

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), IPCC’s *Good Practice Guidance for Land Use, Land-Use Change, and Forestry* (IPCC 2003), and IPCC’s *2006 Guidelines for National Greenhouse Gas Inventories* (IPCC 2006); 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 (including and excluding LULUCF categories) using emissions and uncertainty data in this report, and ranked according to their sector and global warming potential-weighted emissions in 2011. The table also indicates the criteria used in identifying these categories (i.e., level, trend, Tier 1, Tier 2, and/or qualitative assessments).

1 Table A- 1: Key Source Categories for the United States (1990-2011)

IPCC Source Categories	Gas	Tier 1				Tier 2				Qual	2011 Emissions (Tg CO ₂ Eq.)
		Level Without LULUCF	Trend Without LULUCF	Level With LULUCF	Trend With LULUCF	Level Without LULUCF	Trend Without LULUCF	Level With LULUCF	Trend With LULUCF		
Energy											
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	•	•	•	•	•	•	•	•		1,718.0
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	•	•	•	•	•	•	•	•		1,473.2
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	•	•	•	•	•	•	•	•		410.2
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	•	•	•	•	•	•	•	•		409.7
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	•	•	•	•	•	•	•	•		279.9
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	•	•	•	•	•	•	•	•		255.7
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	•	•	•	•	•	•	•	•		171.1
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	•	•	•	•	•	•	•	•		142.8
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	•	•	•	•	•	•	•	•		130.5
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	•	•	•	•	•	•	•	•		90.0
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	•	•	•	•	•	•	•	•		79.2
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	•	•	•	•	•	•	•	•		78.2
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	•	•	•	•	•	•	•	•		49.8
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	•	•	•	•	•	•	•	•		44.7
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	•	•	•	•	•	•	•	•		36.5
CO ₂ Emissions from Natural Gas Systems	CO ₂	•	•	•	•	•	•	•	•		32.3
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	•	•	•	•	•	•	•	•		25.1
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	•	•	•	•	•	•	•	•		4.9
Fugitive Emissions from Natural Gas Systems	CH ₄	•	•	•	•	•	•	•	•		215.4
Fugitive Emissions from Coal Mining	CH ₄	•	•	•	•	•	•	•	•		72.6
Fugitive Emissions from Petroleum Systems	CH ₄	•	•	•	•	•	•	•	•		31.5
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	•	•	•	•	•	•	•	•		3.6
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	•	•	•	•	•	•	•	•		17.9
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	•	•	•	•	•	•	•	•		16.7
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	•	•	•	•	•	•	•	•		2.7
International Bunker Fuels ^b	Several	•	•	•	•	•	•	•	•		1.9
Industrial Processes											
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	•	•	•	•	•	•	•	•		64.3

CO ₂ Emissions from Cement Production	CO ₂	.	.	.						31.6
CO ₂ Emissions from Ammonia Production	CO ₂	.	.	.						8.8
CO ₂ Emissions from Aluminum Production	CO ₂				.	.				3.3
N ₂ O Emissions from Nitric Acid Production	N ₂ O	.	.	.						16.7
N ₂ O Emissions from Adipic Acid Production	N ₂ O	.	.	.						10.6
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	.	.	.	.	.	.	.		121.7
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	.	.	.	.	.	.	.		11.7
HFC-23 Emissions from HCFC-22 Production	HiGWP	.	.	.	.	.	.	.		6.9
PFC Emissions from Aluminum Production	HiGWP	.	.	.	.	.	.	.		2.9
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	.	.	.	.	.	.	.		1.3
Agriculture										
CH ₄ Emissions from Enteric Fermentation	CH ₄	.	.	.	.	.	.	.		139.3
CH ₄ Emissions from Manure Management	CH ₄	.	.	.	.	.	.	.		52.3
CH ₄ Emissions from Rice Cultivation	CH ₄	.	.	.	.	.	.	.		6.6
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	.	.	.	.	.	.	.		285.6
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	.	.	.	.	.	.	.		57.6
Waste										
CH ₄ Emissions from Landfills	CH ₄	.	.	.	.	.	.	.		103.0
Land Use, Land Use Change, and Forestry										
CO ₂ Emissions from Changes in Forest Carbon Stocks	CO ₂		.	.		.	.			(921.8)
CO ₂ Emissions from Urban Trees	CO ₂		.	.		.	.			(98.0)
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂		.	.		.	.			(13.0)
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂		.	.		.	.			(9.0)
CO ₂ Emissions from Land Converted to Cropland	CO ₂		.	.		.	.			12.5
CH ₄ Emissions from Forest Fires	CH ₄		.	.		.	.			4.8
N ₂ O Emissions from Forest Fires	N ₂ O		.	.		.	.			4.0
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂		.	.		.	.			2.4
Subtotal Without LULUCF										6,716.5
Total Emissions Without LULUCF										6,851.2
Percent of Total Without LULUCF										98.0%
Subtotal With LULUCF										5,698.4
Total Emissions With LULUCF										5,829.4
Percent of Total With LULUCF										97.8%

- 1 ^aQualitative criteria.
- 2 ^bEmissions from this source not included in totals.
- 3 Note: Parentheses indicate negative values (or sequestration). Table A-2 provides a complete listing of source categories by IPCC sector, along with notations on the criteria used in identifying key categories, without
- 4 LULUCF sources and sinks. Similarly,
- 5 Table A-3 provides a complete listing of source and sink categories by IPCC sector, along with notations on the criteria used in identifying key categories, including LULUCF sources and sinks. The notations refer specifically
- 6 to the year(s) in the inventory time series (i.e., 1990 to 2009) in which each source category reached the threshold for being a key category based on either a Tier 1 or Tier 2 level assessment.

In addition to conducting Tier 1 and 2 level and trend assessments, a qualitative assessment of the source categories, as described in the IPCC's *Good Practice Guidance* (IPCC 2000), was conducted to capture any key categories that were not identified by any 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, which would qualify it as a key category according to the Tier 2 approach.

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

IPCC Source Categories	2011		Key Category?	ID Criteria ^a	Level in which year(s)? ^b
	Direct GHG	Emissions (Tg CO ₂ Eq.)			
Energy					
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,718.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,473.2	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	410.2	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	409.7	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	279.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	255.7	•	L ₁ L ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	171.1	•	L ₁ T ₁ L ₂	1990, 2011
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	142.8	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	130.5	•	L ₁ L ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	90.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	79.2	•	L ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	78.2	•	L ₁ T ₁ T ₂	1990, 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	49.8	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	44.7	•	L ₁ T ₁ T ₂	1990, 2011 ₁
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	36.5	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Natural Gas Systems	CO ₂	32.3	•	L ₁ T ₁ L ₂ T ₂	1990, 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	25.1	•	L ₁ T ₁ T ₂	1990 ₁
CO ₂ Emissions from Incineration of Waste	CO ₂	12.0			
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	4.9	•	T ₁	
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	3.5			
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	1.5			
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.6			
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	215.4	•	L ₁ T ₁ L ₂ T ₂	1990, 2011

Fugitive Emissions from Coal Mining	CH ₄	72.6	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
Fugitive Emissions from Petroleum Systems	CH ₄	31.5	•	L ₁ T ₁ L ₂ T ₂	1990, 2011 ₂
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	5.0			
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.6	•	T ₂	
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4			
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.3			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9			
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4			
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.4			
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1			
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+			
CH ₄ Emissions from Incineration of Waste	CH ₄	+			
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	16.7	•	L ₁ T ₁ T ₂	1990
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	17.9	•	T ₁ L ₂ T ₂	1990 ₂ , 2011 ₂
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.7	•	T ₂	
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9			
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.4			
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.9			
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.5			
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.4			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.3			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1			
International Bunker Fuels ^e	Several	1.9			

Industrial Processes

CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	64.3	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Cement Production	CO ₂	31.6	•	L ₁	1990 ₁
CO ₂ Emissions from Lime Production	CO ₂	13.8			
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	9.5			
CO ₂ Emissions from Ammonia Production	CO ₂	8.8	•	T ₁	
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	4.3			
CO ₂ Emissions from Petrochemical Production	CO ₂	3.5			
CO ₂ Emissions from Aluminum Production	CO ₂	3.3	•	T ₂	
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.7			
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	2.2			
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.9			
CO ₂ Emissions from Ferroalloy Production	CO ₂	1.7			

CO ₂ Emissions from Glass Production	CO ₂	1.5			
CO ₂ Emissions from Zinc Production	CO ₂	1.3			
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.1			
CO ₂ Emissions from Lead Production	CO ₂	0.5			
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2			
CH ₄ Emissions from Petrochemical Production	CH ₄	3.1			
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	0.6			
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	16.7	•	L ₂	1990 ₂
N ₂ O Emissions from Adipic Acid Production	N ₂ O	10.6	•	T ₁	
N ₂ O Emissions from Product Uses	N ₂ O	4.4			
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	121.7	•	L ₁ T ₁ T ₂	2011 ₁
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	11.7	•	T ₁ T ₂	
HFC-23 Emissions from HCFC-22 Production	HiGWP	6.9	•	L ₁ T ₁ T ₂	1990 ₁
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	HiGWP	5.4			
PFC Emissions from Aluminum Production	HiGWP	2.9	•	T ₁ L ₂ T ₂	1990 ₂
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	1.3	•	T ₁	

Agriculture

CH ₄ Emissions from Enteric Fermentation	CH ₄	139.3	•	L ₁ T ₁ L ₂	1990, 2011
CH ₄ Emissions from Manure Management	CH ₄	52.3	•	L ₁ T ₁ L ₂ T ₂	2011
CH ₄ Emissions from Rice Cultivation	CH ₄	6.6	•	L ₂ T ₂	1990 ₂ , 2011 ₂
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2			
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	285.6	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	57.6	•	L ₁ L ₂ T ₂	1990, 2011
N ₂ O Emissions from Manure Management	N ₂ O	18.5			
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1			

Waste

CH ₄ Emissions from Landfills	CH ₄	103.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CH ₄ Emissions from Wastewater Treatment	CH ₄	16.2			
CH ₄ Emissions from Composting	CH ₄	1.5			
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.2			
N ₂ O Emissions from Composting	N ₂ O	1.7			

1 ^a For the ID criteria, L refers to a key category identified through a level assessment; T refers to a key category identified through a trend assessment and the
2 subscripted number refers to either a Tier 1 or Tier 2 assessment (e.g., L₂ designates a source is a key category for a Tier 2 level assessment).

3 ^b If the source is a key category for both L₁ and L₂ (as designated in the ID criteria column), it is a key category for both assessments in the years provided
4 unless noted by a subscript, in which case it is a key category for that assessment in that year only (e.g., 1990₂ designates a source is a key category for the
5 Tier 2 assessment only in 1990).

6 ^c Emissions from these sources not included in totals.

7 + Does not exceed 0.05 Tg CO₂ Eq.

1 Note: LULUCF sources and sinks are not included in this analysis.
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Table A-3: U.S Greenhouse Gas Inventory Source Categories with LULUCF

IPCC Source Categories	Gas	2011	Key Category?	ID Criteria ^a	Level in which year(s)? ^b
		Emissions (Tg CO ₂ Eq.)			
Energy					
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,718.0	•	L ₁ T ₁ L ₂	1990, 2011
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,473.2	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	410.2	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	409.7	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	279.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	255.7	•	L ₁ L ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	171.1	•	L ₁ T ₁ L ₂	1990, 2011
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	142.8	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	130.5	•	L ₁ T ₁ L ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	90.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	79.2	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	78.2	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	49.8	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	44.7	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	36.5	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Natural Gas Systems	CO ₂	32.3	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	25.1	•	L ₁ T ₁ T ₂	1990 ₁
CO ₂ Emissions from Incineration of Waste	CO ₂	12.0			
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	4.9	•	T ₁	
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	3.5			
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	1.5			
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.6			
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	215.4	•	L ₁ L ₂	1990, 2011
Fugitive Emissions from Coal Mining	CH ₄	72.6	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
Fugitive Emissions from Petroleum Systems	CH ₄	31.5	•	L ₁ T ₁ L ₂ T ₂	1990, 2011 ₂
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	5.0			
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.6	•	T ₂	
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4			

Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.3			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9			
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4			
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.4			
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1			
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+			
CH ₄ Emissions from Incineration of Waste	CH ₄	+			
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	17.9	•	T ₁ L ₂ T ₂	1990 ₂ , 2011 ₂
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	16.7	•	L ₁ T ₁ T ₂	1990 ₁
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.7			
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9			
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.4			
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.9			
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.5			
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.4			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.3			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1			
International Bunker Fuels ^a	Several	1.9	•		

Industrial Processes

CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	64.3	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Cement Production	CO ₂	31.6	•	L ₁ T ₁	1990 ₁ , 2011 ₁
CO ₂ Emissions from Lime Production	CO ₂	13.8			
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	9.5			
CO ₂ Emissions from Ammonia Production	CO ₂	8.8	•	T ₁	
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	4.3			
CO ₂ Emissions from Petrochemical Production	CO ₂	3.5			
CO ₂ Emissions from Aluminum Production	CO ₂	3.3	•	T ₂	
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.7			
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	2.2			
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.9			
CO ₂ Emissions from Ferroalloy Production	CO ₂	1.7			
CO ₂ Emissions from Glass Production	CO ₂	1.5			
CO ₂ Emissions from Zinc Production	CO ₂	1.3			
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.1			
CO ₂ Emissions from Lead Production	CO ₂	0.5			

CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2			
CH ₄ Emissions from Petrochemical Production	CH ₄	3.1			
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	0.6			
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	16.7			
N ₂ O Emissions from Adipic Acid Production	N ₂ O	10.6	•	T ₁	
N ₂ O Emissions from Product Uses	N ₂ O	4.4			
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	121.7	•	L ₁ T ₁ L ₂ T ₂	2011
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	11.7	•	T ₁ T ₂	
HFC-23 Emissions from HCFC-22 Production	HiGWP	6.9	•	L ₁ T ₁ T ₂	1990 ₁
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	HiGWP	5.4			
PFC Emissions from Aluminum Production	HiGWP	2.9	•	T ₁ L ₂ T ₂	1990 ₂
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	1.3	•	T ₁	
Agriculture					
CH ₄ Emissions from Enteric Fermentation	CH ₄	139.3	•	L ₁ T ₁ L ₂	1990, 2011
CH ₄ Emissions from Manure Management	CH ₄	52.3	•	L ₁ T ₁ L ₂ T ₂	1990 ₁ , 2011
CH ₄ Emissions from Rice Cultivation	CH ₄	6.6	•	L ₂ T ₂	1990 ₂ , 2011 ₂
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2			
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	285.6	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	57.6	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
N ₂ O Emissions from Manure Management	N ₂ O	18.5			
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1			
Waste					
CH ₄ Emissions from Landfills	CH ₄	103.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CH ₄ Emissions from Wastewater Treatment	CH ₄	16.2			
CH ₄ Emissions from Composting	CH ₄	1.5			
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.2			
N ₂ O Emissions from Composting	N ₂ O	1.7			
Land Use, Land Use Change, and Forestry					
CO ₂ Emissions from Changes in Forest Carbon Stocks	CO ₂	(921.8)	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Urban Trees	CO ₂	(98.0)	•	L ₁ T ₁ L ₂ T ₂	1990, 2011
CO ₂ Emissions from Land Converted to Grassland	CO ₂	(14.6)			
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	2.4	•	T ₁ L ₂ T ₂	1990 ₂
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	(13.0)	•	T ₁ L ₂ T ₂	1990 ₂ , 2011 ₂
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	(9.0)	•	L ₁ T ₁ L ₂ T ₂	1990
CO ₂ Emissions from Land Converted to Cropland	CO ₂	12.5	•	T ₁ L ₂ T ₂	1990 ₂

CO ₂ Emissions from Liming of Agricultural Soils	CO ₂	4.5		
CO ₂ Emissions from Urea Fertilization	CO ₂	3.7		
CO ₂ Emissions from Wetlands Remaining Wetlands	CO ₂	1.0		
CH ₄ Emissions from Forest Fires	CH ₄	4.8	•	T ₂
N ₂ O Emissions from Forest Fires	N ₂ O	4.0	•	T ₂
N ₂ O Emissions from Settlement Soils	N ₂ O	1.5		
N ₂ O Emissions from Forest Soils	N ₂ O	0.4		
N ₂ O Emissions from Wetlands Remaining Wetlands	N ₂ O	+		

^a For the ID criteria, L refers to a key category identified through a level assessment; T refers to a key category identified through a trend assessment and the subscripted number refers to either a Tier 1 or Tier 2 assessment (e.g., L₂ designates a source is a key category for a Tier 2 level assessment).

^b If the source is a key category for both L₁ and L₂ (as designated in the ID criteria column), it is a key category for both assessments in the years provided unless noted by a subscript, in which case it is a key category only for that assessment in only that year (e.g., 1990₂ designates a source is a key category for the Tier 2 assessment only in 1990).

^c Emissions from these sources not included in totals.

+ Does not exceed 0.05 Tg CO₂ Eq.

Note: Parentheses indicate negative values (or sequestration).

Evaluation of 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.

Including the Tier 2 approach provides additional insight into why certain source categories are considered key, and how to prioritize inventory improvements. In the Tier 2 approach, the level assessment for each category from the Tier 1 approach is multiplied by its percent relative uncertainty. If the uncertainty reported is asymmetrical, the absolute value of the larger uncertainty is used. Uncertainty is not estimated for the following sources: CO₂ emissions from stationary combustion – geothermal energy; CO₂ emissions from mobile combustion by mode of transportation; CH₄ and N₂O emissions from mobile combustion by mode of off-road transportation; and CH₄ from the incineration of waste. While CO₂ emissions from geothermal energy are included in the overall emissions estimate, they are not an official IPCC source category. As a result, there are no guidelines to associate uncertainty with the emissions estimate; therefore, an uncertainty analysis was not conducted. The uncertainty associated with CO₂ from mobile combustion is applied to each mode's emissions estimate, and the uncertainty associated with off-road vehicle CH₄ and N₂O emissions are applied to both CH₄ and N₂O emissions from aviation, marine, and other sources. No uncertainty was associated with CH₄ emissions from waste incineration because emissions are less than 0.05 Gg CH₄ and an uncertainty analysis was not conducted. When source and sink categories are sorted in decreasing order of this calculation, those that fall at the top of the list and cumulatively account for 90 percent of emissions are considered key categories. The key categories identified by the Tier 2 level assessment may differ from those identified by the Tier 1 assessment. The final set of key categories includes all source and sink categories identified as key by either the Tier 1 or the Tier 2 assessment, keeping in mind that the two assessments are not mutually exclusive.

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.

1 Table A- 4 through Table A- 7 contain the 1990 and 2011 level assessments for both with and without LULUCF
 2 sources and sinks, and contain further detail on where each source falls within the analysis. Tier 1 key categories are
 3 shaded dark gray. Additional key categories identified by the Tier 2 assessment are shaded light gray.

4 Trend Assessment

5 The Tier 1 approach for trend assessment is defined as the product of the source or sink category level
 6 assessment and the absolute difference between the source or sink category trend and the total trend. In turn, the source or
 7 sink category trend is defined as the change in emissions from the base year to the current year, as a percentage of current
 8 year emissions from that source or sink category. The total trend is the percentage change in total inventory emissions
 9 from the base year to the current year.

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

15 For the Tier 2 approach, the trend assessment for each category from the Tier 1 approach is multiplied by its
 16 percent relative uncertainty. If the uncertainty reported is asymmetrical, the larger uncertainty is used. When source and
 17 sink categories are sorted in decreasing order of this calculation, those that fall at the top of the list and cumulatively
 18 account for 90 percent of emissions are considered key categories. The key categories identified by the Tier 2 trend
 19 assessment may differ from those identified by the Tier 1 assessment. The final set of key categories includes all source
 20 and sink categories identified as key by either the Tier 1 or the Tier 2 assessment, keeping in mind that the two
 21 assessments are not mutually exclusive.

22 Table A- 8 and Table A- 9 contain the 1990 through 2011 trend assessment for both with and without LULUCF
 23 sources and sinks, and contain further detail on where each source falls within the analysis. Tier 1 key categories are
 24 shaded dark gray. Additional key categories identified by the Tier 2 assessment are shaded light gray.

25 Table A- 4: 1990 Key Source Category Tier 1 and Tier 2 Analysis—Level Assessment, without LULUCF

IPCC Source Categories	Direct GHG	1990	Tier 1 Level Assessment	Cumulative Total	Uncertainty	Tier 2 Level Assessment
		Estimate (Tg CO ₂ Eq.)				
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	0.25	0.25	10%	0.024
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,188.9	0.19	0.44	8%	0.016
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	408.9	0.07	0.50	13%	0.008
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	284.4	0.05	0.55	18%	0.008
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	272.1	0.04	0.59	58%	0.025
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	0.04	0.63	7%	0.003
Fugitive Emissions from Natural Gas Systems	CH ₄	189.6	0.03	0.66	30%	0.009
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	179.3	0.03	0.68	8%	0.002
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	0.03	0.71	5%	0.001
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	155.3	0.02	0.74	17%	0.004
CH ₄ Emissions from Landfills	CH ₄	147.8	0.02	0.76	52%	0.012
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	0.02	0.78	7%	0.002
CH ₄ Emissions from Enteric Fermentation	CH ₄	133.8	0.02	0.80	18%	0.004
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.4	0.02	0.82	21%	0.004
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	99.8	0.02	0.84	17%	0.003
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	97.5	0.02	0.85	7%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	97.4	0.02	0.87	6%	0.001
Fugitive Emissions from Coal Mining	CH ₄	84.1	0.01	0.88	16%	0.002
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	0.01	0.90	8%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	64.9	0.01	0.91	5%	<0.001

Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	54.8	0.01	0.91	153%	0.013
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.5	0.01	0.92	8%	0.001
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	40.3	0.01	0.93	17%	0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.6	0.01	0.93	30%	0.002
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	0.01	0.94	10%	0.001
Fugitive Emissions from Petroleum Systems	CH ₄	35.2	0.01	0.95	149%	0.008
CO ₂ Emissions from Cement Production	CO ₂	33.3	0.01	0.95	14%	0.001
CH ₄ Emissions from Manure Management	CH ₄	31.7	0.01	0.96	20%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	27.2	<0.01	0.96	11%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	<0.01	0.96	25%	0.001
PFC Emissions from Aluminum Production	PFCs	18.4	<0.01	0.97	51%	0.002
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.6	<0.01	0.97	43%	0.001
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.9	<0.01	0.97	31%	0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.8	<0.01	0.97	9%	<0.001
N ₂ O Emissions from Manure Management	N ₂ O	14.8	<0.01	0.98	24%	0.001
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	<0.01	0.98	25%	0.001
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	12.0	<0.01	0.98	15%	<0.001
CO ₂ Emissions from Lime Production	CO ₂	11.5	<0.01	0.98	9%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	<0.01	0.98	24%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	<0.01	0.99	187%	0.002
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	<0.01	0.99	153%	0.002
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	<0.01	0.99	49%	0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	<0.01	0.99	22%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	<0.01	0.99	4%	<0.001
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	4.9	<0.01	0.99	18%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	4.6	<0.01	0.99	127%	0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.4	<0.01	0.99	8%	<0.001
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	4.2	<0.01	0.99	15%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	<0.01	0.99	48%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.5	<0.01	0.99	99%	0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	3.4	<0.01	0.99	31%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.3	<0.01	0.99	187%	0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	<0.01	0.99	15%	<0.001
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	<0.01	0.99	11%	<0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	<0.01	1.00	7%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	2.3	<0.01	1.00	30%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	<0.01	1.00	12%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	<0.01	1.00	68%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.6	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.5	<0.01	1.00	10%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	<0.01	1.00	18%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	<0.01	1.00	30%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.3	<0.01	1.00	47%	<0.001
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	<0.01	1.00	13%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	1.1	<0.01	1.00	187%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	1.0	<0.01	1.00	22%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	0.6	<0.01	1.00	19%	<0.001

CO ₂ Emissions from Zinc Production	CO ₂	0.6	<0.01	1.00	19%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	<0.01	1.00	57%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	15%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	<0.01	1.00	320%	<0.001
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	<0.01	1.00	NA	<0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	<0.01	1.00	149%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	<0.01	1.00	187%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	<0.01	1.00	10%	<0.001
N ₂ O Emissions from Composting	N ₂ O	0.4	<0.01	1.00	50%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.3	<0.01	1.00	127%	<0.001
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	<0.01	1.00	8%	<0.001
CH ₄ Emissions from Composting	CH ₄	0.3	<0.01	1.00	50%	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	<0.01	1.00	47%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	<0.01	1.00	42%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.2	<0.01	1.00	61%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	31%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	187%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	+	<0.01	1.00	127%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	9%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	73%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	24%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	+	<0.01	1.00	17%	<0.001

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

2 ^a Percent relative uncertainty. If the corresponding uncertainty is asymmetrical, the uncertainty given here is the larger and always positive.

3 NE Uncertainty not estimated.

4 + Does not exceed 0.05 Tg CO₂ Eq.

5

6

7 Table A- 5: 1990 Key Source Category Tier 1 and Tier 2 Analysis—Level Assessment, with LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate		Tier 1 Level Assessment	Cumulative Total	Uncertainty	Tier 2 Level Assessment
		(Tg CO ₂ Eq.)					
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	0.22	0.22	10%	0.021	
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,188.9	0.17	0.38	8%	0.014	
CO ₂ Emissions from Changes in Forest Carbon Stocks	CO ₂	701.4	0.10	0.48	12%	0.012	
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	408.9	0.06	0.53	13%	0.007	
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	284.4	0.04	0.57	18%	0.007	
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	272.1	0.04	0.61	58%	0.022	
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	0.03	0.65	7%	0.002	
Fugitive Emissions from Natural Gas Systems	CH ₄	189.6	0.03	0.67	30%	0.008	
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	179.3	0.02	0.70	8%	0.002	
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	0.02	0.72	5%	0.001	
CO ₂ Emissions from Stationary Combustion - Coal -	CO ₂	155.3	0.02	0.74	17%	0.004	

Industrial						
CH ₄ Emissions from Landfills	CH ₄	147.8	0.02	0.76	52%	0.011
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	0.02	0.78	7%	0.001
CH ₄ Emissions from Enteric Fermentation	CH ₄	133.8	0.02	0.80	18%	0.003
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.4	0.02	0.82	21%	0.003
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	99.8	0.01	0.83	17%	0.002
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	97.5	0.01	0.85	7%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	97.4	0.01	0.86	6%	0.001
Fugitive Emissions from Coal Mining	CH ₄	84.1	0.01	0.87	16%	0.002
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	0.01	0.88	8%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	64.9	0.01	0.89	5%	<0.001
CO ₂ Emissions from Urban Trees	CO ₂	57.1	0.01	0.90	23%	0.002
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	54.8	0.01	0.91	153%	0.012
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	52.5	0.01	0.91	32%	0.002
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.5	0.01	0.92	8%	0.001
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	40.3	0.01	0.92	17%	0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.6	0.01	0.93	30%	0.002
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	0.01	0.93	10%	0.001
Fugitive Emissions from Petroleum Systems	CH ₄	35.2	<0.01	0.94	149%	0.007
CO ₂ Emissions from Cement Production	CO ₂	33.3	<0.01	0.94	14%	0.001
CH ₄ Emissions from Manure Management	CH ₄	31.7	<0.01	0.95	20%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	27.2	<0.01	0.95	11%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	<0.01	0.96	25%	0.001
CO ₂ Emissions from Land Converted to Cropland	CO ₂	25.1	<0.01	0.96	40%	0.001
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	24.2	<0.01	0.96	57%	0.002
PFC Emissions from Aluminum Production	PFCs	18.4	<0.01	0.97	51%	0.001
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.6	<0.01	0.97	43%	0.001
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	17.0	<0.01	0.97	194%	0.005
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.9	<0.01	0.97	31%	0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.8	<0.01	0.97	9%	<0.001
N ₂ O Emissions from Manure Management	N ₂ O	14.8	<0.01	0.98	24%	<0.001
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	<0.01	0.98	25%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	12.0	<0.01	0.98	15%	<0.001
CO ₂ Emissions from Lime Production	CO ₂	11.5	<0.01	0.98	9%	<0.001
CO ₂ Emissions from Land Converted to Grassland	CO ₂	11.4	<0.01	0.98	15%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	<0.01	0.98	24%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	<0.01	0.99	187%	0.002
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	<0.01	0.99	153%	0.002
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	<0.01	0.99	49%	<0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	<0.01	0.99	22%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	<0.01	0.99	4%	<0.001
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	4.9	<0.01	0.99	18%	<0.001
CO ₂ Emissions from Liming of Agricultural Soils	CO ₂	4.7	<0.01	0.99	112%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	4.6	<0.01	0.99	127%	0.001

N ₂ O Emissions from Product Uses	N ₂ O	4.4	<0.01	0.99	8%	<0.001
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	4.2	<0.01	0.99	15%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	<0.01	0.99	48%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.5	<0.01	0.99	99%	<0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	3.4	<0.01	0.99	31%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.3	<0.01	0.99	187%	0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	<0.01	0.99	15%	<0.001
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	<0.01	0.99	11%	<0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	<0.01	1.00	7%	<0.001
CH ₄ Emissions from Forest Fires	CH ₄	2.5	<0.01	1.00	148%	0.001
CO ₂ Emissions from Urea Fertilization	CO ₂	2.4	<0.01	1.00	43%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	2.3	<0.01	1.00	30%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	<0.01	1.00	12%	<0.001
N ₂ O Emissions from Forest Fires	N ₂ O	2.1	<0.01	1.00	147%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	<0.01	1.00	68%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.6	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.5	<0.01	1.00	10%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	<0.01	1.00	18%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	<0.01	1.00	30%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.3	<0.01	1.00	47%	<0.001
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	<0.01	1.00	13%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	1.1	<0.01	1.00	187%	<0.001
CO ₂ Emissions from Wetlands Remaining Wetlands	CO ₂	1.0	<0.01	1.00	38%	<0.001
N ₂ O Emissions from Settlement Soils	N ₂ O	1.0	<0.01	1.00	163%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	1.0	<0.01	1.00	22%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	0.6	<0.01	1.00	19%	<0.001
CO ₂ Emissions from Zinc Production	CO ₂	0.6	<0.01	1.00	19%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	<0.01	1.00	57%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	15%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	<0.01	1.00	320%	<0.001
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	<0.01	1.00	NA	<0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	<0.01	1.00	149%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	<0.01	1.00	187%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	<0.01	1.00	10%	<0.001
N ₂ O Emissions from Composting	N ₂ O	0.4	<0.01	1.00	50%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.3	<0.01	1.00	127%	<0.001
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	<0.01	1.00	8%	<0.001
CH ₄ Emissions from Composting	CH ₄	0.3	<0.01	1.00	50%	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	<0.01	1.00	47%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	<0.01	1.00	42%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.2	<0.01	1.00	61%	<0.001

N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	31%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	187%	<0.001
N ₂ O Emissions from Forest Soils	N ₂ O	0.1	<0.01	1.00	211%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	+	<0.01	1.00	127%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	9%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	73%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
N ₂ O Emissions from Wetlands Remaining Wetlands	N ₂ O	+	<0.01	1.00	74%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	24%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	+	<0.01	1.00	17%	<0.001

^a Percent relative uncertainty. If the corresponding uncertainty is asymmetrical, the uncertainty given here is the larger and always positive.

NE Uncertainty not estimated.

+ Does not exceed 0.05 Tg CO₂ Eq.

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6 Table A- 6: 2011 Key Source Category Tier 1 and Tier 2 Analysis—Level Assessment, without LULUCF

IPCC Source Categories	Direct GHG	Current Year Estimate (Tg CO ₂ Eq.)	Tier 1 Level Assessment	Cumulative Total	Uncertainty	Tier 2 Level Assessment
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,718.0	0.25	0.25	10%	0.024
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,473.2	0.22	0.47	8%	0.018
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	410.2	0.06	0.53	5%	0.003
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	409.7	0.06	0.59	13%	0.008
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	285.6	0.04	0.63	58%	0.024
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	279.9	0.04	0.67	18%	0.007
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	255.7	0.04	0.71	7%	0.003
Fugitive Emissions from Natural Gas Systems	CH ₄	215.4	0.03	0.74	30%	0.009
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	171.1	0.02	0.76	7%	0.002
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	142.8	0.02	0.78	8%	0.002
CH ₄ Emissions from Enteric Fermentation	CH ₄	139.3	0.02	0.80	18%	0.004
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	130.5	0.02	0.82	21%	0.004
Emissions from Substitutes for Ozone Depleting Substances	Several	121.7	0.02	0.84	8%	0.001
CH ₄ Emissions from Landfills	CH ₄	103.0	0.02	0.85	52%	0.008
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	90.0	0.01	0.87	17%	0.002
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	79.2	0.01	0.88	8%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	78.2	0.01	0.89	6%	0.001
Fugitive Emissions from Coal Mining	CH ₄	72.6	0.01	0.90	16%	0.002
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	64.3	0.01	0.91	17%	0.002
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	57.6	0.01	0.92	153%	0.013
CH ₄ Emissions from Manure Management	CH ₄	52.3	0.01	0.93	20%	0.002
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	49.8	0.01	0.93	5%	<0.001
CO ₂ Emissions from Stationary Combustion - Oil - U.S.	CO ₂	44.7	0.01	0.94	11%	0.001

Territories						
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	36.5	0.01	0.95	8%	<0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	32.3	<0.01	0.95	30%	0.001
CO ₂ Emissions from Cement Production	CO ₂	31.6	<0.01	0.96	14%	0.001
Fugitive Emissions from Petroleum Systems	CH ₄	31.5	<0.01	0.96	149%	0.007
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	25.1	<0.01	0.96	7%	<0.001
N ₂ O Emissions from Manure Management	N ₂ O	18.5	<0.01	0.97	24%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	17.9	<0.01	0.97	187%	0.005
N ₂ O Emissions from Nitric Acid Production	N ₂ O	16.7	<0.01	0.97	43%	0.001
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	16.7	<0.01	0.97	17%	<0.001
CH ₄ Emissions from Wastewater Treatment	CH ₄	16.2	<0.01	0.98	31%	0.001
CO ₂ Emissions from Lime Production	CO ₂	13.8	<0.01	0.98	9%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	12.0	<0.01	0.98	24%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	11.7	<0.01	0.98	25%	<0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	10.6	<0.01	0.98	9%	<0.001
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	9.5	<0.01	0.98	18%	<0.001
CO ₂ Emissions from Ammonia Production	CO ₂	8.8	<0.01	0.99	25%	<0.001
HFC-23 Emissions from HCFC-22 Production	HFCs	6.9	<0.01	0.99	10%	<0.001
CH ₄ Emissions from Rice Cultivation	CH ₄	6.6	<0.01	0.99	153%	0.001
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	5.4	<0.01	0.99	11%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.2	<0.01	0.99	99%	0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	5.0	<0.01	0.99	22%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	4.9	<0.01	0.99	15%	<0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.4	<0.01	0.99	8%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	4.3	<0.01	0.99	48%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.6	<0.01	0.99	127%	0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	3.5	<0.01	0.99	31%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	3.5	<0.01	0.99	19%	<0.001
CO ₂ Emissions from Aluminum Production	CO ₂	3.3	<0.01	0.99	49%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	3.1	<0.01	0.99	30%	<0.001
PFC Emissions from Aluminum Production	PFCs	2.9	<0.01	0.99	51%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.7	<0.01	1.00	187%	0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.7	<0.01	1.00	7%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	2.2	<0.01	1.00	30%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9	<0.01	1.00	47%	<0.001
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.9	<0.01	1.00	13%	<0.001
N ₂ O Emissions from Composting	N ₂ O	1.7	<0.01	1.00	50%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	1.7	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Composting	CH ₄	1.5	<0.01	1.00	50%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	1.5	<0.01	1.00	17%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.5	<0.01	1.00	10%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.4	<0.01	1.00	68%	<0.001
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4	<0.01	1.00	15%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.3	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Zinc Production	CO ₂	1.3	<0.01	1.00	19%	<0.001

SF ₆ Emissions from Magnesium Production and Processing	SF ₆	1.3	<0.01	1.00	4%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.1	<0.01	1.00	18%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9	<0.01	1.00	127%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.9	<0.01	1.00	187%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.6	<0.01	1.00	15%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	0.6	<0.01	1.00	22%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	15%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.5	<0.01	1.00	57%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	<0.01	1.00	NA	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.4	<0.01	1.00	47%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.4	<0.01	1.00	320%	<0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	0.3	<0.01	1.00	149%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.3	<0.01	1.00	187%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	<0.01	1.00	42%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2	<0.01	1.00	10%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	187%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1	<0.01	1.00	61%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	31%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1	<0.01	1.00	127%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	73%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	9%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	24%	<0.001

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

2 ^a Percent relative uncertainty. If the corresponding uncertainty is asymmetrical, the uncertainty given here is the larger and always positive.

3 NE Uncertainty not estimated.

4 + Does not exceed 0.05 Tg CO₂ Eq.

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6 Table A-7: 2011 Key Source Category Tier 1 and Tier 2 Analysis—Level Assessment with LULUCF

IPCC Source Categories	Direct GHG	2011	Tier 1	Cumulative	Tier 2 Level	
		Estimate (Tg CO ₂ Eq.)	Level Assessment			Total	Uncertainty	Assessment
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,718.0	0.22	0.22	10%	0.021
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,473.2	0.19	0.40	8%	0.016
CO ₂ Emissions from Changes in Forest Carbon Stocks	CO ₂	921.8	0.12	0.52	12%	0.014
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	410.2	0.05	0.57	5%	0.003
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	409.7	0.05	0.62	13%	0.007
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	285.6	0.04	0.66	58%	0.021
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	279.9	0.04	0.69	18%	0.006
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	255.7	0.03	0.72	7%	0.002
Fugitive Emissions from Natural Gas Systems	CH ₄	215.4	0.03	0.75	30%	0.008

CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	171.1	0.02	0.77	7%	0.002
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	142.8	0.02	0.79	8%	0.002
CH ₄ Emissions from Enteric Fermentation	CH ₄	139.3	0.02	0.81	18%	0.003
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	130.5	0.02	0.83	21%	0.003
Emissions from Substitutes for Ozone Depleting Substances	Several	121.7	0.02	0.84	8%	0.001
CH ₄ Emissions from Landfills	CH ₄	103.0	0.01	0.85	52%	0.007
CO ₂ Emissions from Urban Trees	CO ₂	98.0	0.01	0.87	23%	0.003
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	90.0	0.01	0.88	17%	0.002
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	79.2	0.01	0.89	8%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	78.2	0.01	0.90	6%	0.001
Fugitive Emissions from Coal Mining	CH ₄	72.6	0.01	0.91	16%	0.001
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	64.3	0.01	0.91	17%	0.001
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	57.6	0.01	0.92	153%	0.011
CH ₄ Emissions from Manure Management	CH ₄	52.3	0.01	0.93	20%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	49.8	0.01	0.93	5%	<0.001
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	44.7	0.01	0.94	11%	0.001
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	36.5	<0.01	0.94	8%	<0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	32.3	<0.01	0.95	30%	0.001
CO ₂ Emissions from Cement Production	CO ₂	31.6	<0.01	0.95	14%	0.001
Fugitive Emissions from Petroleum Systems	CH ₄	31.5	<0.01	0.96	149%	0.006
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	25.1	<0.01	0.96	7%	<0.001
N ₂ O Emissions from Manure Management	N ₂ O	18.5	<0.01	0.96	24%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	17.9	<0.01	0.96	187%	0.004
N ₂ O Emissions from Nitric Acid Production	N ₂ O	16.7	<0.01	0.97	43%	0.001
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	16.7	<0.01	0.97	17%	<0.001
CH ₄ Emissions from Wastewater Treatment	CH ₄	16.2	<0.01	0.97	31%	0.001
CO ₂ Emissions from Land Converted to Grassland	CO ₂	14.6	<0.01	0.97	15%	<0.001
CO ₂ Emissions from Lime Production	CO ₂	13.8	<0.01	0.97	9%	<0.001
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	13.0	<0.01	0.98	57%	0.001
CO ₂ Emissions from Land Converted to Cropland	CO ₂	12.5	<0.01	0.98	40%	0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	12.0	<0.01	0.98	24%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	11.7	<0.01	0.98	25%	<0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	10.6	<0.01	0.98	9%	<0.001
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	9.5	<0.01	0.98	18%	<0.001
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	9.0	<0.01	0.98	32%	<0.001
CO ₂ Emissions from Ammonia Production	CO ₂	8.8	<0.01	0.99	25%	<0.001
HFC-23 Emissions from HCFC-22 Production	HFCs	6.9	<0.01	0.99	10%	<0.001
CH ₄ Emissions from Rice Cultivation	CH ₄	6.6	<0.01	0.99	153%	0.001
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	5.4	<0.01	0.99	11%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.2	<0.01	0.99	99%	0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	5.0	<0.01	0.99	22%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	4.9	<0.01	0.99	15%	<0.001

CH ₄ Emissions from Forest Fires	CH ₄	4.8	<0.01	0.99	148%	0.001
CO ₂ Emissions from Liming of Agricultural Soils	CO ₂	4.5	<0.01	0.99	112%	0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.4	<0.01	0.99	8%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	4.3	<0.01	0.99	48%	<0.001
N ₂ O Emissions from Forest Fires	N ₂ O	4.0	<0.01	0.99	147%	0.001
CO ₂ Emissions from Urea Fertilization	CO ₂	3.7	<0.01	0.99	43%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.6	<0.01	0.99	127%	0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	3.5	<0.01	0.99	31%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	3.5	<0.01	0.99	19%	<0.001
CO ₂ Emissions from Aluminum Production	CO ₂	3.3	<0.01	0.99	49%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	3.1	<0.01	0.99	30%	<0.001
PFC Emissions from Aluminum Production	PFCs	2.9	<0.01	1.00	51%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.7	<0.01	1.00	187%	0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.7	<0.01	1.00	7%	<0.001
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	2.4	<0.01	1.00	194%	0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	2.2	<0.01	1.00	30%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9	<0.01	1.00	47%	<0.001
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.9	<0.01	1.00	13%	<0.001
N ₂ O Emissions from Composting	N ₂ O	1.7	<0.01	1.00	50%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	1.7	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Composting	CH ₄	1.5	<0.01	1.00	50%	<0.001
N ₂ O Emissions from Settlement Soils	N ₂ O	1.5	<0.01	1.00	163%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	1.5	<0.01	1.00	17%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.5	<0.01	1.00	10%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.4	<0.01	1.00	68%	<0.001
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4	<0.01	1.00	15%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.3	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Zinc Production	CO ₂	1.3	<0.01	1.00	19%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	1.3	<0.01	1.00	4%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.1	<0.01	1.00	18%	<0.001
CO ₂ Emissions from Wetlands Remaining Wetlands	CO ₂	1.0	<0.01	1.00	38%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9	<0.01	1.00	127%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.9	<0.01	1.00	187%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.6	<0.01	1.00	15%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	0.6	<0.01	1.00	22%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	15%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.5	<0.01	1.00	57%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4	<0.01	1.00	127%	<0.001
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	<0.01	1.00	NA	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.4	<0.01	1.00	47%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.4	<0.01	1.00	320%	<0.001
N ₂ O Emissions from Forest Soils	N ₂ O	0.4	<0.01	1.00	211%	<0.001

CO ₂ Emissions from Petroleum Systems	CO ₂	0.3	<0.01	1.00	149%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.3	<0.01	1.00	187%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	<0.01	1.00	42%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2	<0.01	1.00	10%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	187%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1	<0.01	1.00	61%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	31%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1	<0.01	1.00	127%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	73%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	9%	<0.001
N ₂ O Emissions from Wetlands Remaining Wetlands	N ₂ O	+	<0.01	1.00	74%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	24%	<0.001

^a Percent relative uncertainty. If the corresponding uncertainty is asymmetrical, the uncertainty given here is the larger and always positive.

NE Uncertainty not estimated.

+ Does not exceed 0.05 Tg CO₂ Eq.

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Table A- 8: 1990-2011 Key Source Category Tier 1 and 2 Analysis—Trend Assessment, without LULUCF

IPCC Source Categories	Direct GHG	1990	2011	Tier 1 Trend Assessment	Tier 2 Trend Assessment	% Contribution to Trend	Cumulative Total
		Estimate (Tg CO ₂ Eq.)	Estimate (Tg CO ₂ Eq.)				
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	410.2	0.03	0.001	16.9	17
CO ₂ Emissions from Mobile Combustion: Road Emissions from Substitutes for Ozone Depleting Substances	CO ₂	1,188.9	1,473.2	0.02	0.002	13.8	31
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	Several	0.3	121.7	0.02	0.001	9.4	40
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	97.5	25.1	0.01	0.001	6.3	46
CH ₄ Emissions from Landfills	CO ₂	155.3	90.0	0.01	0.002	6.1	52
CO ₂ Emissions from Mobile Combustion: Aviation	CH ₄	147.8	103.0	0.01	0.004	4.5	57
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	179.3	142.8	0.01	0.001	4.1	61
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	99.8	64.3	0.01	0.001	3.4	64
HFC-23 Emissions from HCFC-22 Production	CO ₂	408.9	409.7	<0.01	0.001	2.8	67
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	HFCs	36.4	6.9	<0.01	<0.001	2.5	70
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	1,547.6	1,718.0	<0.01	<0.001	2.5	72
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	284.4	279.9	<0.01	0.001	2.3	75
N ₂ O Emissions from Mobile Combustion: Road	CO ₂	97.4	78.2	<0.01	<0.001	2.2	77
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	N ₂ O	40.3	16.7	<0.01	0.001	2.1	79
Fugitive Emissions from Coal Mining	CO ₂	64.9	49.8	<0.01	<0.001	1.6	80
CH ₄ Emissions from Manure Management	CH ₄	84.1	72.6	<0.01	<0.001	1.5	82
SF ₆ Emissions from Electrical Transmission and	CH ₄	31.7	52.3	<0.01	<0.001	1.4	83
	SF ₆	26.7	11.7	<0.01	0.001	1.3	85

Distribution							
PFC Emissions from Aluminum Production	PFCs	18.4	2.9	<0.01	0.001	1.3	86
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	171.1	<0.01	<0.001	1.3	87
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	27.2	44.7	<0.01	<0.001	1.2	88
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.5	36.5	<0.01	<0.001	0.9	89
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	272.1	285.6	<0.01	0.001	0.8	90
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	17.9	<0.01	0.002	0.8	91
Fugitive Emissions from Natural Gas Systems	CH ₄	189.6	215.4	<0.01	<0.001	0.7	92
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.6	32.3	<0.01	<0.001	0.7	92
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	12.0	4.9	<0.01	<0.001	0.6	93
Fugitive Emissions from Petroleum Systems	CH ₄	35.2	31.5	<0.01	0.001	0.5	93
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.8	10.6	<0.01	<0.001	0.5	94
CH ₄ Emissions from Enteric Fermentation	CH ₄	133.8	139.3	<0.01	<0.001	0.5	94
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	8.8	<0.01	<0.001	0.4	95
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	1.3	<0.01	<0.001	0.4	95
CO ₂ Emissions from Cement Production	CO ₂	33.3	31.6	<0.01	<0.001	0.4	96
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	4.9	9.5	<0.01	<0.001	0.3	96
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	3.3	<0.01	<0.001	0.3	96
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	255.7	<0.01	<0.001	0.3	96
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	12.0	<0.01	<0.001	0.3	96
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	4.2	1.4	<0.01	<0.001	0.3	97
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	0.6	3.5	<0.01	<0.001	0.2	97
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	0.6	<0.01	<0.001	0.2	97
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.4	130.5	<0.01	<0.001	0.2	97
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.6	16.7	<0.01	<0.001	0.2	97
N ₂ O Emissions from Manure Management	N ₂ O	14.8	18.5	<0.01	<0.001	0.2	98
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	5.4	<0.01	<0.001	0.2	98
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	54.8	57.6	<0.01	<0.001	0.2	98
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	5.0	<0.01	<0.001	0.1	98
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	+	1.5	<0.01	<0.001	0.1	98
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	4.6	3.6	<0.01	<0.001	0.1	98
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.5	5.2	<0.01	<0.001	0.1	98
N ₂ O Emissions from Composting	N ₂ O	0.4	1.7	<0.01	<0.001	0.1	99
CO ₂ Emissions from Lime Production	CO ₂	11.5	13.8	<0.01	<0.001	0.1	99
CH ₄ Emissions from Composting	CH ₄	0.3	1.5	<0.01	<0.001	0.1	99
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.9	16.2	<0.01	<0.001	0.1	99
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	6.6	<0.01	<0.001	0.1	99
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.3	2.7	<0.01	<0.001	0.1	99
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	1.7	<0.01	<0.001	0.1	99
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	2.2	<0.01	<0.001	0.1	99
CH ₄ Emissions from Petrochemical Production	CH ₄	2.3	3.1	<0.01	<0.001	<0.1	99

CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	79.2	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.9	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Zinc Production	CO ₂	0.6	1.3	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.1	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	1.4	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.3	1.9	<0.01	<0.001	<0.1	99
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	1.0	0.6	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Product Uses	N ₂ O	4.4	4.4	<0.01	<0.001	<0.1	99
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.6	1.3	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	2.7	<0.01	<0.001	<0.1	99
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	1.1	0.9	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.2	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Petrochemical Production	CO ₂	3.4	3.5	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	4.3	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Glass Production	CO ₂	1.5	1.5	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	0.4	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	0.5	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	0.4	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.3	0.4	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.3	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	0.3	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.2	0.1	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	0.1	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	0.9	0.9	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Lead Production	CO ₂	0.5	0.5	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	+	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	+	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	0.2	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	+	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	+	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Incineration of Waste	CH ₄	+	+	<0.01	<0.001	<0.1	100

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

+ Does not exceed 0.05 Tg CO₂ Eq.

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1 Table A- 9: 1990-2011 Key Source Category Tier 1 and 2 Analysis—Trend Assessment, with LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate (Tg CO ₂ Eq.)	2011	Tier 1 Trend Assessment	Tier 2 Trend Assessment	Percent Contribution to Trend (%)	Cumulative Contribution to Trend (%)
			Estimate (Tg CO ₂ Eq.)				
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	410.2	0.02	0.001	13.8	14
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,188.9	1,473.2	0.02	0.002	10.2	24
CO ₂ Emissions from Changes in Forest Carbon Stocks	CO ₂	701.4	921.8	0.02	0.002	9.4	33
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	121.7	0.01	0.001	7.7	41
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	1,718.0	<0.01	<0.001	0.6	42
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	155.3	90.0	0.01	0.002	5.2	47
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	97.5	25.1	0.01	0.001	5.3	52
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	179.3	142.8	0.01	0.001	3.5	56
CH ₄ Emissions from Landfills	CH ₄	147.8	103.0	0.01	0.004	3.8	60
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	408.9	409.7	<0.01	0.001	2.7	62
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	99.8	64.3	0.01	0.001	2.9	65
HFC-23 Emissions from HCFC-22 Production	HFCs	36.4	6.9	<0.01	<0.001	2.1	67
CO ₂ Emissions from Urban Trees	CO ₂	57.1	98.0	<0.01	0.001	2.2	70
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	97.4	78.2	<0.01	<0.001	1.9	71
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	284.4	279.9	<0.01	0.001	2.2	74
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	40.3	16.7	<0.01	0.001	1.8	75
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	17.0	2.4	<0.01	0.004	1.0	76
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	64.9	49.8	<0.01	<0.001	1.4	78
Fugitive Emissions from Coal Mining	CH ₄	84.1	72.6	<0.01	<0.001	1.3	79
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.5	36.5	<0.01	<0.001	0.8	80
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	52.5	9.0	0.01	0.002	3.1	83
PFC Emissions from Aluminum Production	PFCs	18.4	2.9	<0.01	0.001	1.1	84
CO ₂ Emissions from Land Converted to Cropland	CO ₂	25.1	12.5	<0.01	0.001	1.0	85
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	26.7	11.7	<0.01	<0.001	1.1	86
CH ₄ Emissions from Manure Management	CH ₄	31.7	52.3	<0.01	<0.001	1.1	87
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.8	10.6	<0.01	<0.001	0.4	88
CO ₂ Emissions from Landfilled Yard Trimmings and Food Scraps	CO ₂	24.2	13.0	<0.01	0.001	0.9	89
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	171.1	<0.01	<0.001	0.9	90
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.4	130.5	<0.01	<0.001	0.1	90
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	17.9	<0.01	0.002	0.6	90
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.6	32.3	<0.01	<0.001	0.6	91
CH ₄ Emissions from Enteric Fermentation	CH ₄	133.8	139.3	<0.01	<0.001	0.5	91
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	79.2	<0.01	<0.001	0.1	91
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	272.1	285.6	<0.01	0.001	1.0	92

Fugitive Emissions from Petroleum Systems	CH ₄	35.2	31.5	<0.01	0.001	0.5	93
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	12.0	4.9	<0.01	<0.001	0.5	93
CO ₂ Emissions from Cement Production	CO ₂	33.3	31.6	<0.01	<0.001	0.3	94
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	27.2	44.7	<0.01	<0.001	0.9	95
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	8.8	<0.01	<0.001	0.4	95
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	54.8	57.6	<0.01	0.001	0.2	95
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.4	1.3	<0.01	<0.001	0.3	95
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	3.3	<0.01	<0.001	0.3	96
CO ₂ Emissions from Limestone and Dolomite Use	CO ₂	4.9	9.5	<0.01	<0.001	0.3	96
CO ₂ Emissions from Land Converted to Grassland	CO ₂	11.4	14.6	<0.01	<0.001	0.1	96
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	4.2	1.4	<0.01	<0.001	0.2	96
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	12.0	<0.01	<0.001	0.2	97
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	0.6	3.5	<0.01	<0.001	0.2	97
N ₂ O Emissions from Nitric Acid Production	N ₂ O	17.6	16.7	<0.01	<0.001	0.2	97
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	0.6	<0.01	<0.001	0.2	97
Fugitive Emissions from Natural Gas Systems	CH ₄	189.6	215.4	<0.01	<0.001	0.4	97
PFC, HFC, and SF ₆ Emissions from Semiconductor Manufacture	Several	2.9	5.4	<0.01	<0.001	0.1	98
CH ₄ Emissions from Forest Fires	CH ₄	2.5	4.8	<0.01	<0.001	0.1	98
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.0	5.0	<0.01	<0.001	0.1	98
N ₂ O Emissions from Manure Management	N ₂ O	14.8	18.5	<0.01	<0.001	0.1	98
N ₂ O Emissions from Forest Fires	N ₂ O	2.1	4.0	<0.01	<0.001	0.1	98
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	4.6	3.6	<0.01	<0.001	0.1	98
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.9	16.2	<0.01	<0.001	0.1	98
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	+	1.5	<0.01	<0.001	0.1	98
N ₂ O Emissions from Composting	N ₂ O	0.4	1.7	<0.01	<0.001	0.1	98
CO ₂ Emissions from Liming of Agricultural Soils	CO ₂	4.7	4.5	<0.01	<0.001	<0.1	99
CH ₄ Emissions from Composting	CH ₄	0.3	1.5	<0.01	<0.001	0.1	99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.5	5.2	<0.01	<0.001	0.1	99
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	1.7	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	2.7	<0.01	<0.001	<0.1	99
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.3	2.7	<0.01	<0.001	0.1	99
CO ₂ Emissions from Urea Fertilization	CO ₂	2.4	3.7	<0.01	<0.001	0.1	99
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.1	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.4	2.2	<0.01	<0.001	<0.1	99
CH ₄ Emissions from Rice Cultivation	CH ₄	7.1	6.6	<0.01	<0.001	0.1	99
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	1.4	<0.01	<0.001	<0.1	99
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	1.0	0.6	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Product Uses	N ₂ O	4.4	4.4	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.9	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Zinc Production	CO ₂	0.6	1.3	<0.01	<0.001	<0.1	99

Non-CO ₂ Emissions from Stationary Combustion							
- Industrial	CH ₄	1.6	1.3	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Settlement Soils	N ₂ O	1.0	1.5	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.3	1.9	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Petrochemical Production	CO ₂	3.4	3.5	<0.01	<0.001	<0.1	99
Non-CO ₂ Emissions from Stationary Combustion							
- Residential	N ₂ O	1.1	0.9	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Forest Soils	N ₂ O	0.1	0.4	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	0.5	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	0.2	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Lime Production	CO ₂	11.5	13.8	<0.01	<0.001	0.1	99
CO ₂ Emissions from Wetlands Remaining Wetlands	CO ₂	1.0	1.0	<0.01	<0.001	<0.1	99
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	0.4	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	4.3	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Petroleum Systems	CO ₂	0.4	0.3	<0.01	<0.001	<0.1	99
Non-CO ₂ Emissions from Stationary Combustion							
- Electricity Generation	CH ₄	0.3	0.4	<0.01	<0.001	<0.1	99
Non-CO ₂ Emissions from Stationary Combustion							
- Commercial	N ₂ O	0.4	0.3	<0.01	<0.001	<0.1	99
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	0.4	<0.01	<0.001	<0.1	99
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	255.7	<0.01	<0.001	0.4	100
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.2	0.1	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion							
- Commercial	CH ₄	0.9	0.9	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Petrochemical Production	CH ₄	2.3	3.1	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	0.4	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Lead Production	CO ₂	0.5	0.5	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion							
- U.S. Territories	N ₂ O	0.1	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	+	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion							
- U.S. Territories	CH ₄	+	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	+	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	0.2	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	+	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Wetlands Remaining Wetlands	N ₂ O	+	+	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Glass Production	CO ₂	1.5	1.5	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Incineration of Waste	CH ₄	+	+	<0.01	<0.001	<0.1	100

+ Does not exceed 0.05 Tg CO₂ Eq.

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