



IPCC Inventory Software for National GHG inventories Overview of the Energy Sector

IPCC TFI Side Event
Sharm el-Sheikh - Climate Change Conference
UNFCCC COP27
November 2022

Major updates



Subnational disaggregation at a category level

Fuel Manager

Higher Tiers methods in 2006 IPCC Guidelines (Volume 2)

Improvements in worksheet structure and layout

ipcc

INTERGOVERNMENTAL PANEL ON climate change



WMO



UNEP

Subnational disaggregation

IPCC Inventory Software - TSU - [Worksheets]

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

- 1.A.2.d - Pulp, Paper and Print
- 1.A.2.e - Food Processing, Beverage
- 1.A.2.f - Non-Metallic Minerals
- 1.A.2.g - Transport Equipment
- 1.A.2.h - Machinery
- 1.A.2.i - Mining (excluding fuels) and
- 1.A.2.j - Wood and wood products
- 1.A.2.k - Construction
- 1.A.2.l - Textile and Leather
- 1.A.2.m - Non-specified Industry
- 1.A.3 - Transport
 - 1.A.3.a - Civil Aviation
 - 1.A.3.a.i - International Aviation
 - 1.A.3.a.ii - Domestic Aviation
 - 1.A.3.b - Road Transportation
 - 1.A.3.b.i - Cars
 - 1.A.3.b.i.1 - Passenger cars
 - 1.A.3.b.i.2 - Passenger cars
 - 1.A.3.b.ii - Light-duty trucks
 - 1.A.3.b.ii.1 - Light-duty truck
 - 1.A.3.b.ii.2 - Light-duty truck
 - 1.A.3.b.iii - Heavy-duty trucks and
 - 1.A.3.b.iv - Motorcycles
 - 1.A.3.b.v - Evaporative emission
 - 1.A.3.b.vi - Urea-based catalyst
 - 1.A.3.c - Railways
 - 1.A.3.d - Water-borne Navigation
 - 1.A.3.d.i - International water-b
 - 1.A.3.d.ii - Domestic Water-bor
 - 1.A.3.e - Other Transportation
 - 1.A.3.e.i - Pipeline Transport
 - 1.A.3.e.ii - Off-road
- 1.A.4 - Other Sectors

2006 IPCC Guidelines

Fuel Consumption Data Fuel Combustion Emissions CH4 and N2O Emissions - Tier 3

Worksheet

Sector: Energy

Category: Fuel Combustion Activities

Subcategory: 1.A.3.c - Railways

Sheet: Fuel Consumption Data

Data

Fuel Type: Liquid Fuels

Equation 3.4.2, 3.4.4, 3.4.5

Subdivision	Locomotive type	Fuel	Diesel for locomotive	Consumption calculation method	Number of locomotives	Average fuel consumption per locomotive per day (l/day)	Average number of days of operation per locomotive	Diesel for locomotive (l/Year)	Conversion Factor (Gg/l)	Consumption (Mass, Volume or Energy Unit)	Consumption Unit	Conversion Factor (TJ/Unit) (NCV)	Total consumption (TJ)
S	LT	F			LN	LFC	LD	$LFC \times LN \times LF \times C \times LD$	LCF	$C \times LFC \times LCF$ or specified	U	CF	$TC = C \times CF$
Total													0

Fuel Manager... Time Series data entry...

Worksheet notes

Subdivision's Column allows to report at subnational level as well as to further disaggregate estimates according to e.g. drivers/stakeholders and/or relevant variables

Fuel Manager

- Contains main parameters on fuels, i.e. fuel type, calorific value, carbon content- needed to estimate GHG emissions from combustion
- Allows input of user-defined fuels and their parameters
- Information from fuel manager transfers to all corresponding worksheets

Fuel Manager

Fuel Manager

Conversion Factor Type NCV GCV Show user-defined fuels only

Fuel Type	Fuel Name	Primary Fuel	Net Calorific Value (TJ / Gg)	Carbon content (NCV) (kg C / GJ)
Liquid Fuels	Aviation Gasoline	<input type="checkbox"/>	44.3	19.1
Liquid Fuels	Bitumen	<input type="checkbox"/>	40.2	22
Liquid Fuels	Crude Oil	<input checked="" type="checkbox"/>	42.3	20
Liquid Fuels	Ethane	<input type="checkbox"/>	46.4	16.8
Liquid Fuels	Gas/Diesel Oil	<input type="checkbox"/>	43	20.2
Liquid Fuels	Jet Gasoline	<input type="checkbox"/>	44.3	19.1
Liquid Fuels	Jet Kerosene	<input type="checkbox"/>	44.1	19.5
Liquid Fuels	Liquefied Petroleum Gases	<input type="checkbox"/>	47.3	17.2
Liquid Fuels	Lubricants	<input type="checkbox"/>	40.2	20
Liquid Fuels	Motor Gasoline	<input type="checkbox"/>	44.3	18.9
Liquid Fuels	Naphtha	<input type="checkbox"/>	44.5	20
Liquid Fuels	Natural Gas Liquids	<input checked="" type="checkbox"/>	44.2	17.5
Liquid Fuels	Orimulsion	<input checked="" type="checkbox"/>	27.5	21
Liquid Fuels	Other Kerosene	<input type="checkbox"/>	43.8	19.6
Liquid Fuels	Other Petroleum Products	<input type="checkbox"/>	40.2	20
Liquid Fuels	Paraffin Waxes	<input type="checkbox"/>	40.2	20
Liquid Fuels	Petroleum Coke	<input type="checkbox"/>	32.5	26.6
Liquid Fuels	Refinery Feedstocks	<input type="checkbox"/>	43	20
Liquid Fuels	Refinery Gas	<input type="checkbox"/>	49.5	15.7
Liquid Fuels	Residual Fuel Oil	<input type="checkbox"/>	40.4	21.1
Liquid Fuels	Shale Oil	<input type="checkbox"/>	38.1	20
Liquid Fuels	White Spirit and SBP	<input type="checkbox"/>	40.2	20
Solid Fuels	Anthracite	<input checked="" type="checkbox"/>	26.7	26.8
Solid Fuels	Blast Furnace Gas	<input type="checkbox"/>	2.47	70.8
Solid Fuels	Brown Coal Briquettes	<input type="checkbox"/>	20.7	26.6
Solid Fuels	Coal Tar	<input type="checkbox"/>	28	22
Solid Fuels	Coke Oven Coke / Lignite Coke	<input type="checkbox"/>	28.2	29.2
Solid Fuels	Coke Oven Gas	<input type="checkbox"/>	38.7	12.1
Solid Fuels	Coking Coal	<input checked="" type="checkbox"/>	28.2	25.8
Solid Fuels	Gas Coke	<input type="checkbox"/>	28.2	29.2
Solid Fuels	Gas Works Gas	<input type="checkbox"/>	38.7	12.1
Solid Fuels	Lignite	<input checked="" type="checkbox"/>	11.9	27.6
Solid Fuels	Oil Shale / Tar Sands	<input checked="" type="checkbox"/>	8.9	29.1
Solid Fuels	Other Bituminous Coal	<input checked="" type="checkbox"/>	25.8	25.8
Solid Fuels	Oxygen Steel Furnace Gas	<input type="checkbox"/>	7.06	49.6
Solid Fuels	Patent Fuel	<input type="checkbox"/>	20.7	26.6
Solid Fuels	Sub-Bituminous Coal	<input checked="" type="checkbox"/>	18.9	26.2
Gaseous Fuels	Natural Gas (Dry)	<input checked="" type="checkbox"/>	48	15.3
Gaseous Fuels	Natural Gas + Hydrogen (20%)	<input checked="" type="checkbox"/>	55	13
Other Fossil Fuels	Industrial Wastes	<input checked="" type="checkbox"/>		39

Type and Name of default fuels cannot be changed and default fuels cannot be deleted.

Selected Conversion Factor Type is automatically applied in all the relevant worksheets across all the Inventory Years.

Save Undo Close

Higher Tiers

➤ **Stationary Combustion**

- ✓ further disaggregation of estimates by technology type and its penetration rate

➤ **Mobile Combustion**

- ✓ further disaggregation of estimates by vehicle/equipment type, operating conditions/road type, and emission control technology

➤ **Fugitive emissions**

- ✓ For coal: further disaggregation of estimates by coal rank and emissions rate before abandonment,
- ✓ For oil: further disaggregation of venting and flaring estimates by quantity of gas vented/flared and its composition

Improvements in worksheet structure and layout

- Combination of Tiers within the same set of worksheets, where the structure of IPCC equations allows e.g. Stationary Combustion
- Addition of (set of) worksheets for each different Tier, where IPCC equations do not allow combination of multiple tiers
- 166 worksheets in total available, among which the user selects those that better deal with national circumstances.
- Such a large number allows any combinations of tiers to be composed to estimate GHG emissions from the Energy sector.

Improvements in worksheet structure and layout

Stationary Combustion

IPCC Inventory Software - user - [Worksheets]

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

- 1.A.1 - Energy Industries
 - 1.A.1.a - Main Activity
 - 1.A.1.a.i - Electricity
 - 1.A.1.a.ii - Combine
 - 1.A.1.a.iii - Heat Pla
 - 1.A.1.b - Petroleum Refi
 - 1.A.1.c - Manufacture of
 - 1.A.1.c.i - Manufactu
 - 1.A.1.c.ii - Other Ene
- 1.A.2 - Manufacturing Indust
 - 1.A.2.a - Iron and Steel
 - 1.A.2.b - Non-Ferrous M
 - 1.A.2.c - Chemicals
 - 1.A.2.d - Pulp, Paper an
 - 1.A.2.e - Food Processin
 - 1.A.2.f - Non-Metallic Mi
 - 1.A.2.g - Transport Equi
 - 1.A.2.h - Machinery
 - 1.A.2.i - Mining (excludin
 - 1.A.2.j - Wood and wood
 - 1.A.2.k - Construction
 - 1.A.2.l - Textile and Leat
 - 1.A.2.m - Manufactured

2006 IPCC Guidelines

Fuel Consumption Data Fuel Combustion Emissions

Worksheet

Sector: Energy
 Category: Fuel Combustion Activities
 Subcategory: 1.A.1.a.ii - Combined Heat and Power Generation (CHP)
 Sheet: Fuel Combustion Emissions

Data

Fuel Type (All fuels)

Equation 2.4

Subdivision	Fuel	Total consumption (TJ)	CO2 Emissions (Gg CO2)	CH4 Emissions (Gg CH4)	N2O Emissions (Gg N2O)
S	F	TC	CO2	CH4	N2O
Unspecified	Natural Gas (Dry)	84600	4449.444	0.0846	0.00846

Equation 2.4

Technology		CO2			CH4		N2O		
Type of Technology	Technology penetration (%)	Consumption (TJ)	CO2 Emission Factor (kg CO2/TJ)	Amount Captured (Gg CO2)	CO2 Emissions (Gg CO2)	CH4 Emission Factor (kg CH4/TJ)	CH4 Emissions (Gg CH4)	N2O Emission Factor (kg N2O/TJ)	N2O Emissions (Gg N2O)
T	P	C=TC*(P/100)	EF(CO2)	Z	CO2=C*EF (CO2)/10*6-Z	EF(CH4)	CH4=C*EF (CH4)/10*6	EF(N2O)	N2O=C*EF (N2O)/10*6
Unspecified	80	67680	56100		3796.848	1	0.06768	0.1	0.00677
CCGT	20	16920	56300	300	652.596	1	0.01692	0.1	0.00169
Total		84600			4449.444		0.0846		0.00846

Equation 2.4

Subdivision	Fuel	Total consumption (TJ)	CO2 Emissions (Gg CO2)	CH4 Emissions (Gg CH4)	N2O Emissions (Gg N2O)

Worksheet remarks

Save

1.A.1.a.ii - Time Series

Gas CARBON DIOXIDE (CO2)

Country/Territory: Japan | Inventory Year: 2000 | Base year for assessment of uncertainty in trend: 1990 | CO2 Equivalents: SAR GWPs (100 year time horizon) | Database file:

Save Gas CARBON DIOXIDE (CO2)

Improvements in worksheet structure and layout

Road Transportation

IPCC Inventory Software - user - [Worksheets]

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

- 1.A.3.a.ii - Domestic Aviation
- 1.A.3.b - Road Transportation
 - 1.A.3.b.i - Cars
 - 1.A.3.b.i.1 - Passenger cars with 3-way catalysts
 - 1.A.3.b.i.2 - Passenger cars with 2-way catalysts
 - 1.A.3.b.ii - Light-duty trucks
 - 1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts
 - 1.A.3.b.ii.2 - Light-duty trucks with 2-way catalysts
 - 1.A.3.b.iii - Heavy-duty truck
 - 1.A.3.b.iv - Motorcycles
 - 1.A.3.b.v - Evaporative emissions
 - 1.A.3.b.vi - Urea-based catalysts
- 1.A.3.c - Railways
- 1.A.3.d - Water-borne Navigation
 - 1.A.3.d.i - International water
 - 1.A.3.d.ii - Domestic Water
- 1.A.3.e - Other Transportation
 - 1.A.3.e.i - Pipeline Transport
 - 1.A.3.e.ii - Off-road

4 - Other Sectors

1.A.4.a - Commercial/Institution

1.A.4.b - Residential

1.A.4.c - Agricultural/Forestry/Fishing

Worksheet: Fuel Consumption Data Fuel Combustion Emissions CH4 and N2O Emissions - Tier 3 Fuel Consumption - Validation

Sector: Energy

Category: Fuel Combustion Activities

Subcategory: 1.A.3.b.i.1 - Passenger cars with 3-way catalysts

Sheet: Fuel Consumption - Validation

Data

Fuel Type: (All fuels)

Equation 3.2.6

Subdivision	Fuel	Vehicle type	Road type	Number of vehicles	Distance travelled (km)	Consumption (l/km)	Total fuel consumption (l)	Conversion Factor (Gg/l)	Total fuel consumption (Gg)
				A	B	C	D=B*C	E	F=D*E
Taxis	Gas/Diesel Oil	5 seat	Urban	1	100000	0.8	80000	7.5E-07	0.06
Total				1	100000	0.8	80000		0.06
Unspecified	Motor Gasoline	5-7 seat	OC	66450	69000	4585...	22	1.4619	6 0.3987
Taxis in other cities	Motor Gasoline	5-7 seat	OC	66450	69300	4604...	25	1.661...	8 0.5316
Total				268000		18901.905		5.00765	1.6345

Worksheets map [sectoral approach]

IPCC Category	Number of Worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
1.A.1 - Energy Industries	12			
1.A.1.a - Main Activity Electricity and Heat Production	6			
1.A.1.a.i - Electricity Generation	2		2	
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	2		2	
1.A.1.a.iii - Heat Plants	2		2	
1.A.1.b - Petroleum Refining	2		2	
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	4			
1.A.1.c.i - Manufacture of Solid Fuels	2		2	
1.A.1.c.ii - Other Energy Industries	2		2	
1.A.2 - Manufacturing Industries and Construction	26			
1.A.2.a - Iron and Steel	2		2	
1.A.2.b - Non-Ferrous Metals	2		2	
1.A.2.c - Chemicals	2		2	
1.A.2.d - Pulp, Paper and Print	2		2	
1.A.2.e - Food Processing, Beverages and Tobacco	2		2	
1.A.2.f - Non-Metallic Minerals	2		2	
1.A.2.g - Transport Equipment	2		2	
1.A.2.h - Machinery	2		2	
1.A.2.i - Mining (excluding fuels) and Quarrying	2		2	
1.A.2.j - Wood and wood products	2		2	
1.A.2.k - Construction	2		2	
1.A.2.l - Textile and Leather	2		2	
1.A.2.m - Non-specified Industry	2		2	

Stationary combustion Tiers 1 & 2 do not stratify by technology-specific EFs (thus, variable T is “unspecified” and variable “P” is “100”%)

IPCC Category	Number of worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
1.A.3 - Transport	54			
1.A.3.a - Civil Aviation	8		LTO vs Cruise	
1.A.3.a.i - International Aviation (<i>International Bunkers</i>)	4	2		
			2	
1.A.3.a.ii - Domestic Aviation	4	2		
			2	
1.A.3.b - Road Transportation	31		Vehicle type & ECT**	AD: km travelled per Operating conditions
1.A.3.b.i - Cars	11	2* (+1)		
1.A.3.b.i.1 - Passenger cars with 3-way catalyysts	4	2 (+1)		1**
1.A.3.b.i.2 - Passenger cars without 3-way catalyysts	4	2 (+1)		1**
1.A.3.b.ii - Light-duty trucks	11	2* (+1)		
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalyysts	4	2 (+1)		1**
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalyysts	4	2 (+1)		1**
1.A.3.b.iii - Heavy-duty trucks and buses	4	2 (+1)		1**
1.A.3.b.iv - Motorcycles	4	2 (+1)		1**
1.A.3.b.v - Evaporative emissions from vehicles				
1.A.3.b.vi - Urea-based catalyysts	1	1		
1.A.3.c - Railways	3		Locomotive type	AD: Engine power per load factor per hour
		2		1**
1.A.3.d - Water-borne Navigation	4		Vessel/Engine type	
1.A.3.d.i - International water-borne navigation (<i>International bunkers</i>)	2	2		
1.A.3.d.ii - Domestic Water-borne Navigation	2	2		
1.A.3.e - Other Transportation	5			
1.A.3.e.i - Pipeline Transport	2	2		
1.A.3.e.ii - Off-road	3		Vehicle/Equipment type	AD: Engine power per load factor per hour
		2		1

(+1) Additional Tab for validating fuel consumption data

Worksheets map [sectoral approach]

IPCC Category	Number of worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
1.A.4 - Other Sectors	11			
1.A.4.a - Commercial/Institutional	2		2	
1.A.4.b - Residential	2		2	
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	7			
1.A.4.c.i - Stationary	2		2	
1.A.4.c.ii - Off-road Vehicles and Other Machinery	3	2		1
1.A.4.c.iii – Fishing (mobile combustion)	2	2		
1.A.5 - Non-Specified	20			
1.A.5.a - Stationary	2		2	
1.A.5.b - Mobile	12			
1.A.5.b.i - Mobile (<i>aviation component</i>)	4	2		
			2	
1.A.5.b.ii - Mobile (<i>water-borne component</i>)	2	2		
1.A.5.b.iii - Mobile (<i>other</i>)	6	<i>road</i>	2	1**
		<i>off-road</i>	2	1
1.A.5.c - Multilateral Operations	6	<i>aviation</i>	2	
		<i>waterborne</i>	2	

Worksheets map [sectoral approach]

IPCC Category	Number of Worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
1.B.1 - Solid Fuels	14			
1.B.1.a - Coal mining and handling	11			
1.B.1.a.i - Underground mines	7			
1.B.1.a.i.1 - Mining	2	2		
1.B.1.a.i.2 - Post-mining seam gas emissions	2	2		
1.B.1.a.i.3 - Abandoned underground mines	2	1	1***	
1.B.1.a.i.4 - Flaring of drained CH ₄ or conversion of CH ₄ to CO ₂	1	1		
1.B.1.a.ii - Surface mines	4			
1.B.1.a.ii.1 - Mining	2	2		
1.B.1.a.ii.2 - Post-mining seam gas emissions	2	2		
1.B.1.b - Uncontrolled combustion and burning coal dumps	2	2		
1.B.1.c - Solid fuel transformation	1		1****	

at Tier 2: AD by Coal Rank, while EF by Emission rate before closure and Time since closure,
at Tier 3 historical emissions corrected by an emission factor and by methane recovery

Worksheets map [sectoral approach]

IPCC Category	Number of Worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
1.B.2 - Oil and Natural Gas	22			
1.B.2.a - Oil	14			
1.B.2.a.i - Venting	3	1	1	
1.B.2.a.ii - Flaring	5	1	3	
1.B.2.a.iii - All Other	6			
1.B.2.a.iii.1 - Exploration	1		1	
1.B.2.a.iii.2 - Production and Upgrading	1		1	
1.B.2.a.iii.3 - Transport	1		1	
1.B.2.a.iii.4 - Refining	1		1	
1.B.2.a.iii.5 - Distribution of oil products	1		1	
1.B.2.a.iii.6 - Other	1		1	
1.B.2.b - Natural Gas	8			
1.B.2.b.i - Venting	1		1	
1.B.2.b.ii - Flaring	1		1	
1.B.2.b.iii - All Other	6			
1.B.2.b.iii.1 - Exploration	1		1	
1.B.2.b.iii.2 - Production	1		1	
1.B.2.b.iii.3 - Processing	1		1	
1.B.2.b.iii.4 - Transmission and Storage	1		1	
1.B.2.b.iii.5 - Distribution	1		1	
1.B.2.b.iii.6 - Other	1		1	
1.B.3 - Other emissions from Energy Production	1			1****

Tier 2 AD are quantity of gas vented/flared and its composition

Worksheets map *[sectoral approach]*

IPCC Category	Number of Worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
1.C.1. – Transport of CO₂	3			
1.C.1.a. Pipelines	1		1	
1.C.1.b. Ships	1		1	
1.C.1.c Other (please specify)	1		1	
1.C.2. Injection and Storage	2			
1.C.2.a Injection	1		1	
1.C.2.b Storage	1		1	
1.C.3. Other	1		1	

Worksheets map *[reference approach]*

Energy sector Reference approach	Number of Worksheets	
	Total	IPCC Tier (Equations)
	3	Reference Approach Data Estimating Excluded Carbon Comparison

Worksheets map *[Energy sector]*

IPCC Category	Number of Worksheets
	Total
1.A. - Fuel Combustion Activities	120
1.A.1 - Energy Industries	12
1.A.2 - Manufacturing Industries and Construction	26
1.A.3 - Transport	54
1.A.4 - Other Sectors	11
1.A.5 - Non-Specified	20
1.B. - Fugitive emissions from fuels	37
1.B.1 - Solid Fuels	14
1.B.2 - Oil and Natural Gas	22
1.B.3 - Other emissions from Energy Production	1
1.C. - Carbon dioxide Transport and Storage	6
1.C.1 - Transport of CO ₂	3
1.C.2 - Injection and Storage	2
1.C.3 - Other	1
	Reference Approach 3
TOTAL ENERGY SECTOR	166

Worksheets map *[notes]*

- * the use of worksheet at this aggregate level suits IPCC Tier 1 only, since the use of country-specific EFs requires reporting at subcategory level
- ** CH₄ and N₂O only
- *** CH₄ only
- **** Implements the generic IPCC equation, AD x EF. No default values are provided in the 2006 IPCC Guidelines. It accommodates Tier 3 when plant-specific data are used

Summary

- **All methods in the 2006 IPCC Guidelines are implemented in the IPCC Inventory Software**
Thus, needed flexibility to deal with any national circumstances, as per IPCC tiered approach, is ensured
- **Subnational disaggregation**
Thus, tracking of specific activities/projects, and associated emission level & trend, within a national GHG inventory is allowed
- **Energy sector Guidebook – version 1 under revision**



Thank you

<https://www.ipcc-nggip.iges.or.jp/index.html>

ipcc

INTERGOVERNMENTAL PANEL ON climate change

