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THE 6th GREENHOUSE GAS INVENTORY SYSTEM TRAINING WORKSHOP

28-31 May 2024 – UN Conference Centre Bangkok, Thailand

IPCC Guideline

Industrial Process and Product Use (IPPU)

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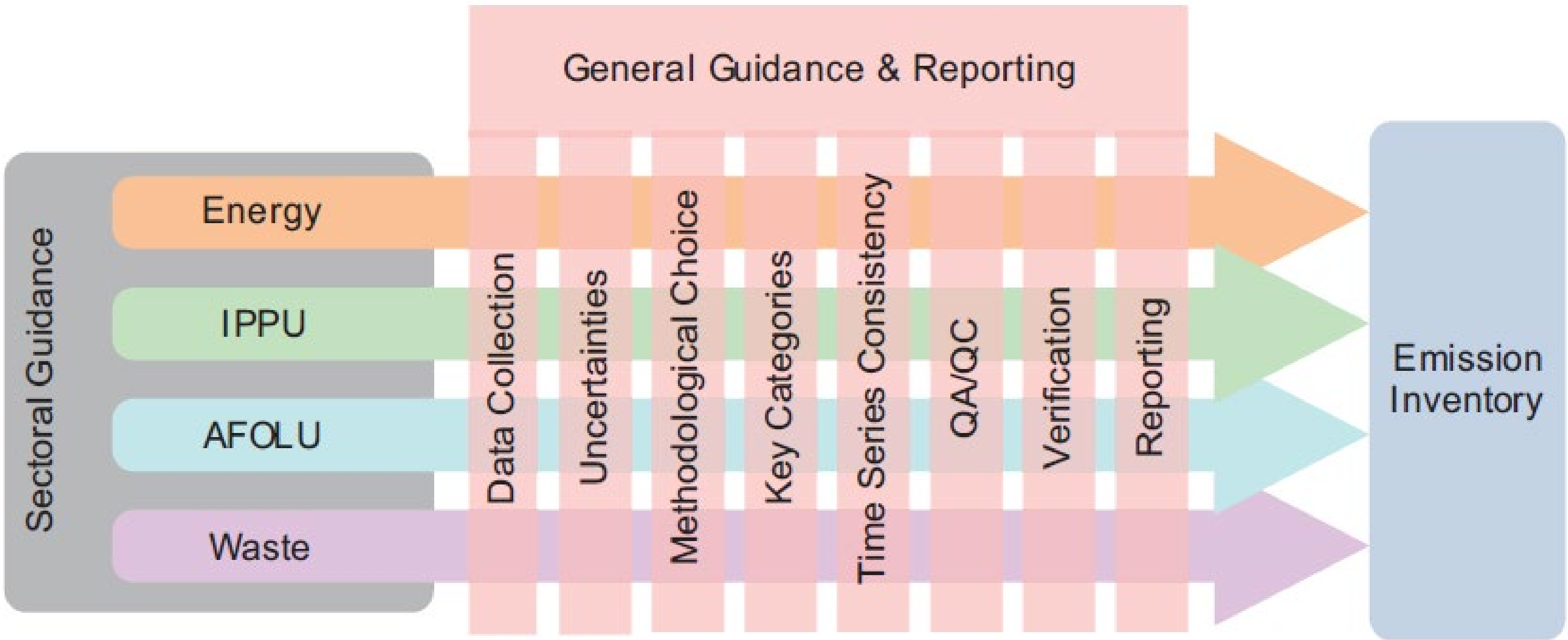
Director
EL Institute Korea

IPCC Guidelines



Relationship between General and Sectoral Guidance

IPPU, What is it about?

- Contents
  - Introduction
  - Mineral/Chemical/Metal Industry Emissions
  - Non-Energy Product from Fuels and Solvent Use
  - Electronics Industry Emissions
  - Fluorinated Substitutes for Ozone Depleting Substances
  - Other Product Manufacture and Use
    - Electrical Equipment
    - SF6 and PFCs from other product uses
    - N2O from Product Uses (Medical, etc.)
  - Other
    - Pulp and paper Industry
    - Food and Beverage Industry
    - Other

What is it really about?

- Greenhouse gas emissions occurring from
  - Industrial processes
  - Use of greenhouse gases in products
  - Non-energy use of fossil fuel carbon

GHG Emission calculation
The Basics

- Greenhouse gas emissions calculation

  - If a company A consumes Bunker C oil 15,000 kilo liter per year
    What is the CO_2 emission/yr?

    - Net calorific value of Bunker C: 39.1 MJ/liter
    - Oxidation factor: 0.99
    - Emission factor: 21.1 kgC/GJ

The Basics

- Greenhouse gas emissions calculation

    If a company A consumes Bunker C oil 15,000 kilo liter per year
    What is the CO_2 emission/yr?

    - Net calorific value of Bunker C: 39.1 MJ/liter
    - Oxidation factor: 0.99
    - Emission factor: 21.1 kgC/GJ

    Total Calorific Value = 15,000 kl * 1,000l/kl*39.1 MJ/l*1GJ/1000MJ
    = 586,500 GJ

    GHG emission
    = 586,500 GJ*21.1kgC/GJ*1tonC/1000kgC *0.99*44/12 tCO_2/tC
    = 44,921.79tCO_2

GHG emissions
= AD * NCV * EF * OF * GWP

What is Industrial Process?

- Emissions from the chemically or physically transformed materials in the industrial processes . e.g.:
  - The blast furnace in the iron and steel industry
  - Cement industry
  - Ammonia and other chemical products manufactured from fossil fuels used as chemical feedstock
    - chemical: $NH_3 + O_2 = 0.5\ N_2O \uparrow + 1.5\ H_2O$ (nitric acid production)
    - physical+chemical: $CaCO_3$ + (Heat) = $CaO + CO_2 \uparrow$

What is Product Use?

- GHG related
- Refrigerators, foams or aerosol cans.
  - HFCs as alternatives to ODS
  - SF_6 used in electrical equipment
  - N_2O used as a propellant in aerosol products in food industry
- End-consumer products
  - SF_6 used in running-shoes
  - N_2O used during anesthesia

Refrigerants as ODS substitutes

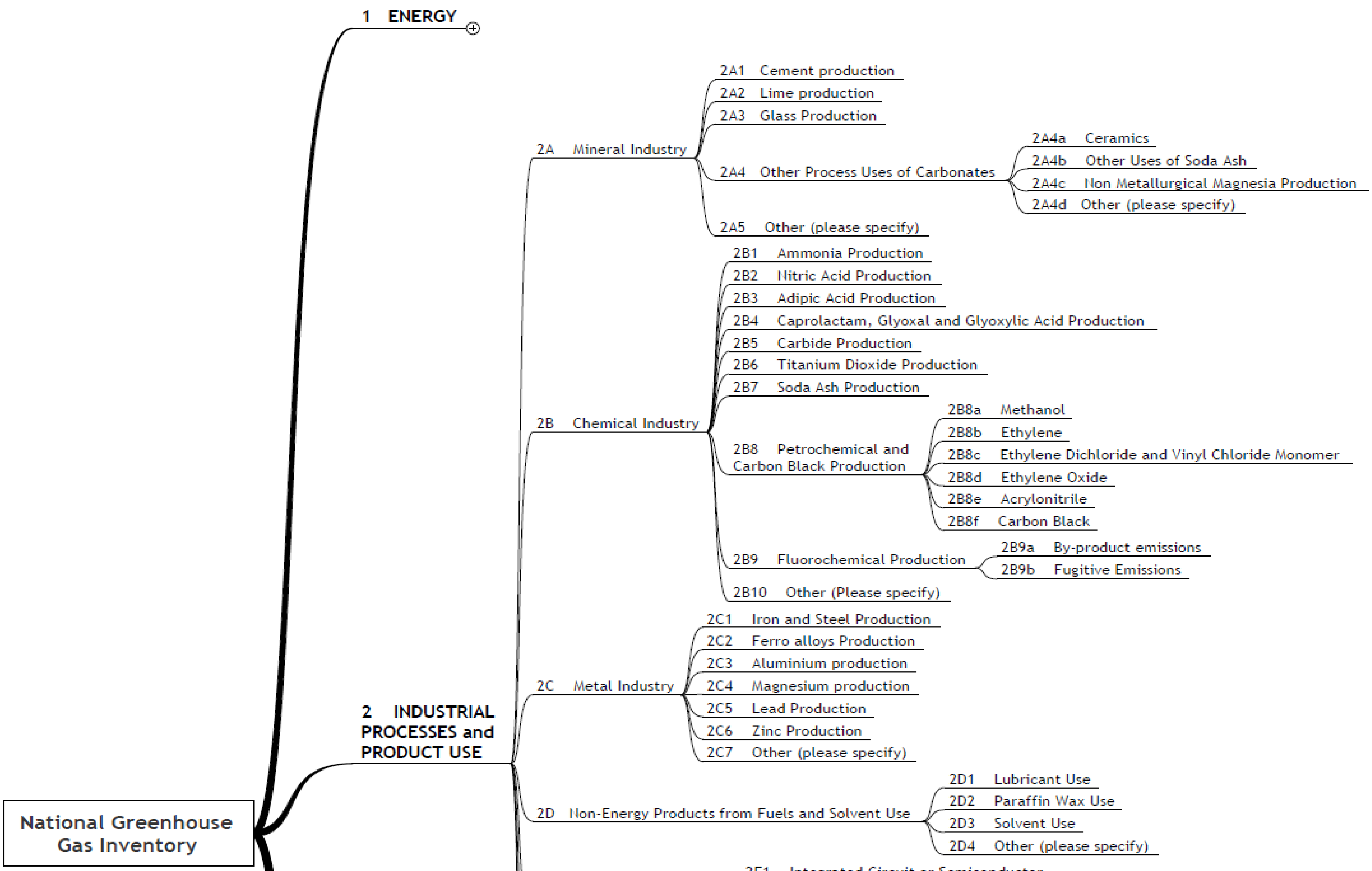
- Old and new refrigerants

Workshop Exercise #1

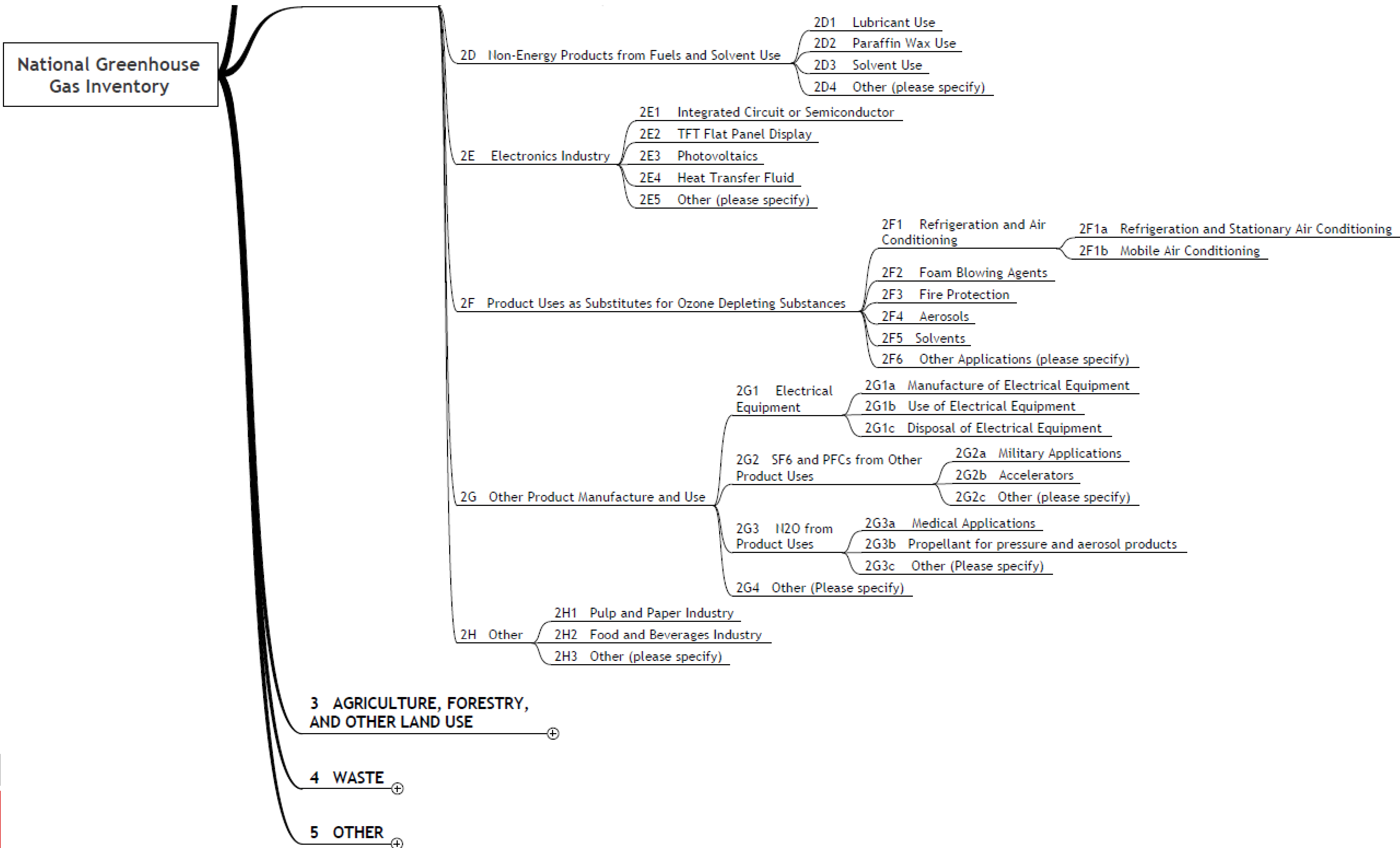
Exercise 1 – Key Category Analysis

Q. What kinds of main industries does your country have?

The IPPU Sector (1/2)



The IPPU Sector (2/2)



Industrial Processes and Product Use

Workshop Exercise #1

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[Sector : Industrial Processes and Product Use]
pre-workshop materials

Exercise 1. What are the key industrial categories of your country?

Country: ____________________

Please indicate the materiality based on the recent national industrial production and product-use volume.

2 - Industrial Processes and Product Use	Production Volume based on the National Statistics (if available)	Materiality based on the Production Volume (H:High, M:Miduim, L:Low)		
2.A - Mineral Industry		H	M	L
2.A.1 - Cement production		H	M	L
2.A.2 - Lime production		H	M	L
2.A.3 - Glass Production		H	M	L
2.A.4 - Other Process Uses of Carbonates		H	M	L
2.A.4.a - Ceramics		H	M	L
2.A.4.b - Other Uses of Soda Ash		H	M	L
2.A.4.c - Non Metallurgical Magnesia Production		H	M	L
2.A.4.d - Other (please specify)		H	M	L
2.A.5 - Other (please specify)		H	M	L
2.B - Chemical Industry		H	M	L
2.B.1 - Ammonia Production		H	M	L

[IPPU]
shop material - K

Key Category Analysis

- Each Party must identify key categories using IPCC approach 1, whereby key

categories are identified using a predetermined cumulative emissions threshold for the starting year

- and the latest reporting year of its GHG inventory with and without LULUCF categories for both level and trend assessment.
- Those developing country Parties that need flexibility in the light of their capacities

have the flexibility to identify key categories at a lower threshold value, no lower than 85 per cent, in place of the 95 per cent threshold defined in the IPCC guidelines.

This flexibility is intended to allow Parties that apply it to focus on improving fewer categories and prioritizing resources.

Key Category Analysis

- Each Party must identify key categories using IPCC approach 1

LEVEL ASSESSMENT

The contribution of each source or sink category to the total national inventory level is calculated according to Equation 4.1:

EQUATION 4.1
LEVEL ASSESSMENT (APPROACH 1)

Key category level assessment = | source or sink category estimate | / total contribution

$$L_{x,t} = \left|E_{x,t}\right| / \sum_{y}\left|E_{y,t}\right|$$

Where:

$L_{x,t}$ = level assessment for source or sink x in latest inventory year (year t).

$\left|E_{x,t}\right|$ = absolute value of emission or removal estimate of source or sink category x in year t

$\sum_{y}\left|E_{y,t}\right|$ = total contribution, which is the sum of the absolute values of emissions and removals in year t calculated using the aggregation level chosen by the country for key category analysis. Because both emissions and removals are entered with positive sign[5], the total contribution/level can be larger than a country's total emissions less removals.[6]

Country-specific emission factors and activity data

- Parties are encouraged to use country-specific and regional emission factors and activity data, where available, or

- to propose plans to develop such emission factors and activity data in accordance with the IPCC guidelines.

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UNOSD ESCAP United Nations Climate Change ipcc

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[Sector : Industrial Processes and Product Use]
pre-workshop materials

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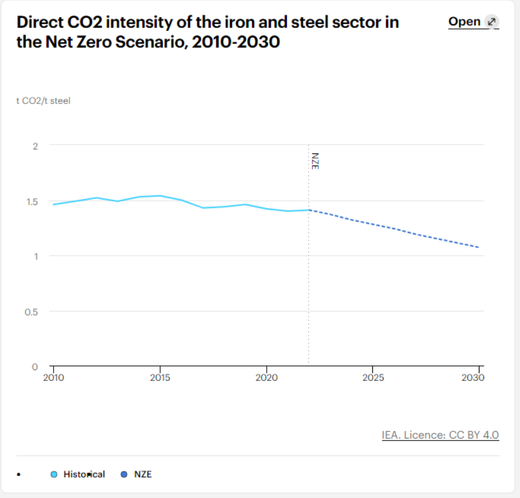
2 - Industrial Processes and Product Use	Production Volume based on the National Statistics (if available)	Materiality based on the Production Volume (H:High, M:Miduim, L:Low)		
2.A - Mineral Industry		H	M	L
2.A.1 - Cement production		H	M	L
2.A.2 - Lime production		H	M	L
2.A.3 - Glass Production		H	M	L
2.A.4 - Other Process Uses of Carbonates		H	M	L
2.A.4.a - Ceramics		H	M	L
2.A.4.b - Other Uses of Soda Ash		H	M	L
2.A.4.c - Non Metallurgical Magnesia Production		H	M	L
2.A.4.d - Other (please specify)		H	M	L
2.A.5 - Other (please specify)		H	M	L
2.B - Chemical Industry		H	M	L
2.B.1 - Ammonia Production		H	M	L

Country's Activity Data X Country's Emission Factors (cf. IEA Industry EF)

The CO2 emission intensity of steel has been relatively stable in recent years, but needs to drop significantly to align with the NZE Scenario



Total CO_2 emissions from the iron and steel sector have risen over the past decade, largely owing to increases in steel demand. Substantial cuts in CO_2 emissions are

Workshop Exercise #2

- What is the Emission Factor of electricity of your country?

- If the electricity consumption of your country is 100 TWh in year 2020, what is the GHG emission caused by?

IEA – Emission Factors 2022

iea

IEA Emission Factors 2022

Contents	Data description
What's included?	This document contains a description of the electricity and heat emissions factors file distributed together with the **2022 edition of the Emission factors** data package. This excel file includes excel sheets with a set of carbon emission factors for electricity and electricity/heat generation. The factors are described below:
Notes & definition	• **CO2 emission factors for electricity only generation** (CHP electricity included) for world countries (in CO2 per kWh, 1990 to 2020). (Sheet CO2KWH ELE)
CO2 per kWh electricity only	• **CO2 emission factors for electricity and heat generation** for world countries (in CO2 per kWh, 1990 to 2020). (Sheet CO2 KWH ELE & HEAT)
CO2 per kWh of electricity and heat	These emission factors are given for electricity and electricity/heat generation for the total electricity generation, and for generation from oil, coal, gas and from non-renewable wastes, as well as from biofuels. (Sheets CO2 KWH ELE & HEAT and CO2KWH ELE)
Trade adjustment	• **2021 provisional emission factors for electricity and electricity/heat generation**, based on provisional electricity generation data (for all OECD countries and selected non-OECD countries). (Sheets CO2 KWH ELE & HEAT and CO2KWH ELE)
T&D losses adjustment	• **CH4 and N2O emission factors for electricity generation** (based on default IPCC factors) (in CO2eq per kWh, 1990 to 2020). (Sheets CH4 factors and N2O factors)
CH4 factors	• **Adjustment factors** to emission factors from electricity generation **for indirect emissions induced by electricity trade** between countries (for OECD countries, 1990 to 2020). (Sheet Trade adjustment)
N2O factors	• **Adjustment factors** to emission factors from electricity generation **for emissions associated to transmission and distribution losses** of electricity in the grid (for countries with available data, 1990 to 2020). (Sheet T&D losses adjustment)
Summary	• **Emission factors** by fuel **from direct combustion** of fuels in other sectors than electricity and heat

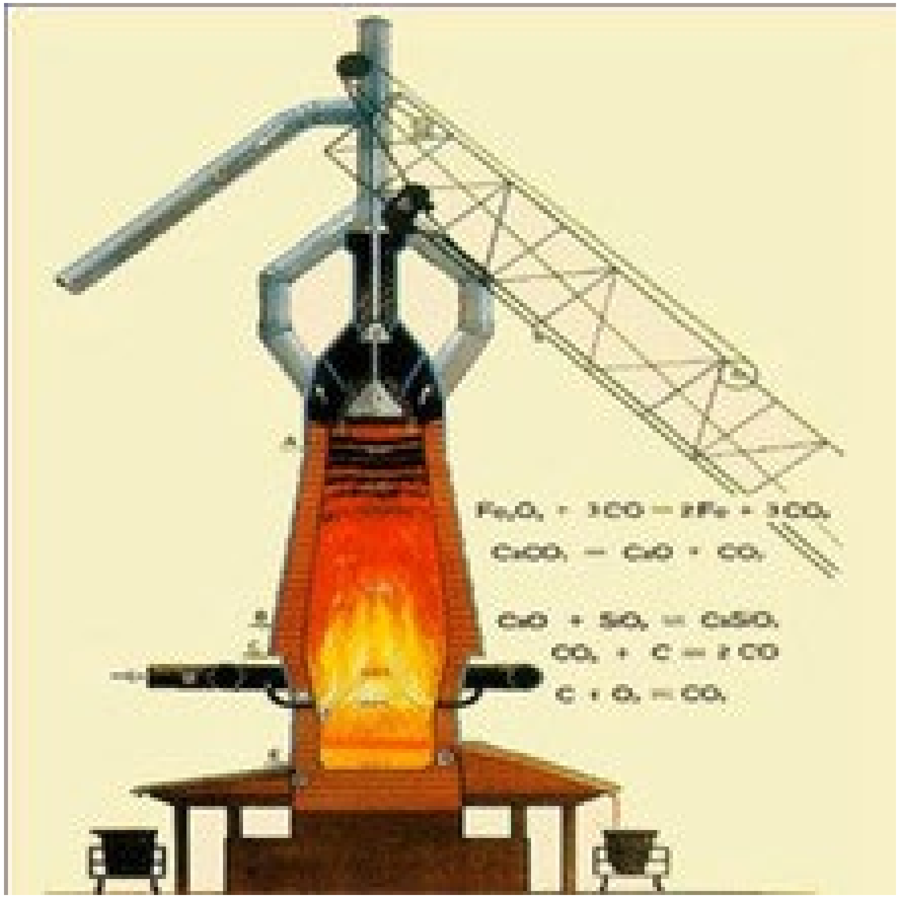
Contents | CO2KWH ELE | CH4 factors | N2O factors

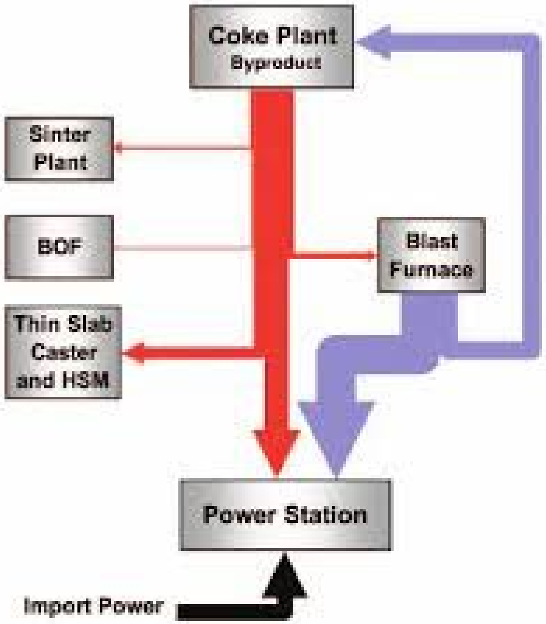
The Complicated Issues in IPPU

Allocation / Double Counting

- by-product fuels or waste gases are transferred from the manufacturing site and combusted elsewhere in quite different activities.
- to be reported in the IPPU sector or fossil fuel use in an Energy Sector?

Example of Allocation Issue – metal industry



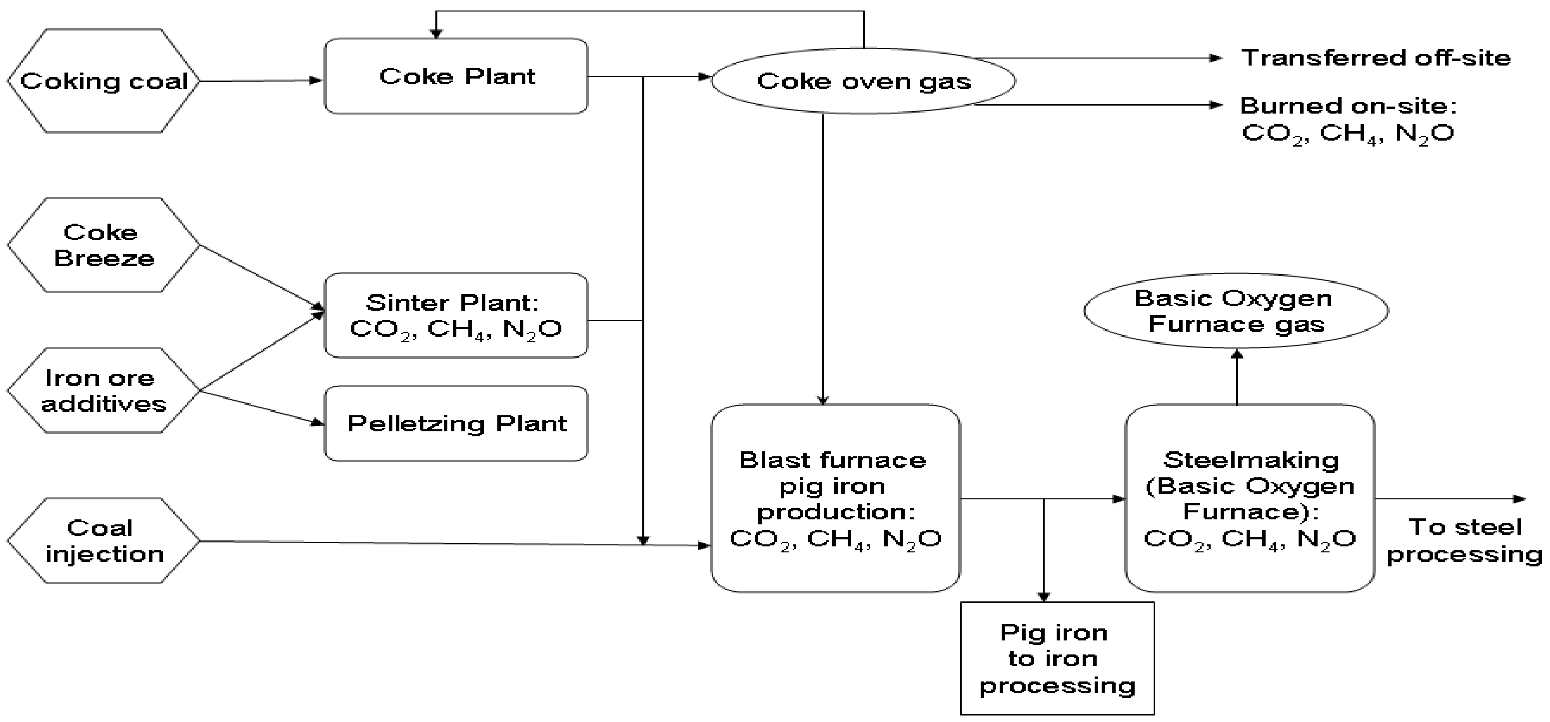


https://youtu.be/otVFDo9YSM8

Steel Manufacturing Process

(18 min film)

Example of Allocation Issue – metal industry



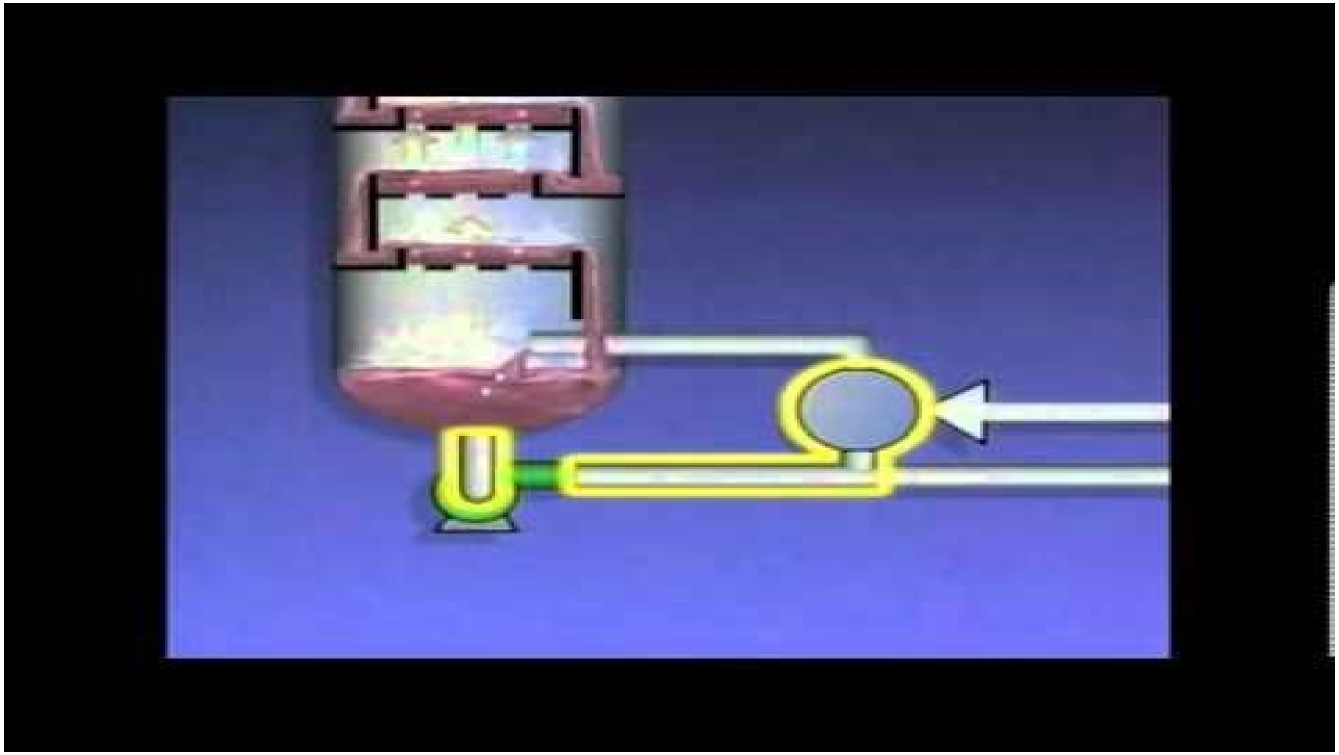
Example of Boundary and Allocation Issues

- blast furnace
  - Blast furnace gas is combusted entirely within the Iron and Steel industry (whether for heating blast air, site power needs or for metal finishing operations) the associated emissions are reported in the IPPU subcategory 2C1 (Iron and steel production).
  - If part of the gas is delivered to a nearby brick works for heat production or a main electricity producer then reported in subcategory 1A2f or 1A1a. (Energy)

Boundary and Allocation

- Naphtha cracking in petrochemical
  - If surplus methane or hydrogen from the steam cracking of naphtha is combusted within the petrochemical site for another process then reported as IPPU, subcategory 2B8.
  - If the gases are passed to a nearby refinery for fuel use, then reported as Energy, 1A1b (Petroleum refining)

Refinery
Crude Oil Distillation Process



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(17 min film)

Capture and Abatement

- Refrigerant in Cars, home & office Air Conditioners?
  - capture and emissions for recovery and use or destruction.
  - good practice to account for capture of emissions using detailed country-specific or more suitably plant-level data.

Capture and Abatement

- Carbon Capture Technology
  - good practice to deduct the GHG captured in a higher tier emission calculation, e.g. plant level.
  - emissions from captured in the process may be both combustion- and process-related. Be careful of double-counting.
  - capture and storage issues refer to Volume 2, Section 2.3.4

What is Non-Energy Use?

- Feedstock: used as raw materials in chemical conversion processes in order to produce primarily organic chemicals and inorganic chemicals and their derivatives.

- Reductant: used as reducing agent for the production of various metals and inorganic products.

- Non-energy product: refineries and coke ovens produce some non-energy products. Lubricants and greases, paraffin waxes, etc.

GHG Calculation in IPPU
The methods (MB and EF)

- The mass-balance approach
  - "I know the beginning and the end"
  - Accountant approach

- The emission factor approach
  - "Based on the trend, I can presume"
  - Empirical

Mass-balance(MB) approach

- More accurate when emission rate vary across equipment and facilities or over time.

- consideration
  - accurate activity data for the MB approach should be available
  - drawbacks:

    1. inaccuracy of measuring devices,

    2. slow leakage afterwards i.e. time lag.

Emission Factor(EF) approach

- Using nameplate capacity of the equipment, apparent leak vs actual leak
- Continuing accuracy of its EF is the key for robustness and reliability.
  - periodical check of EF is necessary.
- Limitation: EF for ODS substitutes and SF_6 from electrical equipment do not exist for all regions of the world.

Methodologies – Understanding the Tier

- It is about Data Accuracy and Data Availability.
  - Tier 1
  - Tier 2
  - Tier 3
- Inventory for small and large GHG emitters, which tier is appropriate?

Understanding the Tier

- Tier 1 – average value of the world
- Tier 2 – national statistical value
- Tier 3 – Actual value (Plant specific data)

Workshop Exercise #3

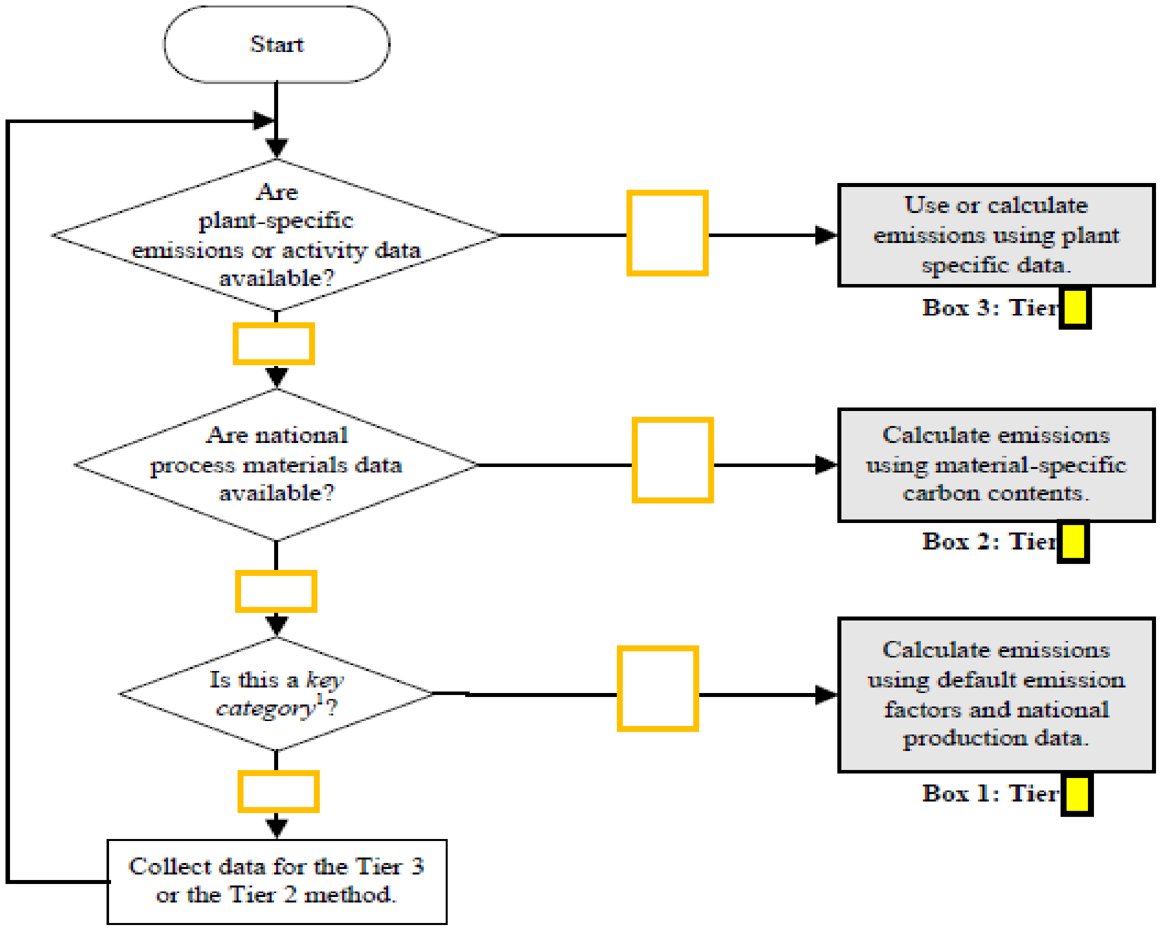
- Understanding the concept of Tier in GHG Inventory

Workshop Exercise #3

- 1) Insert "Yes" or "No" in the ☐

- 2) Insert the appropriate tier in the ☐

Workshop Exercise #3



Industrial Processes and Product Use

Workshop Exercise #3

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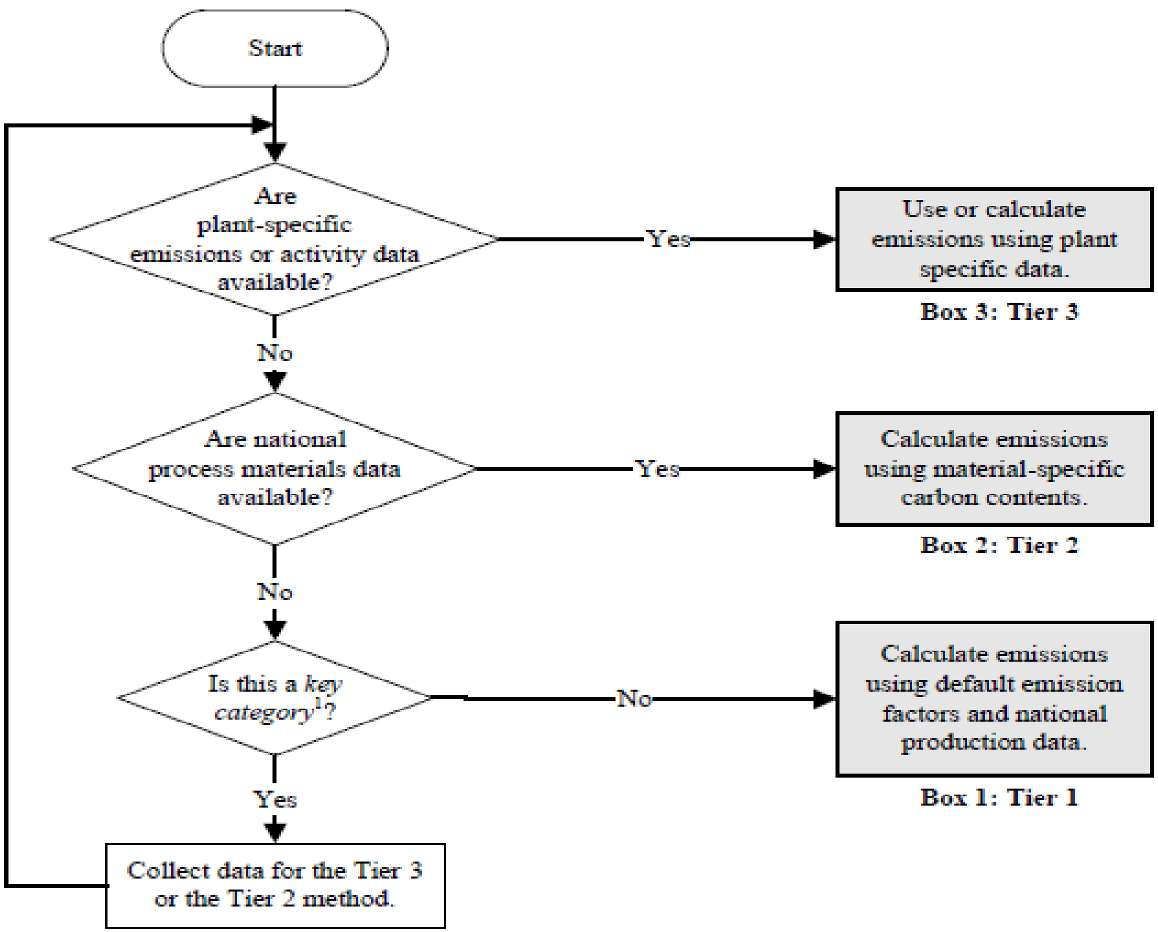

ETF - Tier

- Each Party should make every effort to use a recommended method (tier level) for key categories. A Party may be unable to apply a higher tier method for a particular key category owing to a lack of resources. In such cases, the Party may use a tier 1 approach, and shall clearly document why the methodology used was not in line with the corresponding decision tree of the IPCC guidelines. The Party should prioritize for future improvement any key categories for which the good practice method elaborated in the IPCC guidelines cannot be used.

Uncertainty Assessment

- Uncertainty Assessment
  - *”Doubt is not a pleasant condition, but certainty is an absurd one.” - Voltaire*

- Required uncertainty level

- Parties must quantitatively estimate and qualitatively discuss the uncertainty of the emission and removal estimates for all source and sink categories, including inventory totals, for at least the starting year and the latest reporting year of the inventory time series. It is also essential to estimate the trend uncertainty of emission and removal estimates for all source and sink categories, including totals, between the starting year and the latest reporting year of the inventory time series, using at least approach 1 contained in the 2006 IPCC guidelines.

Iron & Steel Production GHG calculation– How to?

Total emissions are the sum of Equations 4.4 to 4.8.

EQUATION 4.4
CO_2 EMISSIONS FROM IRON AND STEEL PRODUCTION (TIER 1)

Iron & Steel: $E_{CO2,\, non-energy} = BOF \bullet EF_{BOF} + EAF \bullet EF_{EAF} + OHF \bullet EF_{OHF}$

EQUATION 4.5
CO_2 EMISSIONS FROM PRODUCTION OF PIG IRON NOT PROCESSED INTO STEEL (TIER 1)

Pig Iron Production: $E_{CO2,\, non-energy} = IP \bullet EF_{IP}$

EQUATION 4.6
CO_2 EMISSIONS FROM PRODUCTION OF DIRECT REDUCED IRON (TIER 1)

Direct Reduced Iron: $E_{CO2,\, non-energy} = DRI \bullet EF_{DRI}$

EQUATION 4.7
CO_2 EMISSIONS FROM SINTER PRODUCTION (TIER 1)

Sinter Production: $E_{CO2,\, non-energy} = SI \bullet EF_{SI}$

EQUATION 4.8
CO_2 EMISSIONS FROM PELLET PRODUCTION (TIER 1)

Pellet Production: $E_{CO2,\, non-energy} = P \bullet EF_P$

Tier 1

Where:

$E_{CO2,\, non-energy}$ = emissions of CO_2 to be reported in IPPU Sector, tonnes

BOF= quantity of BOF crude steel produced, tonnes

EAF = quantity of EAF crude steel produced, tonnes

OHF = quantity of OHF crude steel produced, tonnes

IP = quantity of pig iron production not converted to steel, tonnes

DRI = quantity of Direct Reduced Iron produced nationally, tonnes

SI = quantity of sinter produced nationally, tonnes

P = quantity of pellet produced nationally, tonnes

EF_x= emission factor, tonnes CO_2/tonne x produced

Iron & Steel Production GHG calculation– How to?

EQUATION 4.9
CO_2 EMISSIONS FROM IRON & STEEL PRODUCTION (TIER 2)

$$E_{CO2,non-energy} = \left[PC \bullet C_{PC} + \sum_a (COB_a \bullet C_a) + CI \bullet C_{CI} + L \bullet C_L + D \bullet C_D + CE \bullet C_{CE} + \sum_b (O_b \bullet C_b) + COG \bullet C_{COG} - S \bullet C_S - IP \bullet C_{IP} - BG \bullet C_{BG} \right] \bullet \frac{44}{12}$$

Focusing on the three things (The carbon contents, + and - , 44/12)

Where, for iron and steel production:

$E_{CO2,\ non\text{-}energy}$ = emissions of CO_2 to be reported in IPPU Sector, tonnes

PC = quantity of coke consumed in iron and steel production (not including sinter production), tonnes

COB_a = quantity of onsite coke oven by-product *a*, consumed in blast furnace, tonnes

CI= quantity of coal directly injected into blast furnace, tonnes

L = quantity of limestone consumed in iron and steel production, tonnes

D = quantity of dolomite consumed in iron and steel production, tonnes

CE = quantity of carbon electrodes consumed in EAFs, tonnes

O_b = quantity of other carbonaceous and process material *b*, consumed in iron and steel production, such as sinter or waste plastic, tonnes

COG= quantity of coke oven gas consumed in blast furnace in iron and steel production, m^3 (or other unit such as tonnes or GJ. Conversion of the unit should be consistent with Volume 2: Energy)

S = quantity of steel produced, tonnes

IP = quantity of iron production not converted to steel, tonnes

BG = quantity of blast furnace gas transferred offsite, m^3 (or other unit such as tonnes or GJ. Conversion of the unit should be consistent with Volume 2: Energy)

C_x = carbon content of material input or output *x*, tonnes C/(unit for material *x*) [e.g., tonnes C/tonne]

Iron & Steel Production GHG calculation– How to?

EQUATION 4.10
CO_2 EMISSIONS FROM SINTER PRODUCTION (TIER 2)

$$E_{CO2,non-energy} = \left[CBR \bullet C_{CBR} + COG \bullet C_{COG} + BG \bullet C_{BG} + \sum_a (PM_a \bullet C_a) - SOG \bullet C_{SOG} \right] \bullet \frac{44}{12}$$

Where, for sinter production:

$E_{CO2,\ non\text{-}energy}$ = emissions of CO_2 to be reported in IPPU Sector, tonnes

CBR = quantity of purchased and onsite produced coke breeze used for sinter production, tonnes

COG= quantity of coke oven gas consumed in blast furnace in sinter production, m^3 (or other unit such as tonnes or GJ. Conversion of the unit should be consistent with Volume 2: Energy)

BG = quantity of blast furnace gas consumed in sinter production, m^3 (or other unit such as tonnes or GJ. Conversion of the unit should be consistent with Volume 2: Energy)

PM_a = quantity of other process material *a*, other than those listed as separate terms, such as natural gas, and fuel oil, consumed for coke and sinter production in integrated coke production and iron and steel production facilities, tonnes

SOG = quantity of sinter off gas transferred offsite either to iron and steel production facilities or other facilities, m^3 (or other unit such as tonnes or GJ. Conversion of the unit should be consistent with Volume 2: Energy)

C_x = carbon content of material input or output *x*, tonnes C/(unit for material *x*) [e.g., tonnes C/tonne]

Non-energy product use calculation – How to?

TABLE 5.1
NON-ENERGY PRODUCT USES OF FUELS AND OTHER CHEMICAL PRODUCTS

Types of fuels used	Examples of non-energy uses	Gases covered in this chapter	
		CO_2	NMVOC, CO
Lubricants	Lubricants used in transportation and industry; Section 5.2	X	
Paraffin waxes	Candles, corrugated boxes, paper coating, board sizing, adhesives, food production, packaging; Section 5.3	X	

EQUATION 5.2
LUBRICANTS – TIER 1 METHOD

$$CO_2\ Emissions = LC \bullet CC_{Lubricant} \bullet ODU_{Lubricant} \bullet 44/12$$

Where:

CO_2 Emissions = CO_2 emissions from lubricants, tonne CO_2

LC = total lubricant consumption, TJ

$CC_{Lubricant}$ = carbon content of lubricants (default), tonne C/TJ (= kg C/GJ)

$ODU_{Lubricant}$ = ODU factor (based on default composition of oil and grease), fraction

44/12 = mass ratio of CO_2/C

Oxidised During Use

Lubricant use calculation – How to?

EQUATION 5.2
LUBRICANTS – TIER 1 METHOD

$$CO_2\ Emissions = LC \bullet CC_{Lubricant} \bullet ODU_{Lubricant} \bullet 44/12$$

Where:

CO_2 Emissions = CO_2 emissions from lubricants, tonne CO_2

LC = total lubricant consumption, TJ

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$ODU_{Lubricant}$ = ODU factor (based on default composition of oil and grease), fraction

44/12 = mass ratio of CO_2/C

For lubricants the default carbon contents factor is 20.0 kg C/GJ on a Lower Heating Value basis. (See Table 1.3 in Chapter 1 of Volume 2).
Note that kg C/GJ is identical to tonne C/TJ.

TABLE 5.2
DEFAULT OXIDATION FRACTIONS FOR LUBRICATING OILS, GREASE AND LUBRICANTS IN GENERAL

Lubricant / type of use	Default fraction in total lubricant [a] (%)	ODU factor
Lubricating oil (motor oil /industrial oils)	90	0.2
Grease	10	0.05
IPCC Default for total lubricants [b]		**0.2**

[a] Excluding the use in 2-stroke engines.

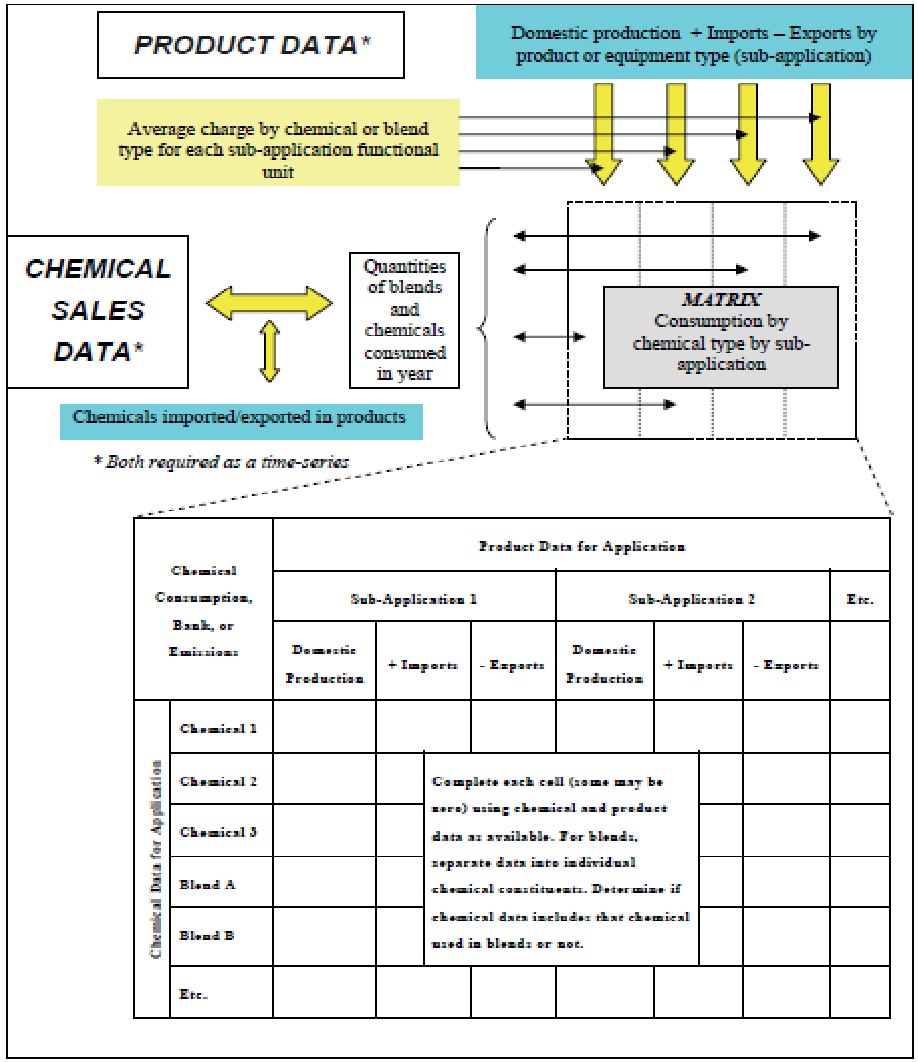
[b] Assuming 90 percent lubricating oil consumption and 10 percent grease consumption and rounded to one significant digit.

Source: Rinehart (2000).

TABLE 7.1
MAIN APPLICATION AREAS FOR HFCS AND PFCS AS ODS SUBSTITUTES [1]

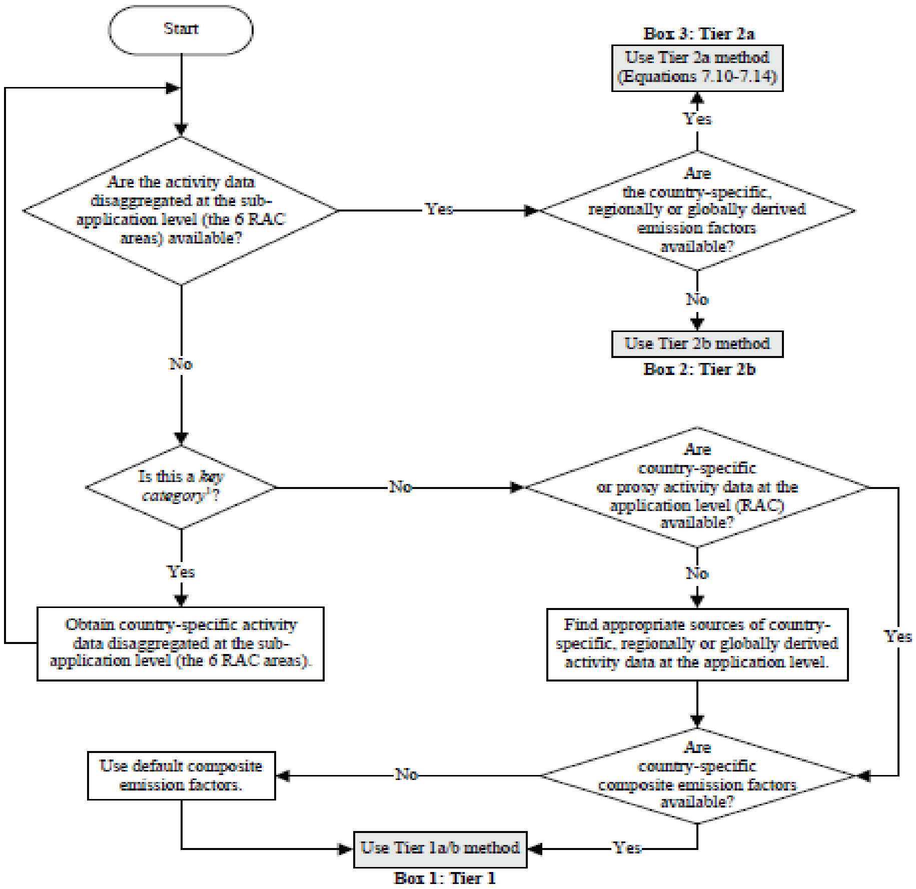
Chemical	Refrigeration and Air Conditioning	Fire Suppression and Explosion Protection	Aerosols		Solvent Cleaning	Foam Blowing	Other Applications[2]
			Propellants	Solvents			
HFC-23	X	X					
HFC-32	X						
HFC-125	X	X					
HFC-134a	X	X	X			X	X
HFC-143a	X						
HFC-152a	X		X			X	
HFC-227ea	X	X	X			X	X
HFC-236fa	X	X					
HFC-245fa				X		X	
HFC-365mfc				X	X	X	
HFC-43-10mee				X	X		
PFC-14[3] (CF_4)		X					
PFC-116 (C_2F_6)							X
PFC-218 (C_3F_8)							
PFC-31-10 (C_4F_{10})		X					
PFC-51-14[4] (C_6F_{14})					X		

ODS calculation – How to? General methodology



ODS calculation
How to? Decision tree for Tier

Figure 7.6 **Decision tree for actual emissions from the refrigeration and air conditioning (RAC) application**



ODS calculation – How to?
General methodology Tier 1a

The calculation formula for Net Consumption within the Tier 1a method is as follows:

EQUATION 7.1
CALCULATION OF NET CONSUMPTION OF A CHEMICAL IN A SPECIFIC APPLICATION

$$Net\ Consumption = Production + Imports - Exports - Destruction$$

Net Consumption values for each HFC or PFC are then used to calculate annual emissions for applications exhibiting prompt emissions as follows:

EQUATION 7.2A
CALCULATION OF EMISSIONS OF A CHEMICAL FROM A SPECIFIC APPLICATION

$$Annual\ Emissions = Net\ Consumption \bullet Composite\ EF$$

Where:

Net Consumption = net consumption for the application

Composite EF = composite emission factor for the application

ODS calculation – How to?

Bank: delay in emission

Tier 1 Refrigeration
Argentina - HFC-143a

HFC-143a

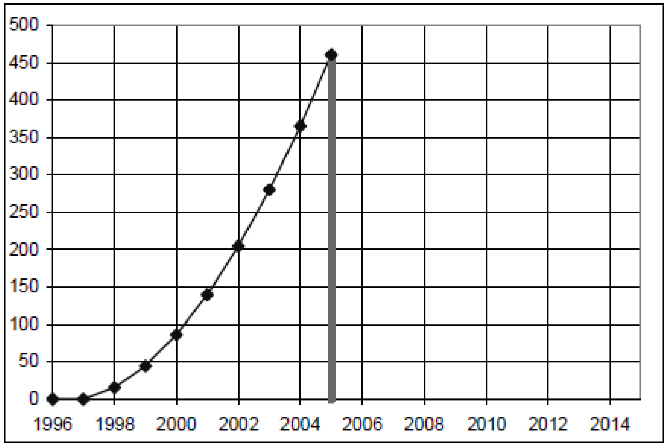
Summary	
Country:	Argentina
Agent:	HFC-143a
Year:	2005
Emission:	**460.7 tonnes**
In Bank:	3071.1 tonnes

Current Year	2005

Use in current year - 2005 (tonnes)	Data Used Here
Production of HFC-143a	800
Imports in current Year	200
Exports in current year	0
Total new agent to domestic market	*1000*

Year of Introduction of HFC-143a	1998
Growth Rate in New Equipment Sales	3.0%

Tier 1 Defaults	
Assumed Equipment Lifetime (years)	15
Emission Factor from installed base	15%
% of HFC-143a destroyed at End-of-Life	0%



Estimated data for earlier years	1996	1997	1998	1999	2000	2001	2002	2003	2004	**2005**
Production	0	0	81	167	259	355	458	566	680	**800**
Agent in Exports	0	0	0	0	0	0	0	0	0	**0**
Agent in Imports	0	0	20	42	65	89	114	141	170	**200**
Total New Agent in Domestic Equipment	0	0	102	209	323	444	572	707	850	**1000**
Agent in Retired Equipment	0	0	0	0	0	0	0	0	0	**0**
Destruction of agent in retired equipment	0	0	0	0	0	0	0	0	0	**0**
Release of agent from retired equipment	0	0	0	0	0	0	0	0	0	**0**
Bank	0	0	102	296	575	933	1365	1867	2437	**3071**
Emission	0	0	15	44	86	140	205	280	365	**461**

Workshop Exercise #4

- Understanding the concept of Bank and Product Use Emissions

Workshop Exercise #4

4-1) Calculate the Bank and the Emissions of HFC-134a in year 2001-2005.
4-2) Convert the emission into CO_2 eq. (cf. GWP of HFC134a = 1,300).

1. Activity Data					
1.1 Imported Amount (Unit: ton)					
Year	2001	2002	2003	2004	2005
HFC-134a Production	100	200	300	400	500
HFC-134a Import	20	40	60	80	100
Bank					
Emission (HFC-134a)					
Emission in CO2eq.					

Workshop Exercise #4

1. Activity Data					
1.1 Imported Amout (Unit:ton)					
Year	2001	2002	2003	2004	2005
HFC-134a Production	100	200	300	400	500
HFC-134a Import	20	40	60	80	100
Total Net Agent of Domestic Equipment	120	240	360	480	600
Bank	**120**	**342**	**651**	**1,033**	**1,478**
Emission (HFC-134a)	**18**	**51**	**98**	**155**	**222**
Emission (CO2eq.)	**23,400**	**66,690**	**126,887**	**201,454**	**288,235**

Time series consistency and recalculations

- The same methods and approach to underlying activity data and emission factors should be used consistently for each reported year.
- In cases when there are missing emission values resulting from a lack of activity data, emission factors or other parameters, surrogate data, extrapolation, interpolation and other methods consistent with splicing techniques contained in the IPCC guidelines should be used to fill in data gaps and ensure a consistent time series.

In the event there are any changes in the methods and/or assumptions, **it is important to recalculate the complete time series** to ensure that changes in emission trends are not introduced as a result of changes in methods or assumptions across the time series, in accordance with the IPCC guidelines.

Summary

- What is IPPU
- Key Category Analysis - Completeness check
- Allocation & Double counting Issues
- Tier (1,2,3)
- Country Specific Emission Factors
- Uncertainty
- Calculation of GHG IPPU sector – Understanding the Methodologies
- Consistency Check