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

IPCC TFI Side Event

Sharm el-Sheikh - Climate Change Conference

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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

Subnational disaggregation

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

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	☐	44.3	19.1
Liquid Fuels	Bitumen	☐	40.2	22
Liquid Fuels	Crude Oil	☑	42.3	20
Liquid Fuels	Ethane	☐	46.4	16.8
Liquid Fuels	Gas/Diesel Oil	☐	43	20.2
Liquid Fuels	Jet Gasoline	☐	44.3	19.1
Liquid Fuels	Jet Kerosene	☐	44.1	19.5
Liquid Fuels	Liquefied Petroleum Gases	☐	47.3	17.2
Liquid Fuels	Lubricants	☐	40.2	20
Liquid Fuels	Motor Gasoline	☐	44.3	18.9
Liquid Fuels	Naphtha	☐	44.5	20
Liquid Fuels	Natural Gas Liquids	☑	44.2	17.5
Liquid Fuels	Orimulsion	☑	27.5	21
Liquid Fuels	Other Kerosene	☐	43.8	19.6
Liquid Fuels	Other Petroleum Products	☐	40.2	20
Liquid Fuels	Paraffin Waxes	☐	40.2	20
Liquid Fuels	Petroleum Coke	☐	32.5	26.6
Liquid Fuels	Refinery Feedstocks	☐	43	20
Liquid Fuels	Refinery Gas	☐	49.5	15.7
Liquid Fuels	Residual Fuel Oil	☐	40.4	21.1
Liquid Fuels	Shale Oil	☐	38.1	20
Liquid Fuels	White Spirit and SBP	☐	40.2	20
Solid Fuels	Anthracite	☑	26.7	26.8
Solid Fuels	Blast Furnace Gas	☐	2.47	70.8
Solid Fuels	Brown Coal Briquettes	☐	20.7	26.6
Solid Fuels	Coal Tar	☐	28	22
Solid Fuels	Coke Oven Coke / Lignite Coke	☐	28.2	29.2
Solid Fuels	Coke Oven Gas	☐	38.7	12.1
Solid Fuels	Coking Coal	☑	28.2	25.8
Solid Fuels	Gas Coke	☐	28.2	29.2
Solid Fuels	Gas Works Gas	☐	38.7	12.1
Solid Fuels	Lignite	☑	11.9	27.6
Solid Fuels	Oil Shale / Tar Sands	☑	8.9	29.1
Solid Fuels	Other Bituminous Coal	☑	25.8	25.8
Solid Fuels	Oxygen Steel Furnace Gas	☐	7.06	49.6
Solid Fuels	Patent Fuel	☐	20.7	26.6
Solid Fuels	Sub-Bituminous Coal	☑	18.9	26.2
Gaseous Fuels	Natural Gas (Dry)	☑	48	15.3
Gaseous Fuels	Natural Gas + Hydorgen (20%)	☑	55	13 ✗
Other Fossil Fuels	Industrial Wastes	☑	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

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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

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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

Improvements in worksheet structure and layout
Road Transportation

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 *(International Bunkers)*	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 catalysts	4	2 (+1)		1**
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	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 catalysts	4	2 (+1)		1**
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	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 catalysts	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 *(International bunkers)*	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

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Worksheets map *[sectoral approach]*

IPCC Category	Total	Number of worksheets		
		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 *(aviation component)*	4	2		
			2	
1.A.5.b.ii - Mobile *(water-borne component)*	2	2		
1.A.5.b.iii - Mobile *(other)* — *road*	6	2		1**
off-road		2		1
1.A.5.c - Multilateral Operations — *aviation*	6	2		
			2	
waterborne		2		

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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

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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		
1.B.2.a.ii - Flaring	5	1	3	
		1		
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 CO_2	**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	

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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**

*	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

**	CH_4 and N_2O only

***	CH_4 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