

ANNEX 1 Key Category Analysis

The United States has identified national key categories based on the estimates presented in this report. The *2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (IPCC 2006) 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 greenhouse gases in terms of the absolute level, the trend, or the uncertainty in emissions and removals.” 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 the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 2006), includes:

- Approach 1 (including both level and trend assessments);
- Approach 2 (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 Land Use, Land-Use Change and Forestry [LULUCF]); discusses Approach 1, Approach 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 (GWP)-weighted emissions in 2015. The table also indicates the criteria used in identifying these categories (i.e., level, trend, Approach 1, Approach 2, and/or qualitative assessments).

Table A-1 : Key Source Categories for the United States (1990-2015)

IPCC Source Categories	Gas									Qual ^a	2015 Emissions (MMT CO ₂ Eq.)
		Approach 1				Approach 2					
		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 Mobile Combustion: Road	CO ₂	•	•	•	•	•	•	•	•		1,463.4
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	•	•	•	•	•	•	•	•		1,350.5
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	•	•	•	•	•	•	•	•		526.1
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	•	•	•	•	•	•	•	•		467.5
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	•	•	•	•	•	•	•			272.2
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	•	•	•	•	•		•			252.8
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	•	•	•	•	•	•	•			175.4
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	•	•	•	•	•	•	•			159.2
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	•		•		•		•			125.5
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	•		•	•						81.5
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	•		•							67.9
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	•	•	•	•		•				66.8
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	•	•	•	•	•	•	•	•		65.9
CO ₂ Emissions from Natural Gas Systems	CO ₂	•		•		•		•			42.4
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	•	•	•	•						34.3
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	•	•	•	•						32.3
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	•	•	•	•	•	•		•		23.7
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂						•				3.0

CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	•	•						2.9
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂				•	•			0.0
CH ₄ Emissions from Natural Gas Systems	CH ₄	•	•	•	•	•	•	•	162.4
Fugitive Emissions from Coal Mining	CH ₄	•	•	•	•	•	•	•	60.9
CH ₄ Emissions from Petroleum Systems	CH ₄	•	•	•	•	•	•	•	39.9
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄				•	•	•	•	3.9
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	•	•		•	•	•		19.5
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	•	•	•	•	•	•		11.2
International Bunker Fuels ^b	Several							•	291.8
Industrial Processes									
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	•	•	•	•	•	•	•	48.9
CO ₂ Emissions from Cement Production	CO ₂	•		•					39.9
CO ₂ Emissions from Petrochemical Production	CO ₂		•	•					28.1
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂		•		•				11.2
N ₂ O Emissions from Adipic Acid Production	N ₂ O		•		•				4.3
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	•	•	•	•	•	•	•	168.5
HFC-23 Emissions from HCFC-22 Production	HiGWP		•		•	•			4.3
PFC Emissions from Aluminum Production	HiGWP	•	•	•	•	•	•		4.2
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP		•		•				2.0
Agriculture									
CH ₄ Emissions from Enteric Fermentation	CH ₄	•		•		•			166.5
CH ₄ Emissions from Manure Management	CH ₄	•	•	•	•	•	•	•	66.3
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	•	•	•		•			213.3
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	•	•	•	•	•	•	•	38.0
Waste									
CH ₄ Emissions from Landfills	CH ₄	•	•	•	•	•	•	•	115.7
Land Use, Land Use Change, and Forestry									
CO ₂ Emissions from Land Converted to Settlements	CO ₂			•	•		•	•	68.3

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CO ₂ Emissions from Land Converted to Cropland	CO ₂	•	•	•	•	22.7
CO ₂ Emissions from Land Converted to Grassland	CO ₂		•		•	20.5
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	•	•	•	•	(18.0)
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂		•	•	•	(20.9)
CO ₂ Emissions from Land Converted to Forest Land	CO ₂	•	•			(75.2)
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	•	•	•	•	(102.1)
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	•	•	•	•	(666.2)
CH ₄ Emissions from Forest Fires	CH ₄			•	•	7.3
N ₂ O Emissions from Forest Fires	N ₂ O				•	4.8
Subtotal Without LULUCF						6,422.0
Total Emissions Without LULUCF						6,586.7
Percent of Total Without LULUCF						98%
Subtotal With LULUCF						5,660.2
Total Emissions With LULUCF						5,827.7
Percent of Total With LULUCF						97%

^a Qualitative criteria.

^b Emissions from this source not included in totals.

Notes: 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 LULUCF sources and sinks. Similarly, 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 to the year(s) in the inventory time series (i.e., 1990 to 2015) in which each source category reached the threshold for being a key category based on either an Approach 1 or Approach 2 level assessment.

In addition to conducting Approach 1 and 2 level and trend assessments, a qualitative assessment of the source categories, as described in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 2006), was conducted to capture any key categories that were not identified by either quantitative method. For this inventory, no additional categories were identified using criteria recommend by IPCC, but EPA continues to update its qualitative assessment on an annual basis.

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

IPCC Source Categories	Direct Greenhouse Gas	2015	Key Category?	ID Criteria ^a	Level in which year(s)? ^b
		Emissions (MMT CO ₂ Eq.)			
Energy					
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,463.4	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,350.5	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	526.1	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	467.5	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	272.2	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	252.8	•	L ₁ T ₁ L ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	175.4	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	159.2	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	125.5	•	L ₁ L ₂	1990, 2015
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	81.5	•	L ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	67.9	•	L ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	66.8	•	L ₁ T ₁ T ₂	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	65.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Natural Gas Systems	CO ₂	42.4	•	L ₁ L ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	34.3	•	L ₁ T ₁	2015 ₁
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	32.3	•	L ₁ T ₁	1990 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	23.7	•	L ₁ T ₁ L ₂ T ₂	1990
CO ₂ Emissions from Incineration of Waste	CO ₂	10.7			
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	4.0			
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6			
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	3.0	•	T ₂	
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	2.9	•	T ₁	
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4			
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.0	•	T ₂	
CH ₄ Emissions from Natural Gas Systems	CH ₄	162.4	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
Fugitive Emissions from Coal Mining	CH ₄	60.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CH ₄ Emissions from Petroleum Systems	CH ₄	39.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.4			
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.9	•	L ₂ T ₂	1990 ₂ , 2015 ₂
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.5			

CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.2			
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.5			
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1			
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	+			
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	19.5	•	T ₁ T ₂	
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	11.2	•	L ₁ T ₁ T ₂	1990 ₁
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.4			
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9			
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.5			
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.8			
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4			
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.3			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1			
International Bunker Fuels ^c	Several	291.8	•		
Industrial Processes					
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	48.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Cement Production	CO ₂	39.9	•	L ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Petrochemical Production	CO ₂	28.1	•	T ₁	
CO ₂ Emissions from Lime Production	CO ₂	13.3			
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	11.2	•	T ₁	
CO ₂ Emissions from Ammonia Production	CO ₂	10.8			
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	4.3			
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8			
CO ₂ Emissions from Aluminum Production	CO ₂	2.8			
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.0			
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.6			
CO ₂ Emissions from Glass Production	CO ₂	1.3			
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	1.1			
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.0			
CO ₂ Emissions from Zinc Production	CO ₂	0.9			
CO ₂ Emissions from Lead Production	CO ₂	0.5			
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2			
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+			
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2			
CH ₄ Emissions from Ferroalloy Production	CH ₄	+			
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+			
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	+			

N ₂ O Emissions from Nitric Acid Production	N ₂ O	11.6			
N ₂ O Emissions from Adipic Acid Production	N ₂ O	4.3	•	T ₁	
N ₂ O Emissions from Product Uses	N ₂ O	4.2			
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	0.2			
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	168.5	•	L ₁ T ₁ L ₂ T ₂	2015
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	HiGWP	4.8			
HFC-23 Emissions from HCFC-22 Production	HiGWP	4.3	•	T ₁ T ₂	
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	4.2	•	L ₁ T ₁ T ₂	1990 ₁
PFC Emissions from Aluminum Production	HiGWP	2.0	•	T ₁	
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	0.9			
HFC-134A Emissions from Magnesium Production and Processing	HiGWP	0.1			
Agriculture					
CO ₂ Emissions from Urea Fertilization	CO ₂	5.0			
CO ₂ Emissions from Liming	CO ₂	3.8			
CH ₄ Emissions from Enteric Fermentation	CH ₄	166.5	•	L ₁ L ₂	1990, 2015
CH ₄ Emissions from Manure Management	CH ₄	66.3	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CH ₄ Emissions from Rice Cultivation	CH ₄	11.2			
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.3			
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	213.3	•	L ₁ T ₁ L ₂	1990, 2015
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	38.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
N ₂ O Emissions from Manure Management	N ₂ O	17.7			
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1			
Waste					
CH ₄ Emissions from Landfills	CH ₄	115.7	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CH ₄ Emissions from Wastewater Treatment	CH ₄	14.8			
CH ₄ Emissions from Composting	CH ₄	2.1			
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.0			
N ₂ O Emissions from Composting	N ₂ O	1.9			

+ Does not exceed 0.05 MMT CO₂ Eq.

^a For the ID criteria, Q refers to "Qualitative", 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 an Approach 1 or Approach 2 assessment (e.g., L₂ designates a source is a key category for an Approach 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 for that assessment in that year only (e.g., 1990₂ designates a source is a key category for the Approach 2 assessment only in 1990).

^c Emissions from these sources not included in totals.

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

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

IPCC Source Categories	Direct Greenhouse Gas	2015 Emissions (MMT CO ₂ Eq.)	Key Category?	ID Criteria ^a	Level in which year(s)? ^b
Energy					
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,463.4	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,350.5	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	526.1	•	L ₁ T ₁ L ₂ T ₂	1990 ₁ , 2015
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	467.5	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	272.2	•	L ₁ T ₁ L ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	252.8	•	L ₁ T ₁ L ₂	1990, 2015

CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	175.4	•	L ₁ T ₁ L ₂	1990 ₁ , 2015
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	159.2	•	L ₁ T ₁ L ₂	1990, 2015 ₁
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	125.5	•	L ₁ L ₂	1990, 2015
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	81.5	•	L ₁ T ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	67.9	•	L ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	66.8	•	L ₁ T ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	65.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Natural Gas Systems	CO ₂	42.4	•	L ₁ L ₂	1990, 2015
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	34.3	•	L ₁ T ₁	2015 ₁
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	32.3	•	L ₁ T ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	23.7	•	L ₁ T ₁ T ₂	1990 ₁
CO ₂ Emissions from Incineration of Waste	CO ₂	10.7			
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	4.0			
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6			
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	3.0			
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	2.9	•	T ₁	
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4			
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.0	•	T ₂	
CH ₄ Emissions from Natural Gas Systems	CH ₄	162.4	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
Fugitive Emissions from Coal Mining	CH ₄	60.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015 ₁
CH ₄ Emissions from Petroleum Systems	CH ₄	39.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.4			
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.9	•	L ₂ T ₂	1990 ₂
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.5			
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.2			
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.5			
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1			
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	+			
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	19.5	•	T ₁ T ₂	
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	11.2	•	L ₁ T ₁ T ₂	1990 ₁
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.4			
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9			
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.5			
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.8			

N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6			
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4			
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.3			
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1			
International Bunker Fuels ^c	Several	291.8	•		
Industrial Processes					
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	48.9	•	L ₁ T ₁ L ₂ T ₂	1990, 2015 ₁
CO ₂ Emissions from Cement Production	CO ₂	39.9	•	L ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Petrochemical Production	CO ₂	28.1	•	L ₁	2015 ₁
CO ₂ Emissions from Lime Production	CO ₂	13.3			
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	11.2	•	T ₁	
CO ₂ Emissions from Ammonia Production	CO ₂	10.8			
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	4.3			
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8			
CO ₂ Emissions from Aluminum Production	CO ₂	2.8			
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.0			
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.6			
CO ₂ Emissions from Glass Production	CO ₂	1.3			
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	1.1			
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.0			
CO ₂ Emissions from Zinc Production	CO ₂	0.9			
CO ₂ Emissions from Lead Production	CO ₂	0.5			
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2			
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+			
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2			
CH ₄ Emissions from Ferroalloy Production	CH ₄	+			
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+			
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	+			
N ₂ O Emissions from Nitric Acid Production	N ₂ O	11.6			
N ₂ O Emissions from Adipic Acid Production	N ₂ O	4.3	•	T ₁	
N ₂ O Emissions from Product Uses	N ₂ O	4.2			
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	0.2			
Emissions from Substitutes for Ozone Depleting Substances	HiGWP	168.5	•	L ₁ T ₁ L ₂ T ₂	2015
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	HiGWP	4.8			
HFC-23 Emissions from HCFC-22 Production	HiGWP	4.3	•	T ₁	
SF ₆ Emissions from Electrical Transmission and Distribution	HiGWP	4.2	•	L ₁ T ₁ T ₂	1990 ₁
PFC Emissions from Aluminum Production	HiGWP	2.0	•	T ₁	
SF ₆ Emissions from Magnesium Production and Processing	HiGWP	0.9			
HFC-134a Emissions from Magnesium Production and Processing	HiGWP	0.1			
Agriculture					
CO ₂ Emissions from Urea Fertilization	CO ₂	5.0			
CO ₂ Emissions from Liming	CO ₂	3.8			

CH ₄ Emissions from Enteric Fermentation	CH ₄	166.5	•	L ₁ L ₂	1990, 2015
CH ₄ Emissions from Manure Management	CH ₄	66.3	•	L ₁ T ₁ L ₂ T ₂	1990 ₁ , 2015
CH ₄ Emissions from Rice Cultivation	CH ₄	11.2			
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.3			
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	213.3	•	L ₁ L ₂	1990, 2015
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	38.0	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
N ₂ O Emissions from Manure Management	N ₂ O	17.7			
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1			
Waste					
CH ₄ Emissions from Landfills	CH ₄	115.7	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CH ₄ Emissions from Wastewater Treatment	CH ₄	14.8			
CH ₄ Emissions from Composting	CH ₄	2.1			
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.0			
N ₂ O Emissions from Composting	N ₂ O	1.9			
Land Use, Land Use Change, and Forestry					
CO ₂ Emissions from Land Converted to Settlements	CO ₂	68.3	•	L ₁ T ₁ L ₂ T ₂	1990 ₁ , 2015
CO ₂ Emissions from Land Converted to Cropland	CO ₂	22.7	•	L ₁ T ₁ L ₂ T ₂	1990
CO ₂ Emissions from Land Converted to Grassland	CO ₂	20.5	•	T ₁ T ₂	
CO ₂ Emissions from Land Converted to Wetlands	CO ₂	0.0			
CO ₂ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CO ₂	(7.8)			
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	(18.0)	•	L ₁ T ₁ L ₂ T ₂	1990, 2015 ₂
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	(20.9)	•	T ₁ L ₂ T ₂	2015 ₂
CO ₂ Emissions from Land Converted to Forest Land	CO ₂	(75.2)	•	L ₁ T ₁	1990 ₁ , 2015 ₁
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	(102.1)	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	(666.2)	•	L ₁ T ₁ L ₂ T ₂	1990, 2015
CH ₄ Emissions from Forest Fires	CH ₄	7.3	•	L ₂ T ₂	2015 ₂
CH ₄ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CH ₄	3.6			
CH ₄ Emissions from Grassland Fires	CH ₄	0.4			
CH ₄ Emissions from Drained Organic Soils	CH ₄	0.0			
CH ₄ Emissions from Land Converted to Coastal Wetlands	CH ₄	0.0			
CH ₄ Emissions from Peatlands Remaining Peatlands	CH ₄	0.0			
N ₂ O Emissions from Forest Fires	N ₂ O	4.8	•	T ₂	
N ₂ O Emissions from Settlement Soils	N ₂ O	2.5			
N ₂ O Emissions from Forest Soils	N ₂ O	0.5			
N ₂ O Emissions from Grassland Fires	N ₂ O	0.4			
N ₂ O Emissions from Coastal Wetlands Remaining Coastal Wetlands	N ₂ O	0.1			
N ₂ O Emissions from Drained Organic Soils	N ₂ O	0.1			
N ₂ O Emissions from Peatlands Remaining Peatlands	N ₂ O	+			

+ Does not exceed 0.05 MMT CO₂ Eq.

^a For the ID criteria, Q refers to "Qualitative", 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 an Approach 1 or Approach 2 assessment (e.g., L₂ designates a source is a key category for an Approach 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 Approach 2 assessment only in 1990).

^c Emissions from these sources not included in totals.

Note: Parentheses indicate negative values (or sequestration).

Evaluation of Key Categories

Level Assessment

When using an Approach 1 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 *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (IPCC 2006) was designed to establish a general level where the key category analysis covers approximately 75 to 92 percent of inventory uncertainty.

Including the Approach 2 provides additional insight into why certain source categories are considered key, and how to prioritize inventory improvements. In the Approach 2, the level assessment for each category from the Approach 1 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 kt 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 Approach 2 level assessment may differ from those identified by the Approach 1 assessment. The final set of key categories includes all source and sink categories identified as key by either the Approach 1 or the Approach 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.

Table A-4 through Table A-7 contain the 1990 and 2015 level assessments for both with and without LULUCF sources and sinks, and contain further detail on where each source falls within the analysis. Approach 1 key categories are shaded dark gray. Additional key categories identified by the Approach 2 assessment are shaded light gray.

Trend Assessment

Approach 1 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.

For Approach 2, the trend assessment for each category from Approach 1 is multiplied by its percent relative uncertainty. If the uncertainty reported is asymmetrical, the larger uncertainty is used. 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 Approach 2 trend assessment may differ from those identified by the Approach 1 assessment. The final set of key categories includes all source and sink categories

identified as key by either the Approach 1 or the Approach 2 assessment, keeping in mind that the two assessments are not mutually exclusive.

Table A-8 and Table A-9 contain the 1990 through 2015 trend assessment for both with and without LULUCF sources and sinks, and contain further detail on where each source falls within the analysis. Approach 1 key categories are shaded dark gray. Additional key categories identified by the Approach 2 assessment are shaded light gray.

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

IPCC Source Categories	Direct	1990 Estimate (MMT CO ₂ Eq.)	Approach 1		Uncertainty ^a	Approach 2
	Greenhouse Gas		Level Assessment	Cumulative Total		Level Assessment
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	0.24	0.24	10%	0.023
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,188.9	0.19	0.43	6%	0.012
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	408.9	0.06	0.49	7%	0.005
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	278.3	0.04	0.54	19%	0.008
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	0.04	0.58	7%	0.003
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	212.0	0.03	0.61	26%	0.009
CH ₄ Emissions from Natural Gas Systems	CH ₄	194.1	0.03	0.64	30%	0.009
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	187.4	0.03	0.67	6%	0.002
CH ₄ Emissions from Landfills	CH ₄	179.6	0.03	0.70	61%	0.017
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	0.03	0.72	5%	0.001
CH ₄ Emissions from Enteric Fermentation	CH ₄	164.2	0.03	0.75	18%	0.005
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	155.3	0.02	0.77	16%	0.004
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	0.02	0.80	7%	0.002
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.6	0.02	0.82	37%	0.007
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	101.5	0.02	0.83	17%	0.003
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	97.5	0.02	0.85	8%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	97.4	0.02	0.86	6%	0.001
Fugitive Emissions from Coal Mining	CH ₄	96.5	0.02	0.88	16%	0.002
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	0.01	0.89	6%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	63.3	0.01	0.90	6%	0.001
CH ₄ Emissions from Petroleum Systems	CH ₄	55.5	0.01	0.91	149%	0.013
HFC-23 Emissions from HCFC-22 Production	HFCs	46.1	0.01	0.91	10%	0.001
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	44.6	0.01	0.92	155%	0.011
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.3	0.01	0.93	6%	<0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.7	0.01	0.93	30%	0.002
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	37.7	0.01	0.94	19%	0.001
CH ₄ Emissions from Manure Management	CH ₄	37.2	0.01	0.95	20%	0.001
CO ₂ Emissions from Cement Production	CO ₂	33.5	0.01	0.95	6%	<0.001
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	26.9	<0.01	0.96	11%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	23.1	<0.01	0.96	11%	<0.001
PFC Emissions from Aluminum Production	PFCs	21.5	<0.01	0.96	6%	<0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	21.3	<0.01	0.97	5%	<0.001
CH ₄ Emissions from Rice Cultivation	CH ₄	16.0	<0.01	0.97	28%	0.001
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.7	<0.01	0.97	26%	0.001

N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.2	<0.01	0.97	4%	<0.001
N ₂ O Emissions from Manure Management	N ₂ O	14.0	<0.01	0.98	24%	0.001
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	<0.01	0.98	8%	<0.001
N ₂ O Emissions from Nitric Acid Production	N ₂ O	12.1	<0.01	0.98	6%	<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	11.7	<0.01	0.98	3%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	<0.01	0.98	13%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	<0.01	0.99	42%	<0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	7.2	<0.01	0.99	23%	<0.001
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	<0.01	0.99	2%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	5.2	<0.01	0.99	234%	0.002
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	5.2	<0.01	0.99	27%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.2	<0.01	0.99	7%	<0.001
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	4.9	<0.01	0.99	16%	<0.001
CO ₂ Emissions from Liming	CO ₂	4.7	<0.01	0.99	111%	0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.2	<0.01	0.99	24%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	<0.01	0.99	12%	<0.001
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	Several	3.6	<0.01	0.99	5%	<0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6	<0.01	0.99	149%	0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.4	<0.01	0.99	107%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.1	<0.01	1.00	206%	0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	<0.01	1.00	NE	<0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	<0.01	1.00	7%	<0.001
CO ₂ Emissions from Urea Fertilization	CO ₂	2.4	<0.01	1.00	43%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	<0.01	1.00	12%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.8	<0.01	1.00	50%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	<0.01	1.00	68%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.5	<0.01	1.00	5%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	<0.01	1.00	20%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.5	<0.01	1.00	5%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.2	<0.01	1.00	68%	<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	1.0	<0.01	1.00	222%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.0	<0.01	1.00	140%	<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	21%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	<0.01	1.00	44%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	16%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	<0.01	1.00	330%	<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 Composting	CH ₄	0.4	<0.01	1.00	50%	<0.001

CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	<0.01	1.00	9%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	<0.01	1.00	173%	<0.001
N ₂ O Emissions from Composting	N ₂ O	0.3	<0.01	1.00	50%	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	<0.01	1.00	67%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.3	<0.01	1.00	22%	<0.001
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	<0.01	1.00	41%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2	<0.01	1.00	56%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	30%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	200%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1	<0.01	1.00	88%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	+	<0.01	1.00	56%	<0.001
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	+	<0.01	1.00	13%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	10%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	69%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	+	<0.01	1.00	19%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+	<0.01	1.00	4%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	NE	<0.001
HFC-134A Emissions from Magnesium Production and Processing	HFCs	0.0	<0.01	1.00	4%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	0.0	<0.01	1.00	17%	<0.001

+ Does not exceed 0.05 MMT CO₂ Eq.

NE (Not Estimated)

NA (Not Available)

^a Percent relative uncertainty. If the corresponding uncertainty is asymmetrical, the uncertainty given here is the larger and always positive. Note: LULUCF sources and sinks are not included in this analysis.

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

IPCC Source Categories	Direct Greenhouse Gas	1990 Estimate (MMT CO ₂ Eq.)	Approach 1		Cumulative Total	Uncertainty ^a	Approach 2 Level Assessment
			Level Assessment				
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	0.21		0.21	10%	0.020
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,188.9	0.16		0.37	6%	0.010
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	697.7	0.09		0.46	78%	0.073
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	408.9	0.06		0.52	7%	0.004
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	278.3	0.04		0.56	19%	0.007
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	0.03		0.59	7%	0.002
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	212.0	0.03		0.62	26%	0.007
CH ₄ Emissions from Natural Gas Systems	CH ₄	194.1	0.03		0.64	30%	0.008
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	187.4	0.03		0.67	6%	0.002
CH ₄ Emissions from Landfills	CH ₄	179.6	0.02		0.69	61%	0.015
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	0.02		0.72	5%	0.001

CH ₄ Emissions from Enteric Fermentation	CH ₄	164.2	0.02	0.74	18%	0.004
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	155.3	0.02	0.76	16%	0.003
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	0.02	0.78	7%	0.001
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.6	0.02	0.80	37%	0.006
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	101.5	0.01	0.81	17%	0.002
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	97.5	0.01	0.82	8%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	97.4	0.01	0.84	6%	0.001
Fugitive Emissions from Coal Mining	CH ₄	96.5	0.01	0.85	16%	0.002
CO ₂ Emissions from Land Converted to Forest Land	CO ₂	92.0	0.01	0.86	11%	0.001
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	86.2	0.01	0.87	67%	0.008
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	0.01	0.88	6%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	63.3	0.01	0.89	6%	<0.001
CH ₄ Emissions from Petroleum Systems	CH ₄	55.5	0.01	0.90	149%	0.011
HFC-23 Emissions from HCFC-22 Production	HFCs	46.1	0.01	0.90	10%	0.001
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	44.6	0.01	0.91	155%	0.009
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.3	0.01	0.92	6%	<0.001
CO ₂ Emissions from Land Converted to Cropland	CO ₂	43.3	0.01	0.92	36%	0.002
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	40.9	0.01	0.93	214%	0.012
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.7	0.01	0.93	30%	0.002
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	37.7	0.01	0.94	19%	0.001
CO ₂ Emissions from Land Converted to Settlements	CO ₂	37.2	0.01	0.94	29%	0.001
CH ₄ Emissions from Manure Management	CH ₄	37.2	0.01	0.95	20%	0.001
CO ₂ Emissions from Cement Production	CO ₂	33.5	<0.01	0.95	6%	<0.001
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	26.9	<0.01	0.96	11%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	23.1	<0.01	0.96	11%	<0.001
PFC Emissions from Aluminum Production	PFCs	21.5	<0.01	0.96	6%	<0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	21.3	<0.01	0.97	5%	<0.001
CO ₂ Emissions from Land Converted to Grassland	CO ₂	17.9	<0.01	0.97	20%	<0.001
CH ₄ Emissions from Rice Cultivation	CH ₄	16.0	<0.01	0.97	28%	0.001
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.7	<0.01	0.97	26%	0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.2	<0.01	0.97	4%	<0.001
N ₂ O Emissions from Manure Management	N ₂ O	14.0	<0.01	0.98	24%	<0.001
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	<0.01	0.98	8%	<0.001
N ₂ O Emissions from Nitric Acid Production	N ₂ O	12.1	<0.01	0.98	6%	<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	11.7	<0.01	0.98	3%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	<0.01	0.98	13%	<0.001
CO ₂ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CO ₂	7.6	<0.01	0.98	59%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	<0.01	0.99	42%	<0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	7.2	<0.01	0.99	23%	<0.001
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	<0.01	0.99	2%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	5.2	<0.01	0.99	234%	0.002
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	5.2	<0.01	0.99	27%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.2	<0.01	0.99	7%	<0.001
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	4.9	<0.01	0.99	16%	<0.001
CO ₂ Emissions from Liming	CO ₂	4.7	<0.01	0.99	111%	0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.2	<0.01	0.99	24%	<0.001

CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	4.2	<0.01	0.99	182%	0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	<0.01	0.99	12%	<0.001
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	Several	3.6	<0.01	0.99	5%	<0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6	<0.01	0.99	149%	0.001
CH ₄ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CH ₄	3.4	<0.01	0.99	30%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.4	<0.01	0.99	107%	<0.001
CH ₄ Emissions from Forest Fires	CH ₄	3.2	<0.01	1.00	161%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.1	<0.01	1.00	206%	0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	<0.01	1.00	NE	<0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	<0.01	1.00	7%	<0.001
CO ₂ Emissions from Urea Fertilization	CO ₂	2.4	<0.01	1.00	43%	<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	157%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.8	<0.01	1.00	50%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	<0.01	1.00	68%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.5	<0.01	1.00	5%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	<0.01	1.00	20%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.5	<0.01	1.00	5%	<0.001
N ₂ O Emissions from Settlement Soils	N ₂ O	1.4	<0.01	1.00	268%	0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.2	<0.01	1.00	68%	<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	1.0	<0.01	1.00	222%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.0	<0.01	1.00	140%	<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	21%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	<0.01	1.00	44%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	16%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	<0.01	1.00	330%	<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 Composting	CH ₄	0.4	<0.01	1.00	50%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.4	<0.01	1.00	9%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	<0.01	1.00	173%	<0.001
N ₂ O Emissions from Composting	N ₂ O	0.3	<0.01	1.00	50%	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	<0.01	1.00	67%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.3	<0.01	1.00	22%	<0.001
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	<0.01	1.00	41%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2	<0.01	1.00	56%	<0.001
N ₂ O Emissions from Coastal Wetlands Remaining Coastal Wetlands	N ₂ O	0.1	<0.01	1.00	116%	<0.001
N ₂ O Emissions from Drained Organic Soils	N ₂ O	0.1	<0.01	1.00	124%	<0.001
N ₂ O Emissions from Forest Soils	N ₂ O	0.1	<0.01	1.00	318%	<0.001
N ₂ O Emissions from Grassland Fires	N ₂ O	0.1	<0.01	1.00	412%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	30%	<0.001
CH ₄ Emissions from Grassland Fires	CH ₄	0.1	<0.01	1.00	402%	<0.001

Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	200%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1	<0.01	1.00	88%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	+	<0.01	1.00	56%	<0.001
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	+	<0.01	1.00	13%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	10%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	69%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	+	<0.01	1.00	19%	<0.001
CO ₂ Emissions from Land Converted to Wetlands	CO ₂	+	<0.01	1.00	30%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Land Converted to Coastal Wetlands	CH ₄	+	<0.01	1.00	30%	<0.001
CH ₄ Emissions from Drained Organic Soils	CH ₄	+	<0.01	1.00	76%	<0.001
CH ₄ Emissions from Peatlands Remaining Peatlands	CH ₄	+	<0.01	1.00	78%	<0.001
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+	<0.01	1.00	4%	<0.001
N ₂ O Emissions from Peatlands Remaining Peatlands	N ₂ O	+	<0.01	1.00	53%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	NE	<0.001
HFC-134A Emissions from Magnesium Production and Processing	HFCs	0.0	<0.01	1.00	4%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	0.0	<0.01	1.00	17%	<0.001

+ Does not exceed 0.05 MMT CO₂ Eq.

NE (Not Estimated)

NA (Not Available)

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

Table A-6: 2015 Key Source Category Approach 1 and Approach 2 Analysis—Level Assessment, without LULUCF

IPCC Source Categories	Direct GHG	Approach 1			Approach 2 Level	
		2015 Estimate (MMT CO ₂ Eq.)	Level Assessment	Cumulative Total	Uncertainty ^a	Assessment
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,463.4	0.22	0.22	6%	0.014
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,350.5	0.21	0.43	10%	0.020
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	526.1	0.08	0.51	5%	0.004
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	467.5	0.07	0.58	7%	0.005
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	272.2	0.04	0.62	19%	0.008
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	252.8	0.04	0.66	7%	0.003
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	213.3	0.03	0.69	26%	0.008
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	175.4	0.03	0.72	7%	0.002
Emissions from Substitutes for Ozone Depleting Substances	Several	168.5	0.03	0.74	12%	0.003
CH ₄ Emissions from Enteric Fermentation	CH ₄	166.5	0.03	0.77	18%	0.005
CH ₄ Emissions from Natural Gas Systems	CH ₄	162.4	0.02	0.79	30%	0.007
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	159.2	0.02	0.82	6%	0.002
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	125.5	0.02	0.84	37%	0.007
CH ₄ Emissions from Landfills	CH ₄	115.7	0.02	0.85	61%	0.011
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	81.5	0.01	0.87	6%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	67.9	0.01	0.88	6%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	66.8	0.01	0.89	6%	0.001

CH ₄ Emissions from Manure Management	CH ₄	66.3	0.01	0.90	20%	0.002
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	65.9	0.01	0.91	16%	0.002
Fugitive Emissions from Coal Mining	CH ₄	60.9	0.01	0.92	16%	0.001
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	48.9	0.01	0.92	17%	0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	42.4	0.01	0.93	30%	0.002
CO ₂ Emissions from Cement Production	CO ₂	39.9	0.01	0.94	6%	<0.001
CH ₄ Emissions from Petroleum Systems	CH ₄	39.9	0.01	0.94	149%	0.009
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	38.0	0.01	0.95	155%	0.009
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	34.3	0.01	0.95	11%	0.001
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	32.3	<0.01	0.96	6%	<0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	28.1	<0.01	0.96	5%	<0.001
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	23.7	<0.01	0.96	8%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	19.5	<0.01	0.97	42%	0.001
N ₂ O Emissions from Manure Management	N ₂ O	17.7	<0.01	0.97	24%	0.001
CH ₄ Emissions from Wastewater Treatment	CH ₄	14.8	<0.01	0.97	26%	0.001
CO ₂ Emissions from Lime Production	CO ₂	13.3	<0.01	0.97	3%	<0.001
N ₂ O Emissions from Nitric Acid Production	N ₂ O	11.6	<0.01	0.98	6%	<0.001
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	11.2	<0.01	0.98	16%	<0.001
CH ₄ Emissions from Rice Cultivation	CH ₄	11.2	<0.01	0.98	28%	<0.001
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	11.2	<0.01	0.98	19%	<0.001
CO ₂ Emissions from Ammonia Production	CO ₂	10.8	<0.01	0.98	8%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	10.7	<0.01	0.98	13%	<0.001
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.4	<0.01	0.99	23%	<0.001
CO ₂ Emissions from Urea Fertilization	CO ₂	5.0	<0.01	0.99	43%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.0	<0.01	0.99	107%	0.001
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	Several	4.8	<0.01	0.99	5%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	4.3	<0.01	0.99	5%	<0.001
HFC-23 Emissions from HCFC-22 Production	HFCs	4.3	<0.01	0.99	10%	<0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	4.3	<0.01	0.99	4%	<0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.2	<0.01	0.99	24%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	4.2	<0.01	0.99	11%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	4.0	<0.01	0.99	19%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.9	<0.01	0.99	234%	0.001
CO ₂ Emissions from Liming	CO ₂	3.8	<0.01	0.99	111%	0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6	<0.01	0.99	149%	0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	3.0	<0.01	0.99	17%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	2.9	<0.01	0.99	15%	<0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	<0.01	1.00	7%	<0.001
CO ₂ Emissions from Aluminum Production	CO ₂	2.8	<0.01	1.00	2%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.4	<0.01	1.00	206%	0.001
CH ₄ Emissions from Composting	CH ₄	2.1	<0.01	1.00	50%	<0.001
PFC Emissions from Aluminum Production	PFCs	2.0	<0.01	1.00	6%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.0	<0.01	1.00	12%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9	<0.01	1.00	68%	<0.001

N ₂ O Emissions from Composting	N ₂ O	1.9	<0.01	1.00	50%	<0.001
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.6	<0.01	1.00	13%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.5	<0.01	1.00	68%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.5	<0.01	1.00	50%	<0.001
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4	<0.01	1.00	27%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.3	<0.01	1.00	5%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.2	<0.01	1.00	140%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	1.1	<0.01	1.00	12%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.0	<0.01	1.00	20%	<0.001
CO ₂ Emissions from Zinc Production	CO ₂	0.9	<0.01	1.00	21%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	0.9	<0.01	1.00	7%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.8	<0.01	1.00	222%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	<0.01	1.00	44%	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.5	<0.01	1.00	67%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	16%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4	<0.01	1.00	22%	<0.001
CO ₂ Emissions from Stationary Combustion - Geothermal Energy	CO ₂	0.4	<0.01	1.00	NA	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	<0.01	1.00	173%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.3	<0.01	1.00	330%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.3	<0.01	1.00	41%	<0.001
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	0.2	<0.01	1.00	13%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2	<0.01	1.00	56%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2	<0.01	1.00	9%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	200%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	30%	<0.001
HFC-134A Emissions from Magnesium Production and Processing	HFCs	0.1	<0.01	1.00	4%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1	<0.01	1.00	56%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	+	<0.01	1.00	88%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	69%	<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	10%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	+	<0.01	1.00	19%	<0.001
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+	<0.01	1.00	4%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	NE	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.0	<0.01	1.00	NE	<0.001

+ Does not exceed 0.05 MMT CO₂ Eq.

NE (Not Estimated)

NA (Not Available)

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

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

Table A-7: 2015 Key Source Category Approach 1 and Approach 2 Analysis—Level Assessment with LULUCF

IPCC Source Categories	Direct GHG (MMT CO ₂ Eq.)	Approach 1		Cumulative Total	Uncertainty ^a	Approach 2
		2015 Estimate	Level Assessment			Level Assessment
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,463.4	0.19	0.19	6%	0.012
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,350.5	0.18	0.37	10%	0.017
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	666.2	0.09	0.46	78%	0.068
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	526.1	0.07	0.53	5%	0.004
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	467.5	0.06	0.59	7%	0.004
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	272.2	0.04	0.62	19%	0.007
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	252.8	0.03	0.66	7%	0.002
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	213.3	0.03	0.69	26%	0.007
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	175.4	0.02	0.71	7%	0.002
Emissions from Substitutes for Ozone Depleting Substances	Several	168.5	0.02	0.73	12%	0.003
CH ₄ Emissions from Enteric Fermentation	CH ₄	166.5	0.02	0.75	18%	0.004
CH ₄ Emissions from Natural Gas Systems	CH ₄	162.4	0.02	0.77	30%	0.006
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	159.2	0.02	0.79	6%	0.001
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	125.5	0.02	0.81	37%	0.006
CH ₄ Emissions from Landfills	CH ₄	115.7	0.02	0.83	61%	0.009
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	102.1	0.01	0.84	67%	0.009
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	81.5	0.01	0.85	6%	0.001
CO ₂ Emissions from Land Converted to Forest Land	CO ₂	75.2	0.01	0.86	11%	0.001
CO ₂ Emissions from Land Converted to Settlements	CO ₂	68.3	0.01	0.87	29%	0.003
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	67.9	0.01	0.88	6%	0.001
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	66.8	0.01	0.89	6%	<0.001
CH ₄ Emissions from Manure Management	CH ₄	66.3	0.01	0.90	20%	0.002
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	65.9	0.01	0.90	16%	0.001
Fugitive Emissions from Coal Mining	CH ₄	60.9	0.01	0.91	16%	0.001
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	48.9	0.01	0.92	17%	0.001
CO ₂ Emissions from Natural Gas Systems	CO ₂	42.4	0.01	0.92	30%	0.002
CO ₂ Emissions from Cement Production	CO ₂	39.9	0.01	0.93	6%	<0.001
CH ₄ Emissions from Petroleum Systems	CH ₄	39.9	0.01	0.93	149%	0.008
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	38.0	<0.01	0.94	155%	0.008
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	34.3	<0.01	0.94	11%	<0.001
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	32.3	<0.01	0.95	6%	<0.001
CO ₂ Emissions from Petrochemical Production	CO ₂	28.1	<0.01	0.95	5%	<0.001
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	23.7	<0.01	0.96	8%	<0.001
CO ₂ Emissions from Land Converted to Cropland	CO ₂	22.7	<0.01	0.96	36%	0.001
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	20.9	<0.01	0.96	182%	0.005
CO ₂ Emissions from Land Converted to Grassland	CO ₂	20.5	<0.01	0.96	20%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	19.5	<0.01	0.97	42%	0.001
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	18.0	<0.01	0.97	214%	0.005
N ₂ O Emissions from Manure Management	N ₂ O	17.7	<0.01	0.97	24%	0.001

CH ₄ Emissions from Wastewater Treatment	CH ₄	14.8	<0.01	0.97	26%	0.001
CO ₂ Emissions from Lime Production	CO ₂	13.3	<0.01	0.97	3%	<0.001
N ₂ O Emissions from Nitric Acid Production	N ₂ O	11.6	<0.01	0.98	6%	<0.001
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	11.2	<0.01	0.98	16%	<0.001
CH ₄ Emissions from Rice Cultivation	CH ₄	11.2	<0.01	0.98	28%	<0.001
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	11.2	<0.01	0.98	19%	<0.001
CO ₂ Emissions from Ammonia Production	CO ₂	10.8	<0.01	0.98	8%	<0.001
CO ₂ Emissions from Incineration of Waste	CO ₂	10.7	<0.01	0.98	13%	<0.001
CO ₂ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CO ₂	7.8	<0.01	0.98	59%	0.001
CH ₄ Emissions from Forest Fires	CH ₄	7.3	<0.01	0.99	161%	0.002
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	6.4	<0.01	0.99	23%	<0.001
CO ₂ Emissions from Urea Fertilization	CO ₂	5.0	<0.01	0.99	43%	<0.001
N ₂ O Emissions from Wastewater Treatment	N ₂ O	5.0	<0.01	0.99	107%	0.001
N ₂ O Emissions from Forest Fires	N ₂ O	4.8	<0.01	0.99	157%	0.001
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	Several	4.8	<0.01	0.99	5%	<0.001
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	4.3	<0.01	0.99	5%	<0.001
HFC-23 Emissions from HCFC-22 Production	HFCs	4.3	<0.01	0.99	10%	<0.001
N ₂ O Emissions from Adipic Acid Production	N ₂ O	4.3	<0.01	0.99	4%	<0.001
N ₂ O Emissions from Product Uses	N ₂ O	4.2	<0.01	0.99	24%	<0.001
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	4.2	<0.01	0.99	11%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	4.0	<0.01	0.99	19%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	3.9	<0.01	0.99	234%	0.001
CO ₂ Emissions from Liming	CO ₂	3.8	<0.01	0.99	111%	0.001
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6	<0.01	0.99	149%	0.001
CH ₄ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CH ₄	3.6	<0.01	0.99	30%	<0.001
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	3.0	<0.01	0.99	17%	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	2.9	<0.01	0.99	15%	<0.001
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	<0.01	1.00	7%	<0.001
CO ₂ Emissions from Aluminum Production	CO ₂	2.8	<0.01	1.00	2%	<0.001
N ₂ O Emissions from Settlement Soils	N ₂ O	2.5	<0.01	1.00	268%	0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	2.4	<0.01	1.00	206%	0.001
CH ₄ Emissions from Composting	CH ₄	2.1	<0.01	1.00	50%	<0.001
PFC Emissions from Aluminum Production	PFCs	2.0	<0.01	1.00	6%	<0.001
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.0	<0.01	1.00	12%	<0.001
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.9	<0.01	1.00	68%	<0.001
N ₂ O Emissions from Composting	N ₂ O	1.9	<0.01	1.00	50%	<0.001
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.6	<0.01	1.00	13%	<0.001
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.5	<0.01	1.00	68%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.5	<0.01	1.00	50%	<0.001
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	1.4	<0.01	1.00	27%	<0.001
CO ₂ Emissions from Glass Production	CO ₂	1.3	<0.01	1.00	5%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.2	<0.01	1.00	140%	<0.001
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	1.1	<0.01	1.00	12%	<0.001
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.0	<0.01	1.00	20%	<0.001

CO ₂ Emissions from Zinc Production	CO ₂	0.9	<0.01	1.00	21%	<0.001
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	0.9	<0.01	1.00	7%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	0.8	<0.01	1.00	222%	<0.001
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	<0.01	1.00	44%	<0.001
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.5	<0.01	1.00	67%	<0.001
CO ₂ Emissions from Lead Production	CO ₂	0.5	<0.01	1.00	16%	<0.001
N ₂ O Emissions from Forest Soils	N ₂ O	0.5	<0.01	1.00	318%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CH ₄	0.4	<0.01	1.00	22%	<0.001
N ₂ O Emissions from Grassland Fires	N ₂ O	0.4	<0.01	1.00	412%	<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 Grassland Fires	CH ₄	0.4	<0.01	1.00	402%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	<0.01	1.00	173%	<0.001
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.3	<0.01	1.00	330%	<0.001
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.3	<0.01	1.00	41%	<0.001
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	0.2	<0.01	1.00	13%	<0.001
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2	<0.01	1.00	56%	<0.001
CO ₂ Emissions from Silicon Carbide Production and Consumption	CO ₂	0.2	<0.01	1.00	9%	<0.001
N ₂ O Emissions from Coastal Wetlands Remaining Coastal Wetlands	N ₂ O	0.1	<0.01	1.00	116%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	N ₂ O	0.1	<0.01	1.00	200%	<0.001
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	<0.01	1.00	30%	<0.001
N ₂ O Emissions from Drained Organic Soils	N ₂ O	0.1	<0.01	1.00	124%	<0.001
HFC-134A Emissions from Magnesium Production and Processing	HFCs	0.1	<0.01	1.00	4%	<0.001
Non-CO ₂ Emissions from Stationary Combustion - U.S. Territories	CH ₄	0.1	<0.01	1.00	56%	<0.001
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	+	<0.01	1.00	88%	<0.001
CH ₄ Emissions from Mobile Combustion: Marine	CH ₄	+	<0.01	1.00	69%	<0.001
CO ₂ Emissions from Land Converted to Wetlands	CO ₂	+	<0.01	1.00	30%	<0.001
CH ₄ Emissions from Drained Organic Soils	CH ₄	+	<0.01	1.00	76%	<0.001
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	<0.01	1.00	12%	<0.001
CH ₄ Emissions from Land Converted to Coastal Wetlands	CH ₄	+	<0.01	1.00	30%	<0.001
CH ₄ Emissions from Silicon Carbide Production and Consumption	CH ₄	+	<0.01	1.00	10%	<0.001
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	+	<0.01	1.00	19%	<0.001
CH ₄ Emissions from Peatlands Remaining Peatlands	CH ₄	+	<0.01	1.00	78%	<0.001
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+	<0.01	1.00	4%	<0.001
N ₂ O Emissions from Peatlands Remaining Peatlands	N ₂ O	+	<0.01	1.00	53%	<0.001
CH ₄ Emissions from Incineration of Waste	CH ₄	+	<0.01	1.00	NE	<0.001
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	0.0	<0.01	1.00	NE	<0.001

+ Does not exceed 0.05 MMT CO₂ Eq.

NE (Not Estimated)

NA (Not Available)

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

Table A-8: 1990-2015 Key Source Category Approach 1 and 2 Analysis—Trend Assessment, without LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate	2015 Estimate	Approach 1	Approach 2	%	% Cumulative Total
		(MMT CO ₂ Eq.)	(MMT CO ₂ Eq.)	Trend Assessment	Trend Assessment	Contribution to Trend	
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	526.1	0.05	0.003	18.5	19
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	1,350.5	0.04	0.004	13.5	32
CO ₂ Emissions from Mobile Combustion: Road Emissions from Substitutes for Ozone Depleting Substances	CO ₂	1,188.9	1,463.4	0.04	0.002	12.5	45
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	Several	0.3	168.5	0.03	0.003	9.0	54
CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	155.3	65.9	0.01	0.002	5.1	59
CH ₄ Emissions from Landfills	CO ₂	97.5	23.7	0.01	0.001	4.2	63
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CH ₄	179.6	115.7	0.01	0.007	3.8	67
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	101.5	48.9	0.01	0.001	3.0	70
HFC-23 Emissions from HCFC-22 Production	CO ₂	408.9	467.5	0.01	<0.001	2.4	72
Fugitive Emissions from Coal Mining	HFCs	46.1	4.3	0.01	0.001	2.3	74
CH ₄ Emissions from Natural Gas Systems	CH ₄	96.5	60.9	0.01	0.001	2.1	76
CO ₂ Emissions from Mobile Combustion: Aviation	CH ₄	194.1	162.4	0.01	0.002	2.1	79
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	187.4	159.2	0.01	<0.001	1.9	80
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	97.4	66.8	0.01	<0.001	1.8	82
CH ₄ Emissions from Manure Management	CO ₂	142.1	175.4	<0.01	<0.001	1.5	84
N ₂ O Emissions from Mobile Combustion: Road	CH ₄	37.2	66.3	<0.01	0.001	1.5	85
PFC Emissions from Aluminum Production	N ₂ O	37.7	11.2	<0.01	0.001	1.5	87
SF ₆ Emissions from Electrical Transmission and Distribution	PFCs	21.5	2.0	<0.01	<0.001	1.1	88
CH ₄ Emissions from Petroleum Systems	SF ₆	23.1	4.2	<0.01	<0.001	1.1	89
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CH ₄	55.5	39.9	<0.01	0.004	0.9	90
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	278.3	272.2	<0.01	<0.001	0.9	91
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	CO ₂	44.3	32.3	<0.01	<0.001	0.7	91
N ₂ O Emissions from Adipic Acid Production	N ₂ O	7.4	19.5	<0.01	0.001	0.6	92
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	N ₂ O	15.2	4.3	<0.01	<0.001	0.6	93
Indirect N ₂ O Emissions from Applied Nitrogen	CO ₂	12.0	2.9	<0.01	<0.001	0.5	93
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	N ₂ O	44.6	38.0	<0.01	0.002	0.4	94
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	26.9	34.3	<0.01	<0.001	0.3	94
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	238.0	252.8	<0.01	<0.001	0.3	94
Direct N ₂ O Emissions from Agricultural Soil Management	CO ₂	4.9	11.2	<0.01	<0.001	0.3	95
CO ₂ Emissions from Petrochemical Production	CO ₂	21.3	28.1	<0.01	<0.001	0.3	95
CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	81.5	<0.01	<0.001	0.3	96
CH ₄ Emissions from Rice Cultivation	CH ₄	16.0	11.2	<0.01	<0.001	0.3	96
CO ₂ Emissions from Cement Production	CO ₂	33.5	39.9	<0.01	<0.001	0.3	96

SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.2	0.9	<0.01	<0.001	0.2	96
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	2.8	<0.01	<0.001	0.2	97
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	5.2	1.4	<0.01	<0.001	0.2	97
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.6	125.5	<0.01	<0.001	0.2	97
CH ₄ Emissions from Enteric Fermentation	CH ₄	164.2	166.5	<0.01	<0.001	0.2	97
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	0.6	4.0	<0.01	<0.001	0.2	97
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.7	42.4	<0.01	<0.001	0.2	98
N ₂ O Emissions from Manure Management	N ₂ O	14.0	17.7	<0.01	<0.001	0.2	98
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	0.0	<0.01	<0.001	0.2	98
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	0.0	3.0	<0.01	<0.001	0.2	98
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	1.1	<0.01	<0.001	0.1	98
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.5	4.3	<0.01	<0.001	0.1	98
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	10.8	<0.01	<0.001	0.1	99
CO ₂ Emissions from Urea Fertilization	CO ₂	2.4	5.0	<0.01	<0.001	0.1	99
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	10.7	<0.01	<0.001	0.1	99
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	63.3	67.9	<0.01	<0.001	0.1	99
CH ₄ Emissions from Composting	CH ₄	0.4	2.1	<0.01	<0.001	0.1	99
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	5.2	3.9	<0.01	0.001	0.1	99
N ₂ O Emissions from Composting	N ₂ O	0.3	1.9	<0.01	<0.001	0.1	99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.4	5.0	<0.01	<0.001	0.1	99
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.7	14.8	<0.01	<0.001	0.1	99
CO ₂ Emissions from Lime Production	CO ₂	11.7	13.3	<0.01	<0.001	0.1	99
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	Several	3.6	4.8	<0.01	<0.001	0.1	100
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	7.2	6.4	<0.01	<0.001	0.1	100
CO ₂ Emissions from Liming	CO ₂	4.7	3.8	<0.01	<0.001	0.1	100
N ₂ O Emissions from Nitric Acid Production	N ₂ O	12.1	11.6	<0.01	<0.001	0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.1	2.4	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.2	1.9	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.0	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.8	1.5	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.6	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	1.5	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Glass Production	CO ₂	1.5	1.3	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	1.0	0.8	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Zinc Production	CO ₂	0.6	0.9	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	2.0	<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
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	+	0.2	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Product Uses	N ₂ O	4.2	4.2	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	0.3	<0.01	<0.001	<0.1	100

CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	0.5	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	2.8	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6	3.6	<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
HFC-134A Emissions from Magnesium Production and Processing	HFCs	0.0	0.1	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.0	1.2	<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
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	0.3	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2	0.2	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	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
CH ₄ Emissions from Silicon Carbide Production and Consumption	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
N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	0.6	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Iron and Steel Production & Metallurgical Coke Production	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
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	0.4	<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
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+	+	<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

+ Does not exceed 0.05 MMT CO₂ Eq.

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

Table A-9: 1990-2015 Key Source Category Approach 1 and 2 Analysis—Trend Assessment, with LULUCF

IPCC Source Categories	Direct GHG	1990 Estimate	2015 Estimate	Approach 1	Approach 2	Percent	Cumulative
		(MM TCO ₂ Eq.)	(MMT CO ₂ Eq.)	Trend Assessment	Trend Assessment	Contribution to Trend (%)	Contribution to Trend (%)
CO ₂ Emissions from Stationary Combustion - Gas - Electricity Generation	CO ₂	175.3	526.1	0.05	0.002	16.3	16
CO ₂ Emissions from Mobile Combustion: Road	CO ₂	1,188.9	1,463.4	0.03	0.002	11.4	28
CO ₂ Emissions from Stationary Combustion - Coal - Electricity Generation	CO ₂	1,547.6	1,350.5	0.03	0.003	11.3	39
Emissions from Substitutes for Ozone Depleting Substances	Several	0.3	168.5	0.02	0.003	7.9	47
CO ₂ Emissions from Stationary Combustion - Coal - Industrial	CO ₂	155.3	65.9	0.01	0.002	4.4	51

CO ₂ Emissions from Stationary Combustion - Oil - Electricity Generation	CO ₂	97.5	23.7	0.01	0.001	3.6	55
CH ₄ Emissions from Landfills	CH ₄	179.6	115.7	0.01	0.005	3.2	58
CO ₂ Emissions from Land Converted to Cropland	CO ₂	100.7	35.3	0.01	0.003	3.2	61
CO ₂ Emissions from Iron and Steel Production & Metallurgical Coke Production	CO ₂	101.5	48.9	0.01	0.001	2.6	64
CO ₂ Emissions from Forest Land Remaining Forest Land	CO ₂	697.6	666.3	0.01	0.005	2.4	66
CO ₂ Emissions from Stationary Combustion - Gas - Industrial	CO ₂	408.9	467.5	0.01	<0.001	2.2	69
HFC-23 Emissions from HCFC-22 Production	HFCs	46.1	4.3	0.01	0.001	2.0	71
CO ₂ Emissions from Land Converted to Grassland	CO ₂	245.2	293.2	0.01	0.001	1.9	73
Fugitive Emissions from Coal Mining	CH ₄	96.5	60.9	<0.01	0.001	1.8	74
CH ₄ Emissions from Natural Gas Systems	CH ₄	194.1	162.4	<0.01	0.001	1.7	76
CO ₂ Emissions from Mobile Combustion: Aviation	CO ₂	187.4	159.2	<0.01	<0.001	1.6	78
CO ₂ Emissions from Stationary Combustion - Oil - Residential	CO ₂	97.4	66.8	<0.01	<0.001	1.6	79
CO ₂ Emissions from Land Converted to Settlements	CO ₂	37.2	68.3	<0.01	0.001	1.4	81
CO ₂ Emissions from Stationary Combustion - Gas - Commercial	CO ₂	142.1	175.4	<0.01	<0.001	1.4	82
CH ₄ Emissions from Manure Management	CH ₄	37.2	66.3	<0.01	0.001	1.3	83
N ₂ O Emissions from Mobile Combustion: Road	N ₂ O	37.7	11.2	<0.01	0.001	1.3	85
CO ₂ Emissions from Cropland Remaining Cropland	CO ₂	40.9	18.0	<0.01	0.007	1.1	86
PFC Emissions from Aluminum Production	PFCs	21.5	2.0	<0.01	<0.001	0.9	87
SF ₆ Emissions from Electrical Transmission and Distribution	SF ₆	23.1	4.2	<0.01	<0.001	0.9	88
CO ₂ Emissions from Land Converted to Forest Land	CO ₂	92.0	75.2	<0.01	<0.001	0.9	89
CH ₄ Emissions from Petroleum Systems	CH ₄	55.5	39.9	<0.01	0.003	0.8	89
CO ₂ Emissions from Grassland Remaining Grassland	CO ₂	4.2	20.9	<0.01	0.004	0.8	90
CO ₂ Emissions from Stationary Combustion - Oil - Industrial	CO ₂	278.3	272.2	<0.01	<0.001	0.6	91
CO ₂ Emissions from Settlements Remaining Settlements	CO ₂	86.2	102.1	<0.01	0.001	0.6	91
CO ₂ Emissions from Mobile Combustion: Marine	CO ₂	44.3	32.3	<0.01	<0.001	0.6	92
Non-CO ₂ Emissions from Stationary Combustion - Electricity Generation	N ₂ O	7.4	19.5	<0.01	0.001	0.6	93
N ₂ O Emissions from Adipic Acid Production	N ₂ O	15.2	4.3	<0.01	<0.001	0.5	93
CO ₂ Emissions from Stationary Combustion - Coal - Commercial	CO ₂	12.0	2.9	<0.01	<0.001	0.4	94
CO ₂ Emissions from Stationary Combustion - Gas - Residential	CO ₂	238.0	252.8	<0.01	<0.001	0.4	94
Indirect N ₂ O Emissions from Applied Nitrogen	N ₂ O	44.6	38.0	<0.01	0.002	0.4	94
CO ₂ Emissions from Stationary Combustion - Oil - U.S. Territories	CO ₂	26.9	34.3	<0.01	<0.001	0.3	95

CO ₂ Emissions from Mobile Combustion: Other	CO ₂	73.3	81.5	<0.01	<0.001	0.3	95
CO ₂ Emissions from Other Process Uses of Carbonates	CO ₂	4.9	11.2	<0.01	<0.001	0.3	95
CO ₂ Emissions from Petrochemical Production	CO ₂	21.3	28.1	<0.01	<0.001	0.3	96
CO ₂ Emissions from Cement Production	CO ₂	33.5	39.9	<0.01	<0.001	0.3	96
CH ₄ Emissions from Rice Cultivation	CH ₄	16.0	11.2	<0.01	<0.001	0.2	96
CO ₂ Emissions from Non-Energy Use of Fuels	CO ₂	117.6	125.5	<0.01	<0.001	0.2	96
SF ₆ Emissions from Magnesium Production and Processing	SF ₆	5.2	0.9	<0.01	<0.001	0.2	96
Direct N ₂ O Emissions from Agricultural Soil Management	N ₂ O	212.0	213.3	<0.01	<0.001	0.2	97
CO ₂ Emissions from Aluminum Production	CO ₂	6.8	2.8	<0.01	<0.001	0.2	97
CH ₄ Emissions from Forest Fires	CH ₄	3.2	7.3	<0.01	0.001	0.2	97
CH ₄ Emissions from Mobile Combustion: Road	CH ₄	5.2	1.4	<0.01	<0.001	0.2	97
CO ₂ Emissions from Natural Gas Systems	CO ₂	37.7	42.4	<0.01	<0.001	0.2	97
CO ₂ Emissions from Stationary Combustion - Coal - U.S. Territories	CO ₂	0.6	4.0	<0.01	<0.001	0.2	98
N ₂ O Emissions from Manure Management	N ₂ O	14.0	17.7	<0.01	<0.001	0.2	98
CO ₂ Emissions from Stationary Combustion - Coal - Residential	CO ₂	3.0	0.0	<0.01	<0.001	0.1	98
CO ₂ Emissions from Stationary Combustion - Gas - U.S. Territories	CO ₂	0.0	3.0	<0.01	<0.001	0.1	98
CO ₂ Emissions from Stationary Combustion - Oil - Commercial	CO ₂	63.3	67.9	<0.01	<0.001	0.1	98
CO ₂ Emissions from Carbon Dioxide Consumption	CO ₂	1.5	4.3	<0.01	<0.001	0.1	98
CO ₂ Emissions from Urea Consumption for Non-Ag Purposes	CO ₂	3.8	1.1	<0.01	<0.001	0.1	98
N ₂ O Emissions from Forest Fires	N ₂ O	2.1	4.8	<0.01	0.001	0.1	99
CO ₂ Emissions from Ammonia Production	CO ₂	13.0	10.8	<0.01	<0.001	0.1	99
CO ₂ Emissions from Urea Fertilization	CO ₂	2.4	5.0	<0.01	<0.001	0.1	99
CO ₂ Emissions from Incineration of Waste	CO ₂	8.0	10.7	<0.01	<0.001	0.1	99
CH ₄ Emissions from Enteric Fermentation	CH ₄	164.2	166.5	<0.01	<0.001	0.1	99
CH ₄ Emissions from Composting	CH ₄	0.4	2.1	<0.01	<0.001	0.1	99
N ₂ O Emissions from Composting	N ₂ O	0.3	1.9	<0.01	<0.001	0.1	99
Non-CO ₂ Emissions from Stationary Combustion - Residential	CH ₄	5.2	3.9	<0.01	<0.001	0.1	99
N ₂ O Emissions from Wastewater Treatment	N ₂ O	3.4	5.0	<0.01	<0.001	0.1	99
CH ₄ Emissions from Wastewater Treatment	CH ₄	15.7	14.8	<0.01	<0.001	0.1	99
CO ₂ Emissions from Lime Production	CO ₂	11.7	13.3	<0.01	<0.001	0.1	99
PFC, HFC, SF ₆ , and NF ₃ Emissions from Semiconductor Manufacture	Several	3.6	4.8	<0.01	<0.001	0.1	99
N ₂ O Emissions from Settlement Soils	N ₂ O	1.4	2.5	<0.01	<0.001	<0.1	100
Fugitive Emissions from Abandoned Underground Coal Mines	CH ₄	7.2	6.4	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Liming	CO ₂	4.7	3.8	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Nitric Acid Production	N ₂ O	12.1	11.6	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Industrial	N ₂ O	3.1	2.4	<0.01	<0.001	<0.1	100

N ₂ O Emissions from Mobile Combustion: Other	N ₂ O	1.2	1.9	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Phosphoric Acid Production	CO ₂	1.5	1.0	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Industrial	CH ₄	1.8	1.5	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Titanium Dioxide Production	CO ₂	1.2	1.6	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Forest Soils	N ₂ O	0.1	0.5	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Grassland Fires	N ₂ O	0.1	0.4	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Mobile Combustion: Aviation	N ₂ O	1.7	1.5	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Grassland Fires	CH ₄	0.1	0.4	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Zinc Production	CO ₂	0.6	0.9	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Glass Production	CO ₂	1.5	1.3	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Residential	N ₂ O	1.0	0.8	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Ferroalloy Production	CO ₂	2.2	2.0	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Semiconductor Manufacture	N ₂ O	+	0.2	<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
CH ₄ Emissions from Mobile Combustion: Other	CH ₄	0.3	0.5	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Incineration of Waste	N ₂ O	0.5	0.3	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Product Uses	N ₂ O	4.2	4.2	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Soda Ash Production and Consumption	CO ₂	2.8	2.8	<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
Non-CO ₂ Emissions from Stationary Combustion - Commercial	CH ₄	1.0	1.2	<0.01	<0.001	<0.1	100
HFC-134A Emissions from Magnesium Production and Processing	HFCs	0.0	0.1	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Petroleum Systems	CO ₂	3.6	3.6	<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
CH ₄ Emissions from Field Burning of Agricultural Residues	CH ₄	0.2	0.3	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Petrochemical Production	CH ₄	0.2	0.2	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Mobile Combustion: Aviation	CH ₄	0.1	+	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Coastal Wetlands Remaining Coastal Wetlands	CO ₂	7.6	7.8	<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 Coastal Wetlands Remaining Coastal Wetlands	CH ₄	3.4	3.6	<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
N ₂ O Emissions from Field Burning of Agricultural Residues	N ₂ O	0.1	0.1	<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 Iron and Steel Production & Metallurgical Coke Production	CH ₄	+	+	<0.01	<0.001	<0.1	100
Non-CO ₂ Emissions from Stationary Combustion - Commercial	N ₂ O	0.4	0.4	<0.01	<0.001	<0.1	100

N ₂ O Emissions from Mobile Combustion: Marine	N ₂ O	0.6	0.6	<0.01	<0.001	<0.1	100
CO ₂ Emissions from Land Converted to Wetlands	CO ₂	+	+	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Coastal Wetlands Remaining Coastal Wetlands	N ₂ O	0.1	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Ferroalloy Production	CH ₄	+	+	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Land Converted to Coastal Wetlands	CH ₄	+	+	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Drained Organic Soils	N ₂ O	0.1	0.1	<0.01	<0.001	<0.1	100
CH ₄ Emissions from Peatlands Remaining Peatlands	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
CO ₂ Emissions from Magnesium Production and Processing	CO ₂	+	+	<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 Drained Organic Soils	CH ₄	+	+	<0.01	<0.001	<0.1	100
N ₂ O Emissions from Peatlands Remaining Peatlands	N ₂ O	+	+	<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 MMT CO₂ Eq.

References

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