Greenhouse Gases

PRESENTED BY

Ratimarth Bunlorm

Product Specialist

Topic

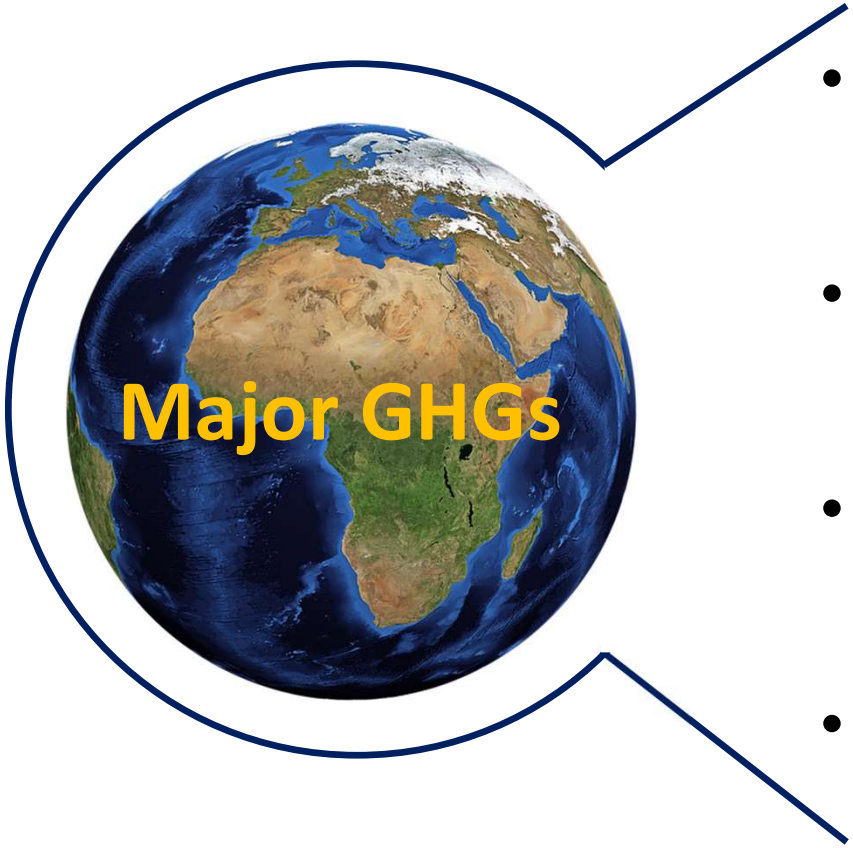
- Greenhouse gases
- Carbon Credit
- Greenhouse gases analyzer

Greenhouse Gases (GHGs)

Greenhouse Gases, GHGs

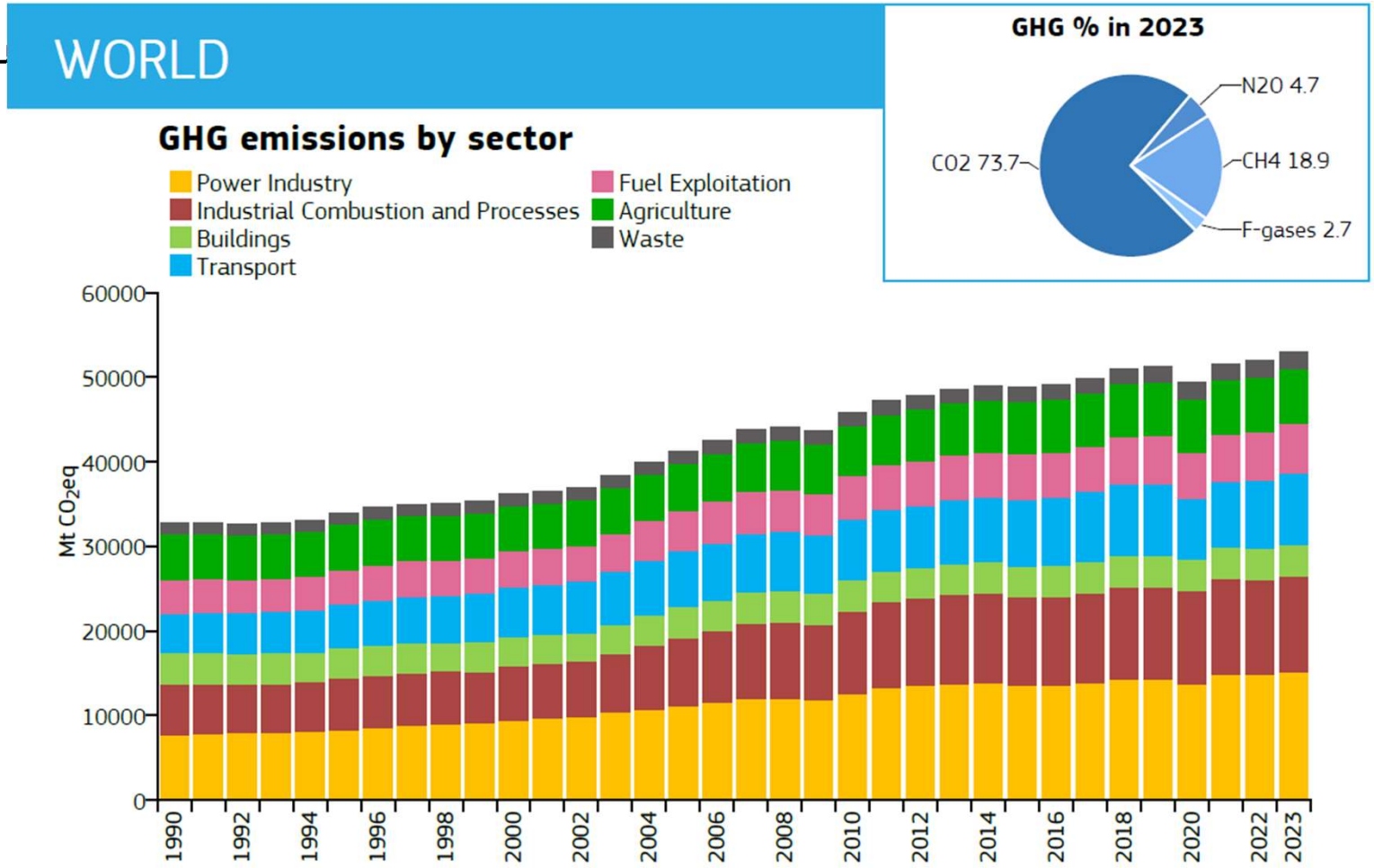
- Natural GHGs are gases in the earth's atmosphere that trap heat.
- Human activities are changing earth's natural greenhouse gases
- Impacts of GHGs
  - Global Warming
  - Weather volatility
  - Sea level rise
  - Impact on agriculture
  - Ecosystem changes

Major GHGs



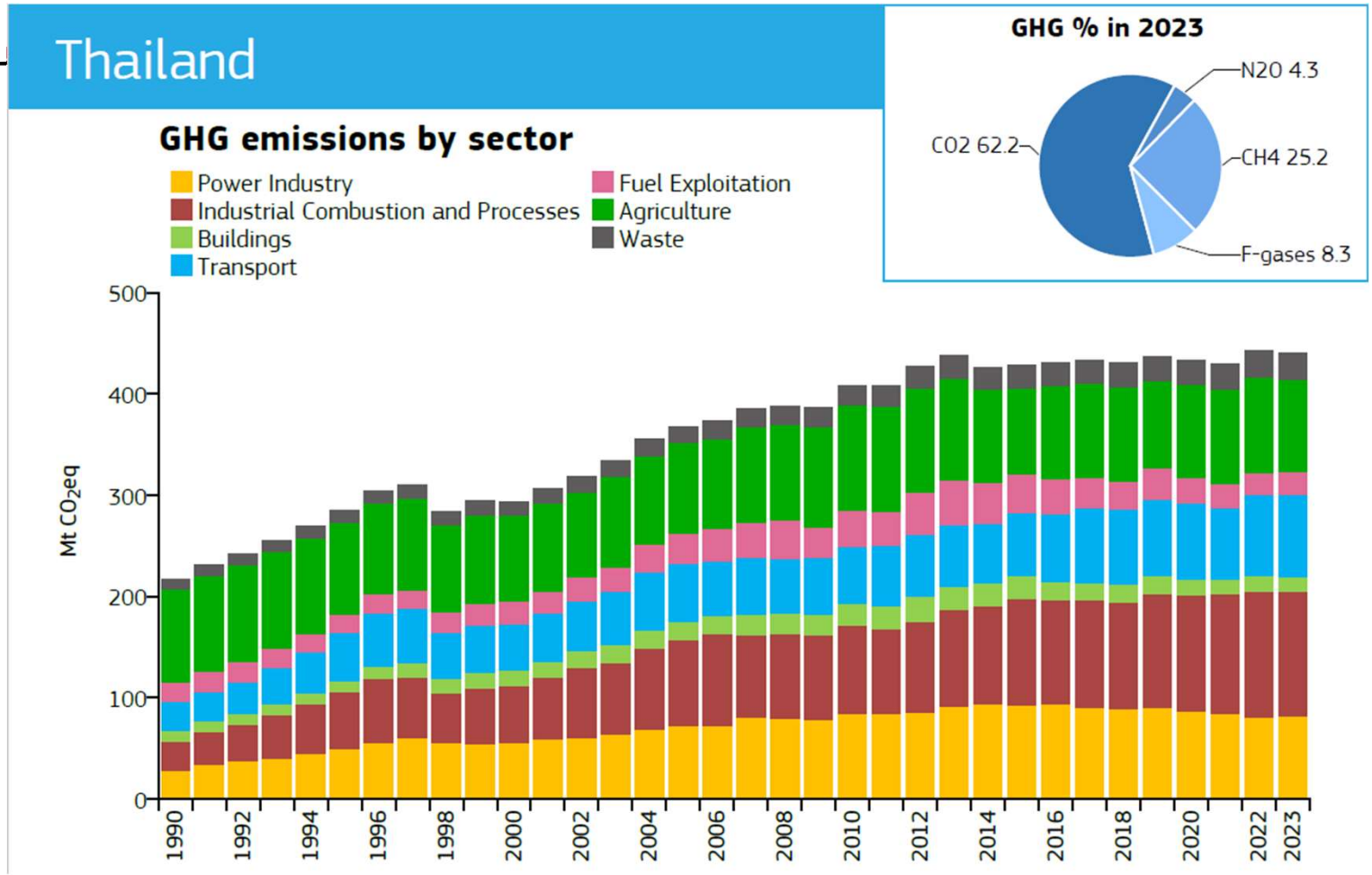
- Carbon Dioxide (CO_2) – Released from burning fossil fuels, deforestation, and industrial processes.
- Methane (CH_4) – Emitted from agriculture, livestock, landfills, and natural gas leaks.
- Nitrous Oxide (N_2O) – Comes from fertilizers, industrial activities, and fuel combustion.
- Fluorinated Gases (HFCs, PFCs, SF_6, NF_3) – Synthetic gases used in refrigeration, electronics, and industrial applications.

GHGs emissions of all world countries, 2023 Report



Source; https://edgar.jrc.ec.europa.eu/report_2024

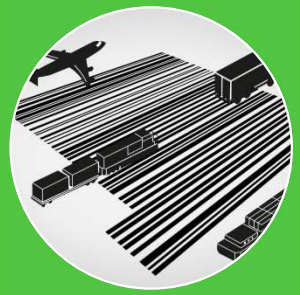
GHGs emissions of Thailand, 2023 Report



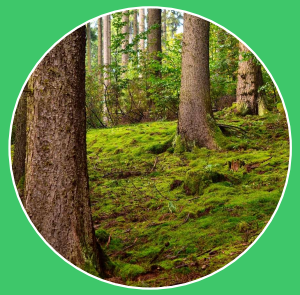
Source; https://edgar.jrc.ec.europa.eu/report_2024

Greenhouse Gas reduction

Renewable Energy



Energy Efficiency



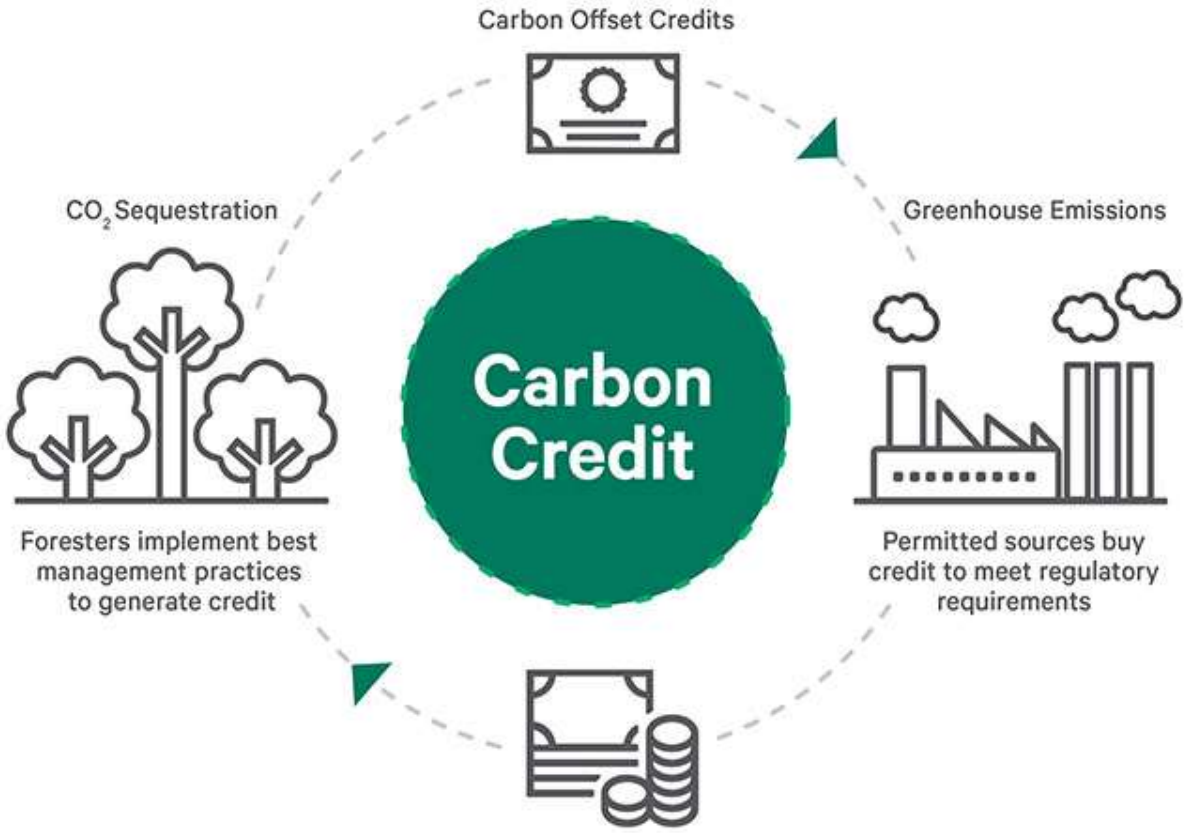
Reduce deforestation

Waste Reduction

Use carbon credits

Carbon Credit

Carbon Credit



1Carbon credit

=

1 tonne of carbon dioxide equivalent (CO_2eq) of GHGs emission reduction or storage.

Source: https://www.davy.ie/market-and-insights/insights/marketwatch/2021/july-2021/what-are-carbon-credits.html

Carbon Credit market

- Mandatory Carbon Market

  Governments regulate emissions through systems like

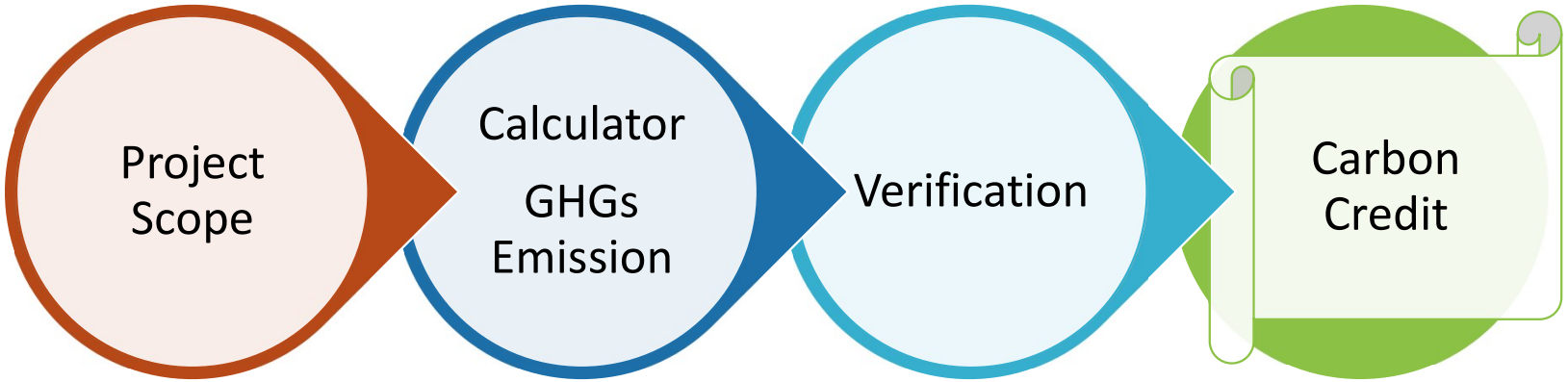
- Voluntary Carbon Market (VCM)

  Organizations and individuals voluntarily purchase credits to offset emissions.

Carbon Credit Project

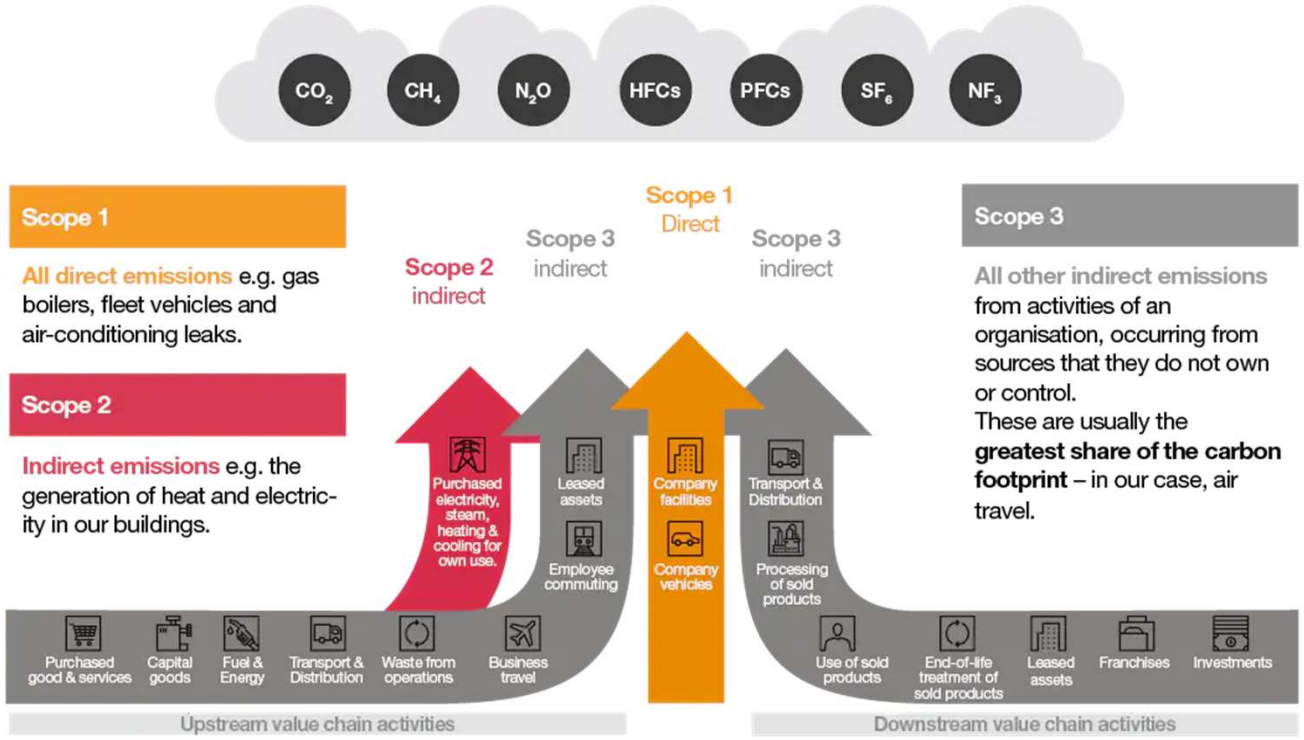
- Renewable Energy
- Transport
- Energy Efficiency
- Waste management
- Land Use
- CCUS

Carbon Credit development



Project Scope

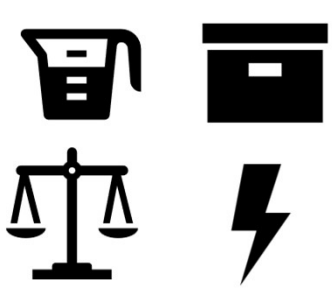
Carbon Emission Source

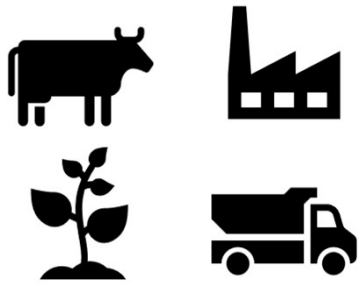


Source: https://www.pwc.lu/en/about-us/pwc-luxembourg-annual-review-2022/appendix-2.html

- Emission Reduction project
- Carbon Sequestration project

GHGs Calculation



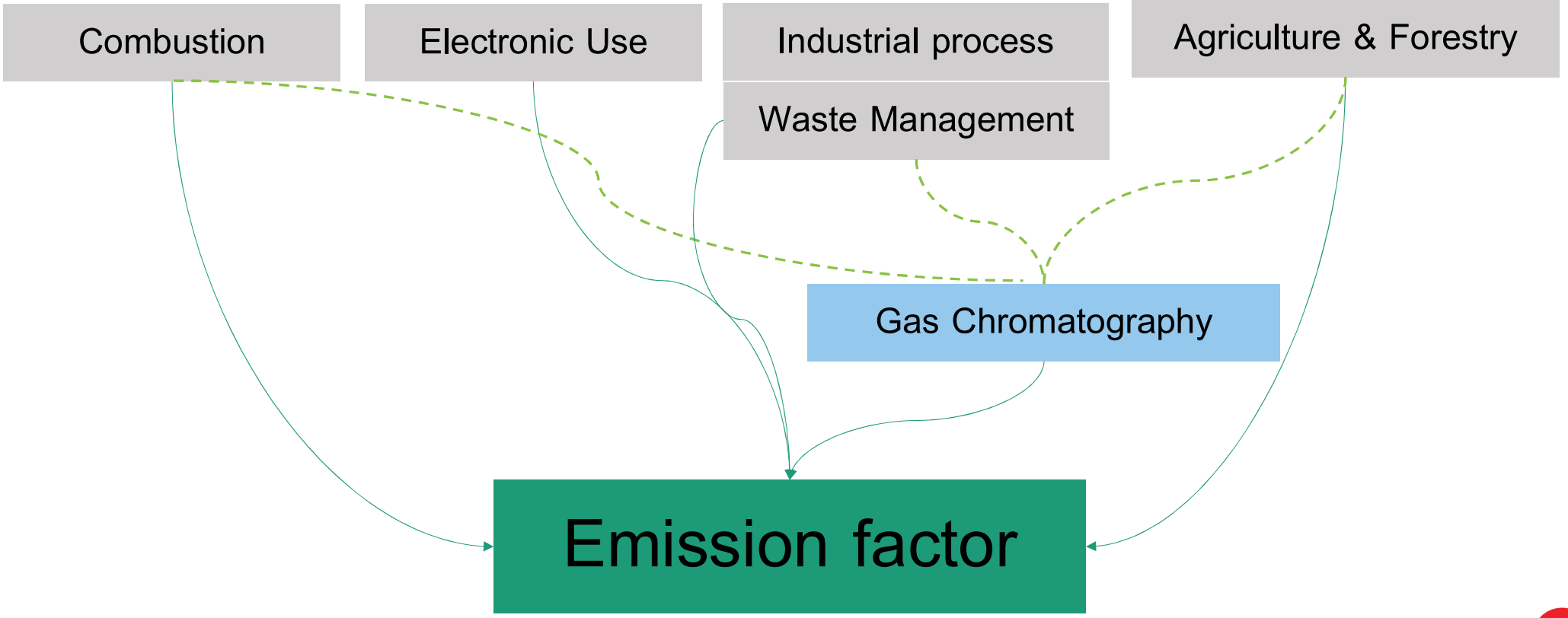


kg CO2 equivalent

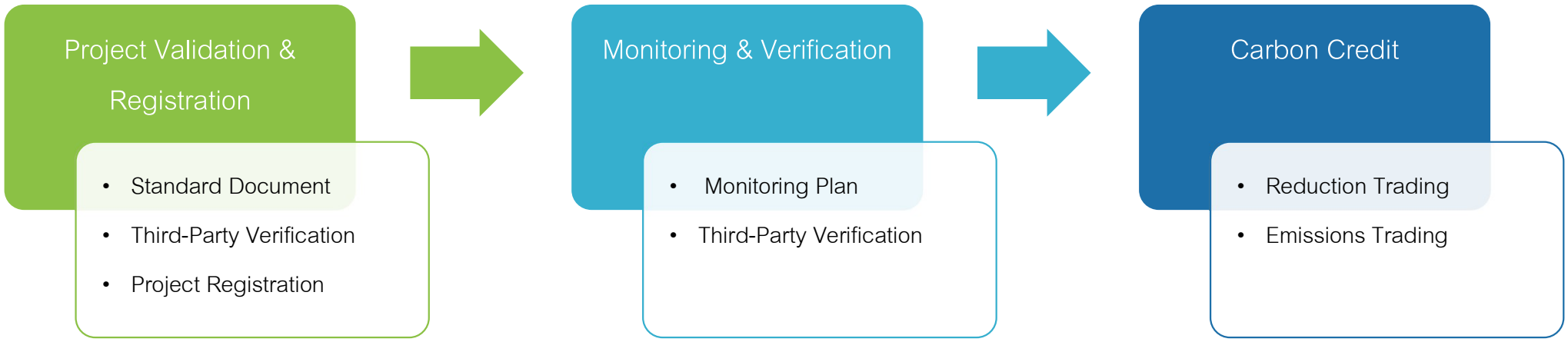
Activity data × Emission factor = GHGs emission

"Carbon Footprint"

GHGs Calculation



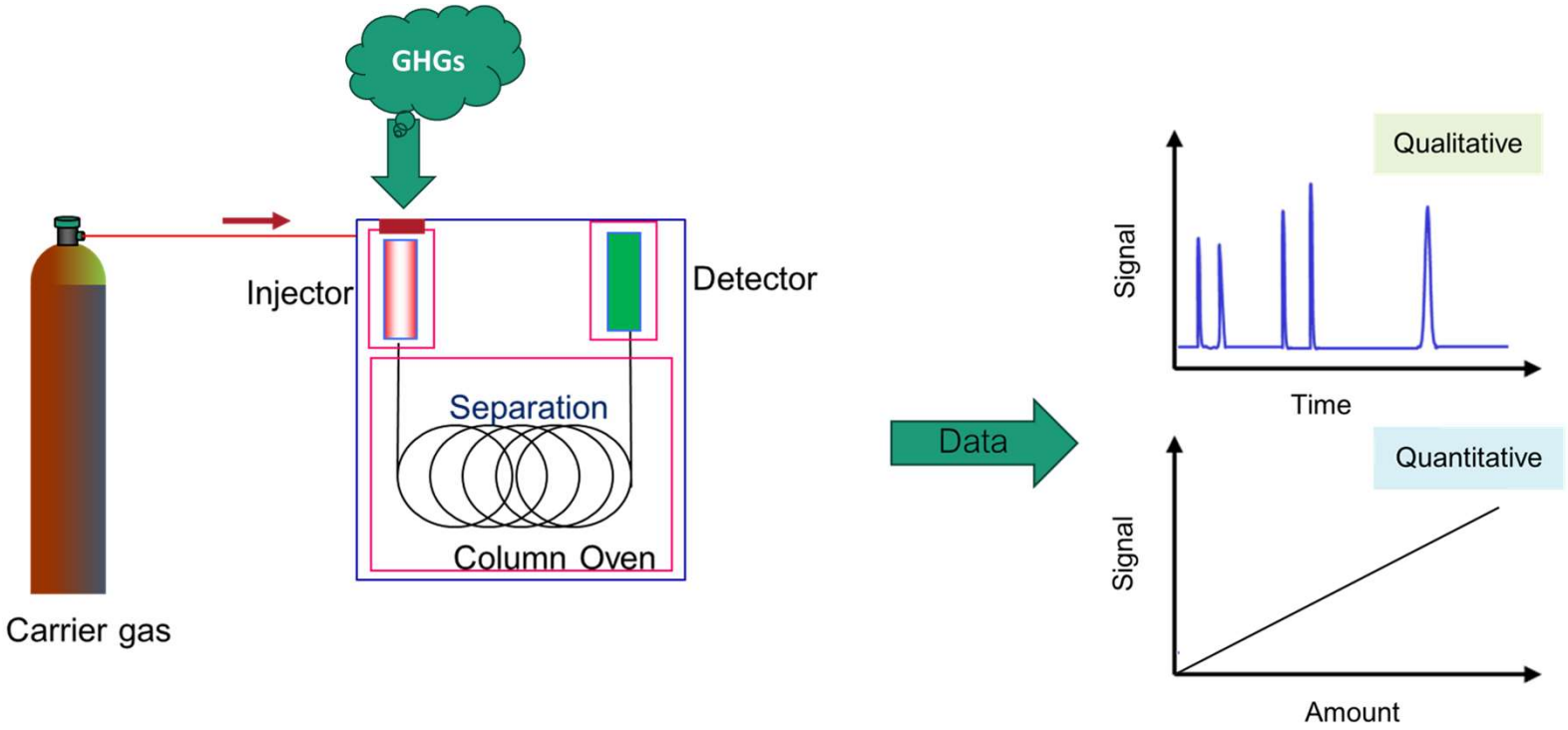
Verification & Certification



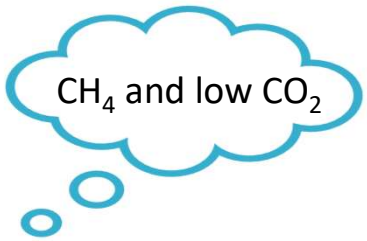
Advantages of carbon credits

GHGs Analyzer

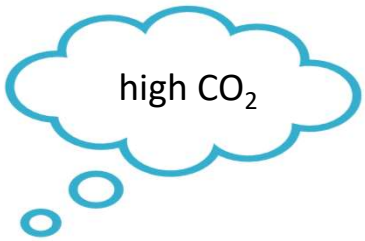
Gas Chromatography (GC)



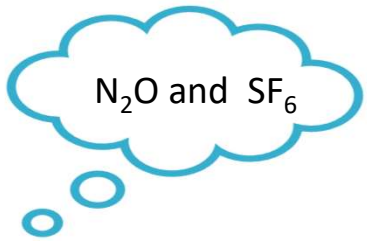
Gas Chromatography detector



Flame Ionization Detector (FID)



Thermal Conductivity Detector (TCD)



Electron Capture Detector (ECD)

Mass Spectrometer (MS)

GHGs Sampling

Canister

Gas Sampling Bags

Gas Syringe

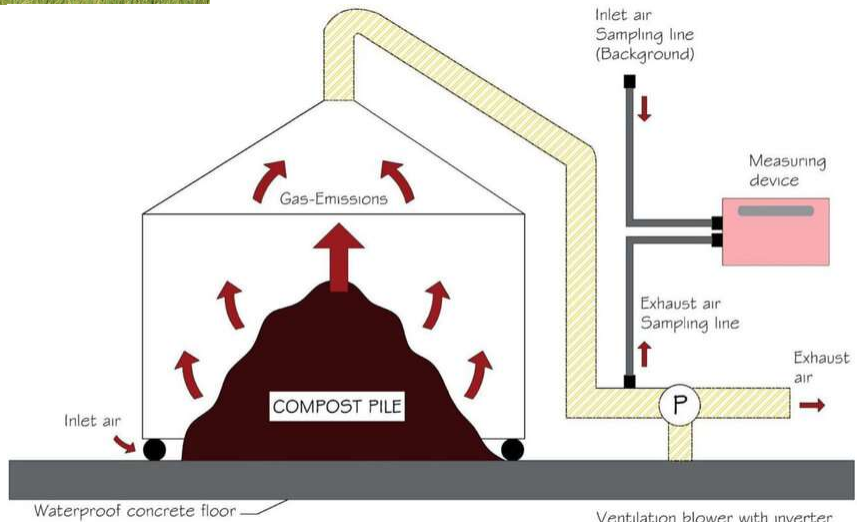
Online sampling

Source: https://www.velocityscientific.com.au/products/gas-chromatography/gas-chromatography-accessories/gas-sampling-bags.html
https://www.tescaglobal.com/product/gas-syringe-100-ml-with-3-way

Ex. GHGs Sampling from close chamber

Souce; https://www.researchgate.net/figure/Examples-of-automated-static-chambers-Photo-S-Weller_fig2_326988457

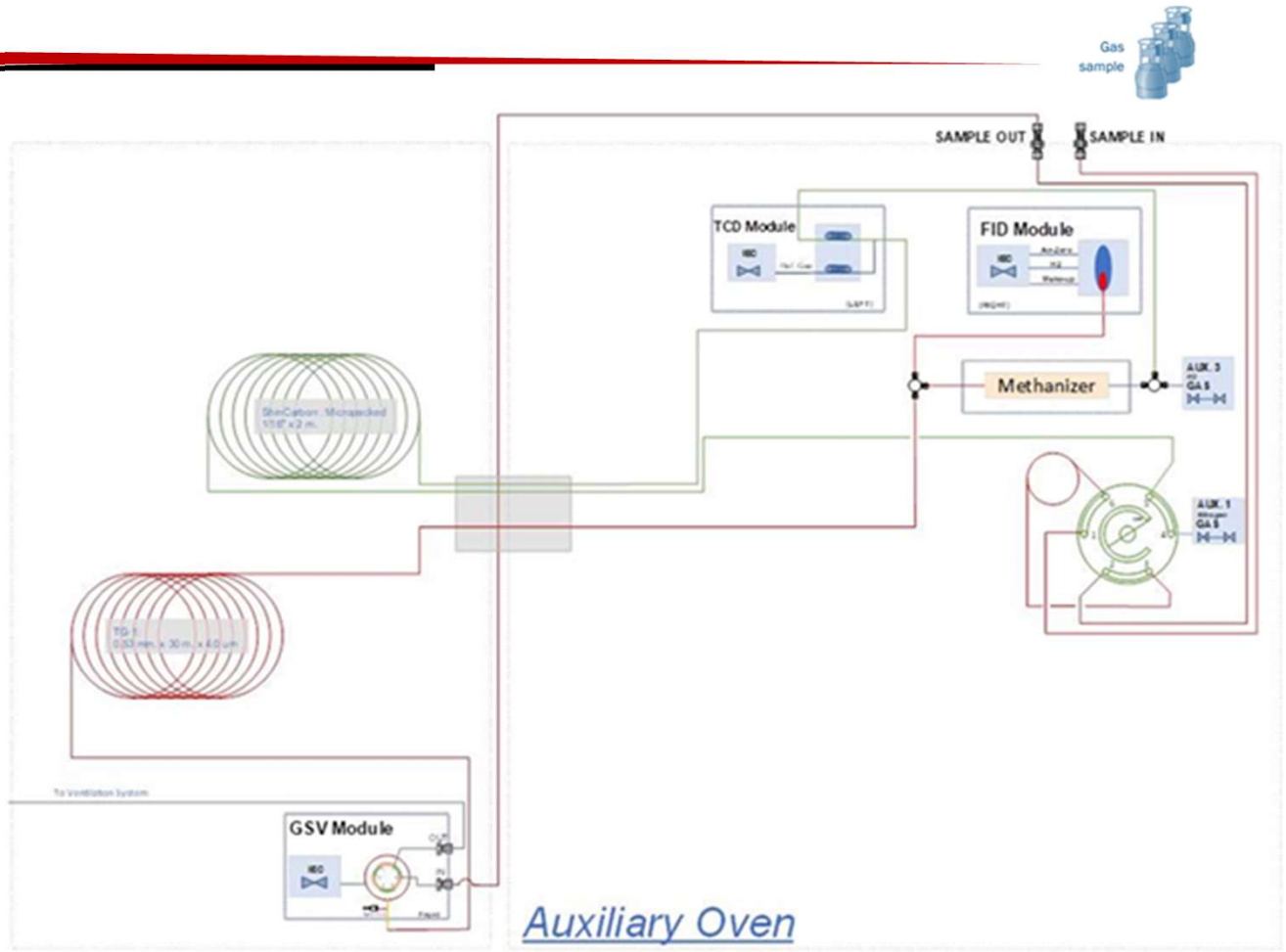
Source : https://www.asean-agrifood.org/thai-researchers-track-greenhouse-gases-from-rice-field-th/

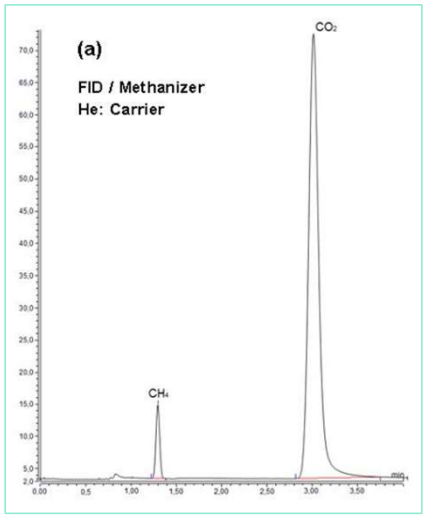


Source; https://www.researchgate.net/figure/Closed-chamber-method-for-the-measurement-of-GHGs-Adopted-from-70_fig2_361311896

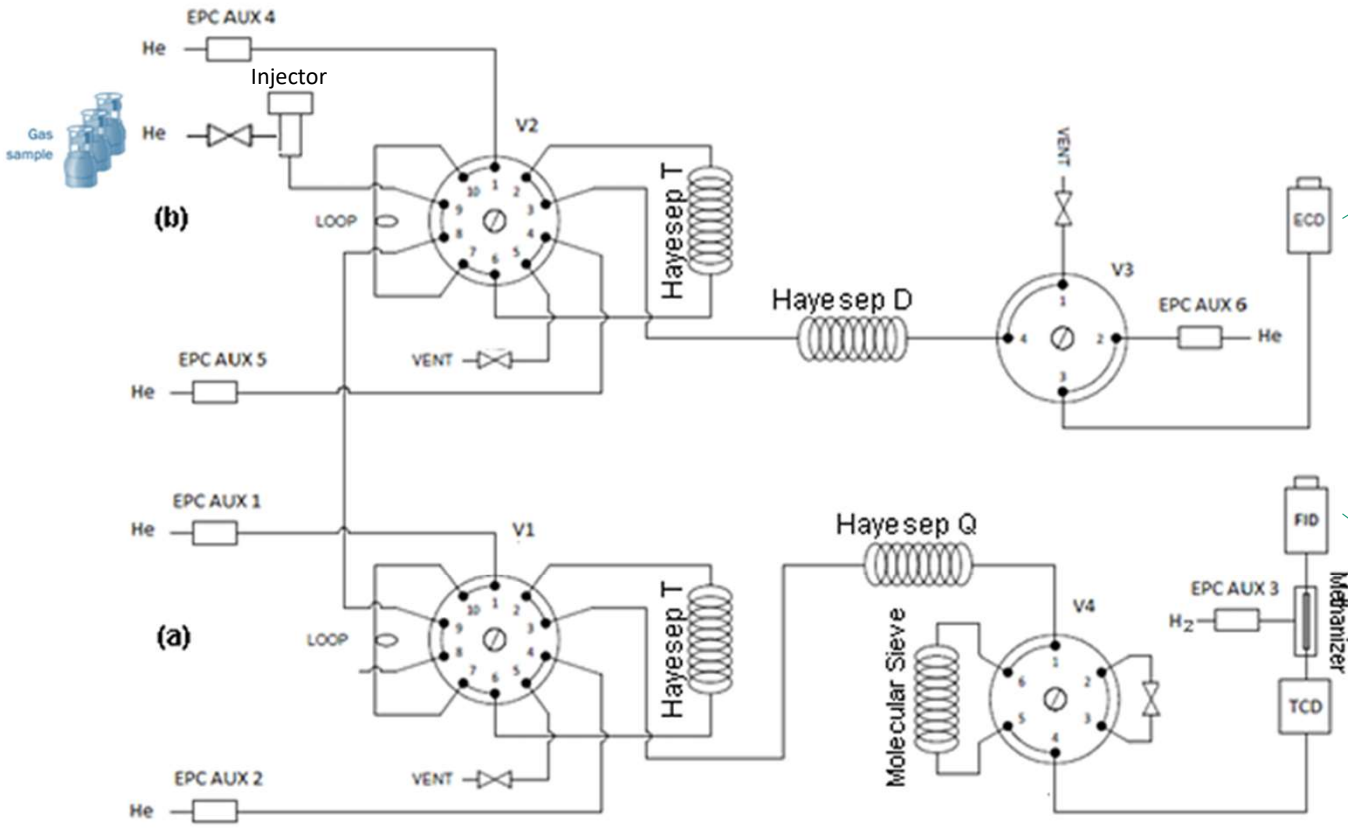
GHGs analysis by GC

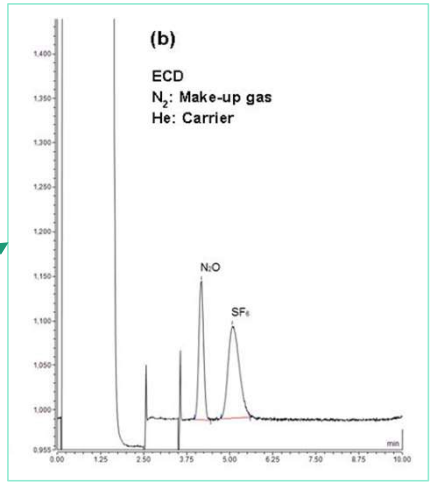
GC system

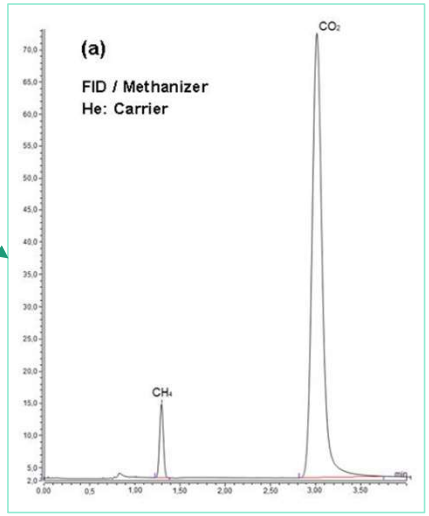

Gas sample
SAMPLE OUT
SAMPLE IN
TCD Module
FID Module
Methanizer
GSV Module
Auxiliary Oven


(a)
FID / Methanizer
He: Carrier
CO₂
CH₄

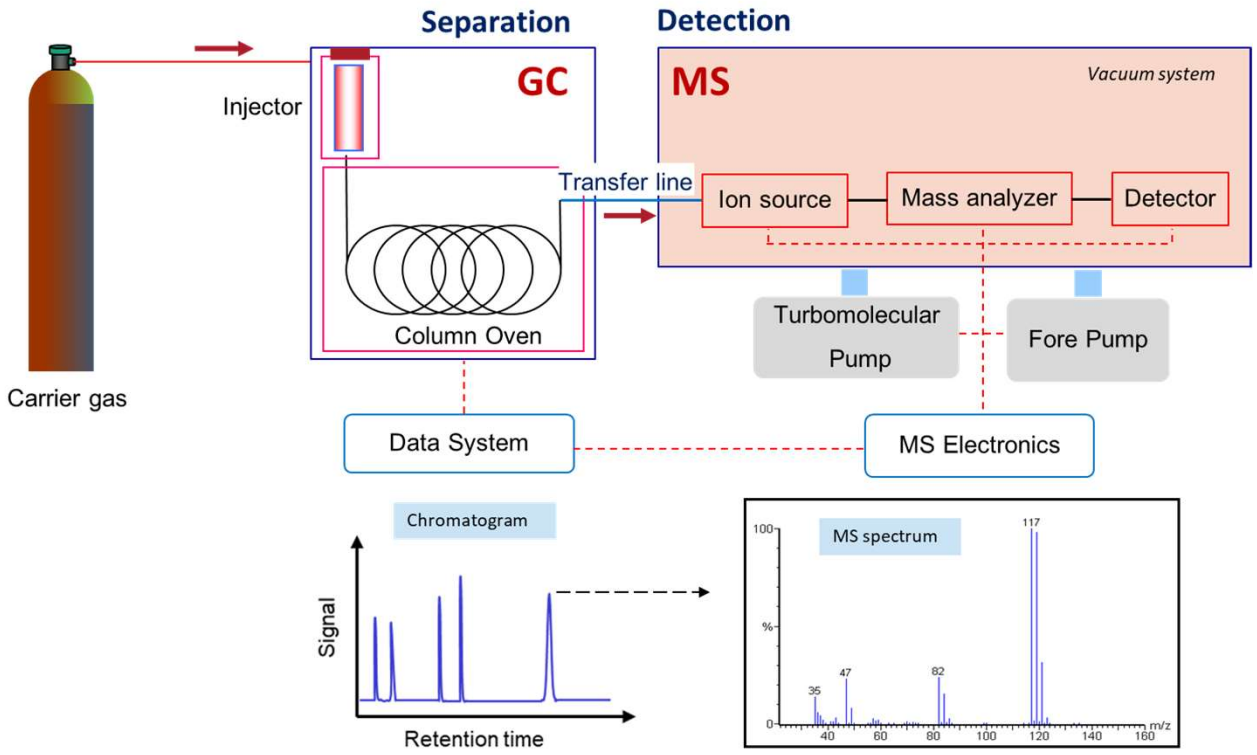
GC system

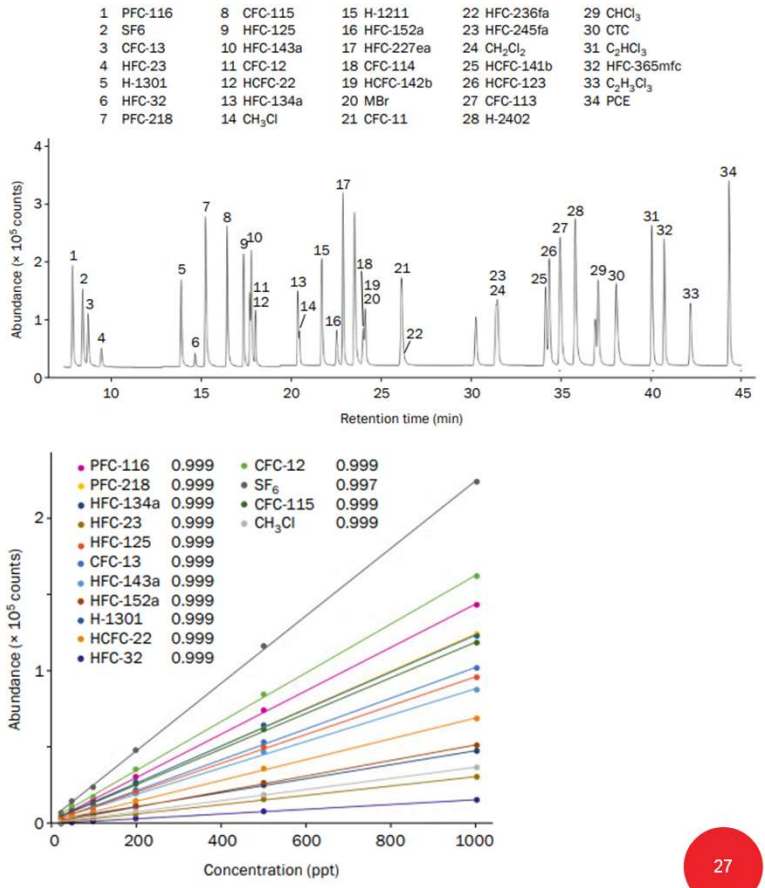

EPC AUX 4
He
Injector
He
Gas sample
(b)
LOOP
V2
Hayesep T
VENT
V3
ECD
Hayesep D
EPC AUX 6
He
EPC AUX 5
He
VENT
EPC AUX 1
He
V1
Hayesep Q
FID
EPC AUX 3
H2
Methanizer
(a)
LOOP
Hayesep T
V4
Molecular Sieve
TCD
EPC AUX 2
He
VENT


(b)
ECD
N2: Make-up gas
He: Carrier
N2O
SF6


(a)
FID / Methanizer
He: Carrier
CO2
CH4

GC/MS system


Separation
Detection
GC
MS
Vacuum system
Injector
Transfer line
Ion source
Mass analyzer
Detector
Column Oven
Carrier gas
Turbomolecular Pump
Fore Pump
Data System
MS Electronics
Chromatogram
Signal
Retention time
MS spectrum
m/z


1 PFC-116
2 SF6
3 CFC-13
4 HFC-23
5 H-1301
6 HFC-32
7 PFC-218
8 CFC-115
9 HFC-125
10 HFC-143a
11 CFC-12
12 HCFC-22
13 HFC-134a
14 CH3Cl
15 H-1211
16 HFC-152a
17 HFC-227ea
18 CFC-114
19 HCFC-142b
20 MBr
21 CFC-11
22 HFC-236fa
23 HFC-245fa
24 CH2Cl2
25 HCFC-141b
26 HCFC-123
27 CFC-113
28 H-2402
29 CHCl3
30 CTC
31 C2HCl3
32 HFC-365mfc
33 C2H3Cl3
34 PCE
Abundance (× 10^5 counts)
Retention time (min)
PFC-116 0.999
PFC-218 0.999
HFC-134a 0.999
HFC-23 0.999
HFC-125 0.999
CFC-13 0.999
HFC-143a 0.999
HFC-152a 0.999
H-1301 0.999
HCFC-22 0.999
HFC-32 0.999
CFC-12 0.999
SF6 0.997
CFC-115 0.999
CH3Cl 0.999
Abundance (× 10^5 counts)
Concentration (ppt)

Other hazardous in air

- Ozone precursors and other ultra-volatiles
- Air Toxics/ Hazardous air pollutants (HAPs)
- Perfluoroalkyl and Polyfluoroalkyl substances (PFAS)
- Microplastic (MPs)

Follow us

WWW.SCISPEC.CO.TH | SCISPEC | @SCISPEC | CRM@SCISPEC.CO.TH

thermo scientific
Authorized Distributor

MARKES international

SepSolve Analytical

FRONTIER LAB

GAS

CTC Analytics

LCTech

908devices