	1698.9	0.25	0.25
Mobile Combustion: Road & Other	CO ₂	1258.5	1258.5	0.18	0.43
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	975.4	975.4	0.14	0.57
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	621.7	621.7	0.09	0.66
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	564.3	564.3	0.08	0.74
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	218.3	218.3	0.03	0.77
Mobile Combustion: Aviation	CO ₂	180.0	180.0	0.03	0.80
CH ₄ Emissions from Landfills	CH ₄	149.6	149.6	0.02	0.82
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.9	126.9	0.02	0.84
Fugitive Emissions from Natural Gas Systems	CH ₄	124.7	124.7	0.02	0.86
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.2	117.2	0.02	0.87
CO ₂ Emissions from Iron and Steel Production	CO ₂	86.2	86.2	0.01	0.89
Fugitive Emissions from Coal Mining	CH ₄	84.1	84.1	0.01	0.90
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	60.6	60.6	0.01	0.91
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	51.1	51.1	0.01	0.92
Mobile Combustion: Marine	CO ₂	46.5	46.5	0.01	0.92
Mobile Combustion: Road & Other	N ₂ O	41.4	41.4	0.01	0.93
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	36.4	0.01	0.93
Fugitive Emissions from Petroleum Systems	CH ₄	33.9	33.9	<0.01	0.94
CO ₂ Emissions from Natural Gas Systems	CO ₂	33.7	33.7	<0.01	0.94
CO ₂ Emissions from Cement Manufacture	CO ₂	33.3	33.3	<0.01	0.95

IPCC Source Categories	Direct GHG	1990 Estimate	1990 Estimate	Level	Cumulative
		(Tg CO ₂ Eq.)	(Tg CO ₂ Eq.)	Assessment	Total of Level
CH ₄ Emissions from Manure Management	CH ₄	31.0	31.0	<0.01	0.95
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	26.7	<0.01	0.96
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	23.9	23.9	<0.01	0.96
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.0	23.0	<0.01	0.96
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	23.0	23.0	<0.01	0.97
PFC Emissions from Aluminum Production	PFCs	18.5	18.5	<0.01	0.97
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.0	17.0	<0.01	0.97
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	16.9	16.9	<0.01	0.97
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.3	15.3	<0.01	0.98
CO ₂ Emissions from Land Converted to Cropland	CO ₂	14.7	14.7	<0.01	0.98
CO ₂ Emissions from Land Converted to Grassland	CO ₂	14.3	14.3	<0.01	0.98
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	12.8	12.8	<0.01	0.98
N ₂ O Emissions from Manure Management	N ₂ O	12.1	12.1	<0.01	0.98
CO ₂ Emissions from Lime Manufacture	CO ₂	12.0	12.0	<0.01	0.99
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	10.9	10.9	<0.01	0.99
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	7.4	7.4	<0.01	0.99
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	7.1	<0.01	0.99
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	6.8	<0.01	0.99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	6.3	6.3	<0.01	0.99
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	6.0	<0.01	0.99
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	5.5	5.5	<0.01	0.99
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	5.4	<0.01	0.99
CH ₄ Emissions from Forest Land Remaining Forest Land	CH ₄	4.5	4.5	<0.01	0.99
Mobile Combustion: Road & Other	CH ₄	4.5	4.5	<0.01	1.00
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4	4.4	<0.01	1.00
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.1	4.1	<0.01	1.00
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	2.9	<0.01	1.00
CO ₂ Emissions from Petrochemical Production	CO ₂	2.2	2.2	<0.01	1.00
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	2.2	<0.01	1.00
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	1.9	1.9	<0.01	1.00
Mobile Combustion: Aviation	N ₂ O	1.7	1.7	<0.01	1.00
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.5	<0.01	1.00
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	1.4	<0.01	1.00
CH ₄ Emissions from Iron and Steel Production	CH ₄	1.3	1.3	<0.01	1.00
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.2	<0.01	1.00
N ₂ O Emissions from Settlements Remaining Settlements	N ₂ O	1.0	1.0	<0.01	1.00
CO ₂ Emissions from Zinc Production	CO ₂	0.9	0.9	<0.01	1.00
CH ₄ Emissions from Petrochemical Production	CH ₄	0.9	0.9	<0.01	1.00
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.7	0.7	<0.01	1.00
N ₂ O Emissions from Forest Land Remaining Forest Land	N ₂ O	0.5	0.5	<0.01	1.00
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.5	0.5	<0.01	1.00
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	1.00
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.4	<0.01	1.00
Mobile Combustion: Marine	N ₂ O	0.4	0.4	<0.01	1.00
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.4	<0.01	1.00
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.4	0.4	<0.01	1.00
N ₂ O Emission from Composting	N ₂ O	0.4	0.4	<0.01	1.00
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	0.3	<0.01	1.00
CH ₄ Emissions from Composting	CH ₄	0.3	0.3	<0.01	1.00
CO ₂ Emissions from Lead Production	CO ₂	0.3	0.3	<0.01	1.00
Mobile Combustion: Aviation	CH ₄	0.2	0.2	<0.01	1.00
Mobile Combustion: Marine	CH ₄	0.1	0.1	<0.01	1.00
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	<0.1	<0.1	<0.01	1.00
CH ₄ Emissions from Ferroalloy Production	CH ₄	<0.1	<0.1	<0.01	1.00

Table A- 6: 2006 Key Source Category Tier 1 Analysis—Level Assessment, without LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate	2006 Estimate	Cumulative	
		(Tg CO ₂ Eq.)	(Tg CO ₂ Eq.)	Level Assessment	Total of Level Assessment
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	1698.9	2065.3	0.29	0.29
Mobile Combustion: Road & Other	CO ₂	1258.5	1643.0	0.23	0.53
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	975.4	1121.9	0.16	0.69
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	564.3	594.3	0.08	0.77
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	218.3	214.7	0.03	0.80
Mobile Combustion: Aviation	CO ₂	180.0	170.6	0.02	0.83
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.2	138.0	0.02	0.85
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.9	126.2	0.02	0.87
CH ₄ Emissions from Landfills	CH ₄	149.6	125.7	0.02	0.88
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	110.4	0.02	0.90
Fugitive Emissions from Natural Gas Systems	CH ₄	124.7	102.4	0.01	0.91
Fugitive Emissions from Coal Mining	CH ₄	84.1	58.5	0.01	0.92
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	51.1	50.3	0.01	0.93
CO ₂ Emissions from Iron and Steel Production	CO ₂	86.2	49.1	0.01	0.94
CO ₂ Emissions from Cement Manufacture	CO ₂	33.3	45.7	0.01	0.94
Mobile Combustion: Marine	CO ₂	46.5	42.4	0.01	0.95
CH ₄ Emissions from Manure Management	CH ₄	31.0	41.4	0.01	0.95
Mobile Combustion: Road & Other	N ₂ O	41.4	31.1	<0.01	0.96
CO ₂ Emissions from Natural Gas Systems	CO ₂	33.7	28.5	<0.01	0.96
Fugitive Emissions from Petroleum Systems	CH ₄	33.9	28.4	<0.01	0.97
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.0	23.9	<0.01	0.97
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	10.9	20.9	<0.01	0.97
CO ₂ Emissions from Lime Manufacture	CO ₂	12.0	15.8	<0.01	0.98
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.0	15.6	<0.01	0.98
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	12.8	14.5	<0.01	0.98
N ₂ O Emissions from Manure Management	N ₂ O	12.1	14.3	<0.01	0.98
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	13.8	<0.01	0.98
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	13.2	<0.01	0.99
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	16.9	12.4	<0.01	0.99
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	5.5	8.6	<0.01	0.99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	6.3	8.1	<0.01	0.99
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	7.4	6.2	<0.01	0.99
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.3	5.9	<0.01	0.99
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	5.9	<0.01	0.99
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	5.4	<0.01	0.99
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	4.8	<0.01	0.99
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4	4.4	<0.01	0.99
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.1	4.2	<0.01	1.00
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	3.9	<0.01	1.00
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	3.2	<0.01	1.00
CO ₂ Emissions from Petrochemical Production	CO ₂	2.2	2.6	<0.01	1.00
PFC Emissions from Aluminum Production	PFCs	18.5	2.5	<0.01	1.00
Mobile Combustion: Road & Other	CH ₄	4.5	2.1	<0.01	1.00
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.9	<0.01	1.00
N ₂ O Emission from Composting	N ₂ O	0.4	1.8	<0.01	1.00
Mobile Combustion: Aviation	N ₂ O	1.7	1.6	<0.01	1.00
CH ₄ Emissions from Composting	CH ₄	0.3	1.6	<0.01	1.00
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	1.6	<0.01	1.00
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	1.5	<0.01	1.00
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.2	<0.01	1.00
CH ₄ Emissions from Petrochemical Production	CH ₄	0.9	1.0	<0.01	1.00
CH ₄ Emissions from Iron and Steel Production	CH ₄	1.3	0.9	<0.01	1.00
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.7	0.8	<0.01	1.00
CO ₂ Emissions from Zinc Production	CO ₂	0.9	0.5	<0.01	1.00
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.4	0.5	<0.01	1.00
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.5	0.4	<0.01	1.00
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	1.00
Mobile Combustion: Marine	N ₂ O	0.4	0.4	<0.01	1.00

IPCC Source Categories	Direct GHG	1990 Estimate (Tg CO ₂ Eq.)	2006 Estimate (Tg CO ₂ Eq.)	Cumulative	
				Level Assessment	Total of Level Assessment
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.3	<0.01	1.00
CO ₂ Emissions from Lead Production	CO ₂	0.3	0.3	<0.01	1.00
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.2	<0.01	1.00
Mobile Combustion: Aviation	CH ₄	0.2	0.1	<0.01	1.00
Mobile Combustion: Marine	CH ₄	0.1	0.1	<0.01	1.00
CH ₄ Emissions from Ferroalloy Production	CH ₄	<0.1	<0.1	<0.01	1.00
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	<0.1	<0.1	<0.01	1.00

Note: LULUCF sources and sinks are not included in this analysis.

Table A- 7: 2006 Key Source Category Tier 1 Analysis—Level Assessment with LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate (Tg CO ₂ Eq.)	2006 Estimate (Tg CO ₂ Eq.)	Cumulative	
				Level Assessment	Total of Level Assessment
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	1698.9	2065.3	0.26	0.26
Mobile Combustion: Road & Other	CO ₂	1258.5	1643.0	0.21	0.47
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	975.4	1121.9	0.14	0.61
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	621.7	745.1	0.09	0.70
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	564.3	594.3	0.07	0.77
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	218.3	214.7	0.03	0.80
Mobile Combustion: Aviation	CO ₂	180.0	170.6	0.02	0.82
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.2	138.0	0.02	0.84
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.9	126.2	0.02	0.86
CH ₄ Emissions from Landfills	CH ₄	149.6	125.7	0.02	0.87
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	110.4	0.01	0.88
Fugitive Emissions from Natural Gas Systems	CH ₄	124.7	102.4	0.01	0.90
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	60.6	95.5	0.01	0.91
Fugitive Emissions from Coal Mining	CH ₄	84.1	58.5	0.01	0.92
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	51.1	50.3	0.01	0.92
CO ₂ Emissions from Iron and Steel Production	CO ₂	86.2	49.1	0.01	0.93
CO ₂ Emissions from Cement Manufacture	CO ₂	33.3	45.7	0.01	0.94
Mobile Combustion: Marine	CO ₂	46.5	42.4	0.01	0.94
CH ₄ Emissions from Manure Management	CH ₄	31.0	41.4	0.01	0.95
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	23.0	33.8	<0.01	0.95
Mobile Combustion: Road & Other	N ₂ O	41.4	31.1	<0.01	0.95
CO ₂ Emissions from Natural Gas Systems	CO ₂	33.7	28.5	<0.01	0.96
Fugitive Emissions from Petroleum Systems	CH ₄	33.9	28.4	<0.01	0.96
CH ₄ Emissions from Forest Land Remaining Forest Land	CH ₄	4.5	24.6	<0.01	0.96
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.0	23.9	<0.01	0.97
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	10.9	20.9	<0.01	0.97
CO ₂ Emissions from Land Converted to Grassland	CO ₂	14.3	16.3	<0.01	0.97
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	1.9	16.2	<0.01	0.97
CO ₂ Emissions from Lime Manufacture	CO ₂	12.0	15.8	<0.01	0.98
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.0	15.6	<0.01	0.98
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	12.8	14.5	<0.01	0.98
N ₂ O Emissions from Manure Management	N ₂ O	12.1	14.3	<0.01	0.98
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	13.8	<0.01	0.98
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	13.2	<0.01	0.98
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	16.9	12.4	<0.01	0.99
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	23.9	10.5	<0.01	0.99
CO ₂ Emissions from Land Converted to Cropland	CO ₂	14.7	9.4	<0.01	0.99
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	5.5	8.6	<0.01	0.99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	6.3	8.1	<0.01	0.99
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	7.4	6.2	<0.01	0.99
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.3	5.9	<0.01	0.99
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	5.9	<0.01	0.99

IPCC Source Categories	Direct GHG	1990 Estimate (Tg CO ₂ Eq.)	2006 Estimate (Tg CO ₂ Eq.)	Level Assessment	Cumulative
					Total of Level Assessment
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	5.4	<0.01	0.99
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	4.8	<0.01	0.99
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4	4.4	<0.01	1.00
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.1	4.2	<0.01	1.00
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	3.9	<0.01	1.00
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	3.2	<0.01	1.00
N ₂ O Emissions from Forest Land Remaining Forest Land	N ₂ O	0.5	2.8	<0.01	1.00
CO ₂ Emissions from Petrochemical Production	CO ₂	2.2	2.6	<0.01	1.00
PFC Emissions from Aluminum Production	PFCs	18.5	2.5	<0.01	1.00
Mobile Combustion: Road & Other	CH ₄	4.5	2.1	<0.01	1.00
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.9	<0.01	1.00
N ₂ O Emission from Composting	N ₂ O	0.4	1.8	<0.01	1.00
Mobile Combustion: Aviation	N ₂ O	1.7	1.6	<0.01	1.00
CH ₄ Emissions from Composting	CH ₄	0.3	1.6	<0.01	1.00
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	1.6	<0.01	1.00
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	1.5	<0.01	1.00
N ₂ O Emissions from Settlements Remaining Settlements	N ₂ O	1.0	1.5	<0.01	1.00
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.2	<0.01	1.00
CH ₄ Emissions from Petrochemical Production	CH ₄	0.9	1.0	<0.01	1.00
CH ₄ Emissions from Iron and Steel Production	CH ₄	1.3	0.9	<0.01	1.00
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.7	0.8	<0.01	1.00
CO ₂ Emissions from Zinc Production	CO ₂	0.9	0.5	<0.01	1.00
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.4	0.5	<0.01	1.00
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.5	0.4	<0.01	1.00
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	1.00
Mobile Combustion: Marine	N ₂ O	0.4	0.4	<0.01	1.00
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.3	<0.01	1.00
CO ₂ Emissions from Lead Production	CO ₂	0.3	0.3	<0.01	1.00
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.2	<0.01	1.00
Mobile Combustion: Aviation	CH ₄	0.2	0.1	<0.01	1.00
Mobile Combustion: Marine	CH ₄	0.1	0.1	<0.01	1.00
CH ₄ Emissions from Ferroalloy Production	CH ₄	<0.1	<0.1	<0.01	1.00
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	<0.1	<0.1	<0.01	1.00

Table A- 8: 1990-2006 Key Source Category Tier 1 Analysis—Trend Assessment, without LULUCF

IPCC Source Categories	Direct GHG	1990	2006 Estimate (Tg CO ₂ Eq.)	Trend Assessment	Percent Contribution to Trend (%)	Cumulative Contribution to Trend (%)
		Estimate (Tg CO ₂ Eq.)				
Mobile Combustion: Road & Other	CO ₂	1258.5	1643.0	0.03	21.3	21
CO ₂ Emissions from Stationary Combustion - Coal Emissions from Substitutes for Ozone Depleting Substances	CO ₂	1698.9	2065.3	0.02	12.8	34
CO ₂ Emissions from Stationary Combustion - Oil	Several	0.3	110.4	0.01	11.5	46
CO ₂ Emissions from Iron and Steel Production	CO ₂	564.3	594.3	0.01	5.3	51
CH ₄ Emissions from Landfills	CO ₂	86.2	49.1	0.01	5.2	56
Fugitive Emissions from Natural Gas Systems	CH ₄	149.6	125.7	0.01	4.7	61
Fugitive Emissions from Coal Mining	CH ₄	124.7	102.4	0.01	4.2	65
Mobile Combustion: Aviation	CH ₄	84.1	58.5	<0.01	3.9	69
Direct N ₂ O Emissions from Agricultural Soil Management	CO ₂	180.0	170.6	<0.01	3.7	73
HFC-23 Emissions from HCFC-22 Production	N ₂ O	218.3	214.7	<0.01	3.7	76
CH ₄ Emissions from Enteric Fermentation	HFCs	36.4	13.8	<0.01	2.9	79
PFC Emissions from Aluminum Production	CH ₄	126.9	126.2	<0.01	2.0	81
SF ₆ Emissions from Electrical Transmission and Distribution	PFCs	18.5	2.5	<0.01	2.0	83
Mobile Combustion: Road & Other	SF ₆	26.7	13.2	<0.01	1.8	85
	N ₂ O	41.4	31.1	<0.01	1.7	87

IPCC Source Categories	Direct GHG	1990	2006 Estimate (Tg CO ₂ Eq.)	Trend Assessment	Percent Contribution to Trend (%)	Cumulative Contribution to Trend (%)
		Estimate (Tg CO ₂ Eq.)				
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.3	5.9	<0.01	1.2	88
Mobile Combustion: Marine	CO ₂	46.5	42.4	<0.01	1.1	89
Fugitive Emissions from Petroleum Systems	CH ₄	33.9	28.4	<0.01	1.1	90
CO ₂ Emissions from Natural Gas Systems	CO ₂	33.7	28.5	<0.01	1.1	91
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	10.9	20.9	<0.01	0.9	92
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	51.1	50.3	<0.01	0.9	93
CO ₂ Emissions from Cement Manufacture	CO ₂	33.3	45.7	<0.01	0.8	94
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	16.9	12.4	<0.01	0.7	94
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	975.4	1121.9	<0.01	0.7	95
CH ₄ Emissions from Manure Management	CH ₄	31.0	41.4	<0.01	0.6	96
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.2	138.0	<0.01	0.4	96
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	3.9	<0.01	0.4	96
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.0	15.6	<0.01	0.4	97
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	3.2	<0.01	0.3	97
Mobile Combustion: Road & Other	CH ₄	4.5	2.1	<0.01	0.3	97
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.0	23.9	<0.01	0.3	98
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	5.5	8.6	<0.01	0.2	98
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	7.4	6.2	<0.01	0.2	98
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	5.9	<0.01	0.2	98
CO ₂ Emissions from Lime Manufacture	CO ₂	12.0	15.8	<0.01	0.2	99
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	5.4	<0.01	0.2	99
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	4.8	<0.01	0.2	99
N ₂ O Emission from Composting	N ₂ O	0.4	1.8	<0.01	0.1	99
CH ₄ Emissions from Composting	CH ₄	0.3	1.6	<0.01	0.1	99
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	1.5	<0.01	0.1	99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	6.3	8.1	<0.01	0.1	99
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4	4.4	<0.01	0.1	100
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.2	<0.01	0.1	100
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.1	4.2	<0.01	0.1	100
CH ₄ Emissions from Iron and Steel Production	CH ₄	1.3	0.9	<0.01	0.1	100
CO ₂ Emissions from Zinc Production	CO ₂	0.9	0.5	<0.01	0.1	100
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.9	<0.01	0.1	100
N ₂ O Emissions from Manure Management	N ₂ O	12.1	14.3	<0.01	0.1	100
Mobile Combustion: Aviation	N ₂ O	1.7	1.6	<0.01	<0.1	100
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.2	<0.01	<0.1	100
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.5	0.4	<0.01	<0.1	100
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.3	<0.01	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	12.8	14.5	<0.01	<0.1	100
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.4	0.5	<0.01	<0.1	100
Mobile Combustion: Marine	N ₂ O	0.4	0.4	<0.01	<0.1	100
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	<0.1	100
CO ₂ Emissions from Lead Production	CO ₂	0.3	0.3	<0.01	<0.1	100
Mobile Combustion: Aviation	CH ₄	0.2	0.1	<0.01	<0.1	100
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	1.6	<0.01	<0.1	100
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.7	0.8	<0.01	<0.1	100
CO ₂ Emissions from Petrochemical Production	CO ₂	2.2	2.6	<0.01	<0.1	100
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	0.0	0.0	<0.01	<0.1	100
CH ₄ Emissions from Petrochemical Production	CH ₄	0.9	1.0	<0.01	<0.1	100

IPCC Source Categories	Direct GHG	1990		2006 Estimate (Tg CO ₂ Eq.)	Trend Assessment	Percent Contribution to Trend (%)	Cumulative Contribution to Trend (%)
		Estimate (Tg CO ₂ Eq.)	2006 Estimate (Tg CO ₂ Eq.)				
Mobile Combustion: Marine	CH ₄	0.1	0.1		<0.01	<0.1	100
CH ₄ Emissions from Ferroalloy Production	CH ₄	<0.1	<0.1		<0.01	<0.1	100

Note: LULUCF sources and sinks are not included in this analysis.

Table A- 9: 1990-2006 Key Source Category Tier 1 Analysis—Trend Assessment, with LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate (Tg CO ₂ Eq.)	2006 Estimate (Tg CO ₂ Eq.)	Trend Assessment	Percent Contribution to Trend (%)	Cumulative Contribution to Trend (%)
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	110.4	0.01	10.4	28
CO ₂ Emissions from Stationary Combustion - Coal	CO ₂	1698.9	2065.3	0.01	9.7	38
CO ₂ Emissions from Stationary Combustion - Oil	CO ₂	564.3	594.3	0.01	5.4	43
CO ₂ Emissions from Iron and Steel Production	CO ₂	86.2	49.1	0.01	4.8	48
CH ₄ Emissions from Landfills	CH ₄	149.6	125.7	0.01	4.4	52
Fugitive Emissions from Natural Gas Systems	CH ₄	124.7	102.4	<0.01	3.9	56
Fugitive Emissions from Coal Mining	CH ₄	84.1	58.5	<0.01	3.6	60
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	218.3	214.7	<0.01	3.5	64
Mobile Combustion: Aviation	CO ₂	180.0	170.6	<0.01	3.5	67
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	13.8	<0.01	2.7	70
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	621.7	745.1	<0.01	2.5	72
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	60.6	95.5	<0.01	2.4	75
CH ₄ Emissions from Enteric Fermentation	CH ₄	126.9	126.2	<0.01	1.9	77
CH ₄ Emissions from Forest Land Remaining Forest Land	CH ₄	4.5	24.6	<0.01	1.8	78
PFC Emissions from Aluminum Production	PFCs	18.5	2.5	<0.01	1.8	80
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	13.2	<0.01	1.7	82
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	23.9	10.5	<0.01	1.6	83
Mobile Combustion: Road & Other	N ₂ O	41.4	31.1	<0.01	1.6	85
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	1.9	16.2	<0.01	1.3	86
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.3	5.9	<0.01	1.1	87
Mobile Combustion: Marine	CO ₂	46.5	42.4	<0.01	1.1	89
Fugitive Emissions from Petroleum Systems	CH ₄	33.9	28.4	<0.01	1.0	90
CO ₂ Emissions from Natural Gas Systems	CO ₂	33.7	28.5	<0.01	1.0	90
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	51.1	50.3	<0.01	0.8	91
CO ₂ Emissions from Municipal Solid Waste Combustion	CO ₂	10.9	20.9	<0.01	0.8	92
CO ₂ Emissions from Land Converted to Cropland	CO ₂	14.7	9.4	<0.01	0.7	93
CO ₂ Emissions from Cement Manufacture	CO ₂	33.3	45.7	<0.01	0.7	94
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	23.0	33.8	<0.01	0.7	94
CO ₂ Emissions from Ammonia Manufacture and Urea Application	CO ₂	16.9	12.4	<0.01	0.7	95
CH ₄ Emissions from Manure Management	CH ₄	31.0	41.4	<0.01	0.5	95
CO ₂ Emissions from Stationary Combustion - Gas	CO ₂	975.4	1121.9	<0.01	0.5	96
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	3.9	<0.01	0.4	96
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.0	15.6	<0.01	0.4	97
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	3.2	<0.01	0.3	97
Mobile Combustion: Road & Other	CH ₄	4.5	2.1	<0.01	0.3	97
CH ₄ Emissions from Wastewater Treatment	CH ₄	23.0	23.9	<0.01	0.3	97
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.2	138.0	<0.01	0.2	98
Non-CO ₂ Emissions from Stationary Combustion	CH ₄	7.4	6.2	<0.01	0.2	98
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	5.9	<0.01	0.2	98
N ₂ O Emissions from Forest Land Remaining Forest Land	N ₂ O	0.5	2.8	<0.01	0.2	98
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	5.5	8.6	<0.01	0.2	99
CO ₂ Emissions from Lime Manufacture	CO ₂	12.0	15.8	<0.01	0.2	99
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	5.4	<0.01	0.1	99
PFC, HFC, and SF ₆ Emissions from Semiconductor	Several	2.9	4.8	<0.01	0.1	99

IPCC Source Categories	Direct GHG	1990 Estimate (Tg CO ₂ Eq.)	2006 Estimate (Tg CO ₂ Eq.)	Trend Assessment	Percent Contribution to Trend (%)	Cumulative Contribution to Trend (%)
Manufacture						
N ₂ O Emission from Composting	N ₂ O	0.4	1.8	<0.01	0.1	99
CH ₄ Emissions from Composting	CH ₄	0.3	1.6	<0.01	0.1	99
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	1.5	<0.01	0.1	99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	6.3	8.1	<0.01	0.1	99
N ₂ O Emissions from N ₂ O Product Usage	N ₂ O	4.4	4.4	<0.01	0.1	100
CO ₂ Emissions from Soda Ash Manufacture and Consumption	CO ₂	4.1	4.2	<0.01	0.1	100
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.2	<0.01	0.1	100
CH ₄ Emissions from Iron and Steel Production	CH ₄	1.3	0.9	<0.01	0.1	100
CO ₂ Emissions from Zinc Production	CO ₂	0.9	0.5	<0.01	0.1	100
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.9	<0.01	<0.1	100
N ₂ O Emissions from Manure Management	N ₂ O	12.1	14.3	<0.01	<0.1	100
Mobile Combustion: Aviation	N ₂ O	1.7	1.6	<0.01	<0.1	100
N ₂ O Emissions from Settlements Remaining Settlements	N ₂ O	1.0	1.5	<0.01	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion	N ₂ O	12.8	14.5	<0.01	<0.1	100
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.2	<0.01	<0.1	100
CO ₂ Emissions from Land Converted to Grassland	CO ₂	14.3	16.3	<0.01	<0.1	100
N ₂ O Emissions from Municipal Solid Waste Combustion	N ₂ O	0.5	0.4	<0.01	<0.1	100
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.3	<0.01	<0.1	100
Mobile Combustion: Marine	N ₂ O	0.4	0.4	<0.01	<0.1	100
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	<0.1	100
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.4	0.5	<0.01	<0.1	100
CO ₂ Emissions from Lead Production	CO ₂	0.3	0.3	<0.01	<0.1	100
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	1.6	<0.01	<0.1	100
Mobile Combustion: Aviation	CH ₄	0.2	0.1	<0.01	<0.1	100
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.7	0.8	<0.01	<0.1	100
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	0.0	0.0	<0.01	<0.1	100
Mobile Combustion: Marine	CH ₄	0.1	0.1	<0.01	<0.1	100
CH ₄ Emissions from Petrochemical Production	CH ₄	0.9	1.0	<0.01	<0.1	100
CO ₂ Emissions from Petrochemical Production	CO ₂	2.2	2.6	<0.01	<0.1	100
CH ₄ Emissions from Ferroalloy Production	CH ₄	<0.1	<0.1	<0.01	<0.1	100

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