



Use of the IPCC Inventory Software for the Energy sector

Training for the Latin America
and Caribbean Regions

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Eduard Karapoghosyan
Consultant, IPCC TFI TSU

ipcc

INTERGOVERNMENTAL PANEL ON climate change



Energy sector



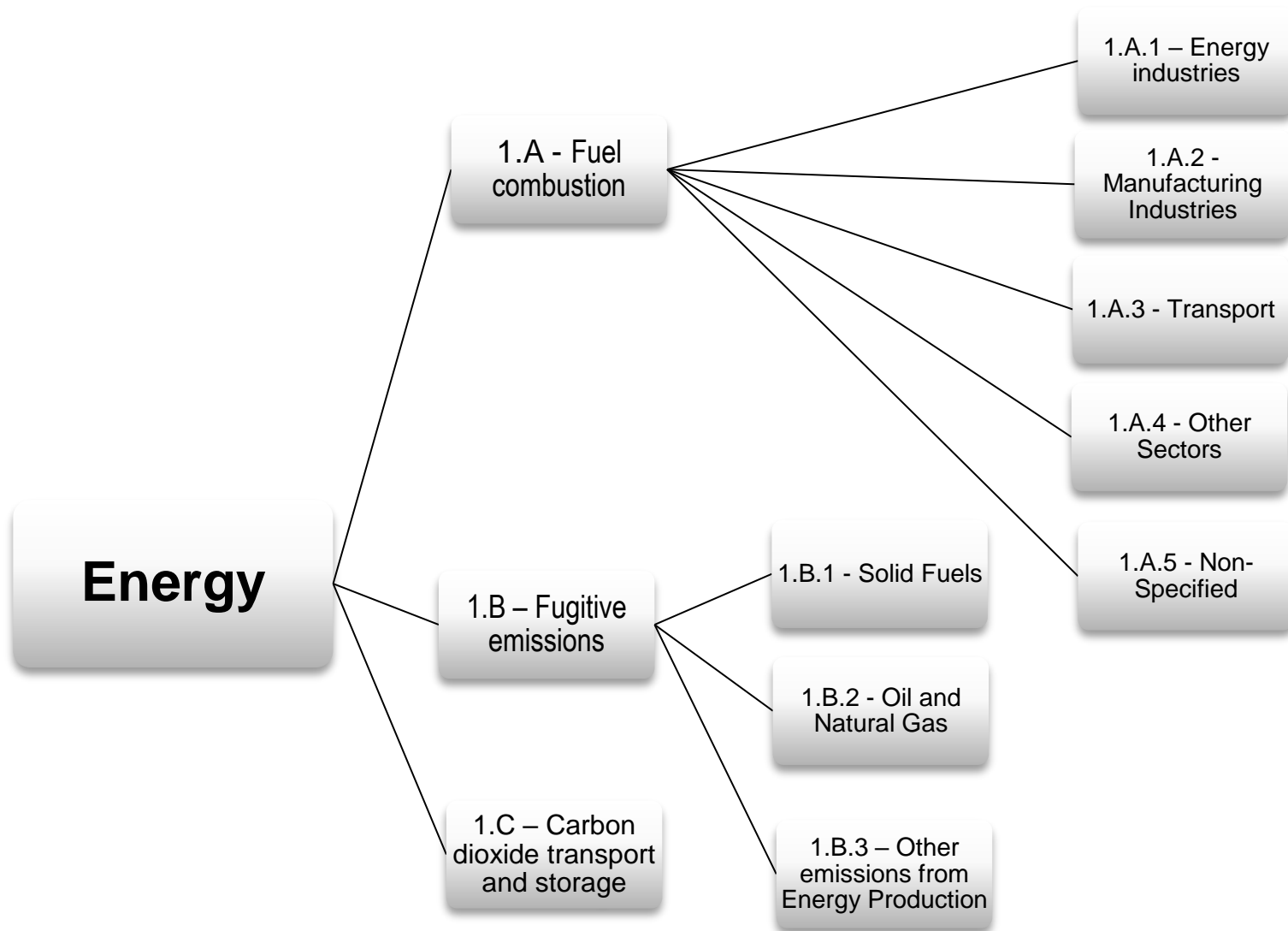
Exploration
and
exploitation of
primary
energy
sources

Conversion of
primary energy
sources into more
useable energy
forms in refineries
and power plants

Transmission
and
distribution of
fuels

Use of fuels
in stationary
and mobile
applications

Sector structure



1.A - Fuel combustion

Sectoral approach - Tier 1

Default CO₂ emission factors assume that 100% of the fuel carbon is oxidized to CO₂

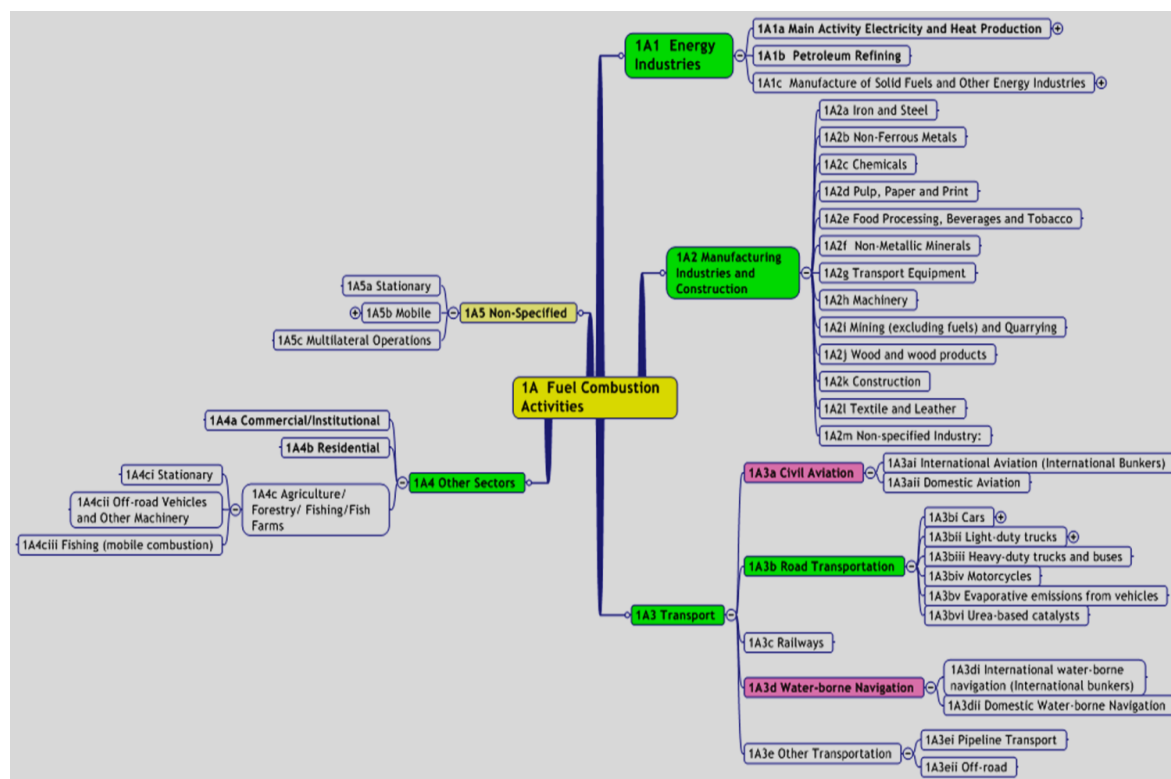
Sectoral approach - Tier 2

Country-specific emission factors

EQUATION 2.1

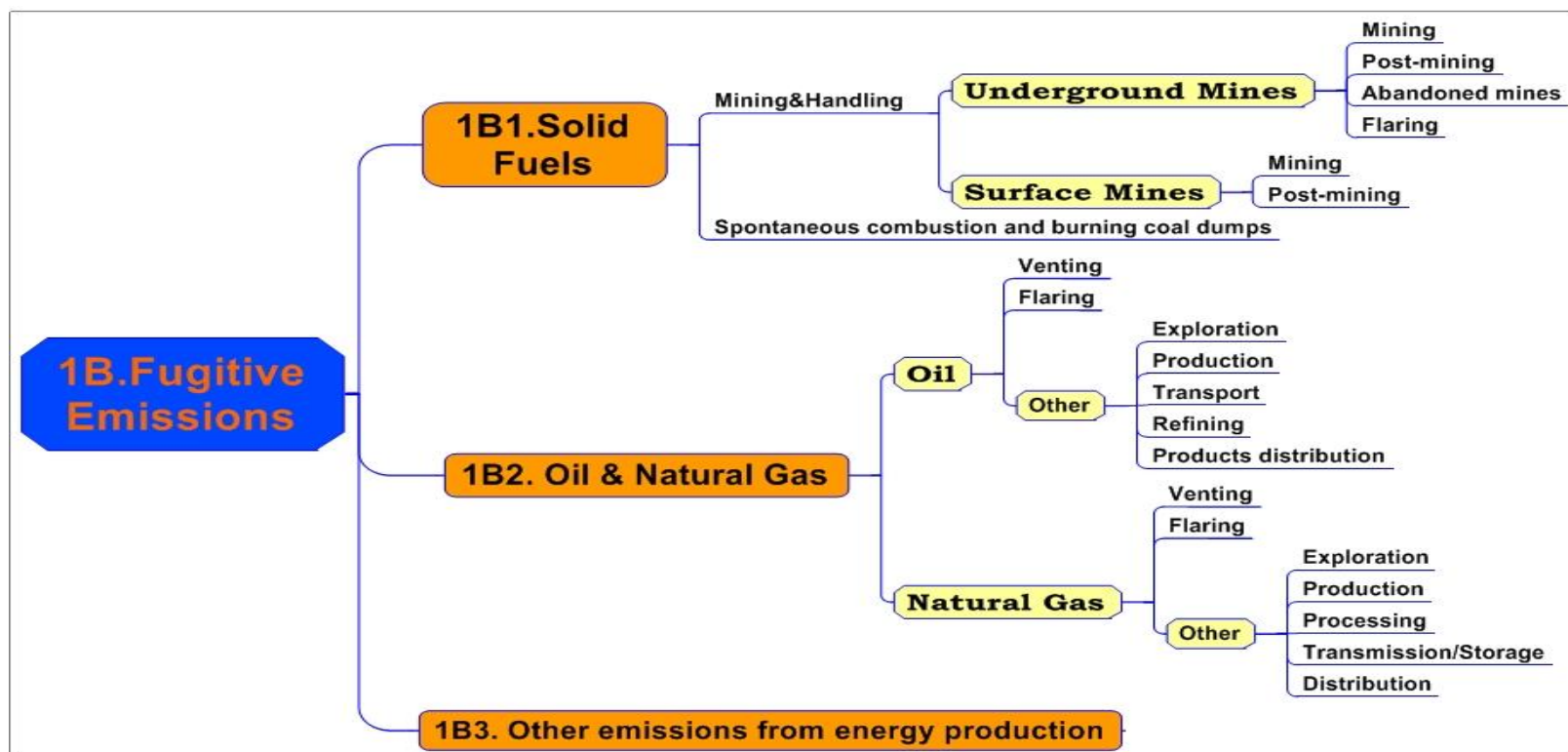
GREENHOUSE GAS EMISSIONS FROM STATIONARY COMBUSTION

$$Emissions_{GHG, fuel} = Fuel\ Consumption_{fuel} \cdot Emission\ Factor_{GHG, fuel}$$



1.B - Fugitive emissions

Intentional or unintentional release of greenhouse gases during the extraction, processing and delivery of fossil fuels to the point of final use



1.C - CO2 Transport, Injection and Geological Storage

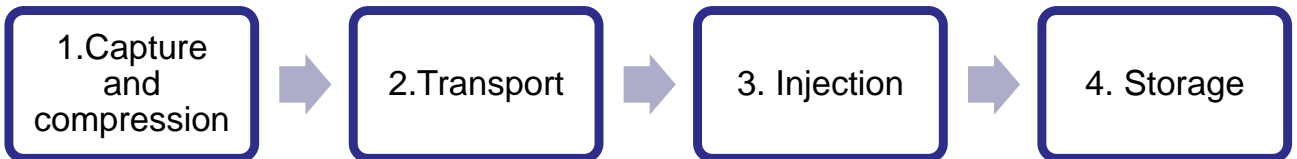
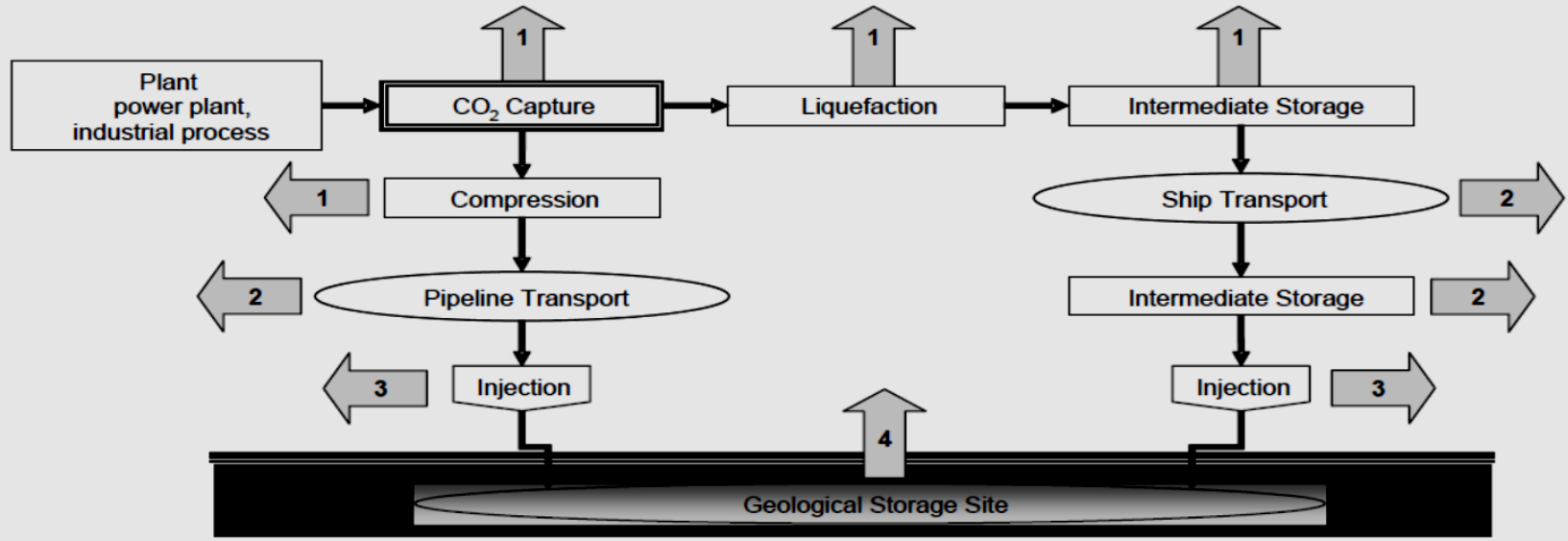


Figure 5.1 Schematic representation of the carbon capture and storage process with numbering linked to systems discussion above.



$$\text{Capture} + \text{Imports} = \text{Injection} + \text{Leakage} + \text{Exports}$$

Methodological approaches

Sectoral approach - bottom-up methodology

Tier 1 (default)

Default calorific values, default emission factors

Tier 2 (country-specific)

Country-specific factors

Tier 3 (technology-specific, measurements)

Combustion technology, operating conditions, control technology, quality of maintenance, age of the equipment, equipment-specific EFs (measurements)

Reference approach - top-down approach, first-order estimate of CO₂ emissions, verification cross-check for Sectoral approach outcomes

Worksheets

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 EI
 - 1.A.1.a.i - Electricity**
 - 1.A.1.a.ii - Combined
 - 1.A.1.a.iii - Heat Plan
 - 1.A.1.b - Petroleum Refin
 - 1.A.1.c - Manufacture of
 - 1.A.1.c.i - Manufactur
 - 1.A.1.c.ii - Other Ener
 - 1.A.2 - Manufacturing Industr
 - 1.A.2.a - Iron and Steel
 - 1.A.2.b - Non-Ferrous Me
 - 1.A.2.c - Chemicals
 - 1.A.2.d - Pulp, Paper and
 - 1.A.2.e - Food Processin
 - 1.A.2.f - Non-Metallic Min
 - 1.A.2.g - Transport Equip
 - 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 - Non-specified I
 - 1.A.3 - Transport
 - 1.A.3.a - Civil Aviation
 - 1.A.3.a.i - Internation
 - 1.A.3.a.ii - Domestic
 - 1.A.3.b - Road Transport

2006 IPCC Guidelines

Fuel Consumption Data Fuel Combustion Emissions

Worksheet

Sector: Energy
 Category: Fuel Combustion Activities
 Subcategory: 1.A.1.a.i - Electricity Generation
 Sheet: Fuel Consumption Data

Data

Fuel Type: (All fuels)

Equation 2.4

Subdivision	Fuel	Consumption Unit	Consumption (Mass, Volume or Energy Unit)	Conversion Factor (TJ/Unit) (NCV)	Total consumption (TJ)
S	F	U	C	CF	TC = C * CF
City Power Plant	Lignite Power Plants	Gg (Auto CF)	300	12	3600
Energy Company 1	Natural Gas (Dry)	Gg (Auto CF)	200	48	9600
Energy Company 2	Residual Fuel Oil	Gg (Auto CF)	800	40.4	32320
Regional Power Plant	Natural Gas Power Plants	TJ	10000	1	10000
Unspecified	Anthracite	Gg (Auto CF)	111	26.7	2963.7
Unspecified	Charcoal	Gg (Auto CF)	400	29.5	11800
Total					70283.7

Fuel Name	Net Calorific Value (TJ / Gg)	Carbon content (NCV) (kg C / GJ)
Aviation Gasoline	44.3	19.1
Bitumen	40.2	22
Crude Oil	42.3	20
Diesel for off-road	38	17
Diesel for trains	40	19
Ethane	46.4	16.8
Gas/Diesel Oil	43	20.2
Jet Gasoline	44.3	19.1

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

CARBON DIOXIDE (CO2) Emissions (Gg CO2 Equivalents)

* Base year for assessment of uncertainty in trend: 1990

Gas CARBON DIOXIDE (CO2)

Country/Territory: Japan Inventory Year: 2012 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: AR4 GWPs (100 year time horizon) Database file:

Reporting

- **Short Summary** – all sectors, leveled on the first categories (1.A, 1.B,...)
- **Summary** – all sectors, breakdown on subsector level (1.A.1, 1.A.3,...)
- **Energy Sectoral Tables** – only sectoral emissions, lowest level of detail (1.A.3.b.ii.1)
- **Energy Background Tables** – sectoral activity data, lowest level of detail, sectoral emissions divided by fuel type, Reference approach results

IPCC Inventory Software - user - [Energy Background Tables]

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

Table 1.1 Energy Background Table: 1.A.1 - 1.A.2 Table 1.2 Energy Background Table: 1.A.3 - 1.A.4 Table 1.3 Energy Background Table: 1.B Table 1.4b Energy Background Table: 1.C - Overview Table 1.5 Energy Background Table: Reference Approach

2006 IPCC Categories	Activity	Peat	Biomass	Emissions Solid Fuels (Gg)			Emissions Liquid Fuels (Gg)			Emissions Gaseous Fuels (Gg)			Emissions Other Fossil Fuels (Gg)					
				CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O	CO2	CH4	N2O			
1.A - Fuel Combustion Activities																		
1.A.1 - Energy Industries																		
1.A.1.a - Main Activity Electricity and Heat Production																		
1.A.1.a.i - Electricity Generation	6563.700	32320.000		19600.000														
1.A.1.a.ii - Combined Heat and Power Generation (CHP)				115600.000														
1.A.1.a.iii - Heat Plants	11900.000																	
1.A.1.b - Petroleum Refining		23200.000																
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries		42300.000																
1.A.1.c.i - Manufacture of Solid Fuels		42300.000																
1.A.1.c.ii - Other Energy Industries																		
1.A.2 - Manufacturing Industries and Construction																		
1.A.2.a - Iron and Steel		42300.000																
1.A.2.b - Non-Ferrous Metals																		
1.A.2.c - Chemicals	3530.000																	
1.A.2.d - Pulp, Paper and Print																		
1.A.2.e - Food Processing, Beverages and Tobacco																		
1.A.2.f - Non-Metallic Minerals																		
1.A.2.g - Transport Equipment																		
1.A.2.h - Machinery				48000.000														
1.A.2.i - Mining (excluding fuels) and Quarrying																		

Number of decimal places: 3 Zero padding

Export to Excel

Legend

Documentation box

(1) Although peat is not strictly speaking a fossil fuel, the CO2 emissions from combustion of peat are included in the national emissions as for fossil fuels. See Chapter 1 of Energy Volume, page 1.15.

(2) Information items that are not themselves emissions, therefore not included in the national total. The carbon should be converted to carbon dioxide. It is subtracted in the CO2 emission columns (net emissions). Only CO2 captured for permanent storage in geological reservoirs should be subtracted.

Save

Activity data sources

National sources

- Energy balance
- Statistical reports
- Utility providers' reports
- Customs services report
- Surveys

International sources

- International Energy Agency
- UN Stat

International bunker

Aviation and water-borne navigation

Domestic

- depart and arrive in the same country
- emissions from these activities are reported in the national total

International

- depart in one country and arrive in a different country
- international aviation and water-borne navigation emissions are reported separately from domestic, and **not** included in the national total

Biomass

- CO₂ emissions from biomass burning for energy purposes are not included in the sectoral or national total, instead they are reported separately as an *information item*.
- Non-CO₂ emissions from biomass burning for energy purposes should be reported in the sectoral and national total

The screenshot shows the IPCC Inventory Software interface for the year 2001. The main window displays the 'Energy Sectoral Table' with the following data:

Categories	Emissions (Gg)						
	CO2	CH4	N2O	NOx	CO	NMVOcs	SO2
Memo Items (3)							
International Bunkers							
1.A.3.a.i - International Aviation (International Bunkers) (1)							
1.A.3.d.i - International water-borne navigation (International bunkers) (1)							
1.A.5.c - Multilateral Operations (1)(2)							
Information Items							
CO2 from Biomass Combustion	275.184						
CO2 from Biomass Combustion Captured							

The interface also shows a tree view of 2006 IPCC Categories on the left, including 1.A.1 - Energy, 1.A.2 - Manufacturing industries and construction, and 1.A.3 - Transport. The 'Memo and Information Items' tab is highlighted in the table header.

Reference approach

- Reference Approach is a top-down approach using a country's energy supply data to calculate the emissions of CO₂ from fuel combustion
- Easily available energy supply statistics
- Comparison with the sectoral approach results

EQUATION 6.1

CO₂ EMISSIONS FROM FUEL COMBUSTION USING THE REFERENCE APPROACH

$$CO_2 \text{ Emissions} = \sum_{\text{all fuels}} \left[\left(\text{Apparent Consumption}_{\text{fuel}} \cdot \text{Conv Factor}_{\text{fuel}} \cdot CC_{\text{fuel}} \right) \cdot 10^{-3} \right. \\ \left. - \text{Excluded Carbon}_{\text{fuel}} \right) \cdot COF_{\text{fuel}} \cdot 44/12$$

Primary fuels

Apparent consumption = Production + Import - Export - International bunker - Stock change

Apparent consumption of crude oil already contains the carbon from which gasoline would be refined

Stocks increase → positive stock change

Excluded Carbon - carbon in feedstocks and non-energy use

Reference approach

IPCC Inventory Software - user - [1.A - Reference Approach]

IPCC Inventory Software - user - [1.A - Reference Approach]

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

Reference Approach Data Estimating Excluded Carbon Comparison

Sector: Energy
 Category: Fuel combustion activities
 Category code: 1.A
 Sheet: 1 of 1 - Comparison of CO2 Emissions from Fuel Combustion

Fuel Types	Reference Approach			Sectoral Approach		Difference		
	Apparent Consumption (TJ)	Excluded consumption (TJ)	Apparent Consumption (excluding non-energy use and feedstocks) (TJ)	CO2 Emissions (Gg)	Energy Consumption (TJ)	CO2 Emissions (Gg)	Energy Consumption (%)	CO2 Emissions (%)
Liquid Fuels: 22 item(s)	300	0	300	19.305	300	21.45	0	-10
Solid Fuels: 11 item(s)	0	0	0	0	0	0	0	0
Gaseous Fuels: 1 item(s)	0	0	0	0	0	0	0	0
Other Fossil Fuels: 3 item(s)	0	0	0	0	0	0	0	0
Peat: 1 item(s)	0	0	0	0	0	0	0	0
Total	300	0	300	19.305	300	21.45	0	-10

1) Values in column K are taken from column E of Estimating Excluded Carbon worksheet

Fuel Type	CO2 Emissions (Gg)	Energy Consumption (TJ)	CO2 Emissions (%)	Energy Consumption (%)
Crude Oil	0	0	0	0
Gas/Diesel Oil	43	20.2	0	0
Residual Fuel Oil	40.4	21.1	0	0
Liquefied Petroleum Gases	47.3	17.2	0	0
Ethane	46.4	16.8	0	0
Naphtha	44.5	20	0	0
Bitumen	40.2	22	0	0
Lubricants	40.2	20	0	0

1) Values in column K are taken from column E of Estimating Excluded Carbon worksheet

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
- In any relevant worksheets to estimate GHG emissions from source-categories where fuels are used, if IPCC default fuels are selected, the parameters are filled automatically in the worksheet

Fuel Manager

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 EI
 - 1.A.1.a.i - Electricity
 - 1.A.1.a.ii - Combined
 - 1.A.1.a.iii - Heat Plant
 - 1.A.1.b - Petroleum Refin
 - 1.A.1.c - Manufacture of
 - 1.A.1.c.i - Manufactur
 - 1.A.1.c.ii - Other Ener
- 1.A.2 - Manufacturing Industr
 - 1.A.2.a - Iron and Steel
 - 1.A.2.b - Non-Ferrous Me
 - 1.A.2.c - Chemicals
 - 1.A.2.d - Pulp, Paper and
 - 1.A.2.e - Food Processin
 - 1.A.2.f - Non-Metallic Min
 - 1.A.2.g - Transport Equip
 - 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 - Non-specified I
- 1.A.3 - Transport
 - 1.A.3.a - Civil Aviation
 - 1.A.3.a.i - Internation
 - 1.A.3.a.ii - Domestic
 - 1.A.3.b - Road Transport

2006 IPCC Guidelines

Worksheet notes

Country/Territory: Japan Inventory Year: 2001 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: AR4 GWPs (100 year time horizon) Database file:

Fuel Manager

Worksheet: Energy
Category: Fuel Combustion Activities
Subcategory: 1.A.1.a.iii - Heat Plants
Sheet: Fuel Consumption Data

Data
Fuel Type: Biomass

Equation 2.4

Subdivision	Fuel	Consumption Unit	Consumption (Mass, Volume or Energy Unit)	Conversion Factor (TJ/Unit) (NCV)	Total consumption (TJ)
S	F	U	C	CF	TC = C * CF
Bio Plant	Other Biogas	Gg (Auto CF)	100	50.4	5040
		Gg (Auto CF)			
		Gg (Manual CF)			
		TJ			
Total					5040

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

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

Country/Territory: Japan Inventory Year: 2001 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: AR4 GWPs (100 year time horizon) Database file:

Stationary Combustion

2 worksheets are provided to estimate emissions

- A. Fuel Consumption Data** - subdivision, fuel, consumption amount, units, conversion factor
- consumption units can be selected from the defaults (Gg, TJ) - in this case conversion factor being filled automatically from Fuel Manager
 - or entered directly whatever unit is provided – and conversion factor thus be entered manually
- B. Fuel Combustion Emissions** – technology type and penetration rate by subdivision/fuel, EFs for each technology/fuel
- click “+” at left to expand subdivision and fill in data
 - Technology type can be left “unspecified” (e.g. Tier 1) or compiled with several ones (if available)
 - All technology penetration rates should sum up to 100% for each fuel in subdivision

Stationary Combustion

IPCC Inventory Software - user - [Worksheets]

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

2006 IPCC Categories Fuel Consumption Data Fuel Combustion Emissions

2006 IPCC Guidelines

1.A.1 - Energy Industries

1.A.1.a - Main Activity Electricity

1.A.1.a.ii - Combined Heat and Power (CHP)

2006

Worksheet

Sector: Energy

Category: Fuel Combustion Activities

Subcategory: 1.A.1.a.ii - Combined Heat and Power (CHP)

Sheet: Fuel Combustion Emissions

Data

Fuel Type: (All fuels)

2000

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
Eastern CHP	Other Biogas	15120	825.552	0.01512	0.00151

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
CCGT	100	15120	54600		825.552	1	0.01512	0.1	0.00151
Total		15120			825.552		0.01512		0.00151

Equation 2.4					
Subdivision	Fuel	Total consumption (TJ)	CO2 Emissions (Gg CO2)	CH4 Emissions (Gg CH4)	N2O Emissions (Gg N2O)
<div style="text-align: right;"> Fuel Manager... Time Series data entry... </div>					

Worksheet remarks

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

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)

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)

Road Transportation

Tier 1, 2, 3 are implemented via 4 worksheets

- **Fuel Consumption Data:** the amount of fuel consumed for each [fuel type/vehicle type/emission control technology]
- **Fuel Combustion Emissions:** EFs and calculation of emissions for each [fuel type/vehicle type/emission control technology]
- **CH₄ and N₂O Emissions – Tier 3:** used for Tier 3 estimations of methane and nitrous oxide considering the fuel type, vehicle type, emission control technology, operating conditions, distance travelled and emissions on cold start of the vehicle
- **Fuel Consumption – Validation:** estimation of fuel use from the distance travelled data based on the types of fuel/vehicle/road

Road Transportation

IPCC Inventory Software - user - [Worksheets]

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

2006 IPCC Categories

- 1.A.1.a.ii - Combined
- 1.A.1.a.iii - Heat Plan
- 1.A.1.b - Petroleum Refin
- 1.A.1.c - Manufacture of
 - 1.A.1.c.i - Manufactur
 - 1.A.1.c.ii - Other Ener
- 1.A.2 - Manufacturing Industr
 - 1.A.2.a - Iron and Steel
 - 1.A.2.b - Non-Ferrous Me
 - 1.A.2.c - Chemicals
 - 1.A.2.d - Pulp, Paper and
 - 1.A.2.e - Food Processin
 - 1.A.2.f - Non-Metallic Min
 - 1.A.2.g - Transport Equip
 - 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 - Non-specified I
- 1.A.3 - Transport
 - 1.A.3.a - Civil Aviation
 - 1.A.3.a.i - Internation
 - 1.A.3.a.ii - Domestic
 - 1.A.3.b - Road Transport
 - 1.A.3.b.i - Cars
 - 1.A.3.b.i.1 - Pass
 - 1.A.3.b.i.2 - Pass

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

Worksheet
 Sector: Energy 2000
 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

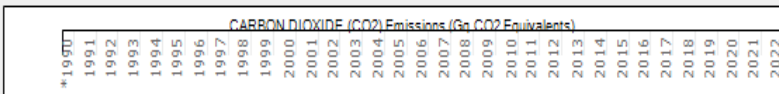
Subdivision	Fuel	Vehicle type	Road type	Number of vehicles	Distance travelled (km)	Consumption (l/km)	Total fuel consumption (l)	Conversion Factor (TJ/l)	Total fuel consumption (TJ)
				A	B	C	D = A * B * C	E	F = D * E
Taxis	Gas/Diesel Oil	5 seat	Urban	5000	124000	0.8	496000000	0	372
Total				5000	124000	0.8	496000000		372

2006 IPCC Guidelines

User notes

1.A.3.b.i.1 - Time Series

Save



Gas CARBON DIOXIDE (CO2)

Worksheet notes

Country/Territory: Japan Inventory Year: 2000 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: AR4 GWPs (100 year time horizon) Database file:

1.A.4.a - Commercial/Institution

Railways

Tier 1, 2, 3 are implemented via 3 worksheets

- **Fuel Consumption Data:** the amount of fuel consumed for each [fuel/locomotive type], either entered directly, or calculated via Equation 3.4.5 based on the number of locomotives, specific fuel consumption and number of days in operation
- **Fuel Combustion Emissions:** EFs and pollutant weighting factors for each [fuel/locomotive type], calculation of emissions
- **CH₄ and N₂O emissions – Tier 3:** used for Tier 3 estimations of methane and nitrous oxide considering the fuel, locomotive type, number of locomotives, annual hours of use, rated power of locomotive and load factor of locomotive

Railways

IPCC Inventory Software - user - [Worksheets]

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

2006 IPCC

2006 IPCC - user - [Worksheets]

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

2006 IPCC Categ... 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: CH4 and N2O Emissions - Tier 3

Data

Fuel Type: (All fuels)

Equation 3.4.3

Subdivision	Locomotive type	Fuel	Number of locomotives	Annual average hours of use of locomotive (hours)	Average rated power of locomotive (kW)	Typical load factor of locomotive (Fraction)	CH4		N2O	
							CH4 Emission Factor (kg CH4/kWh)	CH4 Emissions (Gg CH4)	N2O Emission Factor (kg N2O/kWh)	N2O Emissions (Gg N2O)
S	LT	F	N	H	P	LF	EF(CH4)	CH4=N*H*P*LF*EF(CH4)/10 ⁶	EF(N2O)	N2O=N*H*P*LF*EF(N2O)/10 ⁶
North-Central Rail	EMD SD-40	Diesel for trains	50	6000	2247	0.9	0.004	2.42676	0.013	7.88697
Total			50	6000				2.42676		7.88697

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

User notes 1.A.3.c - Time Series

Off-road transportation

Tier 1, 2, 3 are implemented via 3 worksheets

- **Fuel Consumption Data:** the amount of fuel consumed for each [fuel/vehicle/equipment type]
- **Fuel Combustion Emissions:** EFs for each [fuel/vehicle/equipment type], calculation of emissions
- **Fuel Combustion Emissions – Tier 3:** used for Tier 3 estimations considering the fuel, vehicle type, number of vehicles, annual hours of use, rated power and load factor of vehicles

Off-road transportation

IPCC Inventory Software - user - [Worksheets]

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

2006 IPCC Cat... Fuel Consumption Data Fuel Combustion Emissions Fuel Combustion Emissions - Tier 3

Worksheet

Sector: Energy 2000

Category: Fuel Combustion Activities

Subcategory: 1.A.3.e.ii - Off-road

Sheet: CO2, CH4 and N2O Emissions - Tier 3

Data

Fuel Type (All fuels)

Equation 3.3.3

Subdivision	Vehicle type	Fuel	Source population	Annual average hours of use of vehicle (hours)	Average rated power of vehicle (kW)	Typical load factor of vehicle (Fraction)	CO2		CH4		N2O	
							CO2 Emission Factor (kg CO2/kWh)	CO2 Emissions (Gg CO2)	CH4 Emission Factor (kg CH4/kWh)	CH4 Emissions (Gg CH4)	N2O Emission Factor (kg N2O/kWh)	N2O Emissions (Gg N2O)
S	LT	F	N	H	P	LF	EF(CO2)	$CO_2 = N \cdot H \cdot P \cdot LF \cdot EF(CO_2) / 10^6$	EF(CH4)	$CH_4 = N \cdot H \cdot P \cdot LF \cdot EF(CH_4) / 10^6$	EF(N2O)	$N_2O = N \cdot H \cdot P \cdot LF \cdot EF(N_2O) / 10^6$
Forestry	Chainsaw	Motor Gasoline	1000	3000	1.3	0.9	350	1228.5	25	87.75	1	3.51
Industry	Forklifts	Motor Gasoline	100	2000	5	0.8	310	248	13	10.4	4	3.2
Total			1100	5000				1476.5		98.15		6.71

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

Category: Fuel Combustion Activities

Subcategory: 1.A.3.e.ii - Off-road

Sheet: Fuel Combustion Emissions

Data

Fuel Type Liquid Fuels Uncertainties for Liquid Fuels

Equation 3.3.1, 3.3.2

Subdivision	Fuel	Vehicle / Equipment	Total fuel consumption (TJ)	CO2		CH4		N2O		
				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)
S	F	VE	C	EF(CO2)	Z	$CO_2 = C \cdot EF(CO_2) / 10^6 \cdot Z$	EF(CH4)	$CH_4 = C \cdot EF(CH_4) / 10^6$	EF(N2O)	$N_2O = C \cdot EF(N_2O) / 10^6$
Agriculture	Diesel for off-road	Tractors	19000	74000		1406	5	0.095	11	0.209
Forklifts	Gas/Diesel Oil	2-stroke engine	12900	73500	200	748.15	7	0.0903	8	0.1032
Resorts	Motor Gasoline	Snowmobiles	5000	69300		346.5	170	0.85	0.4	0.002
Unspecified	Gas/Diesel Oil	Unspecified	21500	73000		1569.5	2	0.043	10	0.215
Unspecified	Motor Gasoline	Unspecified	44300	69300		3069.99	50	2.215	2	0.0886
Total			102700			7140.14		3.2933		0.6178

Fugitive – Solid – Abandoned mines

Tier 1, 2, 3 are implemented via 2 worksheets

- **CH₄ Emissions From Abandoned Coal Mines:** counts for Tier 1 emissions based on time from closure, number of mines and fraction of gassy mines
- **CH₄ Emissions From Abandoned Coal Mines – Tier 2&3:** counts for Tier 2 and 3 methane emissions

IPCC Inventory Software - user - [Worksheets]

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

2006 IPCC Cat... CH4 Emissions From Abandoned Coal Mines CH4 Emissions From Abandoned Coal Mines - Tier 2 & 3

Worksheet

Sector: Energy
 Category: Fugitive Emissions from Fuels - Solid Fuels
 Subcategory: 1.B.1.a.i.3 - Abandoned underground mines
 Sheet: CH4 emissions from abandoned underground coal mines - Tier 2 & 3

Data

Equation 4.1.11, 4.1.12, 4.1.13

Subdivision	Region / Basin	Closure Interval	Coal rank	Number of abandoned mines	Fraction of Gassy Coal Mines	Average emission rate before abandonment (m3/Year)	Coefficient A	Coefficient b	Years elapsed since abandonment and inventory year	Emission Factor	Conversion Factor (Gg CH4/m3)	Methane Emissions (Gg CH4)	Methane recovered (Gg CH4)	Methane emissions to be reported (Gg CH4)
S	B	CI	CR	N	G	ER	A	b	T	EF = (1+A*T)^b	CF	E=N*G*ER*EF*CF	Methane recovered (Gg CH4)	ER=E-R
Mid-cent	West	1951 - 1975	Anthracite	100	0.9	10000000	1.72	-0.58	25	0.11138	0	67.16063		67.16063
New	East	1976 - 2000	Bituminous	120	0.95	18800000	3.72	-0.42	5	0.28658	0	411.51906	110	301.51906
Total				220								478.67969		368.67969

Fugitive – Oil – Venting

Tier 1 and 2 are implemented via 3 worksheets

- **Activity Data:** amount of oil production for each [subdivision/industry segment/subcategory], selection of calculation method Tier 1 or 2
- **Emissions:** CO₂ and CH₄ emissions for Tier 1 for each [subdivision/industry segment/subcategory]
- **Emissions – Tier 2:** CO₂ and CH₄ emissions for Tier 2 for each [subdivision/industry segment/subcategory] based on the molecular weight and fraction of associated gas

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2006 IPCC Cat. 2006

Activity Data Emissions Emissions - Tier 2

Worksheet

Sector: Energy

Category: Fugitive Emissions from Fuels - Oil

Subcategory: 1.B.2.a.i - Venting

Sheet: Emissions - Tier 2

Data

Gas: METHANE (CH4) (circled), CARBON DIOXIDE (CO2), METHANE (CH4)

Equation 4.2.3

Subdivision	Industry Segment	Subcategory	Total gas vented (10 ³ m ³)	Molecular weight	Fraction of the associated gas that is composed of CH ₄	CH ₄ Emissions (Gg CH ₄)
S	I	SC	V	M	Y	E=V*M*Y*42.3*10 ⁻⁶
Central production facility	Oil Production	Conventional Oil	12000	16.043	0.3	2.44303
Total			12000			2.44303

Fugitive – Natural Gas – Transmission

Tier 1 and 2 are implemented in 1 worksheet “Oil and Natural Gas”

Activity data can be divided by subdivision/industry segment/subcategory and various EFs can be applied

IPCC Inventory Software - user - [Worksheets]

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

2006 IPCC Cat. Oil and Natural Gas

Worksheet: 2000

Sector: Energy

Category: Fugitive Emissions from Fuels - Oil and Natural Gas

Subcategory: 1.B.2.b.iii.4 - Transmission and Storage

Sheet: CO2, CH4 and N2O from fugitive emissions from fuels by source categories

Data

Equation 4.2.1

Activity					CO2		CH4		N2O	
Subdivision	Industry Segment	Subcategory	Activity	Unit for AD	Emission Factor (Gg CO2/U)	CO2 Emissions (Gg CO2)	Emission Factor (Gg CH4/U)	CH4 Emissions (Gg CH4)	Emission Factor (Gg N2O/U)	N2O Emissions (Gg N2O)
S	I	SC	A	U	EF(CO2)	CO2=A*EF (CO2)	EF(CH4)	CH4=A*EF (CH4)	EF(N2O)	N2O=A*EF (N2O)
Northern Region	Gas Transmission & Storage	Storage	100	10 ⁶ Sm3	0.00000011	0.00001	0.000025	0.0025	0	0
Southern Region	Gas Transmission & Storage	Transmission	1500	10 ⁶ Sm3	0.00000088	0.00132	0.000273	0.4095	0	0
Total						0.00133		0.412		0

Practical Exercises

1. Fuel Manager
2. Stationary combustion
3. Mobile combustion

Thank you!

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