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**WBG Scorecard FY24-FY30 Methods Template – WBG Client Context and Vision Indicators**

The purpose of this template is to ensure the rigor and transparency of the WBG client context and vision indicators included in the new WBG Scorecard FY24-FY30. We ask that the technical team provide a sufficiently detailed methodology, so that anyone who reads this template would be able to understand the method of calculation, underlying source(s) of data, and potential caveats or limitations underlying the inputs.

Definitions included in this template are aligned to the WBG Scorecard paper endorsed by the Board on Dec 19th, 2023.

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| **OVERVIEW** | | |
| **Indicator name** | *Global greenhouse gas emissions* | |
| **Vision / Client Context** | Vision indicator | Client context indicator |
| **Outcome area** | *See the new Scorecard paper for further details on outcome areas (only applicable for Client context indicator).* | |
| Protection for the Poorest  Healthier Lives  Green and blue planet and resilient populations  Sustainable food systems  Affordable, reliable and sustainable energy for all  Digital services  More and Better Jobs | No Learning Poverty  Effective Macroeconomics and Fiscal Management  Inclusive and equitable water and sanitation services  Connected Communities  Digital connectivity  Gender equality and youth inclusion  Better Lives for People in Fragility, Conflict, and Violence  More private investments |
| **SDG alignment** | *See* [*https://sdgs.un.org*](https://sdgs.un.org/)*/ for further details on SDGs (only applicable for Client context indicator). Check all that apply:* | |
| 1. No Poverty  2. Zero Hunger  3. Good Health and Well-being  4. Quality Education  5. Gender Equality  6. Clean Water and Sanitation  7. Affordable and Clean Energy  8. Decent Work and Economic Growth  9. Industry Innovation and Infrastructure | 10. Reduced Inequalities  11. Sustainable Cities and Communities  12. Responsible Consumption and Production  13. Climate Action  14. Life Below Water  15. Life on Land  16. Peace, Justice and Strong Institutions  17. Partnerships for the Goals |
|  | |
| **Disaggregability** | *Check all that apply, otherwise leave boxes empty:*  Youth Sex Disability-inclusive FCS SS, SIDS and LDCs Country income groups Regions | |
| **Legacy indicator name** | Old Scorecard indicator: *CO2 emissions (metric tons per capita)*  New indicator. | |
| **RATIONALE** | | |
| **Definition** | A measure of annual global emissions of the six greenhouse gases covered by the Kyoto Protocol (carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphurhexafluoride (SF6)) from the energy, industry, waste, agriculture, and land use, land use changes, and forestry (LULUCF) sectors, standardized to carbon dioxide equivalent values. | |
| **Unit of measure** | *Check the box that applies:*  Number of people Number of countries USD GW Hectares tCO2eq/year  Other: *gigatons of carbon dioxide equivalent* | |
| **Development**  **Relevance** | ***Outline the indicator’s relevance with respect to the WBG’s new vision and mission as well as principles such as data availability/coverage, technical rigor, amenability to regular updating, SDG alignment, etc.***  Global greenhouse gas (GHG) emissions is a relevant indicator to the WBG’s new vision to create a world free of poverty on a livable planet because of its effect on the climate and thus development. Human-induced GHG emissions are driving atmospheric concentration increases and atmospheric warming, which is leading to a myriad of climatic changes. Climate change is already causing more frequent and extreme weather events and higher temperatures globally, leading to large impacts across the globe and particularly in developing countries that often have a limited means to adapt and build resilience. The international scientific community has warned that emissions need to decline to net zero by the middle of the 21st century to limit global warming to well below a 2deg C increase and help avoid the most consequential climate change impacts.  Climate change is having a disproportionate impact on developing countries and if unabated will not only reverse past development progress and hinder poverty reduction but will also make future development more costly. Country level assessments of the potential climate change impacts on specific developing countries, performed as part of the World Bank’s Country Climate and Development Reports (CCDRs), show that climate change will have a significant impact on developing countries’ economies, ranging from about 0.5% of GDP for higher income developing countries to over 13% for the lowest income developing countries. The costs of partial adaptation to these changes will be significant as well -- ranging between 1 and 10% of developing countries’ GDP.  WBG-supported development must be aligned to the necessary low-emissions development transition. The World Bank has committed to aligning its activities to the goals of the Paris Agreement, including limiting average global warming to 1.5 deg C. As such, the global, regional, and country level emissions levels provide relevant context for the design and tracking of WBG compliance with this requirement.  Different data sources for this metric have different strengths and limitations. To be consistent with the urgency of emissions reduction and to best reflect global progress on emissions reduction, this indicator is based on data that are as up to date as possible and permit meaningful, annual updates. Additionally, this indicator is based on sources that estimate emissions at the subnational and sub sectoral level and thus can be aggregated to and reported by sector at the country, region, and global level. This will permit a granular understanding of the key drivers of emissions and opportunities for mitigation. | |
| **Limitations** | Global GHG emissions are currently not directly measurable, but approaches for their estimation exist, and numerous sources exist to supply data for this indicator. Reputable scientific organizations produce these data for use for research, policy analysis, climate negotiations, and broader public communications. The estimated accuracy from fossil fuel combustion and industrial processes are quite high, as quantities of fossil fuels and other emissive materials (such as cement and steel) produced are well known. For these sectors, emissions estimates are roughly accurate to within 10% when aggregated to the global level and between 4% and 35% at the country level (Crippa et al., 2023). For non- combustion and non- industrial process emissions, the accuracy is lower. Agricultural emissions, for example, depend upon many factors including the type of crops grown and livestock raised, specific agricultural practices, and other climate and non-climate factors. For these emissions, the accuracy is lower—around 30% for CH4 and fluorinated gases (HFCs, PFCs, and SF6). For the LULUCF sectors, country-level uncertainty around emissions estimates are also larger, ranging from around 10% to 102% (McGlynn et al. 2022).  Emissions from anthropogenic LULUCF are more challenging to quantify because of the complexity of terrestrial ecosystem and the difficulties of disentangling natural from anthropogenic fluxes. Two predominant approaches are used to arrive at national LULUCF GHG fluxes. An approach based on submissions to national greenhouse gas inventories, and another based on modelling work by the scientific community. The data to be used for this indicator represents a balance between the following two approaches.  The first approach (“inventory”) is based on country submissions of anthropogenic GHG emissions and removals in accordance with the reporting requirements of parties to the United Nations Framework Convention on Climate Change (UNFCCC) and Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+). Here, countries have different reporting obligations depending on whether they are an Annex 1 or non-Annex 1 country. Non-Annex 1 countries, which have more limited reporting obligations, often lack monitoring and reporting capacity and their data is often less complete than for Annex 1 countries. Additionally, reporting countries often include estimates from large areas of un-managed forests and count indirect human-induced effects. As such, LULUCF emissions from this approach are not well standardized across countries, and aggregating these data may lead to biases in regional and global emissions estimates (Grassi et al 2022).  The second approach (“modeling”) is used by the scientific community for global carbon cycle modeling that simulates GHG exchange between the terrestrial biosphere and atmosphere. Compared to the inventory approach, it adopts a narrower definition of managed forests and excludes a fraction of land sinks by treating them as non-anthropogenic. While this approach presents a standardized methodology across all countries and leads to the least biased results at the regional and global level, results for any single country can be considerably different from those estimates derived using the inventory approach. Globally, these two approaches yield global annual GHG fluxes that differ by several gigatons. Grassi et al. (2018; 2023), however, have observed that these approaches can be largely reconciled by standardizing the definition of sinks from the country data to ensure consistency while still matching country data for the common LULUCF categories. The approach for national LULUCF emissions by Grassi thus strikes a balance between matching country reported LULUCF emissions and global consistency.  To present the most up-to-date estimate of global GHG emissions, the most recent data for this indicator are preliminary estimates and may be modified in the future. Future changes are not expected to be large and are unlikely to change the overarching conclusions from the indicator. As such, using the most recent data, even though it is preliminary, seems to be an acceptable choice for this global indicator, which is expected to change slowly over time. | |
| **DATA AND CALCULATION** | | |
| **Data source(s)** | ***Please specify the underlying data collection infrastructure or institution(s) responsible for collecting inputs that are used to calculate this indicator.***  This indicator at the global and regional level is based directly on the Joint Research Center’s Emissions Database for Global Atmospheric Research (EDGAR), augmented by preliminary estimates for the land use, land use change and forestry (LULUCF) that were developed for the Research Center’s annual report, *GHG Emissions of all World Countries, 2023*.[[1]](#footnote-2) EDGAR includes GHG emissions based on international statistics from the IEA, FAO, USGS and other reputable sources, which are harmonized via a consistent Intergovernmental Panel on Climate Change (IPCC) methodology. This harmonization permits an unbiased cross-country and sector-by-sector comparison, as countries’ own self-reported data may use different methodologies and exclude different types of data, depending on the country capacity and particularly for the LULUCF sectors. These data are currently available through 2022 and are updated annually. For this indicator the data can be obtained from two locations. For the non-LULUCF data, the EDGAR data are presented at two levels of sectoral disaggregation. For all but the agricultural sector, the dataset provided as part of the annual report was used.[[2]](#footnote-3) For the agricultural sectoral data, we use the original EDGAR v8.0 source, as it includes disaggregation of agricultural emissions to those from crops and livestock.[[3]](#footnote-4) The data compiled for this indicator is presented in the following internal World Bank dashboard: https://tab.worldbank.org/t/WBG/views/CSCIndicator-Global\_GHG\_emissions-581659/START.  The country-level data for LULUCF, however, are based on a hybrid dataset produced by Grassi et al., (2023) which is more reflective of country-submitted estimates for these sectors.[[4]](#footnote-5) This method draws data from submissions and briefs to the UNFCCC and REDD+, independent reports, satellite data, and wildfire data to report emissions and removals under four primary categories (managed forest land, deforestation, organic soils, other land uses) at the regional level. These data are currently only available until 2020, although there are plans to update these data in 2024 and annually thereafter.  The emissions estimates from EDGAR used in this indicator are used in numerous reputable publications. The European Commission produces an annual report, GHG Emissions of All World Countries, which summarizes these data and describes notable updates from prior years. The United Nations Environment Program (UNEP)’s Emissions Gap Report, also uses EDGAR data to both describe emissions trends and relate them to global progress towards the Paris Agreement’s GHG emissions reductions targets and countries’ Nationally Determined Contributions (NDCs) and Long-term Strategies (LTS). Additionally, EDGAR data are used in the IPCC’s 6th Assessment Report, Working Group 3, Mitigation of Climate Change, serving as the definitive scientific assessment of the state of global GHG emissions.  The underlying sources used by EDGAR v8.0 and Grassi’s LULUCF estimates are presented in the following table.   |  |  |  | | --- | --- | --- | | **Sector** | **Source** | **Notes** | | Energy | IEA, Greenhouse Gas Emissions from Energy, 2022 (https://www.iea.org/data-and-statistics) | Combustion sources with modifications by the Joint Research Centre (JRC) of the European Commission | | Energy Institute, 2023 Statistical Review of World Energy (https://www.energyinst.org/statistical-review) | Fuel oil regional consumption, last access April 2023 | | IEA World Energy Balances 2022 Edition (https://www.iea.org/data-and-statistics/data-product/world-energy-balances) | Combustion sources emissions for CH4 and N2O | | International Air Transport Association Statistics, 2023 (https://www.iata.org/en/iata-repository/pressroom/fact-sheets/industry-statistics) | International aviation transport emissions, last access July 2023 | | [FAOSTAT](https://www.fao.org/faostat), 2023 (https://www.fao.org/faostat) | Biofuel combustion related emissions, last access April 2023 | | GGFR/NOAA, 2023 (https://www.worldbank.org/en/programs/gasflaringreduction/global-flaring-data#indicators-by-country) | Gas consumption for flaring; last access June 2023 | | UNFCCC, GHG Review Tools, 2023 (https://rt.unfccc.int/locator) | CH4 emissions from venting; last access June 2023 | | U.S. EPA, Natural Gas and Petroleum Systems in the GHG Inventory: Additional Information on the 1990-2021 GHG  Inventory, 2023 (https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systemsghg-  inventory-additional-information-1990-2021-ghg) | CH4 emissions from venting; last access July 2023 | | Höglund-Isaksson, L., Bottom-up simulations of methane and ethane emissions from global oil and gas systems  1980 to 2012, Environ. Res. Lett. 12, 024007, 2017 (https://doi.org/10.1088/1748-9326/aa583e) | CH4 emissions from venting | | U.S. Energy Information Administration, 2023 (https://www.eia.gov/opendata) | For the countries belonging to “Other Africa”, “Other Non-OECD Asia” and “Other Non-OECD Americas; last access May 2023 | | World Steel Association, Steel Statistical Yearbook 2022 (https://worldsteel.org/wpcontent/  uploads/Steel-Statistical-Yearbook-2022.pdf) | Fugitive emissions | | GGFR/NOAA, 2012-22022 data for gas consumption for flaring, 2023 (https://www.worldbank.org/en/programs/gasflaringreduction/global-flaring-data#indicators-by-country) | CO2 flared at oil and gas extraction facilities for 1994 onwards; last access June 2023 | | Industry | World Steel Association, Steel Statistical Yearbook 2022 (https://worldsteel.org/wpcontent/  uploads/Steel-Statistical-Yearbook-2022.pdf) | Metal industry; non-metallic minerals | | USGS Commodity Statistics, 2023 (https://www.usgs.gov/centers/nmic/commodity-statistics-and-information) | Ferro-alloys production up to 2019; pig iron production; non-metallic minerals except for China for the latest years; Clinker production of US up to 2022; lime production; chemicals production; ammonia production; last access May 2023 | | British Geological Survey, British Geological Society for non-ferrous metals, 2023 (https://www.bgs.ac.uk/datasets/uk-and-world-mineral-statistics-datasets/) | Ferro-alloys production up to 2021; pig iron production; last access March 2023 | | National Bureau of Statistics of China, 2023 (http://www.stats.gov.cn/english/) | Pig iron production for China; last access June 2023 | | UNFCCC, National Inventory Submissions, 2023 (https://unfccc.int/ghg-inventories-annex-i-parties/2023) | Clinker production; last access June 2023 | | World Cement,2022 (https://www.worldcement.com/) | Clinker production of China | | Global Cement and Concrete Association, GNR project - Reporting CO2, 2022 (https://gccassociation.org/gnr/) | Clinker production ratios for Brazil, Egypt, Philippines and Thailand up to year 2019; last access July 2023 | | International Fertilizer Association, Urea consumption (updates 2010-2019) and production (updates 2020) statistics, 2022 (https://www.ifastat.org/) | Urea consumption and production; last access June 2023 | | Olivier, J.G.J, Trends in global CO2 and total greenhouse gas emissions: 2021 Summary Report, PBL Netherlands  Environmental Assessment Agency, The Hague, 2022 | Fluorinated gases (F-gases) | | Waste | UNFCCC, GHG Review Tools, 2023 (https://rt.unfccc.int/locator) | Waste incineration, including open burning of municipal solid waste (MSW), industrial solid waste, biogenic waste, clinical waste, sewage sludge waste, waste from cremation and other waste for Annex I countries; landfills emissions; waste composting for Annex I countries; last access June 2023. | | The Cremation Society (https://www.cremation.org.uk/) | GHG emissions from waste from cremation | | Janssens-Maenhout, G., et al. EDGAR v4.3.2 Global Atlas of the three major greenhouse gas emissions for the period 1970–  2012, Earth Syst. Sci. Data, 11, 959–1002, 2019 (https://doi.org/10.5194/essd-11-959-2019) | CH4 and N2O emissions associated with wastewater handling until 2021 | | FAOSTAT, 2023 (https://www.fao.org/faostat) | Meat, pulp, sugar production, average protein supply | | United Nations Statistics Industrial Commodity and Energy Statistics Database, 2023 | Alcohol production | | Renewable Fuels Association, Industrial statistics, 2023 (https://ethanolrfa.org/) | Alcohol production | | UNDP, population statistics (2019), World Population Prospects (WPP), The 2019 Revision Report United Nations,  Department of Economic and Social Affairs, Population Division, 2019 (https://www.un.org/development/desa/pd/news/world-population-prospects-2019-0) | Population | | Janssens-Maenhout, G., et al., EDGAR v4.3.2 Global Atlas of the three major greenhouse gas emissions for the period 1970–  2012, Earth Syst. Sci. Data, 11, 959–1002, 2019 (https://doi.org/10.5194/essd-11-959-2019) | Urban population | | UNSD/ENVSAT, UN Environment Statistics, 2023 (https://unstats.un.org/unsd/envstats/index.cshtml) | Waste composting for non-Annex I countries; last access May 2023 | | Eurostat (https://ec.europa.eu/eurostat) | Hazardous waste | | UNSD/ENVSTAT, UN Environment Statistics, 2023 (https://unstats.un.org/unsd/envstats/index.cshtml) | Hazardous waste | | U.S. EPA, Natural Gas and Petroleum Systems in the GHG Inventory: Additional Information on the 1990-2021 GHG  Inventory, 2023 (https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systemsghg-  inventory-additional-information-1990-2021-ghg) | Hazardous waste for US | | Agriculture (including livestock) | FAOSTAT,2023 (https://www.fao.org/faostat) | Application of urea and  agricultural lime, enteric fermentation, rice cultivation, manure management, fertilizer use (both synthetic and  from manure), and agricultural waste burning in fields; last access April 2023 | | USDA, Foreign Agricultural, 2023 (www.fas.usda.gov) | Crop and livestock data at macro regional level; last access May 2023 | | International Fertilizer Association , Urea consumption (updates 2010-2019) and production (updates 2020) statistics, 2022 (https://www.ifastat.org/)) | Application of urea; last access June 2023 | | Land use, land use change, and Forestry (LULUCF), including wildfires for regional and global results | Grassi G., et al., Carbon fluxes from land 2000–2020: bringing clarity on countries’ reporting, Earth Syst. Sci. Data, 14, 4643–4666, 2022 (<https://essd.copernicus.org/articles/14/4643/2022/>)  Grassi G., et al., Harmonising the Land-Use flux estimates of global models and national  inventories for 2000-2020, Earth System Science Data, 15, 1093-1114, 2023 (https://zenodo.org/records/7650360#.Y--pNuzMJcA) | Deforestation, non-biomass forest pools and non-forest categories (cropland, grassland, wetlands, settlements), organic Soils; data coverage year 2000-2020 | | Global Wildfire Information System (GWIS) (https://gwis.jrc.ec.europa.eu/) | Wildfire emissions in non-tropical regions | | Copernicus Climate Change Service  (C3S), Land cover classification gridded  maps from 1992 to present derived from satellite observations (https://cds.climate.copernicus.eu/cdsapp#!/dataset/satellite-land-cover?tab=overview) | Emissions from forest (biomass only, estimated with an IPCC tier 1 approach) | | FAOSTAT, 2023 (https://www.fao.org/faostat) | Country harvest production statistics | | FAO, Global Ecological Zones (GEZ) (https://www.fao.org/forest-resources-assessment/remote-sensing/global-ecological-zones-gez-mapping/en/) | Spatial and statistical forest data | | FAO, Global Forest Resource Assessment (FRA) (https://www.fao.org/forest-resources-assessment/en/) | Spatial and statistical forest data | | Land use, land use change, and Forestry (LULUCF), including wildfires for national-level results | Grassi G., et al., Harmonising the Land-Use flux estimates of global models and national  inventories for 2000-2020, Earth System Science Data, 15, 1093-1114, 2023 (https://zenodo.org/records/7650360#.Y--pNuzMJcA) | Forest land (forest land remaining forest land (FL-FL) plus land converted to forest land (L-FL), including Harvested Wood Products but excluding organic soils); deforestation (forest land converted to other land used, excluding organic soils); organic soils (organic soils from all land use categories, including peat fires; other land uses including cropland, grassland, wetland, settlement, and other land, if not included in categories above; data coverage year 2000-2020 | | |
| **Method of calculation**  (Core calculation) | ***Describe how the indicator is calculated, including any relevant details related to enumeration or estimation methods, necessary data substitution(s), inferences for special cases, etc. If indicator is based on existing methodologies already compiled by another institution, please provide a link to any available technical details. Describe any qualitative assessments included.***  The greenhouse gas emissions indicator is based on two data sources. EDGAR v8.0, augmented with LULUCF estimates for Crippa (2023), is used for the global and regional emissions for all sectors. EDGAR provides internally consistent data with a one-year time lag. For country-level results, data for non-LULUCF sectors are based on the same EDGAR v8.0 dataset. For LULUCF emissions, however, we use the more country-informed dataset from Grassi et al. (2023). These data, which are based on national emissions inventories, are more compatible with a country’s own emissions estimates, but they are less comparable across countries due to different levels of data availability, capacity, and specific methodology. We believe that despite their lack of inter-country comparability these data are appropriate for country-level analyses.  EDGAR v8.0's GHG estimates for combustion and industrial processes are based on the application of IPCC GHG accounting methodology across all countries. EDGAR uses data from the IEA and Energy Institute to derive GHG emissions at subnational and subsectoral level based on activity and emission factors. Emissions estimates are provided for the following subsectors: power industry, industrial combustion, buildings, transport, agriculture (including livestock), fuel exploitation, and waste. These data are available at the national, regional, and global level.  For LULUCF at the regional and global level, EDGAR applies a methodology described in Grassi et al. (2022) to combine data from a variety of sources. Specifically, the method uses forestry emissions estimated using the IPCC tier 1 methodology, which relies on coarse, non-country specific emissions factors. These data are combined with Grassi et al. (2022) country-level estimates of deforestation (including tropical forest fires), organic soils, other fluxes, and non-tropical forest fires. This methodology is consistent across all countries but may not be well matched to country-specific estimates, specifically non-Annex 1 countries.  To provide the most recent estimates for combustion and industrial processes, EDGAR uses a “Fast-Track” approach to extrapolate emissions to the most recent year. As such, the most recent GHG estimates are usually subject to adjustment, but year-to-year variations have historically been only to within +/- 2 percent. The Fast-Track approach, explained in detail in Crippa et al. (2023), uses emissions data by fuel type from Energy Institute to extrapolate GHG estimates, assuming the same sectoral composition from two years’ prior observed in the last year of IEA’s energy balance statistics. For agriculture emissions, USGS data are used to extend the FAOSTAT statistics. For sectors with lower contributions to GHG, extrapolation is based on relative trends of proxy data. The indicated level of accuracy for Fast-Tracked data is lower than that derived from more robust activity data (such as IEA or FAO), which is within +/- 0.5 percent.  For national-level emissions, the same EDGAR non-LULUCF emissions method described above is used. However, to provide better consistency with national circumstances, LULUCF estimates from Grassi et al. (2023) are used. These estimates are based on country reported information on forestry management and emissions. Presently these data are available only through 2020 and do not include the fires subcategory of emissions. As a result of this current omission of fire emissions estimates, the summation of emissions across all countries using the country-level data will be modestly lower than the global emissions from the regional and global dataset—about 4 percent for 2020. Note that there is an estimated data update for later in 2024 to bring all data up to 2022 and keep them updated at the same schedule as the main EDGAR data. | |
| **Method of calculation**  (Disaggregation) | ***If any of the boxes under the disaggregation section were checked, please provide a brief explanation of the method of disaggregation employed (e.g., if data are sex-disaggregated, are reported figures based on an enumeration or estimation of observations in this stratum).***  For non-LULUCF sectors, data from EDGAR are provided at the national, regional, and global level, disaggregated by 37 subsectors and by GHG. For the WB indicator, we aggregate the data to a more concise set of 10 subsectors for energy, industry, waste, and agriculture as shown in the table below.  For LULUCF sectors, EDGAR and Grassi et al. (2023) provide data disaggregated for five subsectors. The sectors are forest lands, deforestation, organic soils, other land (uses), and fires (non-tropical). The table below shows the EDGAR and Grassi et al. sectors and mapping to the sectors used for the WB indicator.  For all results, data are available at the following spatial aggregations—country, regional, income class, and global—and by sector and gas.   |  |  |  |  | | --- | --- | --- | --- | | **IPCC Code (2006)** | **EDGAR Sector** | **Indicator Sector** | **Indicator Subsector** | | 1.A.1.a | Main Activity Electricity and Heat Production | Energy | En - Electricity/Heat | | 1.A.1.bc | Petroleum Refining - Manufacture of Solid Fuels and Other Energy Industries | En - Fugitive Emissions | | 1.A.2 | Manufacturing Industries and Construction | En - Manufacturing/ Construction | | 1.A.3.a | Civil Aviation | En - Transportation | | 1.A.3.b\_noRES | Road Transportation no resuspension | En - Transportation | | 1.A.3.c | Railways | En - Transportation | | 1.A.3.d | Water-borne Navigation | En - Transportation | | 1.A.3.e | Other Transportation | En - Transportation | | 1.A.4 | Residential and other sectors | En - Building | | 1.A.5 | Non-Specified | En - Building | | 1.B.1 | Solid Fuels | En - Fugitive Emissions | | 1.B.2 | Oil and Natural Gas | En - Fugitive Emissions | | 2.A.1 | Cement production | Industrial Processes |  | | 2.A.2 | Lime production | | 2.A.3 | Glass Production | | 2.A.4 | Other Process Uses of Carbonates | | 2.B | Chemical Industry | | 2.C | Metal Industry | | 2.D | Non-Energy Products from Fuels and Solvent Use | | 2.E | Electronics Industry | | 2.F | Product Uses as Substitutes for Ozone Depleting Substances | | 2.G | Other Product Manufacture and Use | | 3.A.1 | Enteric Fermentation | Agriculture | Ag - Livestock | | 3.A.2 | Manure Management | Ag - Livestock | | 3.C.1 | Emissions from biomass burning | Ag - crops | | 3.C.2 | Liming | Ag - crops | | 3.C.3 | Urea application | Ag - crops | | 3.C.4 | Direct N2O Emissions from managed soils | Ag - crops | | 3.C.5 | Indirect N2O Emissions from managed soils | Ag - crops | | 3.C.6 | Indirect N2O Emissions from manure management | Ag - crops | | 3.C.7 | Rice cultivations | Ag - crops | | 4.A | Solid Waste Disposal | Waste | Waste - Solid Waste | | 4.B | Biological Treatment of Solid Waste | Waste - Solid Waste | | 4.C | Incineration and Open Burning of Waste | Waste - Solid Waste | | 4.D | Wastewater Treatment and Discharge | Waste - Wastewater Treatment | | 5.A | Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3 | Industrial Processes |  | | 5.B | Fossil fuel fires | Energy | En - Fugitive Emissions | |  | | | | | **EDGAR LULUCF – regional level** | | | | |  | Deforestation | Land-Use Change and Forestry | LULUCF - Deforestation | |  | Forest Land | LULUCF - Forest Land | |  | Organic Soil | LULUCF - Organic Soil | |  | Other Land | LULUCF - Other Land | |  | Fires | LULUCF - Fires | |  | | | | | **EDGAR LULUCF – national level** | | | | |  | Deforestation | Land-Use Change and Forestry | LULUCF - Deforestation | |  | Forest Land | LULUCF - Forest Land | |  | Organic Soils | LULUCF - Organic Soil | |  | Other Land Uses | LULUCF - Other Land | |  | Fires | Not included in Grassi et al. (2023) | | | |

# References

Crippa, M., Guizzardi, D., Pagani, F., Banja, M., Muntean, M., Schaaf E., Becker, W., Monforti-Ferrario, F., Quadrelli, R., Risquez Martin, A., Taghavi-Moharamli, P., Köykkä, J., Grassi, G., Rossi, S., Brandao De Melo, J., Oom, D., Branco, A., San-Miguel, J., Vignati, E., GHG emissions of all world countries, Publications Office of the European Union, Luxembourg, doi:10.2760/953332, JRC134504, 2023.

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2. The non-agricultural emissions data are available from the EDGAR GHG emissions file available at https://edgar.jrc.ec.europa.eu/report\_2023. [↑](#footnote-ref-3)
3. The agricultural emissions data are available from the most recent version of EDGAR, v8.0, and are available at <https://edgar.jrc.ec.europa.eu/dataset_ghg80>. Note that this dataset does not include LULUCF emissions. [↑](#footnote-ref-4)
4. National level LULUCF emissions estimates were obtained from the *National inventories LULUCF data 2000-2020 (Dec 2022).xlsx* file available at https://zenodo.org/records/7650360. [↑](#footnote-ref-5)