

### Use of the IPCC Inventory Software for the Energy sector

Training for the African Region *April 19, 2022* 

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INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

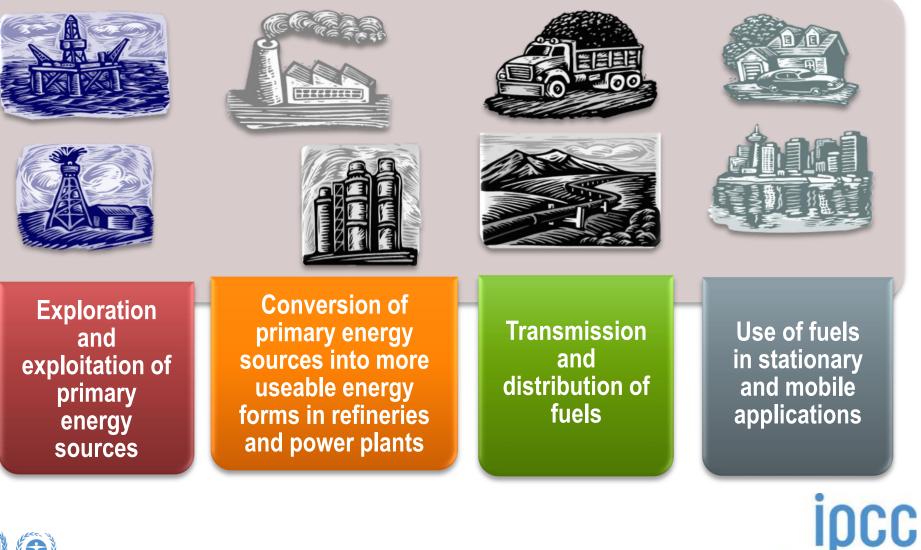
### Content

- Sector overview
- Subcategories/Worksheets
- Methodological Approaches
- Reporting
- Activity data
- Conversion factors
- Sector specific
- Exercises





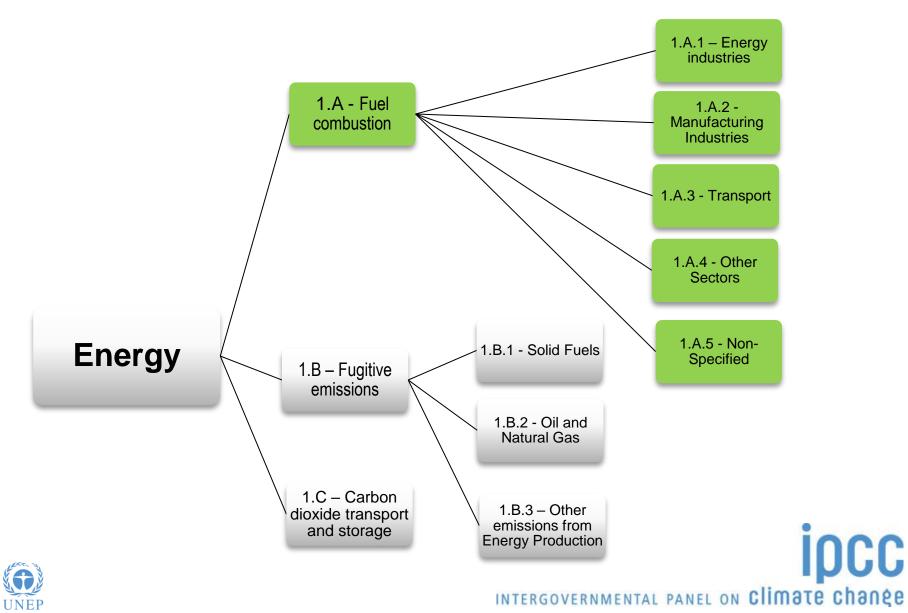
### **Energy sector**





### Sector structure

WMO



### Worksheets

#### Ð Х (ii) IPCC Inventory Software - user - [Worksheets] Application Database Inventory for Worksheets Reports Tools Export/Import Administrate Window \_ 8 X Help 2006 IPCC C: Fuel Combustion Activities ⊡ 1 - Energy Worksheet 1990 I.A - Coel Combustion Activities Sector: Energy A.1 - Energy Industries Category: Fuel Combustion Activities -1.A.1.a - Main Activity Electricity a Subcategory: 1.A.1.b - Petroleum Refining 1.A.1.b - Petroleum Refining CO2, CH4 and N2O from fuel combustion by source categories - Tier 1 Sheet: 1.A.1.c - Manufacture of Solid Fuel Data 1.A.1.c.i - Manufacture of Sod Fuel Ty e (All fuels) Conversion Factor Type NCV O GCV ..... 1.A.1.c.ii - Other Energy Indust (All fuels) Energy Consumption CO2 CH4 ÷ A.2 - Manufacturing Industries and C A.3 - Transport 1.A.3.a - Civil Aviation Emission Consu - 1.A.3.b - Road Transportation Conversion Consumption mption Amount Emissions Emissions -1.A.3.c - Railways Factor Emission Emission Emission (Mass, Volume or Captured (Gg CO2) (Gg CH4) (Gg N20) (TJ/Unit) Factor Factor Factor I.A.3.d - Water-borne Navigation Energy Unit) (C=A\*B (Gq CO2) G=C\*F/10 I=C\*H/10^ (kg N2O/TJ) (kg CO2/TJ) (kg CH4/TJ) E=C\*D/1 1.A.3.e - Other Transportation Consumptio 0^6-Z n Unit 1.A.3.e.i - Pipeline Transpor 1.A.3.e.ii - Off-road ~0> 0 🥑 Gg θ 0 🥑 🔒 0 🥑 🔒 0 🕜 📝 🔒 🏷 🗙 ÷... A.4 - Other Sectors Crude Oil ÷... A.5 - Non-Specified Orimulsion - 1.B - ugitive emissions from fuels Natural Gas Liquids Motor Gasoline B.1 - Solid Fuels Aviation Gasoline B.2 - Oil and Natural Gas Jet Gasoline Other emissions from F Jet Kerosene < 5 DE IPCC G Time Series data entry. orksheet remark 1A1b - Time S \* Base year for assessment of uncertainty in trend: 1990 CARBON DIOXIDE (CO2) Save Gas Country/Territory: Georgia Inventory Year: 1990 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: SAR GWPs (100 year time horizon) Database file: (C:\ProgramData\IPCC2006\_blank\_v270.mdb)

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### Methodological approaches

#### Sectoral approach - bottom-up methodology

<u>Tier 1 (default)</u>

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



### Reporting

- Short Summary all sectors, levelized 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

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- 1.A.1.a.i - Electricity Generation	Sheet: C	AFOLU	•	y source categorie	es - Tier 1										
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- 1.A.1.b - Petroleum Refining			Uncertainties		biomass				1					Odev	
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### Activity data sources

#### **National sources**

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

#### International sources

- International Energy Agency
- UN Stat





### Data units

- Consumption data can be presented in physical (Gg, m3) and/or energy units (TJ)
- Default calorific values are provided in Table 1.2 of Volume 2: Energy, 2006 IPCC Guidelines for National Greenhouse Gas Inventories

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.A.2.i - Mining (excluding fuels) an .A.2.i - Wood and wood products															



### **1.A - Fuel combustion**

#### Sectoral approach

- Tier 1

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

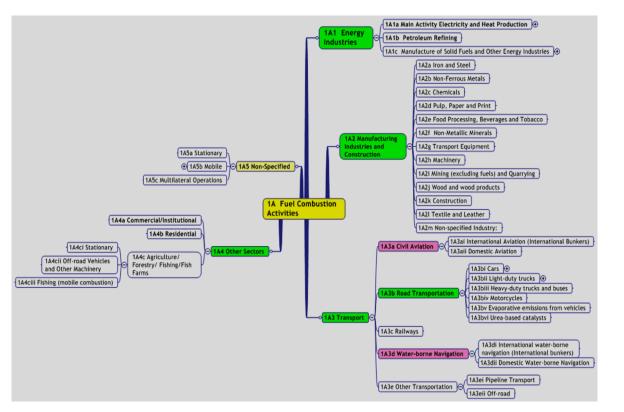
### Sectoral approach

- Tier 2

Country-specific emission factors

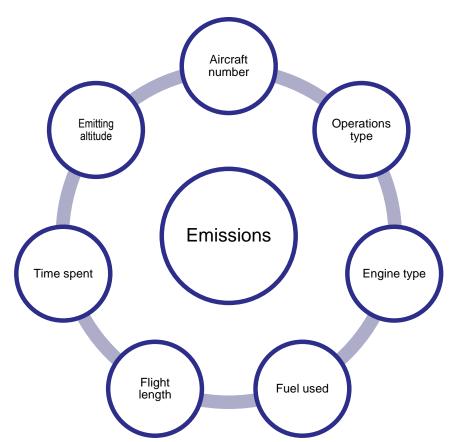
#### EQUATION 2.1 GREENHOUSE GAS EMISSIONS FROM STATIONARY COMBUSTION

Emissions GHG, fuel = Fuel Consumption fuel • Emission Factor GHG, fuel





### Aviation



#### Aircraft operations

- Landing/Take-Off (LTO) cycle
- Cruise (around 90% of emissions)





### Aviation

#### Tier 1

#### Total fuel consumed during all the operations

EQUATION 3.6.1 (AVIATION EQUATION 1) Emissions = Fuel Consumption • Emission Factor

Tier 2

#### Breakdown by operations

Total Emissions = Emissions(LTO) + Emissions(Cruise)

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 $E_{LTO} = N_{LTO} * EF_{LTO}$  $E_{cruise} = (F_{total} - F_{LTO}) * EF_{cruise}$ 



### **Aviation**

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### 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

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### Biomass

- CO<sub>2</sub> 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-CO<sub>2</sub> emissions from biomass burning for energy purposes should be reported in the sectoral and national total

(3) IPCC Inventory Software - user - [Energy Sectoral Table]

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### **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 CO<sub>2</sub> EMISSIONS FROM FUEL COMBUSTION USING THE REFERENCE APPROACH  $CO_2 Emissions = \sum_{all fuels} \begin{bmatrix} ((Apparent Consumption_{fuel} \bullet Conv Factor_{fuel} \bullet CC_{fuel}) \bullet 10^{-3} \\ -Excluded Carbon_{fuel}) \bullet COF_{fuel} \bullet 44/12 \end{bmatrix}$ 

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

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Stocks increase  $\rightarrow$  positive stock change

Excluded Carbon - carbon in feedstocks and non-energy use



### **Reference approach**

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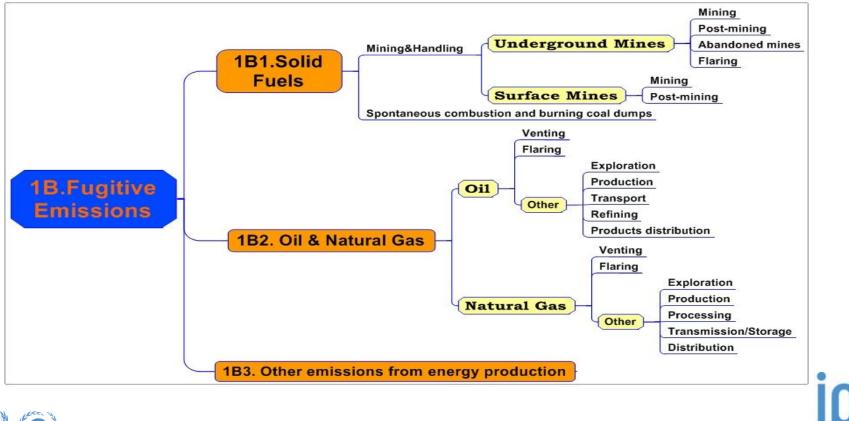
Country/Territory: Georgia Inventory Year: 1990 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: SAR GWPs (100 year time horizon) Database file: (C:\ProgramData\\PCC2006Software\\ipcc2006\_blank\_v270.mdb)

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## **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.B - Fugitive emissions**

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		Worksheet remarks			-	1.B.2.b.iii.4	- Time S	eries					- 9. 9.
						*Base yea	r for assess	ment of uncertainty in trend: 19	CARBON DIOXIDE (CO2) E	missions (Gq CO2 Equivale	nts)		
		<u>S</u> ave				Gas		N DIOXIDE (CO2)					~ ~

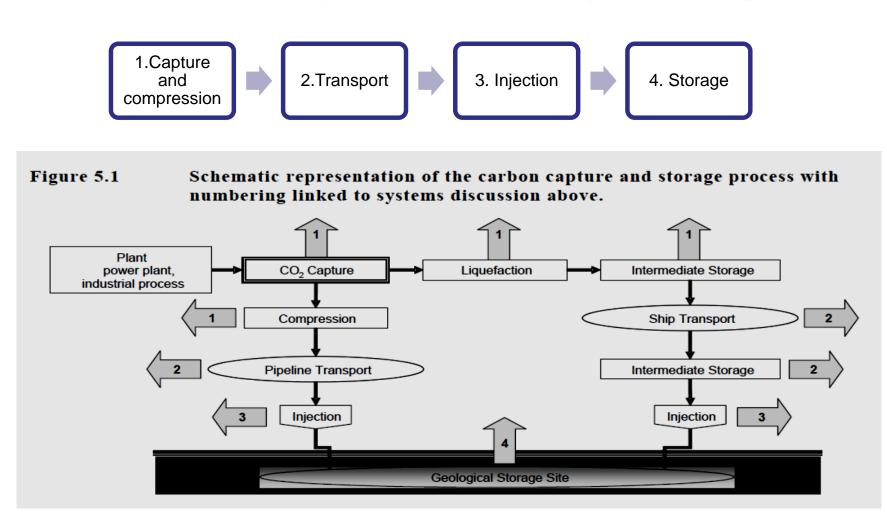
Country/Territory: Gec Country/Territory: Georgia Inventory Year: 1990 Base year for assessment of uncertainty in trend: 1990 CO2 Equivalents: SAR GWPs (100 year time horizon) Database file: (C:\ProgramData\IPCC2006Software\ipcc2006\_blank\_v270.mdb)



INTERGOVERNMENTAL PANEL ON Climate change

**IDCC** 

#### 1.C - CO2 Transport, Injection and Geological Storage



Capture + Imports = Injection + Leakage + Exports



### **Practical Exercises**

- 1. Tier 1. Sectoral approach Stationary combustion
- 2. Tier 1. Sectoral approach Mobile combustion
- 3. Reference Approach
- 4. Tier 2. Sectoral approach Stationary combustion
- 5. Tier 2. Sectoral approach Mobile combustion (Aviation)





### Thank you!

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



