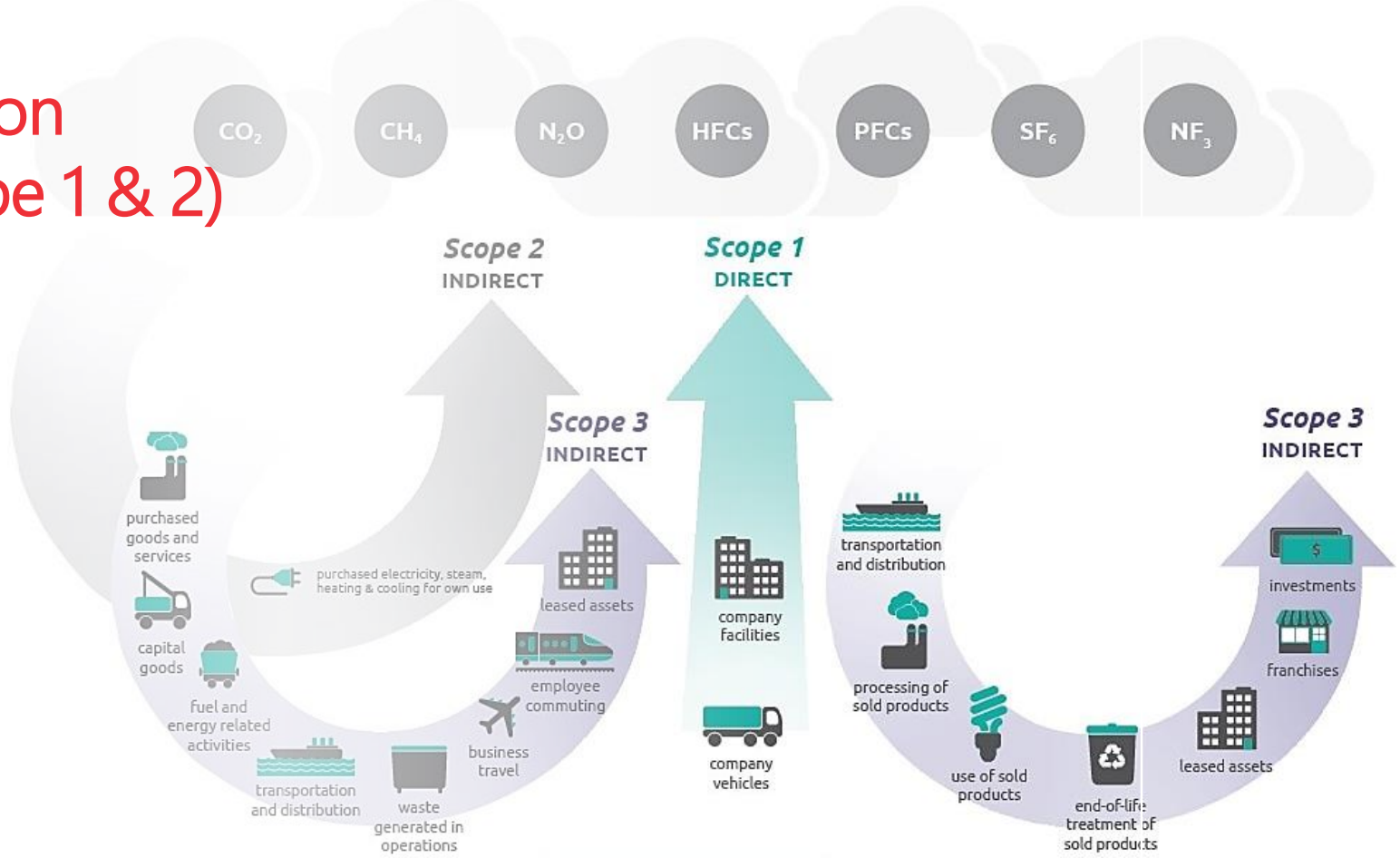
English Workshop
Deep Dive into CASG SME Questionnaire

Practical Guide for SMEs on Carbon Accounting (Scope 1 & 2)

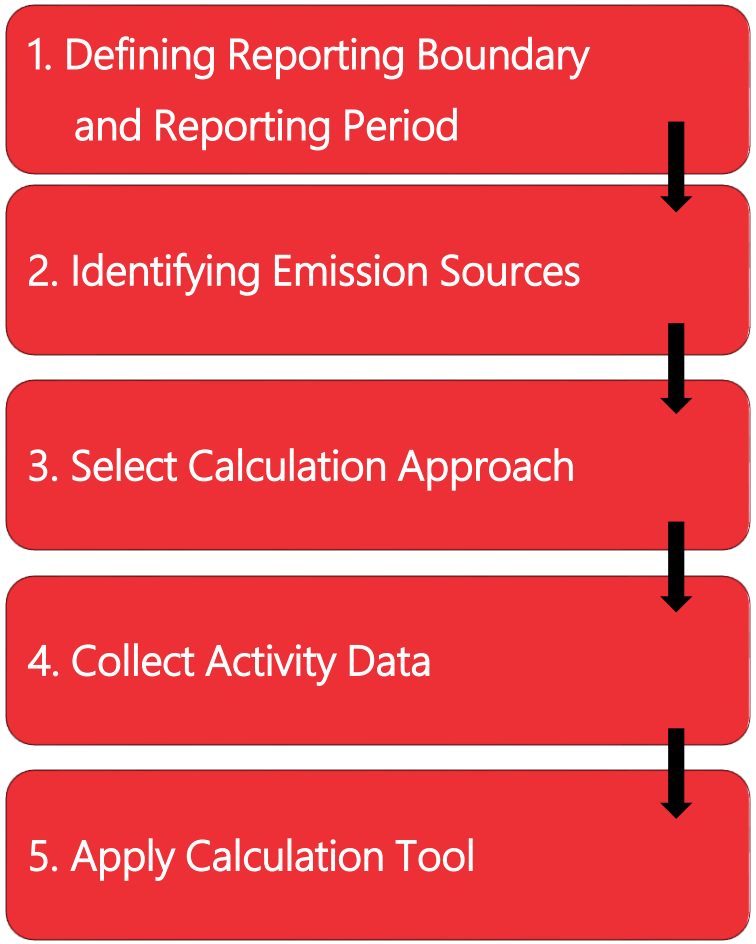
18 September 2023



Agenda

1. Overview Of Carbon Footprint Assessment
2. Defining Reporting Boundary and Reporting Period
3. Identifying Emission Sources
4. Calculation Approach
5. Calculation Tool
6. Q&A

Overview Of Carbon Footprint Assessment



Set Organisational Boundary And Reporting Period

Include All Scope 1 And 2 GHG Emissions And Material Scope 3 Emissions

Choose The Methodology That Allows Representation Of The Emission Profile

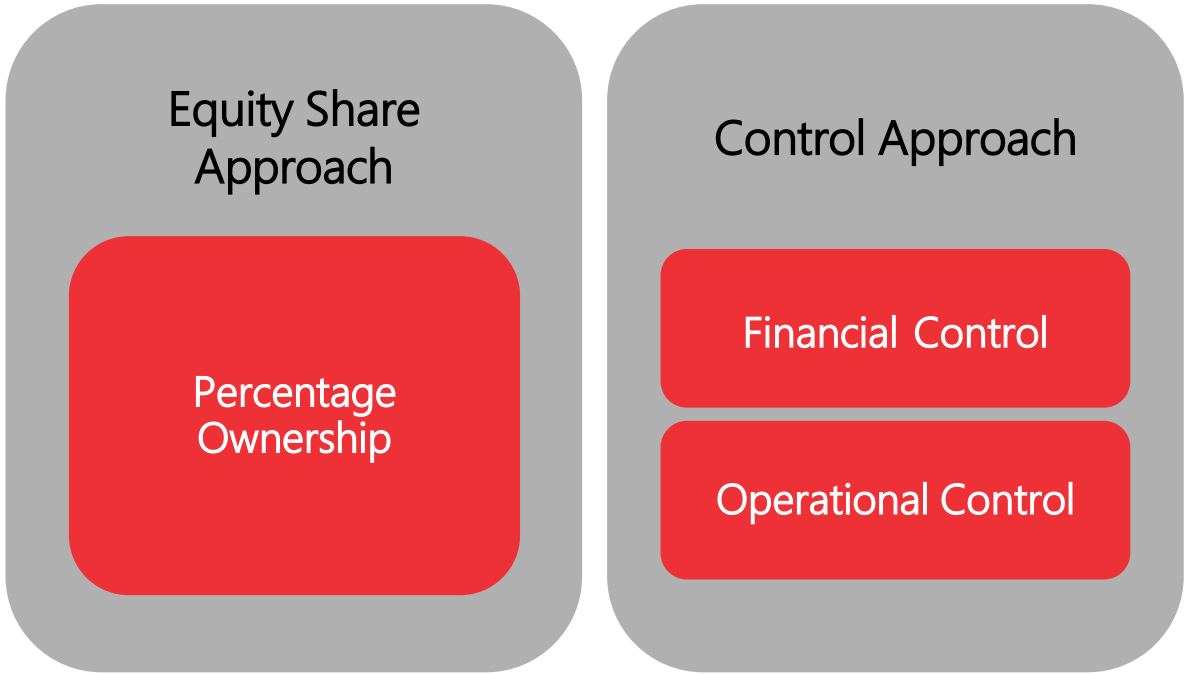
Collect Activity Data And Match Data Owner To The Activity Data

Measure And Compile The Emission Profile To The Organisational Level

1. Defining Reporting Boundary and Reporting Period

Organizational Boundaries

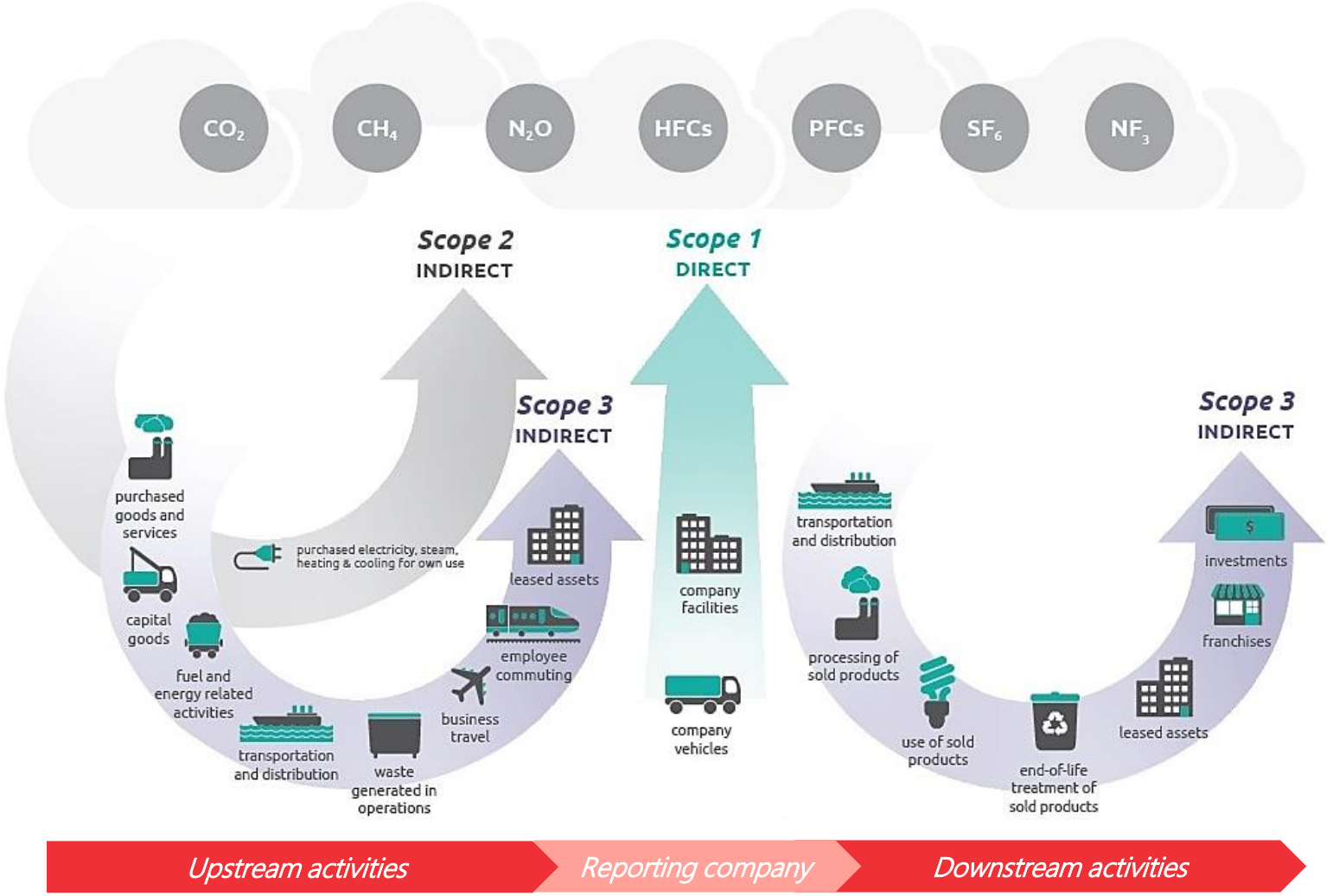
The boundaries that determine the entities owned or controlled by the reporting company, depending on the consolidation approach taken.



Usually Recommend **Operational Control** Approach For GHG Emissions Due To:

a) Easier Access To Data For Carbon Accounting
b) Ability To Influence Operation, Establish Policies To Reduce Emissions

2. Identifying Emission Sources



Exercise: Emission Scopes

What Scope are the following emissions?

Note down Scope 1, 2 or 3?

1. Purchased electricity
2. Petroleum burned by company owned cars
3. Towngas for onsite incinerator
4. Employee travel on MTR
5. Fuel oil used on-site electricity generators
6. Employee travel on airplanes
7. Fugitive emissions leakage from refrigeration systems
8. Non-hazardous waste (such as paper or food) to landfill
9. Gas for office kitchen
10. Company owned Diesel trucks

Exercise: Emission Scopes

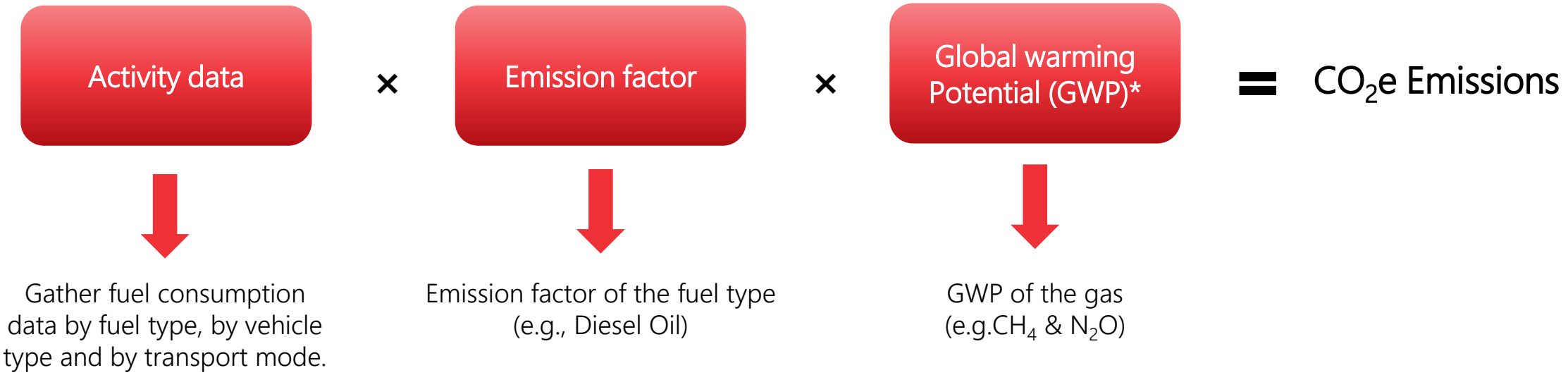
What Scope are the following emissions?

Note down Scope 1, 2 or 3?

1. Purchased electricity	2
2. Petroleum burned by company owned cars	1
3. Towngas for onsite incinerator	1
4. Employee travel on MTR	3
5. Fuel oil used on-site electricity generators	1
6. Employee travel on airplanes	3
7. Fugitive emissions leakage from refrigeration systems	1
8. Non-hazardous waste (such as paper or food) to landfill	3
9. Gas for office kitchen	1 & 2
10. Company owned Diesel trucks	1

GHG Emissions from Mobile Combustion Sources - Calculation Approach

To calculate CO_2 emissions using fuel type, fuel consumption and emission factor data, the following equation is applied:



Fuel use data can be obtained from several different sources including fuel receipts, financial records on fuel expenditures, or direct measurements of fuel use.

GHG Emissions from Mobile Combustion Sources

Table 2-1 CO_2 Emission factor (For mobile combustion sources)

Fuel Type	Emission Factor	Unit
Diesel Oil (DO)	2.614	kg/litre
Unleaded Petrol (ULP)	2.360	kg/litre
Liquefied Petroleum Gas (LPG)	1.679	kg/litre
	3.017	kg/kg
Gas Oil (For Ships only)	2.645	kg/litre
Kerosene (Including Jet Kerosene)	2.429	kg/litre

Table 2-2 CH_4 Emission factor (For mobile combustion sources)

Vehicle Type	Fuel Type	Emission Factor	Unit
Motorcycle	ULP	1.422	g/litre
Passenger Car	ULP	0.253	g/litre
	DO	0.072	g/litre
Private Van	ULP	0.203	g/litre
	DO	0.072	g/litre
	LPG	0.248	g/litre
Public Light Bus	DO	0.072	g/litre
	LPG	0.248	g/litre
Light Goods Vehicle	ULP	0.203	g/litre
	DO	0.072	g/litre
Heavy Goods Vehicle	DO	0.145	g/litre
Medium Goods Vehicle	DO	0.145	g/litre
Ships	Gas Oil	0.146	g/litre
Aviation	Jet Kerosene	0.069	g/litre
Other Mobile Machinery	DO	0.0239	g/litre
	LPG	0.0036	g/litre
		0.006	g/kg
	Kerosene	0.0241	g/litre

Quick tips

IMPORTANT: For CH_4& N_2O, the measurement is in grams so remember to divide by 1,000 to get kg

Table 2-3 N_2O Emission factor (For mobile combustion sources)

Vehicle Type	Fuel Type	Emission Factor	Unit
Motorcycle	ULP	0.046	g/litre
Passenger Car	ULP	1.105	g/litre
	DO	0.110	g/litre
Private Van	ULP	1.140	g/litre

Vehicle Type	Fuel Type	Emission Factor	Unit
	DO	0.506	g/litre
	LPG	0.000	g/litre
Public Light Bus	DO	0.506	g/litre
	LPG	0.000	g/litre
Light Goods Vehicle	ULP	1.105	g/litre
	DO	0.506	g/litre
Heavy Goods Vehicle	DO	0.072	g/litre
Medium Goods Vehicle	DO	0.072	g/litre
Ships	Gas Oil	1.095	g/litre
Aviation	Jet Kerosene	0.000	g/litre
Other Mobile Machinery	DO	0.007	g/litre
	LPG	0.000	g/litre or g/kg
	Kerosene	0.0076	g/litre

Source: Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong

GHG Emissions from Mobile Sources – Calculation Tool

A private car confused 3,800 L of fuel for the current year.
What is the CO_2e emissions for the year?

Step 1	Step 2		Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
A	B	C	D	E	F	G	H	I
Source description (by different vehicle and fuel types)	Fuel Information		CO_2 emission factor*	CO_2 emissions in tonnes of CO_2 equivalent ((B×D)/1000)	CH_4 emission factor*	CH_4 emissions in tonnes of CO_2 equivalent ((B×F)/(1000×1000)×28)	N_2O emission factor*	N_2O emissions in tonnes of CO_2 equivalent ((B×H)/(1000×1000)×265)
	Amount of fuel used (litres)	Fuel Type						
Private Car	3,800	Unleaded						
Total	-	-	-		-		-	

Quick tips

IMPORTANT:
Unit is in tonnes, so you have to convert KG to Tonnes (1 kg = 0.001 tonne)

GHG Emissions from Mobile Sources – Calculation Tool

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	Amount of fuel used (litres)	Fuel Type						
Private Car	3,800	Unleaded	2.360	8.968	0.253	0.027	1.105	1.113
Total	-	-	-	**8.968**	-	**0.027**	-	**1.113**

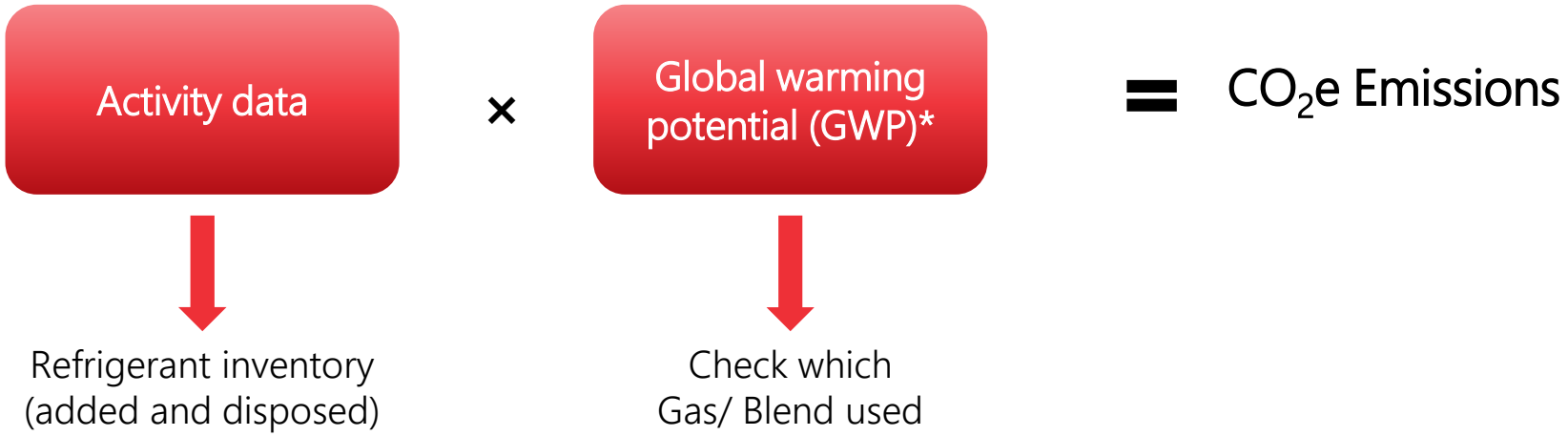
Quick tips

IMPORTANT:
Unit is in tonnes, so you have to convert KG to Tonnes (1 kg = 0.001 tonne)

10.108 Tonnes CO_2e

HFC and PFC Emission from Refrigeration/ Air-conditioning Equipment

It is normally assumed that the mass of refrigerant used to top up the system has leaked into the atmosphere during the same year.



- Hydrofluorocarbons(HFC) & Perfluorocarbons (PFC) are commonly used in refrigeration & air conditioning with GWP much higher than CO_2 (zero for some but can be 11,700 for HFC23)
- Uncontrolled release to atmosphere during the equipment's lifetime may have a significant impact to climate change
- The above calculation only accounts from the operation of refrigeration/air conditioning.

HFC and PFC Emission from Refrigeration/ Air-conditioning Equipment

Table 3-1 Global Warming Potentials (GWP) of Common Refrigeration / Air-Conditioning Refrigerants [Note 1]

Gas or Blend	GWP	Information Source [Note 2]
HFC-23	11,700	A
HFC-32	650	A
HFC-125	2,800	A
HFC-134a	1,300	A
HFC-143a	3,800	A
HFC-152a	140	A
HFC-236fa	6,300	A
R-401A	18	B
R-401B	15	B
R-401C	21	B
R-402A	1,680	B
R-402B	1,064	B
R-403A	1,400	B
R-403B	2,730	B
R-404A	3,260	B
R-406A	0	B
R-407A	1,770	B
R-407B	2,285	B
R-407C	1,526	B
R-407D	1,428	B
R-407E	1,363	B
R-408A	1,944	B
R-409A	0	B
R-409B	0	B
R-410A	1,725	B
R-410B	1,833	B
R-411A	15	B
R-411B	4	B
R-412A	350	B
R-413A	1,774	B
R-414A	0	B
R-414B	0	B
R-415A	25	B
R-415B	105	B
R-416A	767	B
R-417A	1,955	B
R-418A	4	B
R-419A	2,403	B
R-420A	1,144	B
R-500	37	B
R-501	0	B
R-502	0	B
R-503	4,692	B
R-504	313	B
R-505	0	B
R-506	0	B
R-507 or R-507A	3,300	B
R-508A	10,175	B
R-508B	10,350	B
R-509 or R-509A	3,920	B
PFC-116 (C_2F_6)	9,200	A
PFC-14 (CF_4)	6,500	A

Source:

- *Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong*
- *IPCC AR5*

Additional sources may be found in the following global references:

- *US Government EPA's emission factors for greenhouse gas inventories(p.5)*
- *EU's guidance for importers of equipment containing fluorinated greenhouse gases (p.35)*

HFC & PFC Emissions from Refrigeration/ Air-conditioning Equipment – Calculation Approach

R412A: Open stock 40kg, 15kg purchased, 10kg disposed, closing stock 25kg.

What is the CO_2e emissions?

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	B	C	D	E	F	G
Type of refrigerant	Amount of HFC/PFC at the beginning of the reporting period (kg)	Amount of HFC/PFC purchased during the reporting period (kg)	Amount of HFC/PFC disposed (through environmentally responsible means) during the reporting period (kg)	Amount of HFC/PFC at the end of the reporting period (kg)	GWP of refrigerant*	HFC/PFC emissions in tonnes of CO_2 equivalent ((B+C-D-E)×F/1000)
R412A	40					
Total	-	-	-	-	-	

HFC & PFC Emissions from Refrigeration/ Air-conditioning Equipment – Calculation Approach

R412A: Open stock 40kg, 15kg purchased, 10kg disposed, closing stock 25kg.

What is the CO_2e emissions?

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
A	B	C	D	E	F	G
Type of refrigerant	Amount of HFC/PFC at the beginning of the reporting period (kg)	Amount of HFC/PFC purchased during the reporting period (kg)	Amount of HFC/PFC disposed (through environmentally responsible means) during the reporting period (kg)	Amount of HFC/PFC at the end of the reporting period (kg)	GWP of refrigerant*	HFC/PFC emissions in tonnes of CO_2 equivalent ((B+C-D-E)×F/1000)
R412A	40	15	10	25	350	7.000
Total	-	-	-	-	-	7 Tonnes CO_2e

R-412A	350
R-413A	1,774
R-414A	0
R-414B	0

Scope 2 - Indirect emissions - Calculation Approach

Electricity & Town gas

These energy supplies are produced (generated or manufactured) outside the reporting entity's boundary but the reporting entity's operational activity results in the consumption and consequent emission.

Quantity Purchased × Emission factor = CO_2e Emissions

Quantity purchased:

Electricity Unit = kwh

Town gas Unit = 48 MegaJoules

Scope 2 - Indirect emissions

Scope 2- emissions include

- Electricity purchased from power companies (HKE & CLP)
  GHG emissions from the generation of purchased electricity from HKE/CLP and/or Towngas that is consumed by the reporting entity's controlled equipment or its operations within the physical building boundary.

These energy supplies are produced (generated or manufactured) outside the reporting entity's boundary but the reporting entity's operational activity results in the consumption and consequent emission.

- Towngas purchased from Hong Kong and China Gas Company (Towngas).This only accounts for the emissions during the production of Towngas.
  The emission caused by the actual combustion of Towngas is reported under Scope 1.

Power Company specific value

- Obtain from the electricity provider (e.g., CLP / HK Electric) for the relevant reporting period.
- The data can be found in the latest Sustainability Report.

Question: In 2020, the emission factor was 0.37kg of CO_2e per kWh. In 2021 it was 0.39kg of CO_2e and last year it is 0.39kg of CO_2e per kWh.
Why would the emissions factor vary from year to year?

Towngas(Scope 1 & 2):

The factor relates to the production and transmission of the fuel.

- variable from year to year - select factor for reporting period

  NOTE: GHG emission from combustion of town gas in stationary sources must be accounted for and reported separately in Scope 1 & 2

- Scope 2 indirect emission outside the physical boundary due to production & transportation of town gas from the production plant to the building of concern

Scope 2 – Indirect emissions: Electricity – Calculation Tool

Calculate the GHG emissions for the following energy consumption:

5,000,000kWh electricity purchased in 2022 from CLP.

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Facility/source description (i.e., area/facilities the electricity bill is reporting)	Amount of electricity purchased(kwh)	Emission factor (kg/ CO_2e/ kWh)	Indirect GHG emissions in tonnes of CO_2 equivalent(BxC/1000)
Factory electricity (Meter 3456)	5,000,000		
Total	-	-	

Scope 2 – Indirect emissions: Electricity – Calculation Tool

Calculate the GHG emissions for the following energy consumption:

5,000,000kWh electricity purchased in 2022 from CLP.

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Facility/source description (i.e., area/facilities the electricity bill is reporting)	Amount of electricity purchased(kwh)	Emission factor (kg/ CO_2e/ kWh)	Indirect GHG emissions in tonnes of CO_2 equivalent(BxC/1000)
Factory electricity (Meter 3456)	5,000,000	0.39	1,950
Total	-	-	1,950 Tonnes $CO_{2e}e$

Scope 2 – Indirect emissions: Towngas – Calculation Tool

Calculate the GHG emissions for the following Towngas consumption:

2,800 units Towngas for office catering in 2022.

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Facility/source description (i.e., area/facilities the Towngas bill is reporting)	Amount of Towngas purchased(Unit)	Emission factor (kg/Unit)	Indirect GHG emissions in tonnes of CO_2 equivalent(BxC/1000)
Office kitchen	2,800		
Total	-	-	

Scope 2 – Indirect emissions: Towngas – Calculation Tool

Calculate the GHG emissions for the following Towngas consumption:

2,800 units Towngas for office catering in 2022.

Step 1	Step 2	Step 3	Step 4
A	B	C	D
Facility/source description (i.e., area/facilities the Towngas bill is reporting)	Amount of Towngas purchased(Unit)	Emission factor (kg/Unit)	Indirect GHG emissions in tonnes of CO_2 equivalent(BxC/1000)
Office kitchen	2,800	0.576kg	1.613
Total	-	-	**1.613 Tonnes CO_2e**