UNECE's emissions of greenhouse gases (GHGs) indicators

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Agenda

1. UNECE indicators
2. Methodologies to compile Air Emissions Accounts
3. Data sources
4. Bridging table
5. Calculation methods

1

UNECE indicators

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UNECE environment indicators

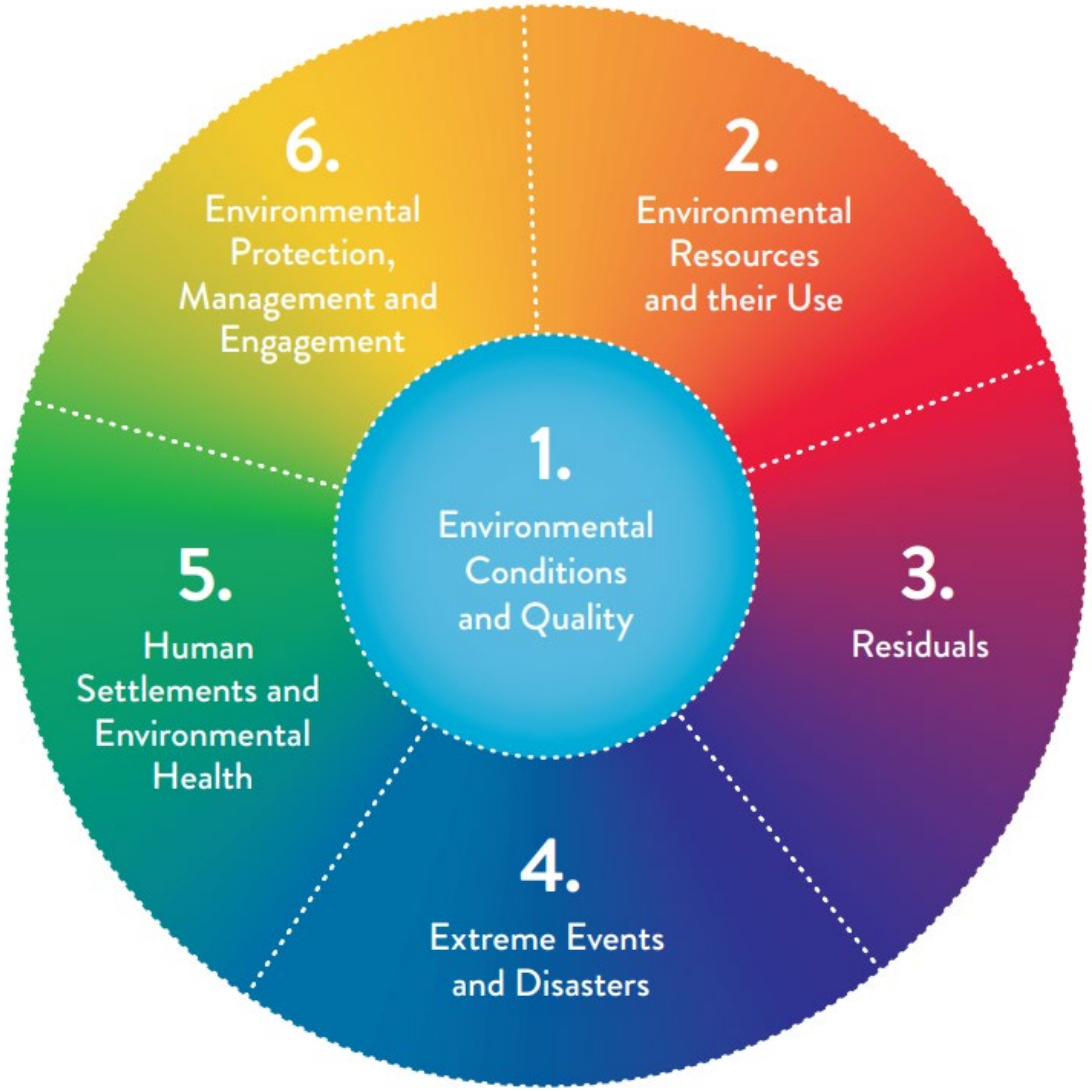
Structure based on FDES

C. Component **Residuals**

C1. subcomponent **emissions to Air**

C1A. topic **emissions of GHGs**

34 indicators



UNECE environment indicators

Global indicators

Air pollutants:

- **GHG**
- **SO_x**
- **NO_x**
- **NMVOC**
- Hydrofluorocarbon

Types of indicator :

- **Total emissions**
- **Emissions per capita**
- **Emissions per km^2**
- **Emissions per GDP**
- **Share of emissions form stationary or mobile sources**

Dual indicators !!!

Dual indicators

Dual means « having two parts, functions, or aspects » (Collins Dictionary)

In our specific case, a dual indicator is **an indicator that has two known calculation methods while these two methods are not equivalent .**

Example : Total GHG emissions

This indicator could be calculated with a territorial approach or a residential approach

It is important to avoid confusion and give clear and precise names to the indicators

Example: Total GHG territorial emissions; Total GHG residential emissions

UNECE environment indicators

Specific indicators

- Total GHG emissions by sectors (energy, transport, industrial processes, solvent & other product use, agriculture, land use and forestry, waste)
- Total greenhouse gas emissions from production activities

  + Direct greenhouse gas emissions from households

- Greenhouse gas emissions from land use, land use change and forestry (LULUCF)
- Net emissions/removals of carbon dioxide by forest land

- CO_2 emission per unit of value added (SDG 9.4.1)
- Greenhouse gas emission intensity of production activities
- CO_2 emissions from fuel combustion within the national territory
- Average CO_2 emissions from newly registered motor vehicles

2

Methodologies to compile AEA

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Air emissions accounts

Main difficulties:

- Apply resident principle
- Disaggregate by Economic activities

Air emissions accounts : select a method

Selection of a method should be based on

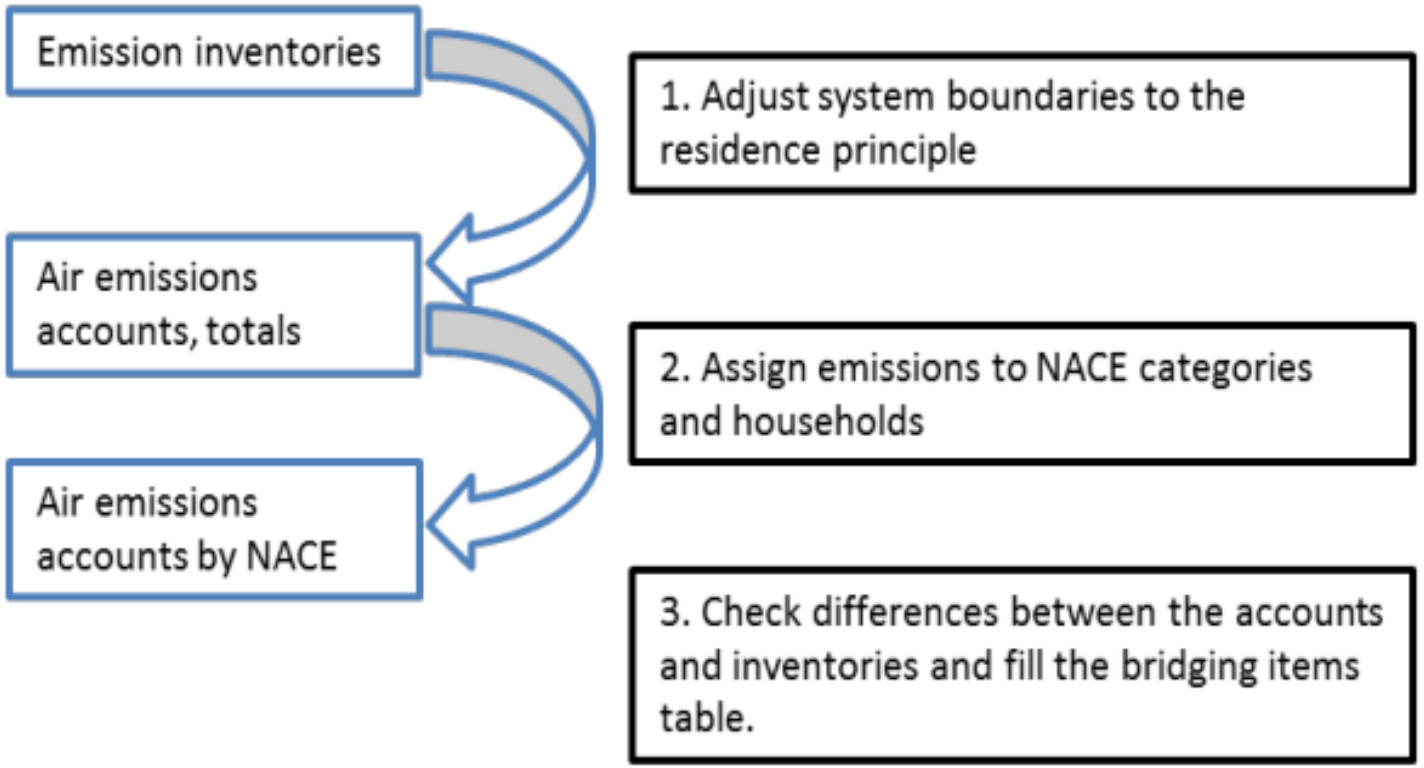
Pollutants related to energy combustion: **CO_2, CH_4, N_2O**	**2 methods:** **Inventory-first approach** **or** **Energy-first approach**
Pollutants non-related to energy combustion: **NOx, SOx, NMVOC**	**1 method:** **Inventory**

Air emissions accounts

Compilation process

1

Inventory-first approach



Source: Eurostat AEA Manual, 2015

Air emissions accounts

First question

1

Inventory-first approach

1. Adjust system boundaries to the residence principle

Question : Do we need make this adjustment ?

theoretical answer: yes, because there is a conceptual difference

practical answer: no, if emissions from foreigners on territory are equal to emissions from resident abroad

Air emissions accounts

Second question

1

Inventory-first approach

2. Assign emissions to NACE categories and households

Question : How to distribute emissions by economic activities ?

theoretical answer: detailed statistics from inventories allow to define the economic activities from emitters

practical answer: for some pollutants, we can use distribution key (i.e. from National accounts,…)

Air emissions accounts

Third question

1

Inventory-first approach

3. Check differences between the accounts and inventories and fill the bridging items table.

Question : Should this step be done ?

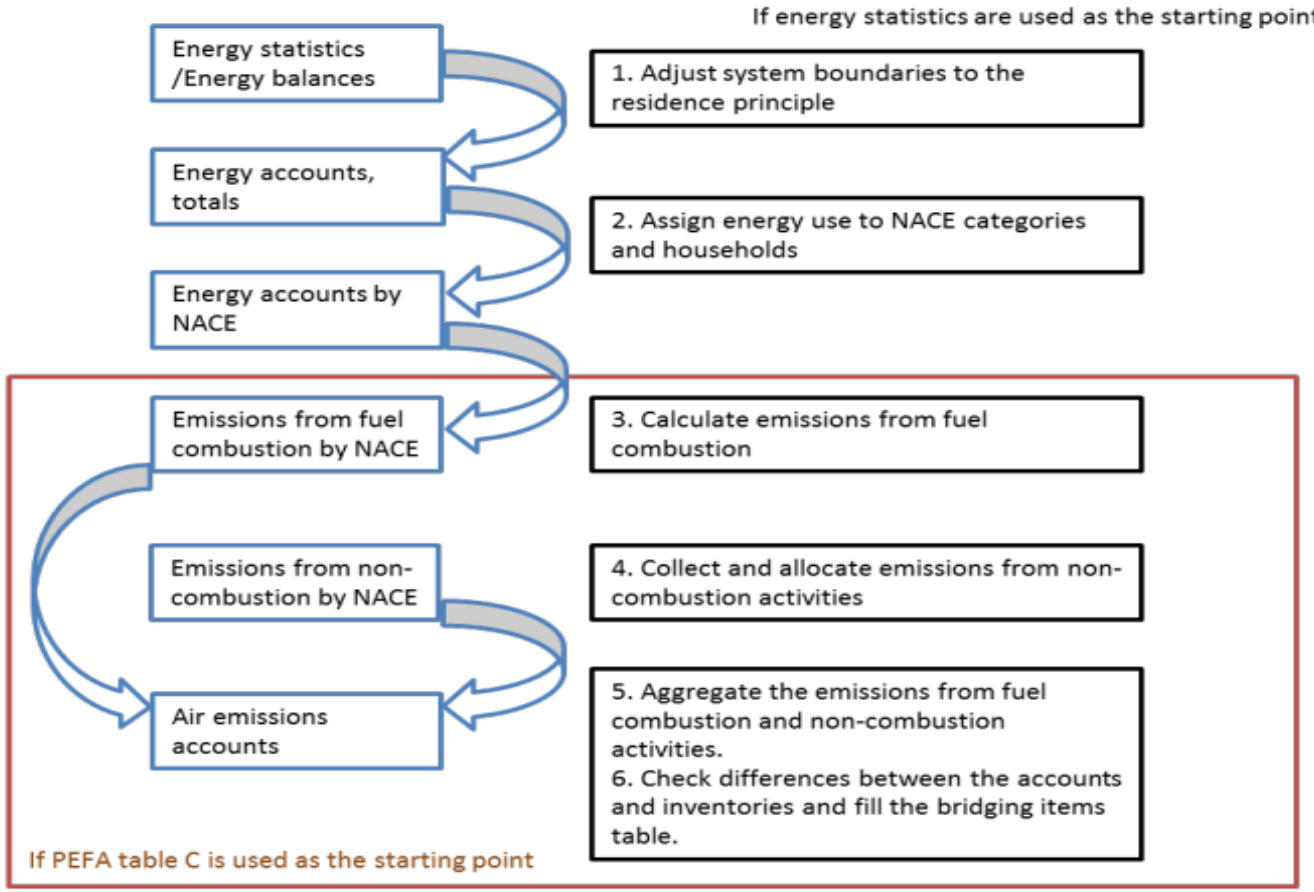
unique answer: yes !!!

Air emissions accounts

Compilation process

2

Energy-first approach



Source: Eurostat AEA Manual, 2015

Air emissions accounts

Compilation process

2

Energy-first approach

3. Calculate emissions from fuel combustion

Emissions = quantities x emission factor

Emission factors vary annually according to the product's origin

and

for some pollutants (i.e. CH_4 or N_2O), vary according to the burning technology

Air emissions accounts

Compilation process

2

Energy-first approach

4. Collect and allocate emissions from non-combustion activities

usually localized emissions and often monitor

i.e. ETS industries

Air emissions accounts

Compilation process

2

Energy-first approach

5. Aggregate the emissions from fuel combustion and non-combustion activities.
6. Check differences between the accounts and inventories and fill the bridging items table.

easy steps

3

Data sources

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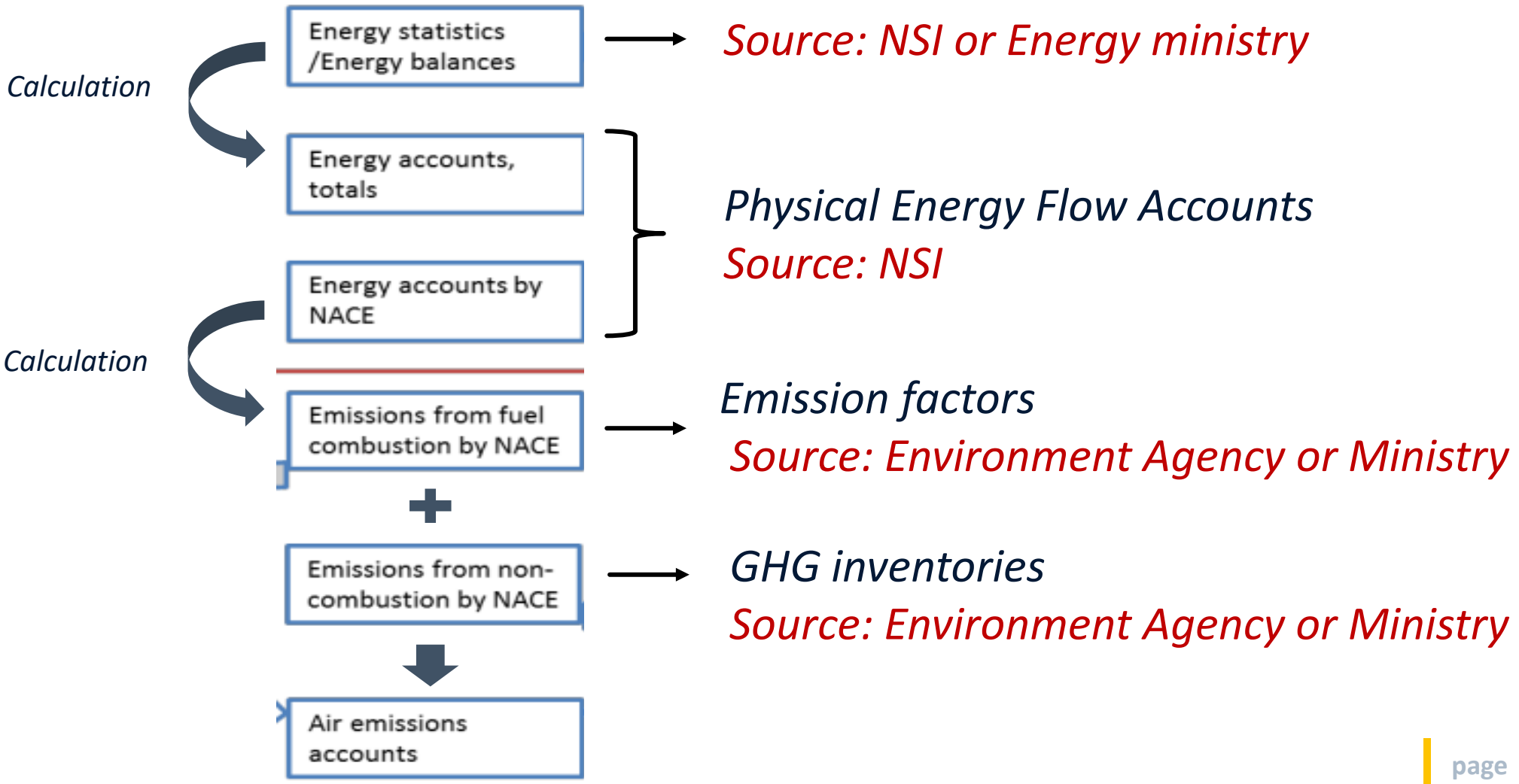
Data sources



Methods for GHG inventories: CRF files

https://unfccc.int/ghg-inventories-annex-i-parties/

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 1 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1. Energy	CS,T1,T2,T3	CS,D,PS	CS,T1,T3	CS,D,M	T1,T2,T3	D,M						
A. Fuel combustion	T1,T2,T3	CS,D,PS	T1,T3	D,M	T1,T2,T3	D,M						
1. Energy industries	T2	CS	T1	D	T1	D						
2. Manufacturing industries and construction	T1,T2,T3	CS,D,PS	T1,T3	D,M	T1,T2,T3	D,M						
3. Transport	T1,T2	CS,D	T1,T3	D,M	T1,T3	D,M						
4. Other sectors	T1,T2	CS,D	T1,T3	D,M	T1,T3	D,M						
5. Other	T1,T2	CS,D	T3	M	T3	M						
B. Fugitive emissions from fuels	CS,T1	CS,D	CS,T1	CS,D								
1. Solid fuels												
2. Oil and natural gas	CS,T1	CS,D	CS,T1	CS,D								
C. CO_2 transport and storage												
2. Industrial processes	CS,M,T1,T2	CS,D,PS			D,T1	D	T1,T2,T3	CS,M,PS			D,T1,T3	CS,D,M,PS
A. Mineral industry	CS,T2	CS,PS										
B. Chemical industry												
C. Metal industry	CS,T1,T2	CS,PS										
D. Non-energy products from fuels and solvent use	CS,M,T1	CS,D										
E. Electronic industry												
F. Product uses as ODS substitutes							T1,T2	CS,M,PS				
G. Other product manufacture and use					D,T1	D	T3	PS			D,T1,T3	CS,D,M,PS
H. Other												

Use the following notation keys to specify the method applied:

D (IPCC default)
RA (Reference Approach)
T1 (IPCC Tier 1)
T1a, T1b, T1c (IPCC Tier 1a, Tier 1b and Tier 1c, respectively)
T2 (IPCC Tier 2)
T3 (IPCC Tier 3)
CR (CORINAIR)
CS (Country Specific)
OTH (Other)
M (model)

Methods for GHG inventories: CRF files

SUMMARY 3 SUMMARY REPORT FOR METHODS AND EMISSION FACTORS USED
(Sheet 2 of 2)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2		CH_4		N_2O	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
3. Agriculture	T1	D	T1,T2	CS,D	T1,T2	CS,D
A. Enteric fermentation			T1,T2	CS,D		
B. Manure management			T1,T2	CS,D	T2	CS
C. Rice cultivation						
D. Agricultural soils(3)					T1,T2	CS,D
E. Prescribed burning of savannas						
F. Field burning of agricultural residues						
G. Liming	T1	D				
H. Urea application	T1	D				
I. Other carbon-containing fertilizers	T1	D				
J. Other						
4. Land use, land-use change and forestry	T1,T3	CS,D			T1	D
A. Forest land	T1,T3	CS,D				
B. Cropland	T1	CS,D			T1	D
C. Grassland	T1	CS,D			T1	D
D. Wetlands	T1	CS,D			T1	D
E. Settlements	T1	CS,D			T1	D
F. Other land						
G. Harvested wood products	T1	CS				
H. Other						
5. Waste			T1	CS,D	T1	D,PS
A. Solid waste disposal			T1	D		
B. Biological treatment of solid waste			T1	D	T1	D
C. Incineration and open burning of waste						
D. Waste water treatment and discharge			T1	CS	T1	D,PS
E. Other						
6. Other ***(as specified in summary 1.A)***						

Assign non-energy GHG emissions – main ideas

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	
1. Energy	*No need Received from PEFA*
A. Fuel combustion	
1. Energy industries	
2. Manufacturing industries and construction	
3. Transport	
4. Other sectors	
5. Other	
B. Fugitive emissions from fuels	ISIC D
1. Solid fuels	
2. Oil and natural gas	
C. CO_2 transport and storage	
2. Industrial processes	ISIC C
A. Mineral industry	
B. Chemical industry	
C. Metal industry	
D. Non-energy products from fuels and solvent use	
E. Electronic industry	
F. Product uses as ODS substitutes	ISIC C, D F, H and HH
G. Other product manufacture and use	
H. Other	

3. Agriculture	ISIC A
A. Enteric fermentation	
B. Manure management	
C. Rice cultivation	
D. Agricultural soils[3]	
E. Prescribed burning of savannas	
F. Field burning of agricultural residues	
G. Liming	
H. Urea application	
I. Other carbon-containing fertilizers	
J. Other	
4. Land use, land-use change and forestry	LULUCF
A. Forest land	
B. Cropland	
C. Grassland	
D. Wetlands	
E. Settlements	
F. Other land	
G. Harvested wood products	
H. Other	
5. Waste	ISIC E
A. Solid waste disposal	
B. Biological treatment of solid waste	
C. Incineration and open burning of waste	
D. Waste water treatment and discharge	
E. Other	
6. Other ***(as specified in summary 1.A)***	

Air Emissions accounts

CO2

	2018	2019	2020
ISIC 1			
ISIC 2			
…			
Total ISIC			

CH4

	2018	2019	2020
ISIC 1			
ISIC 2			
…			
Total ISIC			

N2O

	2018	2019	2020
ISIC 1			
ISIC 2			
…			
Total ISIC			

1000 tons (Gg) or t CO2-eq

or

2020

CO2-eq	**CO2**	**CH4**	**N2O**	**Total GHG**
ISIC 1				
ISIC 2				
…				
Total ISIC				

2021

CO2-eq	**CO2**	**CH4**	**N2O**	**Total GHG**
ISIC 1				
ISIC 2				
…				
Total ISIC				

4

Bridging table

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Bridging table

CO2

1000 tons (Gg)	2018	2019	2020
ISIC 1			
ISIC 2			
…			
Total ISIC			
Households			
Total AEA (ISIC+HH)			
less National residents abroad			
plus Non-residents on the territory			
Other adjustments and statistical discrepancy			
Total CO2 emissions without LULUCF			

Air emissions accounts

Total emissions from international aviation must be excluded

GHG inventories

Bridging table

National residents abroad – examples:

- Emissions emitted by resident during holidays abroad
- Emissions emitted by commuters buying fuels in neighbouring countries
- Emissions from international aviation operated by national companies

Non-resident on the territory – examples:

- Emissions emitted by commuters buying fuels on the territory
- Emissions emitted by freight transport companies buying fuels on the territory

5

Calculation methods

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Air emissions indicators

key indicators

1

Total GHG emissions per capita, per square kilometre, per unit of GDP, by IPCC sector

Total GHG emissions (excluding LULUCF)

Emission from LULUCF

CO_2 emissions from fuel combustion within the national territory

2

Total GHG emission from production activities

GHG emission intensity of production activities

CO_2 emissions per unit of value added (SDG 9.4.1)

Air emissions accounts required

1 Total GHG emissions

per capita, per square kilometre, per unit of GDP, by IPCC sector

Definition

This indicator is a measure of anthropogenic emissions of greenhouse gases (GHGs):

carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6)

on the **national territory**.

Context:

Policy monitoring under Paris agreement (UNFCCC)

1 Total GHG emissions

per capita, per square kilometre, per unit of GDP, by IPCC sector

Unit: CO2-eq (=CO2 equivalent)

=> *need to convert CH_4 tons and N_2O tons in CO2-eq*

Global warning potential (100years) is calculated base on international factor AR5 (fifth assessment report*)

CO_2-eq= 1 * CO2 tons

CO_2-eq= 28 * CH4 tons

CO_2-eq= 265 * N2O tons

* WG1AR5_Chapter08_FINAL.pdf (ipcc.ch) p.73

1 Total GHG emissions

per capita, per square kilometre, per unit of GDP, by IPCC sector

Calculation:

GHG emissions = anthropogenic activities * emission factor

Remarks:

- include net emission from LULUCF
- biomass has by default a value equal to 0

Data sources:

GHG inventories

National Statistical Institute or Environment agency

1 Total GHG emissions

per capita, per square kilometre, per unit of GDP, by IPCC sector

Derived indicators:

GHG emissions per capita

Remarks: GHG emissions calculated for a complete year but population is usually calculated at 1st January => need adjustment: average population

GHG emissions per square kilometre

GHG emission per GDP

Remarks: GDP at constant prices;

For international comparison only ! It is not an intensity indicator !

1 Total GHG emissions

per IPCC sector

Derived indicators:

GHG emissions per sector

CRF 2nd commitment period

1. **Total Energy**
   - A. Fuel combustion activities
     - 1. Energy industries
     - 2. Manufacturing industries and construction
     - 3. Transport
     - 4. Other sectors
   - B. Fugitive emissions from fuels
     - 1. Solid fuels
     - 2. Oil and natural gas and other emissions from energy production
   - C. CO_2 Transport and storage
   - *Memo. International bunkers*
2. Total **Industrial processes**
   - A. Mineral industry
   - B. Chemical industry
   - C. Metal industry
   - D. Non-energy products from fuels and solvent use
   - E. Electronics industry
   - F. Product uses as substitutes for ODS
   - G. Other product manufacture and use
3. Total **Agriculture**
4. Total **LULUCF**
5. Total **Waste**
   - A. Solid waste disposal
   - B. Biological treatment of solid waste
   - C. Incineration and open burning of waste
   - D. Wastewater treatment and discharge

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2 Total GHG emission from production activities

Definition

This indicator is a measure of anthropogenic emissions of greenhouse gases (GHGs):

carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6)

of **national residents**.

Context:

Policymakers analysis: establishment of national reduction measures

2 Total GHG emission from production activities

Unit: CO_2-eq (=CO_2 equivalent)

Calculation:

Inventory-first approach or Energy-first approach

Data sources:

Air emission accounts

National Statistical Institute: National accounts team

Disaggregation:

economic activities (ISIC)

2 Total GHG emission from production activities

Derived indicators:

GHG emission intensity of production activities

GHG intensity is the ratio of GHG emissions per unit of economic value (e.g., metric tons of CO_2-eq per unit of total revenues) or per unit of production (e.g., metric tons of CO_2-eq per unit of product produced)

CO2 emissions per unit of value added (SDG 9.4.1)

CO_2 intensity is the ratio of CO_2 emissions per unit of value added

Air emissions indicators

key indicators

Total SOx emissions

Total SOx emissions per capita

Total NOx emissions

Total NMVOC emissions per capita, per square kilometre

Share of NMVOC emissions from stationary or mobile sources

Share of hydrocarbons emissions from stationary or mobile sources

Core messages

- Establish a System of information on Environment Statistics (SIES)
- Based on international harmonized framework
- Give clear name to Environment Indicators
- Write metadata sheet for each indicator
- Explain calculation methods to users

Any Questions?

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Institut national de la statistique
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