Supplemental Information for
Energy-related CO_2 Emission Accounts and Datasets for 40 Emerging Economies in 2010 - 2019

Can Cui[1], Shuping Li[2], Weichen Zhao[3], Binyuan Liu[4], Yuli Shan[5], Dabo Guan[1,3]

[1]Department of Earth System Science, Tsinghua University, Beijing, 100084, China

[2]Institute of Blue and Green Development, Shandong University, Weihai, 264209, China

[3]The Bartlett School of Sustainable Construction, University College London, London, UK

[4]Integrated Research on Energy, Environment and Society (IREES), Energy and Sustainability Research Institute Groningen, University of Groningen, Groningen 9747 AG, the Netherlands

[5]School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham B15 2TT, UK

Correspondence to: Dabo Guan (guandabo@tsinghua.edu.cn)

This file includes 10 tables and 3 figures as follows:

Table S 1 Country-specific data sources of the dataset.

Table S 2 Comparison of CO_2 emissions data from major institutes

Table S 3 Countries covered in this Dataset

Table S 4 Sector classification of CEADS dataset for 40 emerging economies.

Table S 5 Eight energy groups and the sourced energy type from original energy balances.

Table S 6 Countries and years for data correction

Table S 7 Country groups (CGs) by activity volume data sources

Table S 8 Sector groups (SGs) by uncertainty level of activity volume data

Table S 9 Uncertainty level of activity volume data by country groups (CGs) and sector groups (SGs)

Table S 10 Comparison of CO_2 emissions data from different institutes. Unit: Mt.

Figure S 1 Probability distribution of emission factor uncertainty by energy types

Figure S 2 Comparison of this dataset (CEADs with and without biomass) and IEA, EDGAR, and GCB.

Figure S 3 Data uncertainty for 40 countries by sector. Colors show the 17 sectors and sizes of point show the uncertainty of emissions.

1. Data sources

Table S 1 Country-specific data sources of the dataset.

Country	Data type	Source	Website
Argentina	Energy balance sheets	National Institute of Statistics and Censuses	www.argentina.gob.ar/economia/energia/hidrocarbu ros/balances-energeticos
	Emission factors	IPCC	www.iea.org/areas-of-work/global-engagement/china?language=zh
	Sectoral mapping indicators	National Institute of Statistics and Censuses	www.indec.gob.ar/indec/web/Nivel3-Tema-3-9
	National to regional downscaling indicators	National Institute of Statistics and Censuses	www.indec.gob.ar/indec/web/Nivel4-Tema-3-9-138
Bolivia	Energy balance sheets	Ministry of Hydrocarbons and Energy	https://www.hidrocarburos.gob.bo/
	Emission factors	IPCC	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	National to regional downscaling indicators	National Institute of Statistics	https://www.ine.gob.bo/
Brazil	Energy balance sheets	Brazilian Institute of Geography and Statistics	www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicaca o-377/topico-494/BEN%202019%20Completo%20WEB.pdf
	Emission factors	IPCC	www.iea.org/areas-of-work/global-engagement
	Sectoral mapping indicators	Brazilian Institute of Geography and Statistics	www.ibge.gov.br/en/statistics/social/population/183 91-2010-population-census.html?edicao=19720&t=series-historicas
	National to regional downscaling indicators	Brazilian Institute of Geography and Statistics	www.ibge.gov.br/en/statistics/economic/national-accounts/16855-regional-accounts-of-brazil.html?=&t=o-que-e
Cambodia	Energy balance sheets	ERIA	www.eria.org/RPR_FY2015_No.8_Chapter_2.pdf
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	ADB	https://data.adb.org/dataset/cambodia-input-output-economic-indicators
Chile	Energy balance sheets	National Energy Commission	http://energiaabierta.cl/visualizaciones/balance-de-energia/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	National to regional downscaling indicators	National Statistics Office	www.ine.cl/estadisticas/
Colombia	Energy balance sheets	Colombian National Mining and Energy Planning Unit	https://www1.upme.gov.co/InformacionCifras/Pagin as/BECOCONSULTA.aspx
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	National to regional downscaling indicators	National Department of Statistics	https://dane.maps.arcgis.com/apps/MapSeries/index. html?appid=9d091f802200470d816eb1f063aa6aee
Djibouti	Energy balance sheets	AFREC Africa Energy Database	https://au-afrec.org/bk-keyafrica-en.php

	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: International Trade Statistics Yearbook	https://comtrade.un.org/
Ecuador	Energy balance sheets	Ministry of Energy and Non-renewable Natural Resources, Ecuador	https://www.recursosyenergia.gob.ec/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	National to regional downscaling indicators	Central Bank of Ecuador	www.ecuadorencifras.gob.ec/cuentas-economicas/
Ethiopia	Energy balance sheets	The Ministry of Water Resources, Irrigation and Energy of Ethiopia	www.csa.gov.et/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	CEADs	www.ceads.net/
		Ministry of Employment of Ethiopia	www.csa.gov.et/
Ghana	Energy balance sheets	Ghana Ministry of Energy	www.energycom.gov.gh/files
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	CEADs	www.ceads.net/
	Nation-to-region downscaling indicator	Ghana Statistical Service	statsghana.gov.gh
Guatemala	Energy balance sheets	Guatemalan Ministry of Energy and Mines	https://mem.gob.gt/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	National to regional downscaling indicators	National Institute of Statistics	www.ine.gob.gt/ine/portal-estadistico-1-0/
India	Energy balance sheet	National Bureau of Statistics	http://mospi.gov.in/
	Emission factor	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Departmental match index	Bureau of Statistics of India - Industry Survey Data	www.csoisw.gov.in/CMS/cms/Home.aspx
	Country-to-region downscaling index	Indian Energy Statistics Yearbook GHG Platform India	http://mospi.nic.in/statistical-year-book-india/2018/185 www.ghgplatform-india.org/economy-wide
Indonesia	Energy balance sheet	BPS	www.bps.go.id/
	Emission factor	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Departmental match index	Added value, CEIC database	www.ceicdata.com/zh-hans/products/global-economic-database
	Country-to-region downscaling index	Added value, CEIC database	www.ceicdata.com/zh-hans/products/global-economic-database
Jamaica	Energy balance sheets	Statistical Institute of Jamaica	www.mset.gov.jm/document-category/energy-balances/
	Emission factors	IEA	https://www.iea.org/areas-of-work/global-engagement/china?language=zh
	Sectoral mapping indicators	Statistical Institute of Jamaica	https://statinja.gov.jm/BusinessStatistics.aspx
	National to regional downscaling indicators	Statistical Institute of Jamaica	https://statinja.gov.jm/BusinessStatistics.aspx

Jordan	Energy balance sheet	Ministry of Energy and Mineral Resources	www.memr.gov.jo/Default/Ar
	Emission factor	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Departmental match index	Jordanian Bureau of Statistics (Industry Department)	http://jorinfo.dos.gov.jo/Databank/pxweb/ar/DOS_Database/START__10__1001__1101/FIN_T1/
		Jordanian Bureau of Statistics (Agriculture, Services and Construction)	http://jorinfo.dos.gov.jo/Databank/pxweb/ar/NationalAccount/
Kenya	Energy balance sheets	UNSD	https://unstats.un.org/unsd/energystats/pubs/balance/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Kenya National Bureau of Statistics	www.knbs.or.ke/
	Nation-to-region downscaling indicator	Kenya National Bureau of Statistics: GDP	www.knbs.or.ke/
Laos	Energy balance sheet	ERIA	www.eria.org/publications/energy-demand-and-supply-of-the-lao-peoples-democratic-republic-2010-2018/
	Emission factor	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Departmental match index	Lao Statistics Bureau: GDP	https://laosis.lsb.gov.la/tblInfo/TblInfoList.do
Mongolia	Energy balance sheet	National Statistical Office of Mongolia	www.1212.mn/Stat.aspx?LIST_ID=976_L11&type=tables
	Emission factor	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Departmental match index	Industry and construction industry-industrial sales and production	www.1212.mn/Stat.aspx?LIST_ID=976_L11&type=tables
		Family	www.1212.mn/Stat.aspx?LIST_ID=976_L03&type=tables
	Country-to-region downscaling index	Ulaanbaatar Bureau of Statistics	http://ubstat.mn/Statistics
		Orkhon Statistics Bureau	https://orkhon.nso.mn/page/614
		Bureau of Statistics of Dar Khan Ul Province	https://darkhan-uul.nso.mn/page/1298
		Khentii Provincial Bureau of Statistics	www.khentii.nso.mn/page/1132
		Statistics Bureau of Kusugul Province	https://khuvsgul.nso.mn/page/726
		Kobdo Statistics Office	https://khovd.nso.mn/page/651
		Statistics Bureau of Ubusu Province	https://uvs.nso.mn/page/156
		Central Provincial Bureau of Statistics	https://tuv.nso.mn/page/919
		Statistics Bureau of Selenga Province	https://selenge.nso.mn/page/778
		Sukhbaatar Provincial Statistics Bureau	https://sukhbaatar.nso.mn/page/295
		South Gobi Statistics Bureau	https://umnugovi.nso.mn/page/1321
		Former Hang'ai Provincial Statistics Bureau	https://uvurkhangai.nso.mn/page/94
		Zabhan Provincial Statistics Bureau	https://zavkhan.nso.mn/page/637
		Statistics Bureau of Central Gobi Province	http://dundgovi.nso.mn/page/645
		Oriental Statistics Bureau	https://dornod.nso.mn/page/276
		Gobi Sumber Provincial Statistics Bureau	http://govisumber.nso.mn/page/674
		Statistics Bureau of Gobi Altai Province	https://govi-altai.nso.mn/page/1244
		Bureau of Statistics of Burgan Region	https://bulgan.nso.mn/page/853

		Statistics Bureau of Bayanhongor Province	http://bayankhongor.nso.mn/page/122
		Statistics Bureau of Bayan-Urga Province	https://bayan-ulgii.nso.mn/page/333
		Statistics Bureau of Houhangai Province	https://arkhangai.nso.mn/page/1359
		Statistics Bureau of East Gobi Province	https://dornogovi.nso.mn/
Myanmar	Energy balance sheets	ERIA	www.eria.org/publications/energy-demand-and-supply-of-the-republic-of-the-union-of-myanmar-2010-2017/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	ADB	https://data.adb.org/dataset/myanmar-key-indicators
Paraguay	Energy balance sheets	General Directorate of Statistics, Surveys and Censuses	www.dgeec.gov.py/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
Peru	Energy balance sheets	Peruvian National Environmental Information System	https://sinia.minam.gob.pe/
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	National to regional downscaling indicators	National Institute of Statistics and Informatics	https://www.inei.gob.pe/
South Africa	Energy balance sheets	Statistics South Africa	www.energy.gov.za/files/media/Energy_Balances.html
	Emission factors	IEA	www.iea.org/areas-of-work/global-engagement/china?language=zh
	Sectoral mapping indicators	Statistics South Africa	www.energy.gov.za/files/media/Energy_Balances.html
	Nation-to-region downscaling indicator	World Bank	https://datatopics.worldbank.org/world-development-indicators/
Tanzania	Energy balance sheets	AFREC	au-afrec.org
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade	UN Comtrade | International Trade Statistics Database
		Tanzania National Bureau of Statistics	www.nbs.go.tz/index.php/en/
	Nation-to-region downscaling indicator	Tanzania National Bureau of Statistics: regional GDP reports	www.nbs.go.tz
Thailand	Energy balance sheet	Ministry of Energy	www.dede.go.th/ewt_news.php?nid=47340
	Emission factor	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Departmental match index	ADB: GDP	https://data.adb.org/dataset/thailand-key-indicators
Uganda	Energy balance sheets	AFREC	https://au-afrec.org ;
		IRENA	www.irena.org/publications/2020/Jul/Renewable-energy-statistics-2020
		UNSD	https://unstats.un.org/unsd/energystats/pubs/yearbook/documents/2016eyb.pdf
		OAG	www.oag.com/analytics/traffic-analyser ; www.iea.org/

		IEA Secretariat	
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	CEADs	www.ceads.net/
	Nation-to-region downscaling indicator	Uganda Bureau of Statistics: population projections	www.ubos.org/explore-statistics/20/
Uruguay	Energy balance sheets	National Institute of Statistics	www.ine.gub.uy/inicio
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
Philippine	Energy balance sheets	Philippine Statistics Authority	https://psa.gov.ph/sites/default/files/attachments/ird/specialrelease/Table%202.5%20Energy%20Balance%20Tables%2C%202010%20to%202019.xlsx
	Emission factors	IPCC	https://www.ipcc-nggip.iges.or.jp/efdb/
	Sectoral mapping indicators	UN Comtrade	https://comtrada.un.org
	Nation-to-region downscaling indicator	Philippine Statistics Authority	https://psa.gov.ph/people
Saudi Arabia	Energy balance sheets	Ministry of Energy	https://www.stats.gov.sa/en/1024
	Emission factors	IPCC	https://www.ipcc-nggip.iges.or.jp/efdb/
	Sectoral mapping indicators	UN Comtrade: export data	https://comtrada.un.org
	Nation-to-region downscaling indicator	The General Authority for Statistics	https://database.stats.gov.sa/beta/dashboard/landing
Egypt	Energy balance sheets	Central Bureau of Statistics of Egypt	https://www.capmas.gov.eg/
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sector Matching Indicators	Central Statistical Office of Egypt (industrial sector)	https://www.capmas.gov.eg/
		Central Bureau of Statistics of Egypt (Agriculture, Services and Construction)	https://www.capmas.gov.eg/
Micronesia	Energy balance sheets	Federated States of Micronesia National Statistics Office - Secondary Energy Consumption	https://www.fsmstatistics.fm/environment/seea-experimental-energy-accounts/
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Federated States of Micronesia National Statistics Office - National GDP	https://www.fsmstatistics.fm/wp-content/uploads/2019/02/FSM-Experimental-Energy-Accounts.pdf
	Nation-to-region downscaling indicator	National Statistics Office of the Federated States of Micronesia - Gross Domestic Product by Region	https://www.fsmstatistics.fm/document-library/
Mauritius	Energy balance sheets	Mauritius Bureau of Statistics	https://statsmauritius.govmu.org/Pages/Statistics/By_Subject/Energy_Water/Arch_Energy-Water.aspx
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Mauritius Bureau of Statistics	https://statsmauritius.govmu.org/Pages/Statistics/By_Subject/Manufacturing/SB_Manufacturing.aspx
Morocco	Energy balance sheets	Higher Programme	https://www.hcp.ma/

	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Higher Programme	https://www.hcp.ma/
	Nation-to-region downscaling indicator	Higher Programme	https://www.hcp.ma/
Togo	Energy balance sheets	Togo Energy Information System	http://www.sie-togo.com/bilan-energetique/
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	National Institute of Statistics and Economic and Demographic Research of Togo (INSEED)	https://inseed.tg/comptes-nationaux/
	Nation-to-region downscaling indicator	Population in the five different economic regions of Togo	The population estimates are based on the (1) national population censuses and national estimates, and (2) total population estimates from World Development Indicators.
Nicaragua	Energy balance sheets	Ministry of Energy and Mines, Nicaragua	http://www.mem.gob.ni/
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	National Institute for Information Development of Nicaragua	https://www.inide.gob.ni/
Nigeria	Energy balance sheets	African Energy Commission	https://au-afrec.org/en/western-africa/nigeria https://www.giz.de/en/downloads/giz2015-en-nigerian-energy-sector.pdf
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Nigeria official statistics website (industry, public services, population)	https://nigeria.opendataforafrica.org/jlbfmme/selected-banking-sector-report-q3-2018
Niger	Energy balance sheets	African Energy Commission (AFREC)	https://au-afrec.org/en/energy-balances
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	China Carbon Accounting Database	https://www. ceads. net/
	Nation-to-region downscaling indicator	Niger Bureau of Statistics	https://www.stat-niger.org/wp-content/uploads/2020/06-TBS_2018.pdf
Algeria	Energy balance sheets	Ministry of Energy and Mines	http://www.energy.gov.dz/
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Algerian Institute of Statistics	https://www.ons.dz/
	Nation-to-region downscaling indicator	World Bank	https://www.citypopulation.de/en/algeria/
Liberia	Energy balance sheets	African Energy Commission	https://au-afrec.org/en/energy-balances
	Emission factors	Intergovernmental Panel on Climate Change (IPCC)	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	Liberia Data Portal	https://liberia.opendataforafrica.org/
Rwanda	Energy balance sheets	AFREC Africa Energy Database	https://au-afrec.org/en/energy-balances
	Emission factors	IPCC	www.ipcc-nggip.iges.or.jp/EFDB/

	Sectoral mapping indicators	National Bureau of Statistics	https://www.statistics.gov.rw/statistical-publications/subject/statistical-yearbook
Madagascar	Energy balance sheets	AFREC Africa Energy Database	https://au-afrec.org/en/energy-balances
	Emission factors	IPCC	https://www.ipcc-nggip.iges.or.jp/EFDB/
	Sectoral mapping indicators	National Bureau of Statistics	https://www.instat.mg/telechargements/publications-mensuelles/comptes-nationaux-annuels

Sectoral mapping indicators   National Bureau of Statistics   https://www.statistics.gov.rw/statistical-publications/subject/statistical-yearbook

Energy balance sheets   AFREC Africa Energy Database   https://au-afrec.org/en/energy-balances

Emission factors   IPCC   https://www.instat.mg/telechargements/publications-mensuelles/comptes-nationaux-annuels

2. Data overview

The datasets of CO_2 emissions from energy consumption (as the largest proportion of CO_2 emissions with world total emissions of 33.5 gigatons, over 90% in 2018[1]) from the datasets of IEA, CDIAC, and EDGAR all show a long time-series and wide coverage of countries, but coarse classifications of sectors, no subnational divisions, and broad energy types (see Table S 2).

Table S 2 Comparison of CO_2 emissions data from major institutes.

Dataset	Energy type	Sectors	Time-series	National or Subnational	Countries covered
IEA-CO_2 emission from fuel combustion(International Energy Agency, 2022)	3 (free); 8 (purchased)	8 (free); 26 (purchased)	1971-2019	National	190
EDGAR v6.0 - Fossil CO_2 emissions(Crippa et al., 2020, 2021)	NA	5 (FT); 35 (Full)	1970-2020 (FT); 1970-2018 (Full)	National	208
GCB-2021(Friedlingstein et al., 2022)	3	NA	1959-2020	National	141

Currently, this dataset covers 40 countries of year 2010-2019 (see Table S 3), in which 28 countries have subnational inventory.

Table S 3 Countries covered in this Dataset.

Country	Location	Development stage	Number of regions	Time span
Asia				
Cambodia	Southeast Asia	Least Developed Countries	-	2010-2019
Laos	Southeast Asia	Least Developed Countries, Landlocked Developing Countries	-	2010-2019
Myanmar	Southeast Asia	Least Developed Countries	-	2010-2019
India	South Asia	Developing Economies	33	2 007-2019
Philippines	Southeast Asia	Developing Economies	17	2 010-2019
Indonesia	Southeast Asia	Developing Economies	34	2010-2019
Mongolia	East Asia	Landlocked Developing Countries	22	2010-2019
Jordan	West Asia	Developing Economies	-	2010-2019
Thailand	Southeast Asia	Emerging Market Economies, Developing Economies	-	2010-2019
Saudi Arabia	West Asia	Developing Economies	13	2010-2019
Africa				
Madagascar	East Africa	Least Developed Countries	22	2010-2019
Liberia	West Africa	Least Developed Countries	-	2010-2019

Country	Region	Classification	Value	Period
Niger	West Africa	Least Developed Countries, Landlocked Developing Countries	8	2010-2019
Rwanda	East Africa	Least Developed Countries, Landlocked Developing Countries	-	2010-2019
Ethiopia	East Africa	Least Developed Countries, Landlocked Developing Countries	11	2010-2019
Uganda	East Africa	Least Developed Countries, Landlocked Developing Countries	135	2010-2019
Togo	West Africa	Least Developed Countries	5	2010-2019
Tanzania	East Africa	Least Developed Countries	23	2010-2019
Djibouti	East Africa	Least Developed Countries	-	2010-2019
Kenya	East Africa	Developing Economies	47	2010-2019
Nigeria	West Africa	Developing Economies	37	2010-2019
Ghana	East Africa	Developing Economies	16	2010-2019
Morocco	North Africa	Developing Economies	13	2010-2019
Algeria	North Africa	Developing Economies	48	2010-2019
Egypt	North Africa	Developing Economies	27	2010-2019
Mauritius	East Africa	Small Island Developing States	3	2010-2019
South Africa	South Africa	Developing Economies	9	2010-2019
Latin America				
Nicaragua	North America	Developing Economies	-	2010-2019
Bolivia	South America	Landlocked Developing Countries	9	2010-2019
Guatemala	North America	Developing Economies	22	2010-2019
Jamaica	North America	Small Island Developing States	-	2 010-2019
Paraguay	South America	Landlocked Developing Countries	-	2010-2019
Colombia	South America	Emerging Market Economies, Developing Economies	32	2010-2019
Ecuador	South America	Developing Economies	24	2010-2019
Peru	South America	Emerging Market Economies, Developing Economies	25	2010-2019
Brazil	South America	Emerging Market Economies, Developing Economies	26	2010-2019
Argentina	South America	Emerging Market Economies, Developing Economies	23	2010-2019
Chile	South America	Emerging Market Economies, Developing Economies	16	2010-2019
Uruguay	South America	Developing Economies	-	2010-2019
Oceania				
Micronesia		Small Island Developing States	4	2010-2019

2.1 Sector classification

The 47 sectors and the merged 17 sectors are listed in Table S 4.

Table S 4 Sector classification of CEADS dataset for 40 emerging economies.

No.	Sector (47)	Sector (17)
1	Agriculture, forestry, hunting, fishing and husbandry	Agriculture, forestry, hunting, fishing and husbandry
2	Coal Mining and Dressing	Coal Mining, Petroleum and Natural Gas Extraction
3	Petroleum and Natural Gas Extraction	
4	Ferrous Metals Mining and Dressing	Minerals Mining and Dressing
5	Nonferrous Metals Mining and Dressing	
6	Nonmetal Minerals Mining and Dressing	
7	Other Minerals Mining and Dressing	
8	Logging and Transport of Wood and Bamboo	Logging, Timber, Food, Beverage and Tobacco
9	Food Processing	
10	Food Production	
11	Beverage Production	
12	Tobacco Processing	
13	Timber Processing, Bamboo, Cane, Palm Fiber & Straw Products	
14	Furniture Manufacturing	
15	Textile Industry	Textile, Garments and Leather
16	Garments and Other Fiber Products	
17	Leather, Furs, Down and Related Products	
18	Papermaking and Paper Products	Papermaking, Printing and Cultural
19	Printing and Record Medium Reproduction	
20	Cultural, Educational and Sports Articles	
21	Petroleum Processing and Coking	Petroleum Processing, Raw Chemical, and Medical
22	Raw Chemical Materials and Chemical Products	
23	Medical and Pharmaceutical Products	
24	Chemical Fiber	
25	Rubber Products	Nonmetal Mineral Products
26	Plastic Products	
27	Nonmetal Mineral Products	
28	Smelting and Pressing of Ferrous Metals	Metal Smelting, Pressing and Products
29	Smelting and Pressing of Nonferrous Metals	
30	Metal Products	
31	Ordinary Machinery	Ordinary, Special, Transportation, Electric, Electronic and Instrument Machinery
32	Equipment for Special Purposes	
33	Transportation Equipment	
34	Electric Equipment and Machinery	
35	Electronic and Telecommunications Equipment	
36	Instruments, Meters, Cultural and Office Machinery	
37	Other Manufacturing Industry	Other Manufacturing and Waste
38	Scrap and waste	
39	Production and Supply of Electric Power, Steam and Hot Water	Production of Electricity, Heat, Gas and Tap Water

40	Production and Supply of Gas	
41	Production and Supply of Tap Water	
42	Construction	Construction
43	Transportation, Storage, Post and Telecommunication Services	Transportation, Storage, Post and Telecommunication Services
44	Wholesale, Retail Trade and Catering Services	Wholesale, Retail Trade and Catering Services
45	Other Services	Other Services
46	Urban	Residential
47	Rural	

2.2 Energy groups

The 8 energy groups and the sourced energy types from original energy balances are listed in Table S 5. The "other" descriptions are different among countries, and the precise meanings of them can be referred to the sourced data.

Table S 5 Eight energy groups and the sourced energy type from original energy balances.

Energy groups	Original energy types		
Biomass	Agricultural waste	Etanol	Paddy husk renewable energy
	Agricultural waste renewable energy	Ethanol	Paddy husk traditional renewable energy
	Agricultural waste traditional renewable energy	Firewood	Pelleted wood
	Animal droppings	Firewood, wood and agricultural waste	Primary biomass energy
	Animal waste	Fuel wood	Primary solid biofuels
	Bagasse	Fuel wood renewable energy	Productos de cana
	Bagazo	Fuel wood traditional renewable energy	Products cane
	Bagazo de caña	Fuel wood, in logs, in billets, in twigs , in faggots or in similar forms	Pure bio jet kerosene
	Baggase agro residues	Fuelwood	Pure biodiesels
	Bio diesel	Fuelwood commercial	Pure biogasoline
	Bio fuel	Incineration of non-renewable waste	Recovery/ waste
	Bio jet kerosene	Industrial and municipal waste	Residue vegetable
	Bio mass	Industrial waste	Residue vegetables
	Biochemical fuel	Industrial waste non-renewable	Sawdust and wood waste
	Biodieasel	Industrial wastes	Sewage sludge gas
	Biodiesel	Landfill gas	Solid biofuels
	Biodiesels	Lena	Solid biomass and animal products
	Bioethanol	Liquid biofuels	Straw
	Biofuels	Liquid fuels from biomass	Sugar cane bagasse
	Biofuels and waste	Msw	Sugar cane juice
	Biogas	Municipal waste for heating	Sugar-cane products
	Biogas and liquid biofuel bioethanol	Municipal waste non-renewable	Total re vege
	Biogases	Municipal waste renewable	Used rubber tyres and other rubber products
	Biogasoline	Municipal wastes	Waste
	Biomass	Non-renewable municipal waste	Wastes non renewable
	Biomass and other	Non-renewable waste	Wastes or scraps
	Biomass energy	Non-specified primary biofuels and waste	Wood
	Biomass waste	Other biogas	Wood briquettes
	Bkb brown coal briquettes	Other biomass	Wood charcoal
	Black liquor and residual gas	Other liquid biofuels	Wood chips
	Blended biodiesels	Other non-energy products	Wood chips and waste
	Blended biogasoline	Other primary sources	Wood coal

	Bogas electric power produced by biogas power plants	Other renewables	Wood waste
	Briquettes, pellets and wood residues	Other solid biofuels unspecified	Wood wastes
	Cana bagasse	Other solid fuel	
	Cascarilla de arroz	Other vegetal and agricultural waste	
	Cascarilla de café	Otra biomasa	
	Cascarilla de maní	Otras biomasas	
	Charcoal	Otras primary	
	Comb. Vegetables	Paddy husk	
Coal	Anthracite	Coke and semi-coke of coal	Other bit. Coal
	Artificial coke gas	Coke gas	Other bituminous coal
	Bet coke	Coke oven coke	Other coal
	Bfg	Coke oven gas	Other coking products
	Bituminous	Coking coal	Other gas
	Bkb	Consentrate of coal	Other lignite
	Blast furnace gas	Coqe	Other recovered gases
	Briguettes, pellets of lignite	Derived gas	Other washed coal
	Briquette and pellets	Derived gases	Patent fuel
	Briquettes	Gas coke	Patent fuels
	Briquettes and cokes	Gas manufactured from coal	Peat briquettes
	Briquettes and other coal	Gas works gas	Pet coke
	Briquettes, pellets and wood residues	Hard coal	Petcoke
	Bronw coal	Hard coal and lignite	Primary coal and peat
	Brown coal	Hard coal briquettes	Primary ngls
	Brown coal briquettes	Hard coal, brown coal and peat	Raw coal
	Carbon	Hard coal, lignite and peat	Residual coal
	Cleaned coal	Heating and othergas oil	Running gas
	Coal	Jet fuels	Secondary solid fuel coke, coal and peat briquettes, charcoal, peat pellets
	Coal and coal products	Kerosene and aerokerosene	Solid fossil
	Coal and coke	Krabi	Solid fossil fuels
	Coal and peat	L coke	Solid fuel
	Coal and peat products	Lignit	Solid fuels
	Coal coke	Lignite	Steam coal
	Coal fuels	Lignite briquettes bkb	Stone coal of coke
	Coal products	Lignite/brown coal	Stone coal of energy
	Coal products and peat products produits de charbon et de tourbe	Maemoh	Stone coal of energy with high ash
	Coal tar	Manufactured gases	Sub-bituminous coal
	Coke	Metallurgical coal	Tar
	Coke and semi - coke of coal	Mineral carbon	Tar, benzol
	Coke and semi-coke	Mineral coke	
	Additives/blending components	Crude oil, feedstocks and additives for refinery1	Gasohol

Crude, NGL, Ref Feeds.	Anhydrous and hydrated ethyl alcohol	Crude oil, other inputs to refineries	Raw oil
	Asphalt	Crude oil, otherinputs to refineries	Reconstituted crude
	Crude oil	Crude oiland ngl	Reconstituted crude oil
	Crude oil including gas condensate	Crude petroleum and condensate	Reduced crude
	Crude oil reduction	Feed stock	Refinery feedstocks
	Crude oil refineries	Feedstocks	Vegetable alcohols
	Crude oil	Fuel alcohol	
Natural gas	Atfandav gas	Gas natural	N.g
	Combustible natural gas	Gaseous fuel	Natural gas
	Compressed natural gas metane	Gases	Natural gas liquids
	Current gas	High-methane natural gas	Natural gasoline
	Ethane	Imports gas	Ngl
	Gas	Iquidos de gas natural	Nitrified natural gas
	Gas condensate	Lean gas	Produced gas
	Gas dis.	Manufactured and recovered gases	Sale gas
	Gas distributed by networks	Methane	Well natural gas
	Gas ind.	N. Gas	
Oil products	All oil products	Heavy oil products	Oil bitumen
	Artificial gas	Heavy petroleum products	Oil distilation products
	Asphaltite	Heavy petroleum products transport diesel, fuel oil, light heating oil	Oil easy distille
	Asphated	Household boiler fuel	Oil easy distille r
	Associated petroleum gas	Illumina ting kerosene	Oil easy distiller
	Auto mobile gasoline	Illuminating kerosene	Oil product
	Automotive diesel oil	Jet a-1	Oil production
	Avia tion gasoline	Jet fuel	Oil products
	Aviation fuel	Jet fuel kerosene	Oil shale and oil sands
	Aviation gasoline	Jet fuel of gasoline type	Oil\r\nproducts
	Aviation kerosene	Jet fuel of kerosene type	Oils
	Base oil	Jet fuel/kerosene	Orim
	Bitumen	Jet kerosene	Orimulsion and shale oil
	Bitumin	Ker	Other diesel oil
	Bituminous coal	Kero / jet fuel	Other energy oil and gas
	Blended bio jet kerosene	Kerosene	Other gas oils n.e.c
	Blended biodiesel	Kerosene and jet fuel	Other gasoline
	Boi diesel	Kerosene and turbo	Other kerosene
	Boi gas	Kerosene aviation	Other nonenergy
	Bunker fuel	Kerosene fuel	Other oil
	By products	Kerosene type jet fuel	Other oil products
	Coke oven gas and blast furnace gas	Kerosene type jet fuel e0cl. Biofuels	Other oil secondaries
	Combustible gas	Kerosene type jet fuel excl. Biofuels	Other oils n.e.c.
	Condensate	Kerosene,aviation fuels	Other petro products
	Condensed oil and natural gasoline	Kerosene/ jetfuel	Other petrolem products
	Crude oil and ngl	Kerosene-av jet	Other petroleum

Crudeoil	Kerosenes, jet fuels	Other petroleum and gas products
Denatured alcohol	Kerosene-type jet fuel excluding biofuel portion	Other petroleum products
Diesel	L.p.g	Other petroleum products petroleum coke, bitumen, lubricants, sulphur, paraffin, waxes
Diesel b5	L91	Other petroleum products
Diesel fuel	L95	Other primaries
Diesel oil	Light dies el oil	Other products
Diesel oil + gas oil	Light diesel oil	Other products petro, energy
Diesel oil oven fuel inclusive	Light fuel oil	Other secondary petroleum
Diesel oil	Light fuel oil and diesel	Other types of kerosene
Dieselhdo+ldo	Light oil products	Otros pro ductos de petroleo y gas
Do	Light petroleum products	Paraffin
Doil	Light petroleum products motor gasoline	Paraffin wax
Dry gas	Liquefied and refinery not liquefied gases	Paraffin waxes
E20 ron 95	Liquefied gas	Paraffins
E85	Liquefied hydrocarbon	Petro resid
Fat	Liquefied petroleum gas	Petrol
Fats	Liquefied petroleum gas lpg	Petrol type jet fuel
Fg	Liquefied petroleum gases	Petrol/motor spirit
Fo	Liquefied petroleum gases lpg	Petroleo
Fuel	Liquefied petroleum gases	Petroleum
Fuel oil	Liquefied petroleum gaseslpg	Petroleum coke
Fuel oil with low sulfur content <1%	Liquefied propane and butane	Petroleum coke
Fuel oils n.e.c.	Liquid gas	Petroleum condensate and natural gasoline
Gas de refineria	Lpg	Petroleum d.i.
Gas from oil refineries	Lpg and refinery gas	Petroleum gases and other
Gas licuado de petroleo	Lpg, refinery gas, ethane	Petroleum liquid gas
Gas oil	Lsd	Petroleum product, total
Gas oil and diesel oil excluding biofuel portion	Lubricants	Petroleum products
Gas produced by distillation at refineries	Lubricating greases	Premium and regular gasoline
Gas refinery	Lubricating oil and grease	Premium gasoline
Gas/desiel oil	Lubricating oils	Primary oil
Gas/diesel	Lubrication oils	Propane
Gas/diesel oil excl. Biofuels	Marine fuel	Purified gases including ethylene, propylene, butylenes, butadiene and other petroleum gases
Gaseousfuel	Methanol	Refiner oil products
Gasline	Motonafta total	Refinery gas
Gasoil	Motor	Residual fuel oil
Gasolene	Motor and aviation petrol	Residual heavy fuel oils
Gasolina	Motor gasoilne	Road diesel
Gasoline	Motor gasoline	Ron 91
Gasoline and naphtha	Motor gasoline e0cl. Biofuels	Ron 95

	Gasoline engine	Motor gasoline excl. Biofuels	Second petroleum
	Gasoline excluding aviation	Motor gasoline excluding biofuel portion	Special gasoline
	Gasoline type jet fuel	Motor spirit	Sugarcane products
	Gasoline,oil and other oil products	Motor spirit premium and regular	Super 91 gasoline
	Gasoline,oil and otheroil products	Naphta	Super gasoline
	Gasoline/alcohol	Naphtha	Turbine fuel
	Gasoline-type jet fuel	Naphtha and solvents	Turbo
	Gave. Oil	Navigation diesel oil	Turbo,aviation, jet fuel kerosene
	Gm+gv	Navigation fuel	Un-leaded petroleum
	Greased oil	Oil	Used oils
	Heating and other gas oil	Oil and gas condensate	White gasoline
	Heating and other gasoil	Oil and petroleum products	White spirit
	Heating oil	Oil and shale bitumen,tons	White spirit and sbp
	Heavy diesel oil	Oil and shale coke	White spirit and special boiling point industrial spirits
	Heavy fuel oil		
Oil shale & oil sands	Oil and shale bitumen	Oil shales	Shale oil heavy fraction
	Oil and shale coke	Shale oil	Shale oil light fraction
	Oil shale	Shale oil gas	Shale-distilling
Others	Additives and oxygenates excluding biofuel portion	Jeotermal	Solar heat
	Ambient heat heat pumps	Large hydro power	Solar other
	Derived energy	Modern renewablesbiogas,solar,wind,and off-grid micro and mini hydro	Solar photovoltaics
	Derived heat	Non-energy products	Solar pv
	Domestic heating fuel	Non-fossil electricity	Solar thermal
	Eolica	Non-fossil heat	Solar, wind, others
	Ge	Nuclear	Solidfuel
	Geo heat and other heat	Nuclear energy	Thermal
	Geoe	Nuclear heat	Thermal energy
	Geoenergy	Nuclear, hydro, wind, geothermal energy, solar and energy from chemikal proceses	Thermal energy obtained from geothermal sources
	Geotherm., solar etc.	Of which: renewables	Thermal energy produced by the use of biomass
	Geothermal	Other heat	Thermal energy received from solar radiation
	Geothermal and solar	Other hydrocarbons	Tide, wave and ocean
	Geothermal energy	Otras fuentes secunda-rias	Tide, wave, ocean
	Geothermal heat	Paddy husk renewable energy	Uranium
	Geothermal. Solar etc.	Photovoltaic	Uranium contained in uo2
	Hay.bit.artK	Renewable energy sources and wastes	Uranium u3o8
	He	Renewable municipal waste	Used rubber tyres and other rubber products
	Hidroenergia	Renewables	Water energy
	Hydraulic energy	Renewables and biofuels	Wind
	Hydric energy	Renewables and wastes	Wind and geothermal and solar pv
	Hydro	Renewables and wastes incl. Non-renewable wastes	Wind and otherand solar pv

	Hydro and wind energy	Small hydro power	Wind electric power produced by wind power plants
	Hydro electricity	Small otherpower	Wind electricity
	Hydro energy	Solar	Wind energy
	Hydro power	Solar electric power produced by solar power plants	Wind power
	Hydroelectric power	Solar electricity	Wind, solar, etc.
	Hydroenergy	Solar energy	Wind, water and biogas
	Hydropower	Solar etc	Windother sources electricity heat
	Hydropower produced by hydroelectric power plants		
Peat & Peat products	Briquette	Peat and wood	Pellets
	Milled peat	Peat briquette	Sod peat
	Peat	Peat briquettes and semi-briquettes	
	Peat and peat products	Peat products	

2.3 Uncertainty information supplement

In cases where the underlying statistics are temporarily missing or when there is a significant anomaly in the statistics compared to preceding and subsequent years, without any plausible explanation, carbon emissions are estimated using the following formula:

$$CE_{t1} = CE_{t0} \times (1 + agr)^{t1-t0}$$

where CE_{t1} represents the carbon emissions in the year of revision, CE_{t0} represents the emissions in the reference year. The parameter agr denotes the historical annual growth rate of CO_2 emissions. The emissions in the year of revision are thus estimated based on the emissions in the reference year. The table below displays the specific year of revision.

Table S 6 Countries and years for data correction.

Countries	Years of revision	Countries	Years of revision
Cambodia	2018, 2019	Morocco	2010
Djibouti	2017, 2018, 2019	Myanmar	2018, 2019
Egypt	2010, 2011, 2017, 2018, 2019	Nicaragua	2010, 2011, 2018, 2019
Ethiopia	2010, 2016, 2017, 2018, 2019	Nigeria	2019
Ghana	2010, 2011, 2012, 2013, 2014, 2015	Peru	2010, 2019
Jordan	2019	Rwanda	2019
Kenya	2010, 2011, 2016, 2017, 2018, 2019	Saudi Arabia	2010, 2011, 2012, 2013, 2014
Laos	2010, 2011, 2019	South Africa	2018, 2019
Liberia	2019	Tanzania	2017, 2018, 2019
Madagascar	2019	Thailand	2010, 2011, 2012
Micronesia	2015, 2016, 2017, 2018, 2019	Togo	2017, 2018, 2019
Mongolia	2019		

The distribution of activity level data and emission factor data by sector and energy type for each country and year is determined based on specific data sources, degree of missing data, and the IPCC National Greenhouse Gas Inventory Guidelines(Intergovernmental Panel on Climate Change (IPCC), 2006). Generally, countries with more complete statistical data have lower uncertainty in their activity level data, and energy-intensive sectors such as electricity and heavy industries have lower uncertainty in their activity levels. The uncertainties in activity levels for each country and sector are based on information shown in Table S 7, Table S 8 and Table S 9. As for emission factors, fossil fuel emission factors with higher commercialization have lower uncertainty (such as natural gas), while emission factors for energy sources with large differences in production regions and fuel types have higher uncertainty (such as coal and biomass energy). The uncertainty distributions of each emission factor are shown in Figure S 1.

Table S 7 Country groups (CGs) by activity volume data sources.

Country Group	Countries
CG1	Algeria; Argentina; Cambodia; Djibouti; Jamaica; Jordan; Kenya; Laos; Liberia; Madagascar; Micronesia; Myanmar; Nicaragua; Niger; Rwanda; Thailand; Uganda; Uruguay
CG2	Bolivia; Brazil; Chile; Colombia; Ecuador; Egypt; Ethiopia; Ghana; Guatemala; India; Indonesia; Mauritius; Mongolia; Morocco; Nigeria; Panama; Paraguay; Peru; Philippines; South Africa; Tanzania; Togo
CG3	Algeria; Argentina; Cambodia; Djibouti; Jamaica; Jordan; Kenya; Laos; Liberia; Madagascar; Myanmar; Nicaragua; Niger; Rwanda; Thailand; Uganda; Uruguay
CG4	Bolivia; Brazil; Chile; Colombia; Ecuador; Ethiopia; Ghana; Guatemala; Indonesia; Mauritius; Morocco; Nigeria; Panama; Paraguay; Peru; Philippines; Tanzania; Togo

Table S 8 Sector groups (SGs) by uncertainty level of activity volume data.

Sector Group	Sectors
SG1	Agriculture, forestry, hunting, fishing and husbandry; Construction; Logging, Timber, Food, Beverage and Tobacco; Ordinary, Special, Transportation, Electric, Electronic and Instrument Machinery; Other Manufacturing and Waste; Papermaking, Printing and Cultural; Textile, Garments and Leather
SG2	Coal Mining, Petroleum and Natural Gas Extraction; Metal Smelting, Pressing and Products; Minerals Mining and Dressing; Nonmetal Mineral Products; Petroleum Processing, Raw Chemical, and Medical
SG3	Other Services; Residential; Transportation, Storage, Post and Telecommunication Services; Wholesale, Retail Trade and Catering Services
SG4	Production of Electricity, Heat, Gas and Tap Water
SG5	Agriculture, forestry, hunting, fishing and husbandry; Construction; Logging, Timber, Food, Beverage and Tobacco; Ordinary, Special, Transportation, Electric, Electronic and Instrument Machinery; Other Manufacturing and Waste; Other Services; Papermaking, Printing and Cultural; Residential; Textile, Garments and Leather; Transportation, Storage, Post and Telecommunication Services; Wholesale, Retail Trade and Catering Services
SG6	Residential

Table S 9 Uncertainty level of activity volume data by country groups (CGs) and sector groups (SGs).

CG	SG	Uncertainty (statistics)	Uncertainty (estimated)
CG1	SG1	12.5%	17.5%
	SG2	2.5%	7.5%
	SG3	12.5%	20.0%
	SG4	1.5%	7.5%
CG2	SG5	4.0%	7.5%
	SG2	2.5%	4.0%
	SG4	1.0%	4.0%
CG3	SG6	45.0%	80.0%

| CG4 | SG6 | 20.0% | 30.0% |
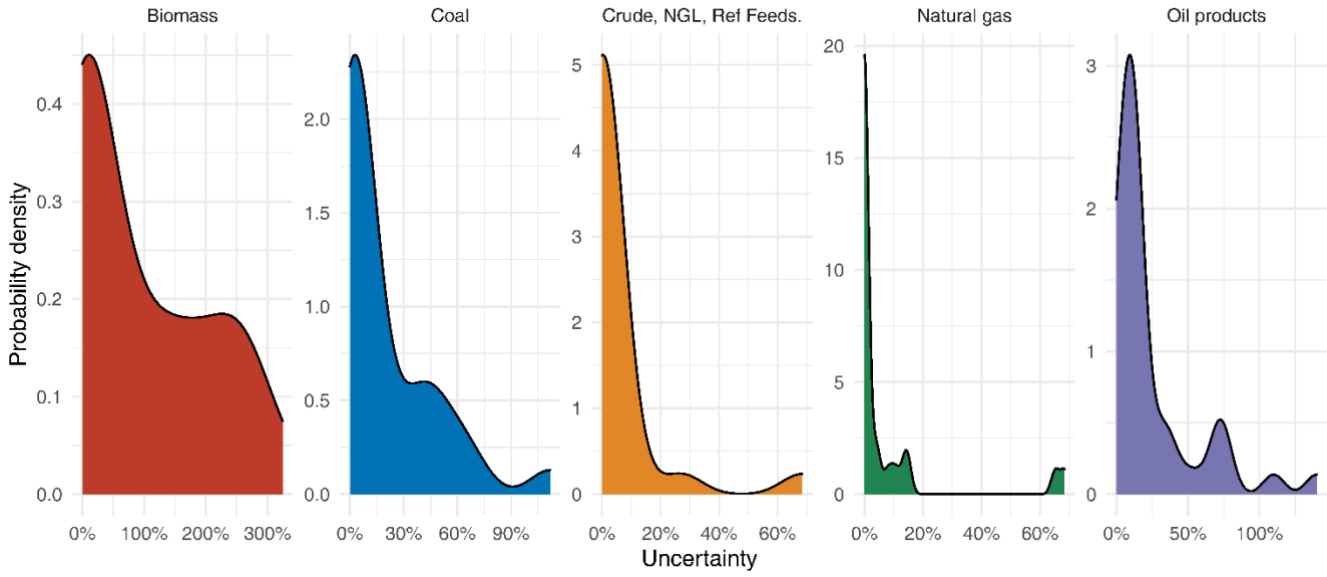
Figure S 1 Probability distribution of emission factor uncertainty by energy types.

3. Data verification

3.1 Data comparison among institutes

The CO_2 emissions data from CEADs (with and without biomass-related emissions) and other institutes are listed in Table S 10 and shown in Figure S 2.

Table S 10 Comparison of CO_2 emissions data from different institutes. Unit: Mt.

Country	Year	CEADs_withBiomass	CEADs_withoutBiomass	IEA	EDGAR	GCB
Algeria	2010	76.15	76.11	95.64	116.44	117.90
	2011	81.46	81.45	102.89	122.79	119.89
	2012	89.14	89.14	112.49	137.15	128.20
	2013	91.38	91.35	115.83	141.45	132.53
	2014	100.18	100.17	123.18	152.71	143.33
	2015	105.75	105.74	130.49	162.42	150.93
	2016	104.10	104.09	127.89	160.64	148.95
	2017	106.55	106.54	130.54	159.91	153.56
	2018	112.53	112.50	137.30	171.33	164.43
	2019	117.95	117.94	142.37	180.57	171.83
Argentina	2010	148.86	145.63	162.43	191.57	186.87
	2011	158.83	155.38	171.17	199.73	190.41
	2012	159.82	156.71	172.64	205.58	191.85
	2013	166.37	162.85	177.37	202.04	190.29
	2014	163.19	159.84	173.86	209.98	188.83
	2015	169.50	165.98	179.75	212.87	192.51
	2016	168.63	165.39	178.07	212.61	191.07
	2017	165.18	161.91	173.94	206.06	187.55
	2018	155.87	152.82	171.19	204.92	185.16
	2019	149.84	145.73	162.22	199.41	179.07
Bolivia	2010	15.97	15.97	14.07	14.83	14.65
	2011	17.00	17.00	15.44	16.15	16.05
	2012	16.99	16.99	16.24	17.93	18.13
	2013	18.50	18.50	17.46	18.11	18.44
	2014	19.78	19.78	19.00	19.56	19.63
	2015	20.04	20.04	19.29	19.61	19.44
	2016	21.52	21.52	20.52	21.67	20.71
	2017	22.11	22.11	21.27	23.71	21.83
	2018	22.64	22.64	21.74	24.17	22.36
	2019	19.33	19.33	20.85	24.51	22.59
Brazil	2010	476.83	360.28	374.44	446.57	411.54
	2011	494.05	378.47	392.76	467.29	430.27
	2012	527.00	410.54	426.04	502.86	460.43
	2013	577.30	439.23	457.51	526.85	495.41
	2014	608.81	453.59	481.64	552.84	524.28
	2015	593.18	431.58	457.61	521.46	495.57
	2016	559.27	395.91	421.78	488.17	478.79

	2017	579.74	406.57	433.26	497.27	484.94
	2018	567.18	384.64	411.35	479.97	466.99
	2019	608.08	416.77	410.99	478.15	466.05
Cambodia	2010	11.96	4.45	4.77	5.01	5.03
	2011	12.70	5.15	4.93	5.28	5.11
	2012	13.28	5.42	5.19	5.50	5.34
	2013	13.37	5.18	5.23	5.64	5.48
	2014	14.74	6.15	6.44	6.69	6.52
	2015	16.23	7.38	7.78	8.67	8.45
	2016	18.39	9.71	9.65	9.99	9.73
	2017	18.94	10.41	10.39	11.53	11.19
	2018	21.39	11.76	11.26	15.90	15.49
	2019	24.15	13.27	12.86	16.49	16.04
Chile	2010	74.09	74.09	68.60	72.05	71.38
	2011	82.28	82.28	75.32	78.65	78.14
	2012	86.84	86.84	77.24	80.83	79.76
	2013	85.93	85.93	81.86	85.12	81.75
	2014	82.79	82.79	75.47	78.99	77.48
	2015	86.95	86.95	81.09	84.70	81.69
	2016	91.34	91.34	85.25	88.96	84.21
	2017	92.84	92.84	86.14	89.86	84.12
	2018	92.95	92.95	85.73	91.54	85.89
	2019	91.25	91.25	90.50	89.89	84.33
Colombia	2010	90.97	73.39	58.58	66.72	76.33
	2011	88.19	71.07	63.22	72.34	76.14
	2012	92.83	76.09	63.02	72.80	79.79
	2013	95.80	79.55	70.61	78.11	90.05
	2014	99.72	83.80	72.48	80.13	91.02
	2015	98.66	83.78	73.22	80.09	86.13
	2016	101.21	86.82	76.32	89.04	100.87
	2017	88.69	75.53	68.83	77.53	91.74
	2018	93.70	80.53	72.43	77.99	92.30
	2019	95.21	82.96	74.88	86.55	102.28
Djibouti	2010	2.07	1.28	0.52	1.13	0.52
	2011	2.07	1.27	0.48	1.32	0.47
	2012	2.27	1.46	0.50	1.38	0.48
	2013	2.18	1.35	0.50	0.92	0.56
	2014	2.29	1.35	0.34	0.93	0.37
	2015	2.38	1.40	0.40	0.93	0.45
	2016	2.25	1.47	0.35	0.96	0.40
	2017	2.28	1.49	0.34	0.99	0.38
	2018	2.31	1.51	0.33	1.02	0.39
	2019	2.34	1.53	0.35	1.05	0.40
Ecuador	2010	33.09	31.54	31.58	37.91	34.85
	2011	34.89	33.37	32.06	38.57	37.43

	2012	36.30	34.87	33.30	38.86	37.18
	2013	39.13	37.74	35.66	40.58	39.39
	2014	40.95	39.55	37.40	43.84	43.24
	2015	34.73	33.44	37.18	42.76	40.67
	2016	38.77	37.50	35.54	40.92	39.53
	2017	35.91	34.67	34.38	39.68	39.27
	2018	39.38	38.18	36.24	41.83	41.85
	2019	33.28	32.13	35.35	40.70	40.57
Egypt	2010	200.81	200.81	176.92	212.30	198.95
	2011	203.83	203.83	182.79	220.21	211.19
	2012	206.89	206.89	189.23	234.16	210.51
	2013	205.61	205.61	189.37	230.03	207.02
	2014	208.67	208.67	193.35	234.62	222.10
	2015	216.89	216.89	199.54	240.10	219.46
	2016	221.99	221.99	203.31	246.95	233.69
	2017	225.32	225.32	216.24	254.29	250.42
	2018	228.71	228.71	222.84	255.80	251.64
	2019	232.14	232.14	225.48	255.37	246.82
Ethiopia	2010	130.71	6.53	5.84	6.91	6.34
	2011	134.86	6.74	6.74	8.02	7.41
	2012	139.39	7.66	7.12	9.03	8.12
	2013	143.65	8.38	8.33	10.40	9.79
	2014	148.24	9.40	10.24	12.61	12.03
	2015	152.81	10.55	9.99	13.61	12.70
	2016	157.66	10.88	11.75	15.76	14.44
	2017	162.67	11.23	12.33	17.27	15.60
	2018	167.83	11.58	13.64	17.95	16.20
	2019	173.16	11.95	14.76	18.25	16.27
Ghana	2010	20.67	10.59	10.34	11.42	9.72
	2011	21.57	11.05	10.73	12.28	11.23
	2012	22.51	11.53	12.79	14.70	14.33
	2013	23.49	12.03	13.71	15.58	14.19
	2014	24.52	12.56	13.11	15.13	14.77
	2015	25.58	13.10	14.03	15.90	16.13
	2016	26.70	13.67	14.21	14.92	16.56
	2017	28.13	14.89	14.90	16.15	13.83
	2018	30.23	16.38	16.79	16.24	14.49
	2019	30.34	16.39	18.15	16.84	14.97
Guatemala	2010	38.54	12.25	10.34	11.73	11.11
	2011	39.53	12.46	10.62	11.97	11.25
	2012	40.81	13.08	11.03	12.15	11.57
	2013	42.96	14.30	11.85	14.02	12.59
	2014	44.37	15.14	12.59	18.16	13.58
	2015	47.92	18.31	14.98	17.10	15.44
	2016	51.20	19.67	16.09	18.21	16.39

	2017	52.41	18.95	15.14	17.75	17.23
	2018	54.66	20.53	16.85	20.06	19.43
	2019	55.32	20.55	17.84	21.20	20.53
India	2010	1383.81	1383.81	1572.14	1761.40	1679.70
	2011	1284.65	1284.65	1662.62	1858.61	1767.36
	2012	1434.80	1434.80	1805.42	2000.84	1942.72
	2013	1638.19	1638.19	1861.15	2068.60	2034.88
	2014	1846.08	1846.08	2027.55	2235.92	2186.03
	2015	2098.36	2098.36	2036.12	2292.96	2255.07
	2016	2134.19	2134.19	2067.83	2321.80	2394.10
	2017	2290.67	2290.67	2196.40	2425.42	2458.64
	2018	2433.07	2433.07	2310.25	2556.55	2593.21
	2019	2328.44	2328.44	2309.98	2597.36	2617.72
Indonesia	2010	426.46	426.46	391.65	420.32	428.49
	2011	497.19	497.19	449.83	431.02	508.44
	2012	573.46	573.46	451.12	444.00	526.77
	2013	538.22	538.22	416.86	448.19	411.49
	2014	515.50	515.50	452.26	485.38	417.13
	2015	508.09	508.09	458.19	493.14	507.38
	2016	517.22	517.22	448.23	490.61	568.61
	2017	534.84	534.84	480.56	531.99	531.40
	2018	629.80	629.80	538.02	579.23	577.00
	2019	686.51	686.51	583.41	625.66	617.96
Jamaica	2010	8.49	7.25	7.15	7.45	7.68
	2011	10.61	9.65	7.21	7.69	8.26
	2012	7.99	7.08	6.62	7.25	7.92
	2013	8.37	7.43	7.04	7.75	8.50
	2014	8.30	7.19	6.78	7.55	7.68
	2015	10.25	9.21	6.67	7.41	7.94
	2016	10.45	9.80	7.18	7.94	8.15
	2017	7.48	6.90	6.86	7.28	7.80
	2018	9.30	8.67	8.29	7.49	8.02
	2019	7.91	7.66	8.06	7.44	8.02
Jordan	2016	20.22	20.22	23.15	25.86	24.01
	2017	20.00	20.00	24.39	27.62	25.49
	2018	22.05	22.05	22.99	27.06	24.94
	2019	22.63	22.63	22.84	28.34	26.09
	2013	24.19	24.19	22.34	24.11	23.83
	2014	24.53	24.53	24.02	25.83	25.91
	2015	24.39	24.39	23.74	25.70	25.29
	2010	25.85	25.85	18.79	20.61	20.63
	2011	23.68	23.68	19.76	21.08	21.26
	2012	24.16	24.16	22.71	24.49	23.83
Kenya	2010	54.30	10.28	11.21	13.21	11.75
	2011	56.51	10.70	11.32	13.51	12.94

	2012	58.81	11.13	10.36	12.63	12.00
	2013	77.46	11.97	12.13	14.07	12.78
	2014	84.98	13.59	12.87	14.91	13.78
	2015	76.39	16.01	14.75	16.98	16.31
	2016	79.50	16.66	16.51	18.71	17.16
	2017	82.73	17.33	16.60	18.83	16.54
	2018	86.10	18.04	15.31	19.51	17.15
	2019	89.60	18.77	20.10	19.81	17.33
Laos	2010	5.98	1.79	2.42	1.72	3.00
	2011	7.14	2.14	2.55	2.17	3.17
	2012	8.52	2.55	2.71	2.43	3.40
	2013	8.75	2.81	3.34	3.21	4.01
	2014	9.62	3.63	3.50	2.49	4.33
	2015	15.26	9.19	7.69	2.50	8.81
	2016	20.98	14.95	14.40	3.45	14.27
	2017	24.30	18.26	17.55	3.91	17.93
	2018	24.60	18.55	17.83	6.66	32.29
	2019	29.36	22.14	17.18	6.78	32.84
Liberia	2010	5.53	0.59	0.71	0.57	0.76
	2011	5.72	0.61	0.82	0.67	0.85
	2012	5.93	0.64	0.91	0.71	0.96
	2013	6.08	0.61	0.84	1.02	0.88
	2014	6.10	0.61	1.10	1.08	1.19
	2015	6.29	0.61	1.14	1.06	1.21
	2016	5.33	0.64	1.32	1.07	1.36
	2017	5.51	0.61	1.17	1.11	1.22
	2018	5.63	0.62	1.01	1.16	1.28
	2019	5.64	0.62	1.06	1.21	1.32
Madagascar	2010	15.98	1.89	1.81	2.20	1.94
	2011	16.13	2.04	2.12	3.02	2.38
	2012	16.27	2.36	2.65	3.33	2.74
	2013	17.02	2.56	2.84	3.89	3.15
	2014	18.56	3.82	2.95	3.82	3.10
	2015	20.12	3.91	3.23	3.82	3.52
	2016	18.54	2.58	3.12	3.93	3.36
	2017	23.56	4.06	3.40	4.07	3.89
	2018	25.81	5.45	3.27	4.39	4.19
	2019	27.24	5.75	4.04	4.20	4.02
Mauritius	2010	2.43	2.40	3.66	3.68	3.92
	2011	2.52	2.49	3.64	3.66	3.92
	2012	2.59	2.55	3.73	3.76	3.97
	2013	2.52	2.48	3.82	3.85	4.07
	2014	2.59	2.56	3.95	3.98	4.21
	2015	2.65	2.62	3.96	3.99	4.21
	2016	2.74	2.71	4.04	4.07	4.35

	2017	2.88	2.86	4.17	4.21	4.54
	2018	2.94	2.91	4.13	4.57	4.91
	2019	3.08	3.06	4.17	4.33	4.69
Micronesia	2010	0.15	0.15			
	2011	0.14	0.14			
	2012	0.15	0.15			
	2013	0.15	0.15			
	2014	0.16	0.16			
	2015	0.14	0.14			
	2016	0.17	0.17			
	2017	0.17	0.17			
	2018	0.17	0.17			
	2019	0.18	0.18			
Mongolia	2010	10.60	10.60	14.14	14.37	13.83
	2011	10.98	10.98	15.57	15.84	21.44
	2012	12.02	12.02	16.98	17.23	35.06
	2013	13.03	13.03	18.29	18.51	43.59
	2014	12.80	12.80	17.94	18.25	29.61
	2015	12.39	12.39	17.12	17.47	23.26
	2016	12.84	12.84	17.98	18.33	25.34
	2017	13.96	13.96	19.28	19.61	34.18
	2018	15.74	15.74	21.13	35.28	64.56
	2019	16.54	16.54	22.66	35.93	65.56
Morocco	2010	46.87	46.87	46.40	52.00	56.31
	2011	48.71	48.71	50.75	56.22	56.75
	2012	50.53	50.53	52.24	58.49	59.07
	2013	50.64	50.64	51.52	58.61	58.78
	2014	52.21	52.21	53.52	60.21	59.69
	2015	54.74	54.74	55.11	61.77	61.07
	2016	55.25	55.25	55.09	61.82	61.08
	2017	58.26	58.26	57.95	64.96	63.88
	2018	59.97	59.97	59.39	66.74	65.42
	2019	66.31	66.31	65.90	73.91	71.98
Myanmar	2010	49.06	12.39	7.93	8.57	13.09
	2011	52.45	13.16	8.49	8.77	15.08
	2012	51.62	12.02	11.62	12.39	11.90
	2013	55.56	12.88	13.17	14.82	12.95
	2014	62.61	17.28	16.54	21.19	16.18
	2015	64.17	22.56	18.66	25.32	22.09
	2016	61.34	21.24	20.90	28.86	25.49
	2017	66.45	29.69	30.40	43.07	23.69
	2018	75.28	33.64	31.35	46.87	26.11
	2019	85.30	38.11	35.13	48.31	26.25
Nicaragua	2010	4.48	4.01	4.28	4.67	4.47
	2011	4.61	4.12	4.49	4.85	4.81

	2012	4.74	4.24	4.45	4.82	4.55
	2013	4.58	4.07	4.22	4.67	4.35
	2014	4.86	4.34	4.49	4.93	4.60
	2015	5.28	4.78	5.00	5.57	5.25
	2016	5.50	4.93	5.11	5.63	5.45
	2017	5.46	4.89	5.13	5.67	5.38
	2018	5.62	5.04	4.76	5.67	5.38
	2019	5.78	5.18	4.88	5.86	5.55
Niger	2010	4.96	1.56	1.36	1.43	1.17
	2011	5.08	1.60	1.38	1.45	1.32
	2012	5.63	2.08	1.87	2.04	1.76
	2013	5.64	1.98	1.78	2.02	1.89
	2014	6.29	2.39	1.97	2.19	2.08
	2015	6.51	2.18	1.99	2.15	2.04
	2016	6.93	2.15	2.00	2.14	2.07
	2017	9.33	1.98	1.82	2.22	2.01
	2018	7.69	2.12	1.87	2.31	2.10
	2019	21.55	2.54	2.07	2.36	2.14
Nigeria	2010	840.78	47.60	56.90	90.52	112.40
	2011	932.45	50.29	66.47	95.18	129.66
	2012	1032.89	52.19	70.64	90.61	116.42
	2013	939.79	51.81	82.31	89.78	122.19
	2014	984.56	50.25	90.83	85.70	127.92
	2015	433.99	38.01	84.84	89.43	113.62
	2016	532.18	74.02	88.19	90.82	116.86
	2017	1011.22	78.36	86.36	94.14	130.37
	2018	1017.59	68.68	87.38	97.67	136.18
	2019	1041.49	70.29	92.02	100.22	140.13
Paraguay	2010	11.08	4.89	4.79	5.19	5.03
	2011	11.20	5.11	5.01	5.38	5.20
	2012	11.23	5.31	4.88	5.64	5.18
	2013	10.55	5.25	5.08	5.57	5.18
	2014	11.05	5.53	5.37	5.83	5.46
	2015	11.57	6.07	6.02	6.38	6.06
	2016	12.45	6.88	6.80	7.32	7.16
	2017	16.64	7.96	7.65	8.18	8.02
	2018	16.93	8.43	8.06	8.28	8.11
	2019	17.60	8.25	7.81	8.47	8.28
Peru	2010	50.79	41.71	41.54	45.28	57.19
	2011	52.02	42.72	44.92	48.39	48.99
	2012	54.05	45.03	44.09	48.95	54.20
	2013	54.30	45.56	45.18	49.81	42.96
	2014	55.67	46.87	48.12	53.05	49.09
	2015	57.01	48.32	49.53	54.12	48.73
	2016	61.31	52.46	52.20	56.30	52.40

	2017	61.45	50.85	49.76	53.99	52.53
	2018	61.66	51.31	50.05	55.81	54.25
	2019	65.66	52.43	52.21	56.29	54.57
Philippines	2010	65.80	65.80	75.76	87.36	83.01
	2011	65.88	65.88	76.34	87.17	83.80
	2012	67.72	67.72	78.74	92.38	88.47
	2013	74.42	74.42	87.54	100.75	95.86
	2014	78.99	78.99	93.36	107.64	101.26
	2015	86.02	86.02	101.48	116.51	112.22
	2016	94.92	94.92	112.06	127.79	122.33
	2017	103.80	103.80	123.29	139.96	134.62
	2018	107.93	107.93	128.40	144.64	139.03
	2019	113.32	113.32	135.25	150.64	144.37
Rwanda	2010	7.18	0.62	0.71	0.79	0.65
	2011	7.03	0.46	0.75	0.92	0.72
	2012	7.12	0.56	0.83	0.96	0.78
	2013	7.11	0.54	0.92	0.87	0.81
	2014	7.10	0.53	0.93	0.92	0.93
	2015	4.87	0.54	1.05	0.95	1.05
	2016	6.93	0.55	1.11	1.05	1.05
	2017	7.30	0.65	1.20	1.09	1.08
	2018	7.36	0.53	1.33	1.12	1.11
	2019	7.38	0.54	1.43	1.15	
Saudi Arabia	2010	667.11	667.11	418.24	478.17	518.09
	2011	590.78	590.78	434.34	499.30	498.02
	2012	542.35	542.35	463.38	531.10	563.59
	2013	513.92	513.92	471.16	541.27	541.20
	2014	487.30	487.30	506.94	577.99	602.33
	2015	500.24	500.24	531.39	604.00	645.88
	2016	484.67	484.67	527.79	600.93	566.16
	2017	459.71	459.71	516.62	608.85	579.84
	2018	393.75	393.75	491.74	605.31	577.18
	2019	371.69	371.69	495.15	614.61	582.57
South Africa	2010	391.33	391.33	420.29	465.00	467.27
	2011	366.59	366.59	404.69	445.93	474.29
	2012	373.25	373.25	422.29	461.81	461.47
	2013	418.83	418.83	432.21	473.04	456.20
	2014	397.84	397.84	443.19	484.59	482.24
	2015	363.66	363.66	419.55	477.75	451.92
	2016	387.51	387.51	419.89	476.50	460.38
	2017	366.76	366.76	430.01	481.71	466.44
	2018	363.37	363.37	428.28	487.54	472.34
	2019	360.02	360.02	433.57	494.86	478.96
Tanzania	2010	21.37	6.12	6.02	7.19	6.93
	2011	23.23	7.78	7.27	8.87	7.76

	2012	25.91	9.87	8.88	11.04	9.07
	2013	28.55	10.21	9.89	11.35	9.92
	2014	29.10	10.23	9.63	11.52	9.91
	2015	20.41	11.39	10.47	12.93	10.65
	2016	17.53	10.41	9.62	12.09	10.54
	2017	16.96	10.07	10.21	12.58	11.03
	2018	16.40	9.74	10.26	13.10	11.51
	2019	15.87	9.43	10.71	13.34	11.63
Thailand	2010	251.30	219.56	221.89	246.13	256.61
	2011	256.29	223.92	220.07	245.13	253.99
	2012	261.39	228.37	236.56	263.10	270.37
	2013	266.58	232.91	244.98	274.33	286.28
	2014	256.37	221.61	240.91	270.33	280.20
	2015	271.43	237.73	248.01	274.44	283.50
	2016	274.72	252.51	244.09	272.27	281.91
	2017	276.08	254.26	244.04	273.24	286.54
	2018	278.68	258.01	241.37	279.31	292.67
	2019	282.35	262.09	251.41	275.06	288.49
Togo	2010	8.36	2.29	2.08	2.54	2.60
	2011	7.70	1.46	1.89	2.33	2.51
	2012	8.27	1.88	1.63	2.22	2.22
	2013	8.07	1.53	1.28	2.33	2.13
	2014	8.12	1.42	1.15	2.37	2.24
	2015	8.70	1.84	1.01	2.43	2.69
	2016	8.64	1.62	1.49	2.53	3.10
	2017	8.63	1.62	1.25	2.64	3.05
	2018	8.61	1.61	1.44	2.75	3.17
	2019	8.60	1.61	1.50	2.85	3.26
Uganda	2010	27.11	1.61	3.01	3.77	3.57
	2011	26.05	3.28	3.35	4.33	3.83
	2012	28.67	2.81	3.35	4.55	3.63
	2013	37.89	10.44	3.34	4.48	3.76
	2014	39.39	10.42	3.72	4.57	4.10
	2015	42.27	10.54	4.36	4.69	4.53
	2016	59.54	4.75	4.57	4.87	4.81
	2017	59.64	4.85	4.79	5.05	5.23
	2018	68.47	5.83	5.48	5.18	5.39
	2019	153.41	5.77	5.48	5.34	5.54
Uruguay	2010	8.14	5.65	5.95	6.42	6.30
	2011	9.66	7.04	7.23	7.71	7.66
	2012	10.50	7.93	8.18	8.78	8.60
	2013	9.40	6.78	7.02	7.62	7.50
	2014	8.43	5.91	6.17	6.76	6.66
	2015	8.57	6.13	6.30	6.81	6.66
	2016	8.45	6.01	6.23	6.80	6.53

2017	8.30	5.87	5.78	6.36	6.18
2018	9.41	6.00	6.22	6.43	6.26
2019	8.25	5.89	6.17	6.56	6.38
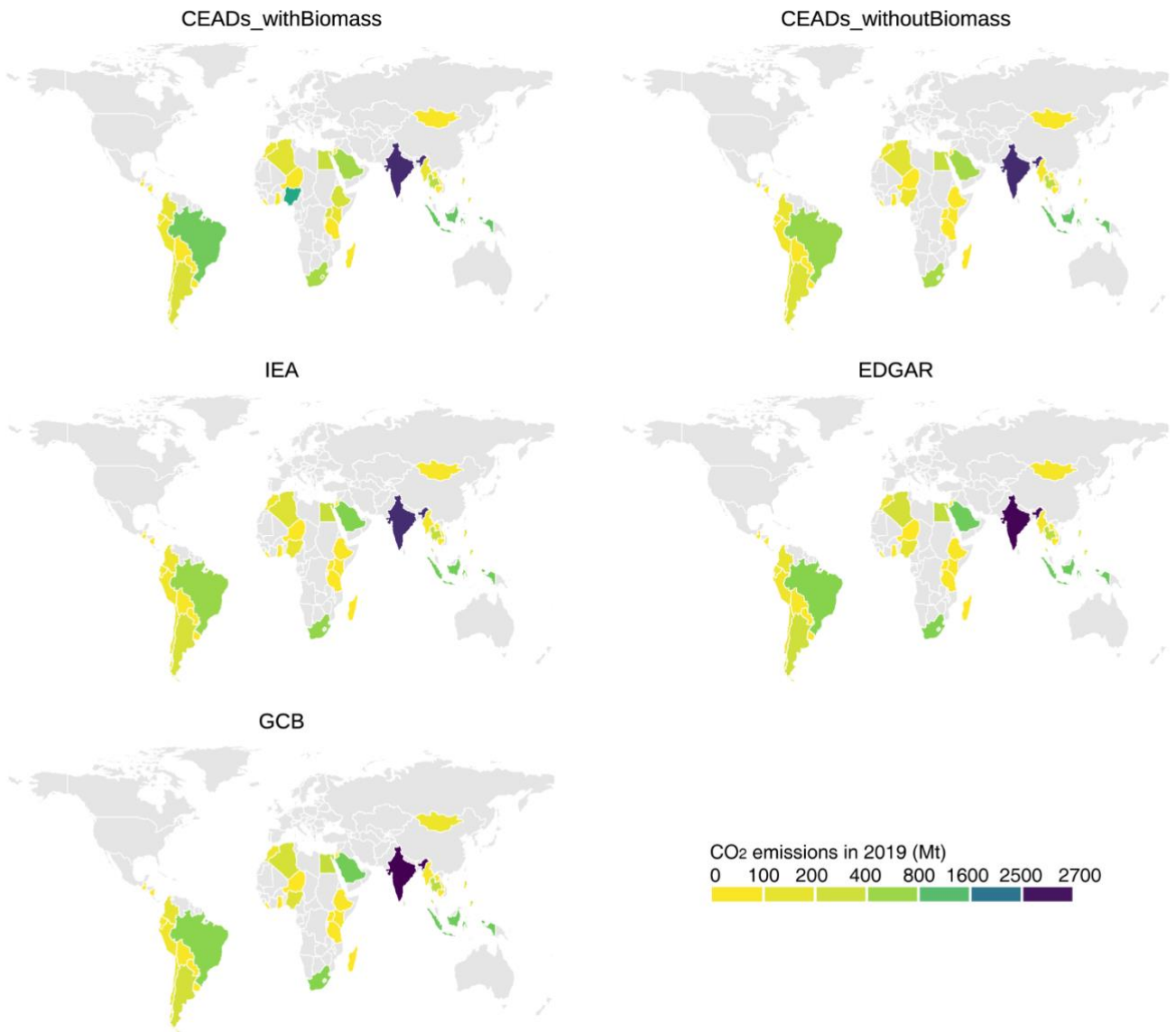
Figure S 2 Comparison of this dataset (CEADs with and without biomass) and IEA, EDGAR, and GCB.

3.2 Data uncertainty by sector
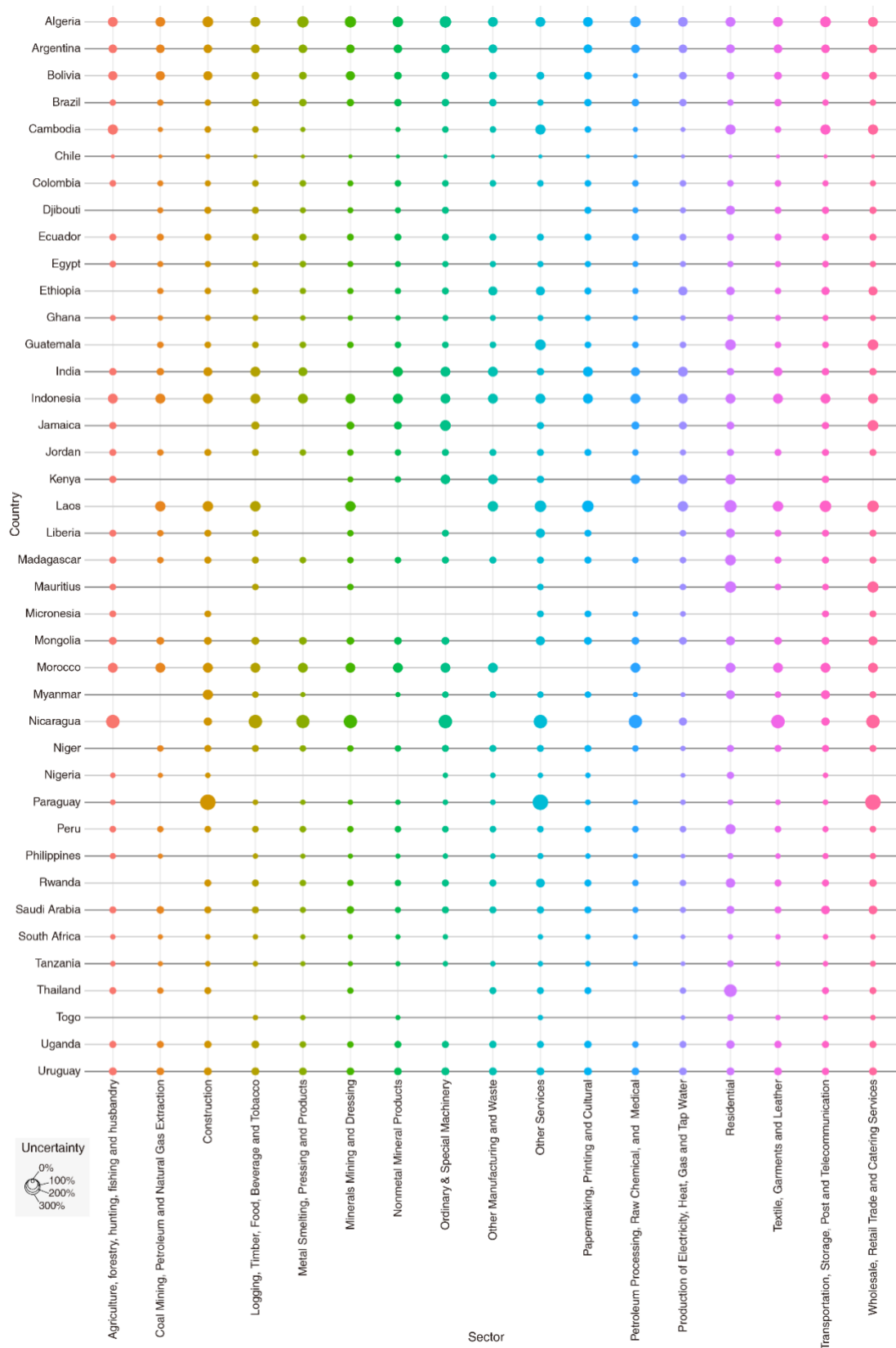
Figure S 3 Data uncertainty for 40 countries by sector. Colors show the 17 sectors and sizes of point show the uncertainty of emissions.

4. Supplemental Results

Our previous work on 30 emerging economies' CO_2 emissions are provided as a report in CEADs website: https://ceads.oss-cn-hangzhou.aliyuncs.com/CEADs_en_v1.4.pdf.

References

Crippa, M., Solazzo, E., Huang, G., Guizzardi, D., Koffi, E., Muntean, M., Schieberle, C., Friedrich, R., and Janssens-Maenhout, G.: High resolution temporal profiles in the Emissions Database for Global Atmospheric Research, Sci Data, 7, 121, https://doi.org/10.1038/s41597-020-0462-2, 2020.

Crippa, M., Guizzardi, D., Muntean, M., Schaaf, E., Monforti-Ferrario, F., Banja, M., Oliver, J. G. J., Grassi, G., Rossi, S., and Vignati, E.: GHG emissions of all world countries - 2021 Report, Publications Office of the European Union, LU, 2021.

Friedlingstein, P., Jones, M. W., O'Sullivan, M., Andrew, R. M., Bakker, D. C. E., Hauck, J., Le Quéré, C., Peters, G. P., Peters, W., Pongratz, J., Sitch, S., Canadell, J. G., Ciais, P., Jackson, R. B., Alin, S. R., Anthoni, P., Bates, N. R., Becker, M., Bellouin, N., Bopp, L., Chau, T. T. T., Chevallier, F., Chini, L. P., Cronin, M., Currie, K. I., Decharme, B., Djeutchouang, L. M., Dou, X., Evans, W., Feely, R. A., Feng, L., Gasser, T., Gilfillan, D., Gkritzalis, T., Grassi, G., Gregor, L., Gruber, N., Gürses, Ö., Harris, I., Houghton, R. A., Hurtt, G. C., Iida, Y., Ilyina, T., Luijkx, I. T., Jain, A., Jones, S. D., Kato, E., Kennedy, D., Klein Goldewijk, K., Knauer, J., Korsbakken, J. I., Körtzinger, A., Landschützer, P., Lauvset, S. K., Lefèvre, N., Lienert, S., Liu, J., Marland, G., McGuire, P. C., Melton, J. R., Munro, D. R., Nabel, J. E. M. S., Nakaoka, S.-I., Niwa, Y., Ono, T., Pierrot, D., Poulter, B., Rehder, G., Resplandy, L., Robertson, E., Rödenbeck, C., Rosan, T. M., Schwinger, J., Schwingshackl, C., Séférian, R., Sutton, A. J., Sweeney, C., Tanhua, T., Tans, P. P., Tian, H., Tilbrook, B., Tubiello, F., van der Werf, G. R., Vuichard, N., Wada, C., Wanninkhof, R., Watson, A. J., Willis, D., Wiltshire, A. J., Yuan, W., Yue, C., Yue, X., Zaehle, S., and Zeng, J.: Global Carbon Budget 2021, Earth System Science Data, 14, 1917–2005, https://doi.org/10.5194/essd-14-1917-2022, 2022.

Intergovernmental Panel on Climate Change (IPCC): IPCC Guidelines for national greenhouse gas inventories, Institute for Global Environmental Strategies (IGES), Hayama, Japan, 2006.

International Energy Agency: World CO2 Emissions from Fuel Combustion, 2022.