GREEN COUNCIL
環保促進會

Training Course:
Carbon Audit in Practice (Value-chain focus)

Instructor:

Ir Sophia Lau

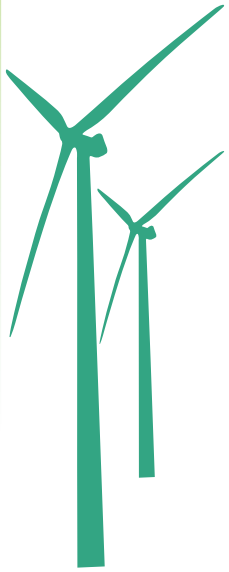
Director, ASEL Environmental Consulting Company Limited

Remarks: This material/event is funded by the Professional Services Advancement Support Scheme of the Government of the Hong Kong Special Administrative Region. Any opinions, findings, conclusions or recommendations expressed in this material/any event organised under this project do not reflect the views of the Government of the Hong Kong Special Administrative Region or the Vetting Committee of the Professional Services Advancement Support Scheme.

ASEL Environmental Consulting Company Limited
活 化 環 保 有 限 公 司

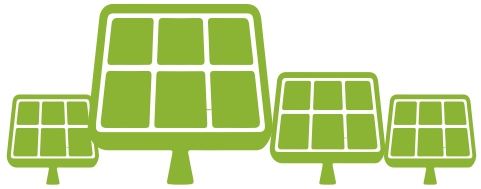
GREEN COUNCIL
環 保 促 進 會

Session 1
Overview of Carbon Audit, Scope 1 and Scope 2



By Ir Sophia Lau

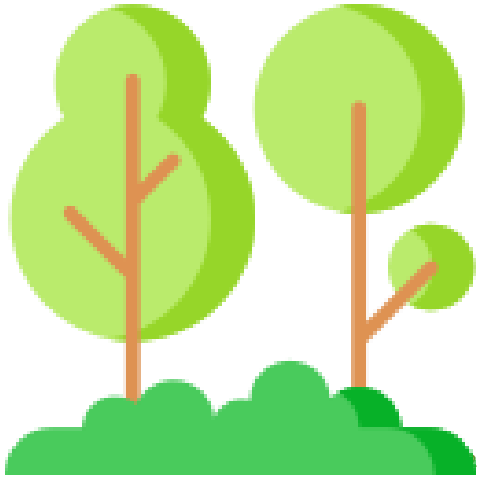
Director, ASEL Environmental Consulting Company Limited



Sophia.lau@asel.com.hk

To manage carbon emissions, the first step you should do, is to quantify your carbon emissions by conducting carbon audit.

What is Carbon Audit?



What is Carbon Audit ?

- Carbon Audit or Greenhouse Gas (GHG) Accounting, is a mechanism to account and report on greenhouse gas (GHG) emissions based on common standards and protocols

- Quantifies the total greenhouse gases produced directly and indirectly from a business or organisation's activities. Also known as a carbon footprint, it is an essential tool, providing your business with a basis for understanding and managing its climate change impacts.

Support Government's Reduction Target

Functions of Carbon Audit

Functions:

- Help you to understand your emissions profile
- Help you to understand your emissions sources
- Identify key emissions sources and work out corresponding effective carbon reduction measures

Support Government's Reduction Target

Measuring your carbon footprint will also enable you to:

- Prepare for future greenhouse gas legislation
- Manage carbon risk exposure and identify areas for improvement
- Improve efficiency and cut costs through reduced energy consumption
- Gain credibility by demonstrating environmental responsibility
- Motivate and engage staff by involving them in carbon reduction plans

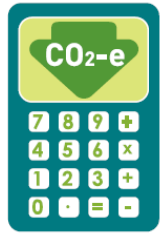
Reduce Operational Cost


Improve Organisation's Image


Demonstrate Corporate Responsibilities


Staff Engagement

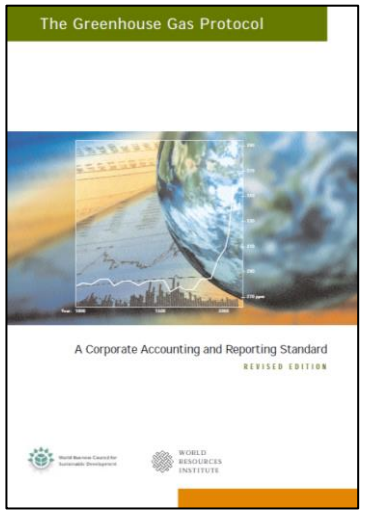

Meet Stakeholders' Expectation

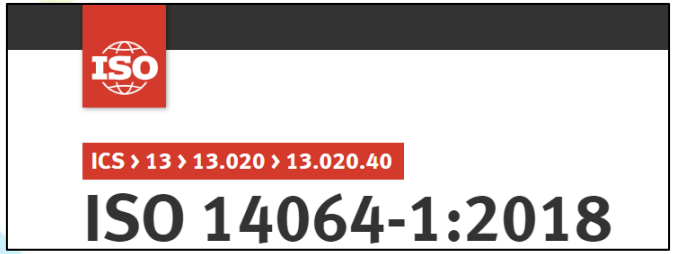


Support Government's Reduction Target

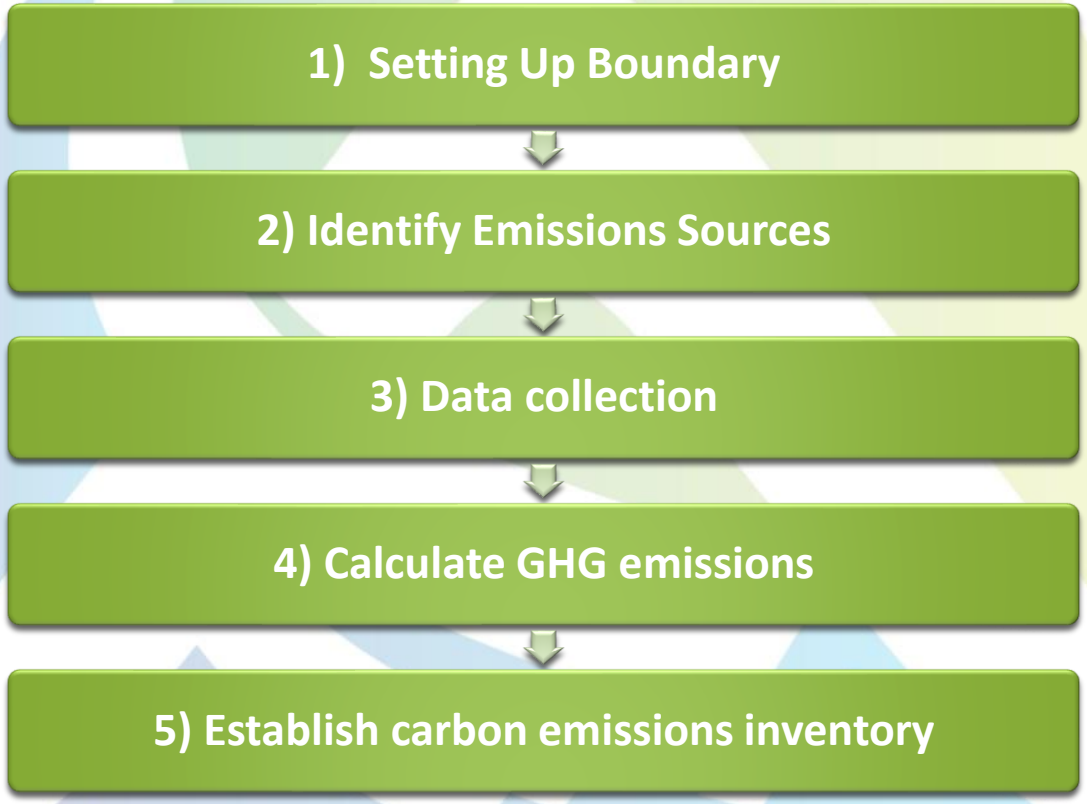
Carbon Audit Guidelines

- The “Greenhouse Gas Protocol” published by World Resources Institute and World Business Council for Sustainable Development
- “Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong” published by EMSD and EPD in July 2008 (2nd edition Feb 2010)
- **ISO 14064-1:2018** Greenhouse gases — Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals



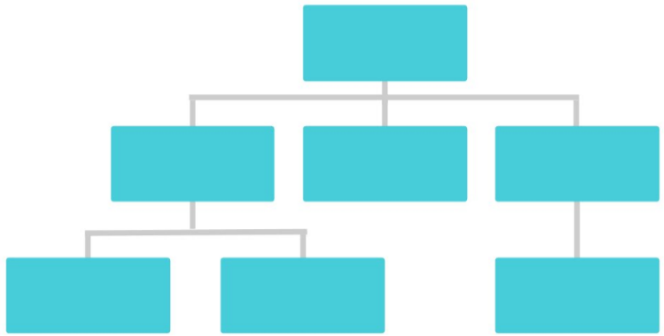


Carbon Audit Step by Step



1) Setting Up Boundaries

① Organization Boundary



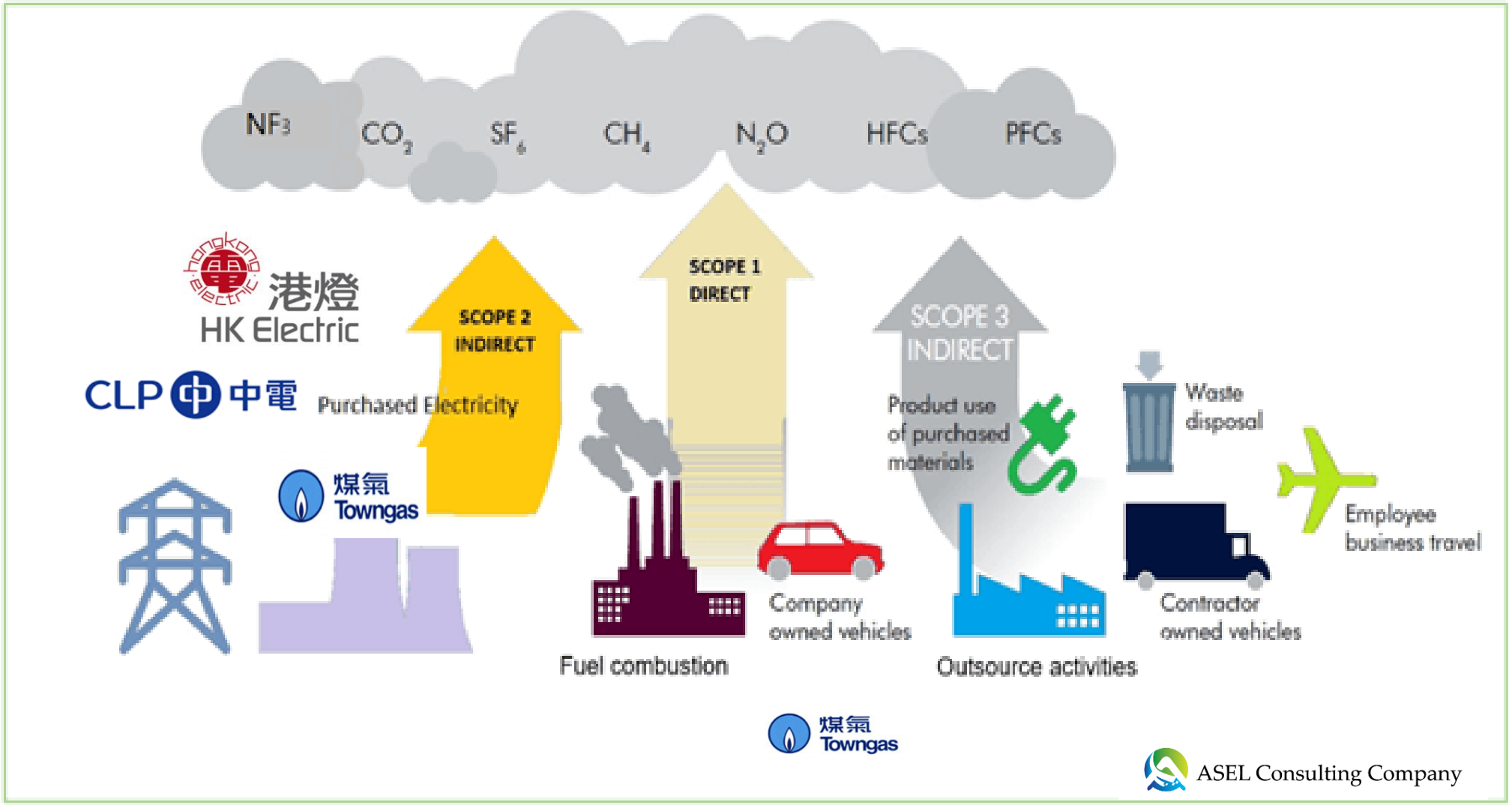
- Equity Approach
- Control Approach

② Operational Boundary

- Scope 1
- Scope 2
- Scope 3

Step 1 - Setting up Operational Boundaries

To define which operational activities at a facility are included in the inventory.



Harmony Restaurant

1

2

3

4

5

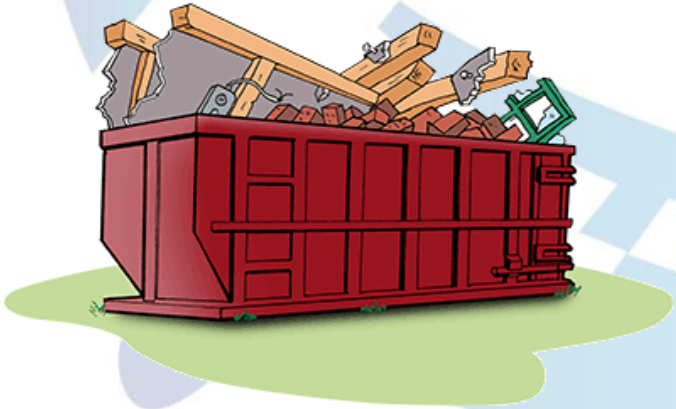
Construction Company

1

2

3

4



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Step 2 Identify Emission Source

Scope 1: Direct Emissions	
Stationary sources	from burning of fuels e.g. Generators, steamers Examples of fuel types: diesel, petroleum, natural gas, towngas (HK specific)
mobile sources	from vehicles, ground services equipment emissions Examples of fuel types: diesel, petroleum, jet fuel
Physical or chemical emissions	e.g. CO_2 from cement manufacturing
Fugitive emissions	Leakage from the use of refrigerants, use of fire extinguishers, methane emissions from coal mines and venting etc.

煤氣 Towngas

Step 2 Identify Emission Source

Scope 2: Electricity Indirect GHG Emissions

- Purchased electricity
- Use of towngas (HK specific)

Step 2 Identify Emission Source

Scope 3 (Optional): Other Indirect GHG Emissions

Upstream	• Extraction and production of purchased materials and fuels • Emissions from transport-related activities e.g. purchased materials / goods, employee business travel, employee commuting to and from work, transportation of waste • Electricity consumed due to water consumption
Downstream	• Emissions from outsources activities e.g. contractors, leased assets, franchises etc. • Electricity consumed due to sewage disposal • Waste disposal

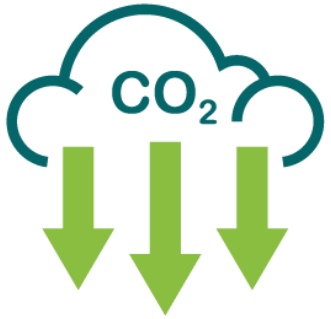
Step 2 Identify Removal Sources

Emissions Removal

- Each Newly Planted tree in the company's boundary will remove 23kg of CO_2 per year on site.

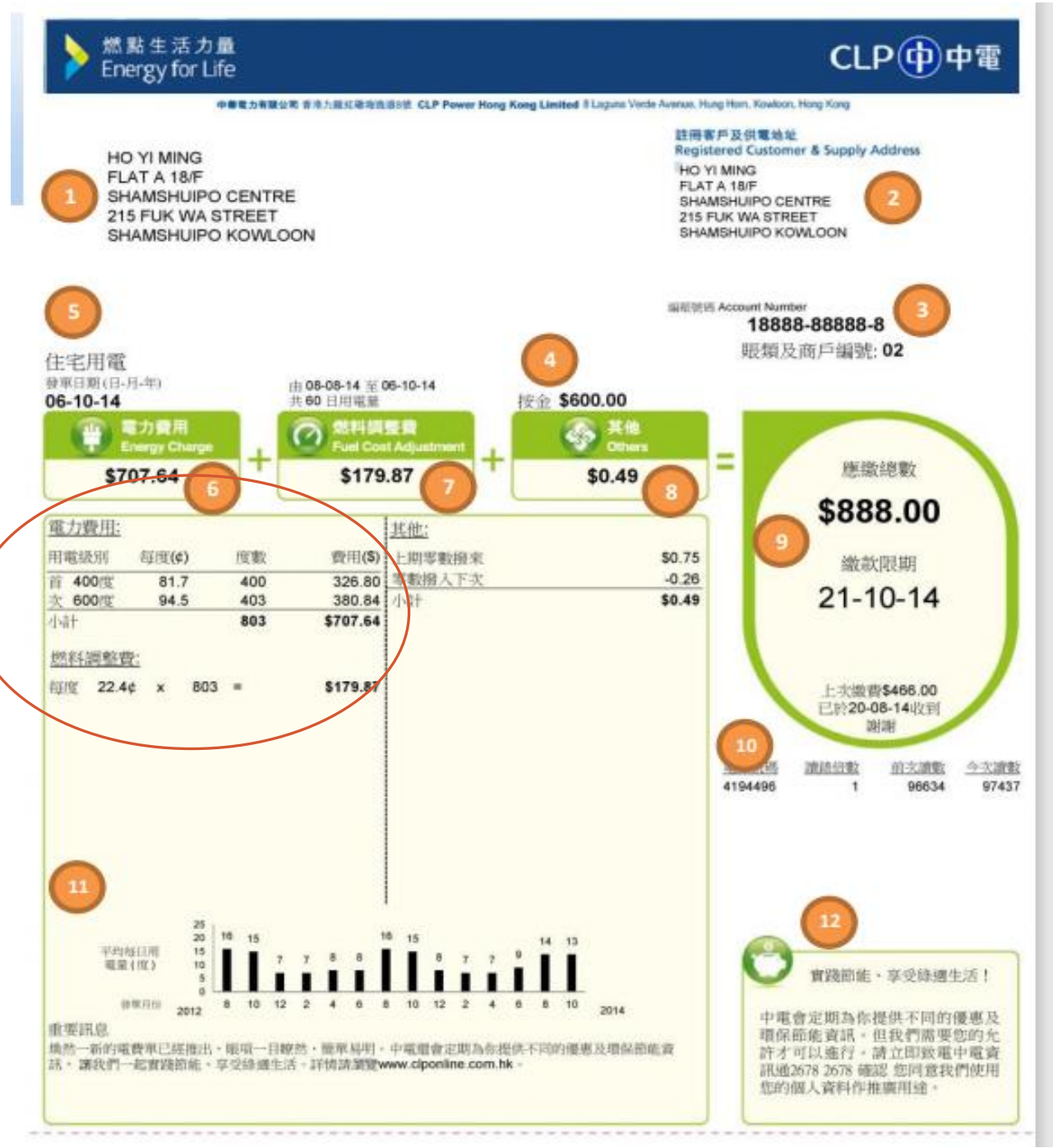
- trees that are capable to reach 5m in height

(Under EPD/EMSD guideline)



Step 3 – Data Collection

Table	Emission Type	Data Source
Scope 1	Fixed Source - Generator etc.	-Fuel invoice -Filling record
	Mobile Source -Vehicle -Ships -Aircraft	-Fuel invoice -Filling record
	Emissions from refrigerants leakage	- Refilling record
	Emissions Removal from Newly planted trees	- Property management / landscape contractor
Scope 2	Electricity Consumption	- Electricity bills
	Towngas	- Towngas bills
Scope 3	Waste paper disposed to landfill	-purchasing record, recycling record -Purchasing Dept, Admin office, waste collector
	Fresh water consumption	- Water bills
	Sewage disposal	- Water bills



燃點生活力量
Energy for Life

CLP 中電

中華電力有限公司 香港九龍紅磡海逸路8號 CLP Power Hong Kong Limited 8 Laguna Verde Avenue, Hung Hom, Kowloon, Hong Kong

1
HO YI MING
FLAT A 18/F
SHAMSHUIPO CENTRE
215 FUK WA STREET
SHAMSHUIPO KOWLOON

註冊客戶及供電地址
Registered Customer & Supply Address
2
HO YI MING
FLAT A 18/F
SHAMSHUIPO CENTRE
215 FUK WA STREET
SHAMSHUIPO KOWLOON

5
住宅用電
發單日期(日-月-年)
06-10-14

賬戶號碼 Account Number
3
18888-88888-8
賬類及商戶編號: 02

4
由 08-08-14 至 06-10-14
共 60 日用電量
按金 $600.00

電力費用 Energy Charge
6
~~$707.64~~

+

燃料調整費 Fuel Cost Adjustment
7
$179.87

+

其他 Others
8
$0.49

=

應繳總數
9
$888.00
繳款限期
21-10-14

上次繳費$466.00
已於20-08-14收到
謝謝

電力費用:

用電級別	每度(¢)	度數	費用($)
首 400度	81.7	400	326.80
次 600度	94.5	403	380.84
小計		803	$707.64

燃料調整費:

每度 22.4¢ x 803 = $179.87

其他:

上期零數撥來	$0.75
零數撥入下次	-0.26
小計	$0.49

10

讀錶號碼	讀錶倍數	前次讀數	今次讀數
4194496	1	96634	97437

11

重要訊息
煥然一新的電費單已經推出，賬項一目瞭然，簡單易明。中電還會定期為你提供不同的優惠及環保節能資訊，讓我們一起實踐節能，享受綠適生活。詳情請瀏覽www.clponline.com.hk。

12

實踐節能，享受綠適生活！

中電會定期為你提供不同的優惠及環保節能資訊。但我們需要您的允許才可以進行。請立即致電中電資訊通2678 2678 確認 您同意我們使用您的個人資料作推廣用途。

香港電燈有限公司
The Hongkong Electric Co., Ltd.

港燈 HK Electric

1 **CHAN TAI MAN**
FLAT 2 5/F BLOCK A
HONG KAM COURT
100 SASSOON ROAD POK FU LAM

2 Service Address: ROOM 801, LOK YEE TERRACE, 128 BONHAM ROAD

Account Number
0123456789
Date of Bill
30/09/2014

Domestic Tariff

3 From 01/09/2014 to 30/09/2014 for 30 days of consumption

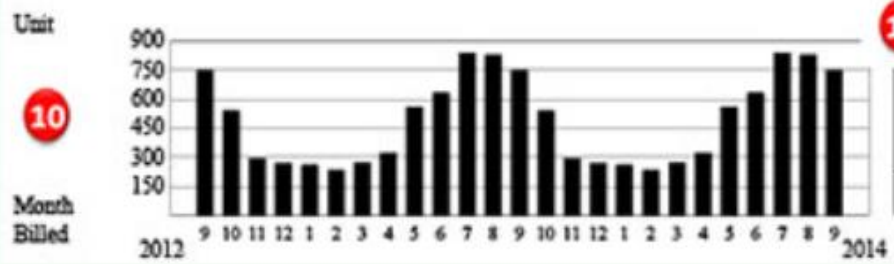
Meter No.	Present Reading	4 Previous Reading	5 Units	Scheduled Next Meter Reading Date 31/10/2014
3033845	16309	15559	750	

6 Basic Charge	$663.40
7 Fuel Clause Adjustment 33.1 ¢/unit	248.25
8 Current Month Charge	911.65
Previous Balance	0.94
Balance Carried Forward	-0.59

Last payment of $1038.00 on 15/09/2014. Thank you.
Deposit Amount $1000.00

Please Pay This Amount: 9 **$912.00**

PPS Merchant Code: 03



11 12

CO2 emission per unit of electricity consumed	Per capita consumption for HK Electric domestic customers
0.78 kg	160 units / month

煤氣
Towngas

MR CHAN TAI MAN
22/F, BLK 18
TOWNGAS BUILDING
168 TG ROAD
HK

Account number : 1234-5678-90

Amount due $492.00
Please pay by 28 Dec 2018

Registered customer name and address :
MDM TGA
FLAT 1868, 18/F
ABCD BLDG
668 HONG KONG RD
KLN

Bill information Billing date : **16 Dec 2018**

Previous bill amount	$ 428.38	$	
Payment received : 26 Oct 2018	-428.00		**Bal b/f**
Balance brought forward	0.38		**0.38**

From 15 Oct 2018 to 15 Nov 2018	1 unit = 48 MJ	Consumption (MJ)
168 Estimate 180 Estimate	12 units x 48	576
This consumption is estimated. Please report meter reading.		

Standard gas charge	143.92	
Fuel cost adjustment (3.900 cents per MJ)	22.46	**last month**
Monthly maintenance charge	9.50	**charge**
	175.88	**175.88**

From 15 Nov 2018 to 15 Dec 2018	1 unit = 48 MJ	Consumption (MJ)
180 Estimate 193 Self	13 units x 48	624

Standard gas charge	155.88	
Fuel cost adjustment (3.740 cents per MJ)	23.34	**this month**
Monthly maintenance charge	9.50	**charge**
	188.72	**188.72**

Spare parts : S1234567	45.00	**Other**
Hotplate instalment (1st of 12)	83.00	**charges**
	128.00	**128.00**

Total bill amount	492.98	
Odd cents to be carried forward	-0.98	**Please pay**
Amount due	492.00	**492.00**

Report Meter Reading Methods
- 24-hr Self-reading Hotline ☎ **2880 5522**
- Website://www.towngas.com
- **Mobile Apps "Towngas 煤氣公司"**
- Self-reading QR Code

Meter reading date : 15th of each month
Reading reported on other days will be used for estimation.

Environmental Information – CO_2 emission per MJ of town gas: 0.065kg

Deposit held $600.00

Stub and message to customer

MB

Self-reading by QR Code - Simple, Easy & Quick : A new Self-reading method has been launched. Simply scan your gas bill's QR Code, your account number will be displayed automatically. Entre the meter reading and submit.

With effect from 30 October 2018, the Towngas Tai Po Customer Centre will be moved to Shop 091, Level 1, Uptown Plaza, Tai Po, NT.

Please pay this bill by 28 Dec 2018 $ 492.00

FPS Payment

: 1234567890 <28 > 00000049200 > 45

TotalCare Award 全面關懷大獎

香港中華煤氣有限公司 The Hong Kong and China Gas Company Limited
香港郵政總局信箱 3141號 G.P.O.Box 134 Hong Kong

發出日期：01/11/2019

水務署
Water Supplies Department

付款通知書 每日慳水10公升

繳款單編號	12345678900
應繳總額	$359.40
在此日期或之前繳付	25/11/2019

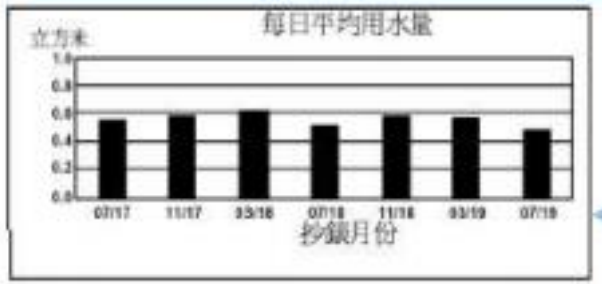
CHAN TAI MAN
FLAT 01, 11/F
CHAN TAI MANSION
KOWLOON

用戶編號：1234 5678 900

上次繳款日期	上次繳款金額	現存按金款額	爭議金額	分期付款金額
25/07/2019	$480.00	$400.00	$0.00	$0.00

用水樓宇地址
FLAT 01, 11/F
CHAN TAI MANSION
KOWLOON

現有水錶編號：MSL00000000



供水性質： 住宅供水(010010)

水錶編號	日期	度數	日期	度數	用水量	每日平均用水量
MSL00000000	01/07/2019	1,412A	31/10/2019	1,470A	58 立方米/122日	0.475立方米 (475 公升)

A：抄錶度數 E：估計度數 S：客戶報讀度數

請參閱下列附註

	$
餘額承前	0.10
水費	
01/07/2019 - 31/10/2019	
第一級 12.036 立方米 @ $0.00	0.00
第二級 31.091 立方米 @ $4.16	129.33
第三級 14.873 立方米 @ $6.45	95.93
小計	225.26

	$
排污費	
01/07/2019 - 31/10/2019	
第一級 12.036 立方米 @ $0.00	0.00
第二級 45.964 立方米 @ $2.92	134.21
小計	134.21

收費總額	359.57	
餘額撥入下期	0.17	CR
應繳款額	359.40	

Customer Address 客戶地址:

GREEN VALLEY LANDFILL LTD
P.O.BOX 65036
TSEUNG KWAN O POST OFFICE
KOWLOON
Hong Kong

EXXONMOBIL HONG KONG LIMITED
23/F., Central Plaza,
18 Harbour Road,
Wanchai.
Hong Kong

Account No. 1181223
Date of Invoice 31/12/2019
Invoice No. HKInv-1150333

INVOICE(發票)

Trx Date 交易日期	Trx Time 交易時間	Receipt No. 收據編號		Station Location 油站	VRN/Driver 車牌號碼	Odometer 里數 (km)	Product/Service 產品/服務	Quantity 數量 (ltr)	Unit Price 單價 (HKD)	Total Amt 總金額 (HKD)
7800344181223006320			**WF2520**							
03/12/2019	07:51	O99658		ESSO KOWLOON BAY 1			SYNERGY EXTRA	43.38	15.09	654.64
09/12/2019	06:36	O92001		ESSO TAI WO ROAD			SYNERGY EXTRA	43.05	15.09	649.56
14/12/2019	17:33	O91158		ESSO TAI PO			SYNERGY EXTRA	40.91	15.09	617.25
19/12/2019	21:50	O93766		ESSO TAI PO			SYNERGY EXTRA	40.42	15.09	610.02
25/12/2019	09:47	O96809		ESSO TAI PO			SYNERGY EXTRA	43.09	15.09	650.35
Subtotal							**FUELS**	210.85		3,181.82
Card Total								**210.85**		**3,181.82**
7800344181223006346			**WJ3905**							
04/12/2019	15:17	O90316		FEOSO NORTH POINT			SYNERGY EXTRA	35.94	15.09	542.27
07/12/2019	15:03	O97098		ESSO TSEUNG KWAN O 1			SYNERGY EXTRA	36.98	15.09	558.06
12/12/2019	15:49	O99202		ESSO TSEUNG KWAN O 1			SYNERGY EXTRA	39.16	15.09	590.85
14/12/2019	15:06	O90300		ESSO TSEUNG KWAN O 1			SYNERGY EXTRA	17.74	15.09	267.73
18/12/2019	20:17	O97356		ESSO KWUN TONG ROAD			SYNERGY EXTRA	35.83	15.09	540.68
21/12/2019	15:14	O93559		ESSO TSEUNG KWAN O 1			SYNERGY EXTRA	34.50	15.09	520.60
28/12/2019	03:17	O92471		ESSO KWUN TONG ROAD			SYNERGY EXTRA	40.29	15.24	613.99
Subtotal							**FUELS**	240.44		3,634.18
Card Total								**240.44**		**3,634.18**
Total Fuels								**6,004.45**		**80,291.10**
Total Fuels & Non-Fuels								**6,004.45**		**80,291.10**

Step 4 - Calculate GHG Emissions

1 tonne of Carbon Dioxide is equivalent to a balloon **10 metres** in Diameter!

6. Calculate GHG Emissions

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)
- Nitrogen trifluoride (NF_3)

} "CO_2-e" (tonnes)

- **Carbon dioxide equivalent** (**CO_2-e**) describes how much global warming a given type and amount of greenhouse gas may cause, using the functionally equivalent amount or concentration of carbon dioxide(CO_2) as the reference.

CO2-e	=	GHG emissions	X	Global Warming Potential (GWP)

Global Warming Potential (GWP) (updated in 2014 IPCC AR5)

Global warming potential (GWP) is a measure of how much a given mass of greenhouse gas contributes to global warming relative to CO_2.

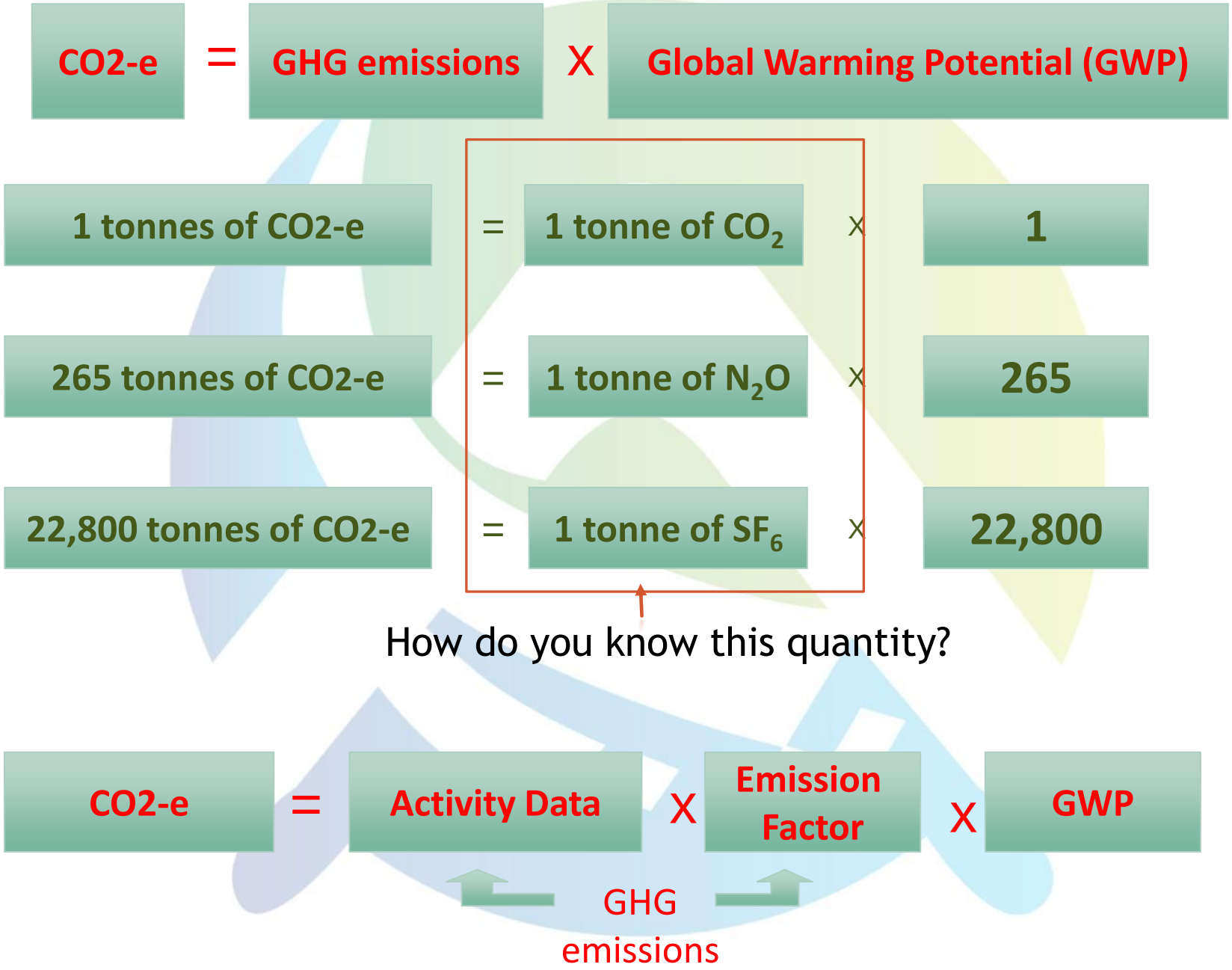
	GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28
Nitrous oxide (N_2O)	265
Hydrofluorocarbons (HFCs)	12-14,800
Perfluorocarbons (PFCs)	7,300-12,200
Sulphur hexafluoride (SF_6)	22,800
Nitrogen trifluoride (NF3)	17,200

example

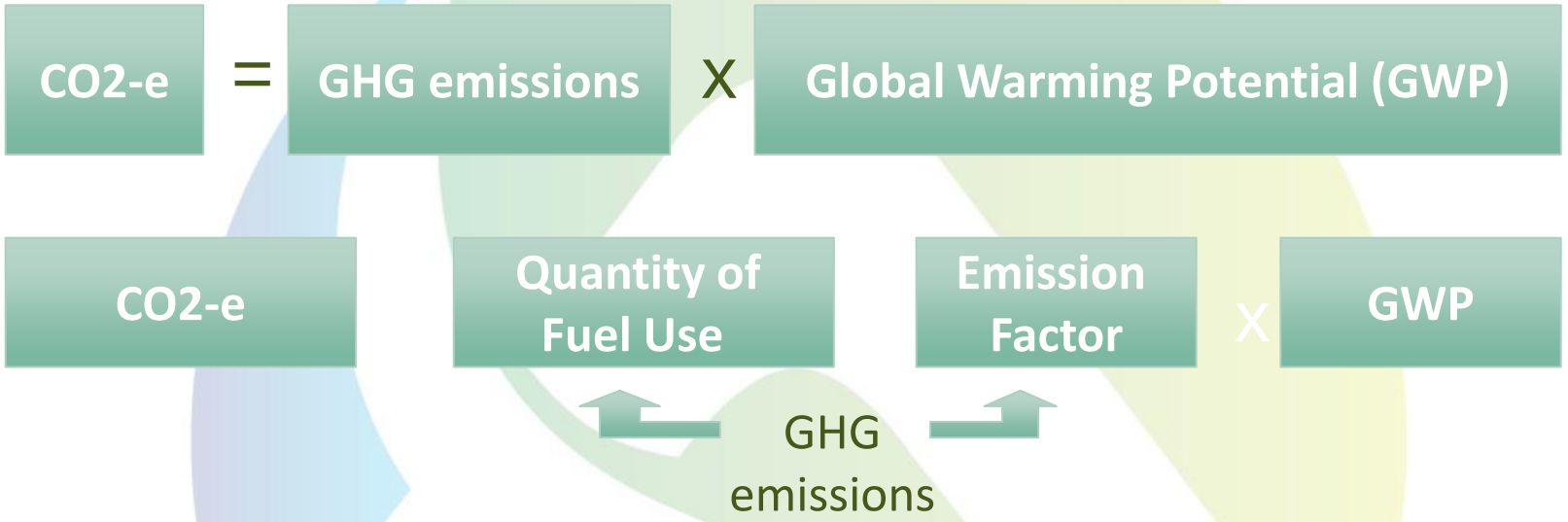
Example for 1 tonne of CH_4

28 tonnes of CO2-e = **1 tonne of CH4** X **28**

Source: IPCC 5th Assessment Report ,2014


CO2-e = GHG emissions X Global Warming Potential (GWP)
1 tonnes of CO2-e = 1 tonne of CO_2 x 1
265 tonnes of CO2-e = 1 tonne of N_2O x 265
22,800 tonnes of CO2-e = 1 tonne of SF_6 x 22,800
How do you know this quantity?
CO2-e = Activity Data X Emission Factor X GWP
GHG emissions

How to calculate emissions?



- Emission factors describe how much of greenhouse gases will be emitted during the burning of a particular fuel source.
- Emission factors are preferably time- and country-specific

Emission Factors are usually publicly available.

Samples of CO_2 Emissions Factors

1. Emissions factor for vehicle fuels

Fuel Type	Emission factors	Unit
Diesel Oil	2.614	kg/litre
Unleaded Petrol	2.360	kg/litre
LPG	1.679	kg/litre

2. Emissions factors (EF) for Towngas (kg CO_2-e/Unit of Towngas purchased)

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
EF	0.735	0.693	0.592	0.593	0.628	0.620	0.618	0.610	0.62	0.60	0.6	0.599	0.592	0.564	0.597	0.592

3. Emission factors (EF) for electricity use in HK (in kg CO_2-e/kWh)

Power Company	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2017	2018	2019	2020
CLP	0.56	0.53	0.52	0.53	0.57	0.54	0.56	0.54	0.59	0.58	0.51	0.51	0.50	0.37
HEC	0.98	0.98	0.92	0.91	0.83	0.84	0.79	0.79	0.79	0.79	0.78	0.79	0.81	0.71

Source: Guidelines to Account for and Report on GHG emisions and removals for buildings in HK 2010 Edition

Samples of CO_2 Emissions Factors

Aspects	Organization	Emission factors used	Reference	Link
Electricity Consumption	CLP	0.5 $kgCO_2/kWh$	CLP Sustainability Report 2019 P.86	CLP Sustainability Report 2019 (clpgroup.com)
Fresh Water Consumption	WSD	0.424 $kgCO2e/m^3$	WSD Annual Report 18/19 P.61	https://www.wsd.gov.hk/filemanager/common/annual_report/2018_19/pdf/WSD_AR2018-19_20200327_R1.pdf
Sewage Disposal	DSD	0.7 x 0.28 = 0.2 $kgCO2e/m^3$	DSD Sustainability Report 18/19	https://www.dsd.gov.hk/Documents/SustainabilityReports/1819/en/key_statistics_and_data.html
Fuels	Environmental Protection Department, Electrical and Mechanical Services Department	Refer to *Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong. Published by EPD & EMSD 2010* https://www.climateready.gov.hk/files/pdf/Guidelines_English_2010.pdf		

Establish Carbon Emission Inventory

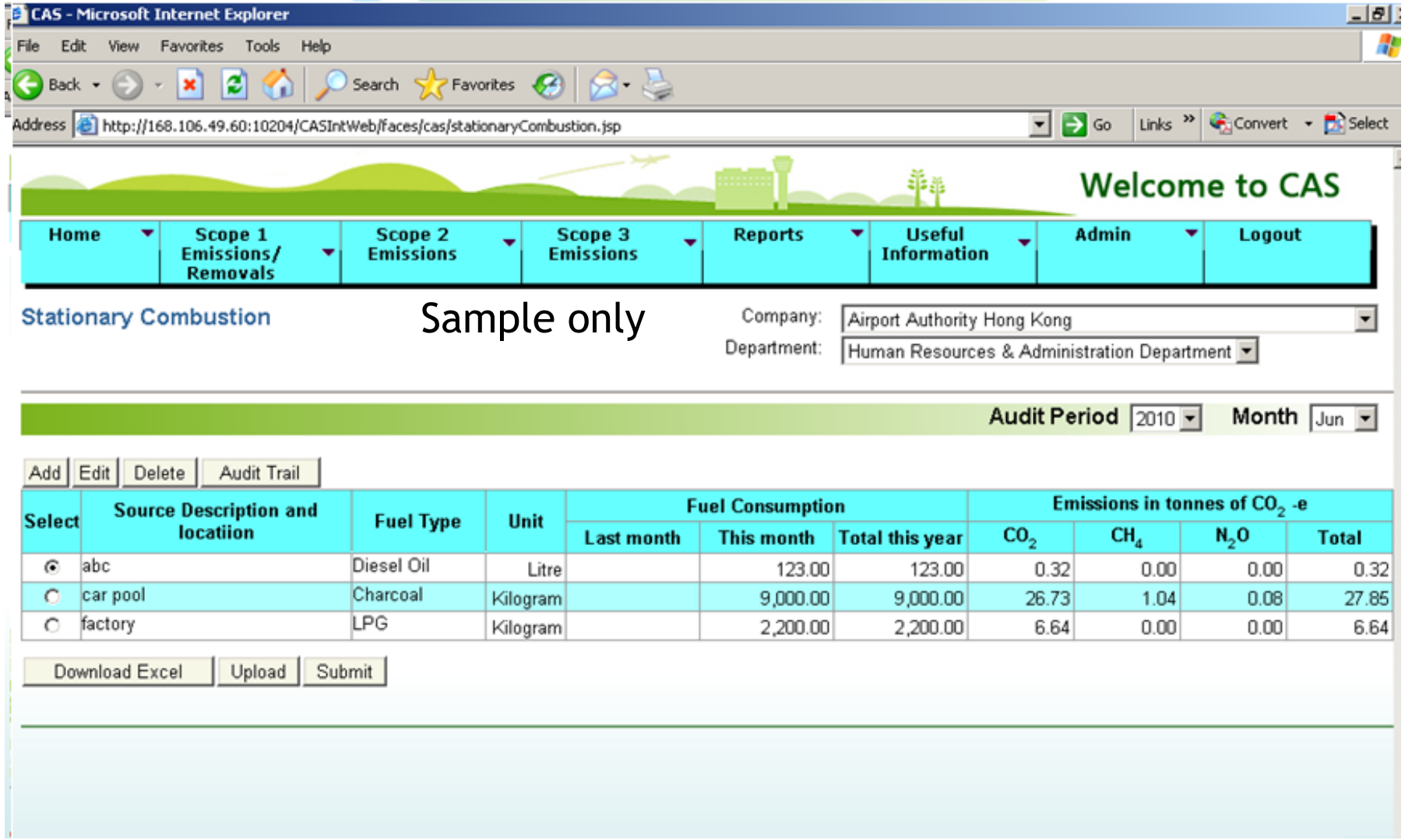
Calculation tools :

- Excel files
- Online Carbon calculator
- Off the shelf carbon calculator

"Low Carbon Living Calculator"

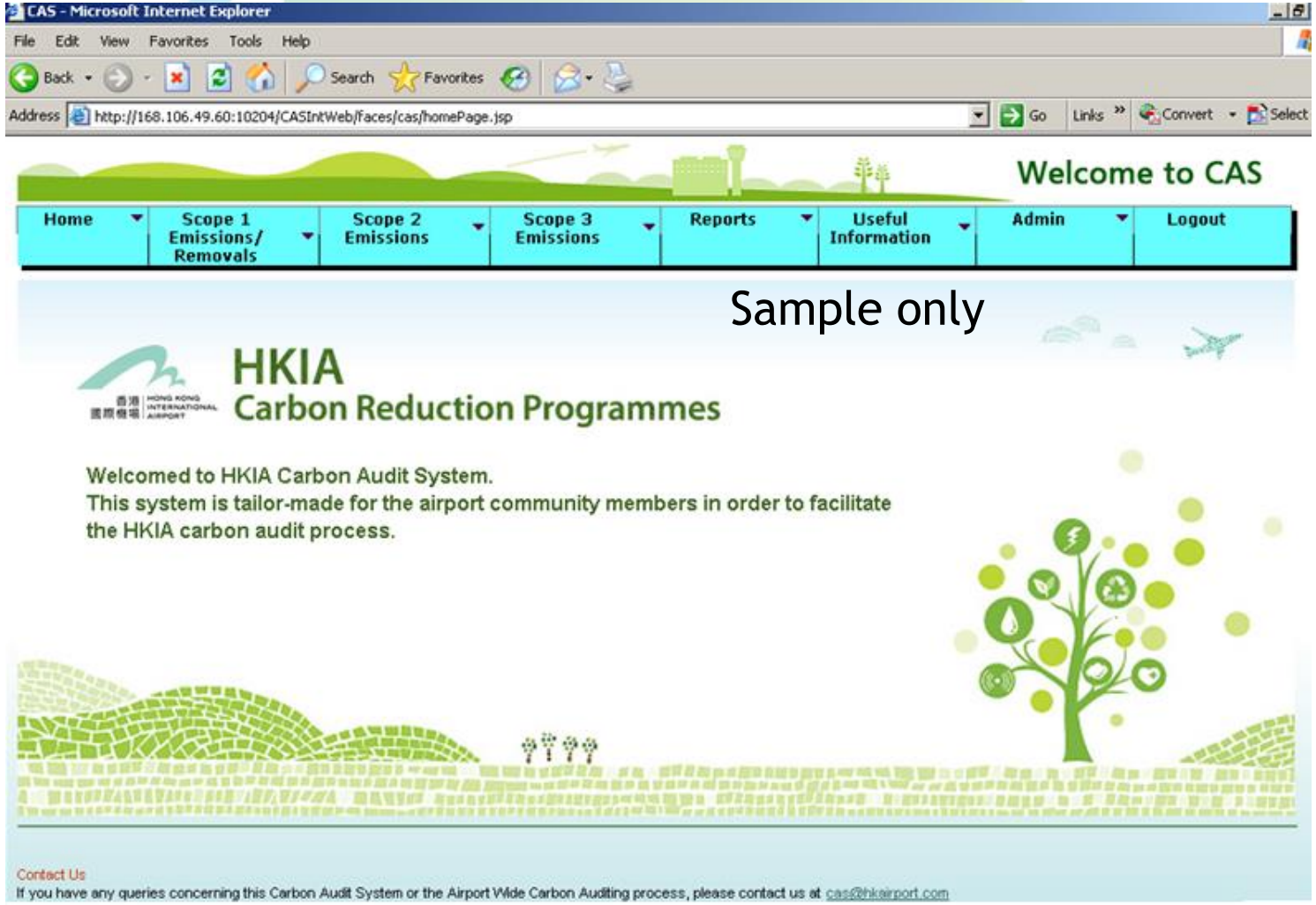
https://www.carboncalculator.gov.hk/en

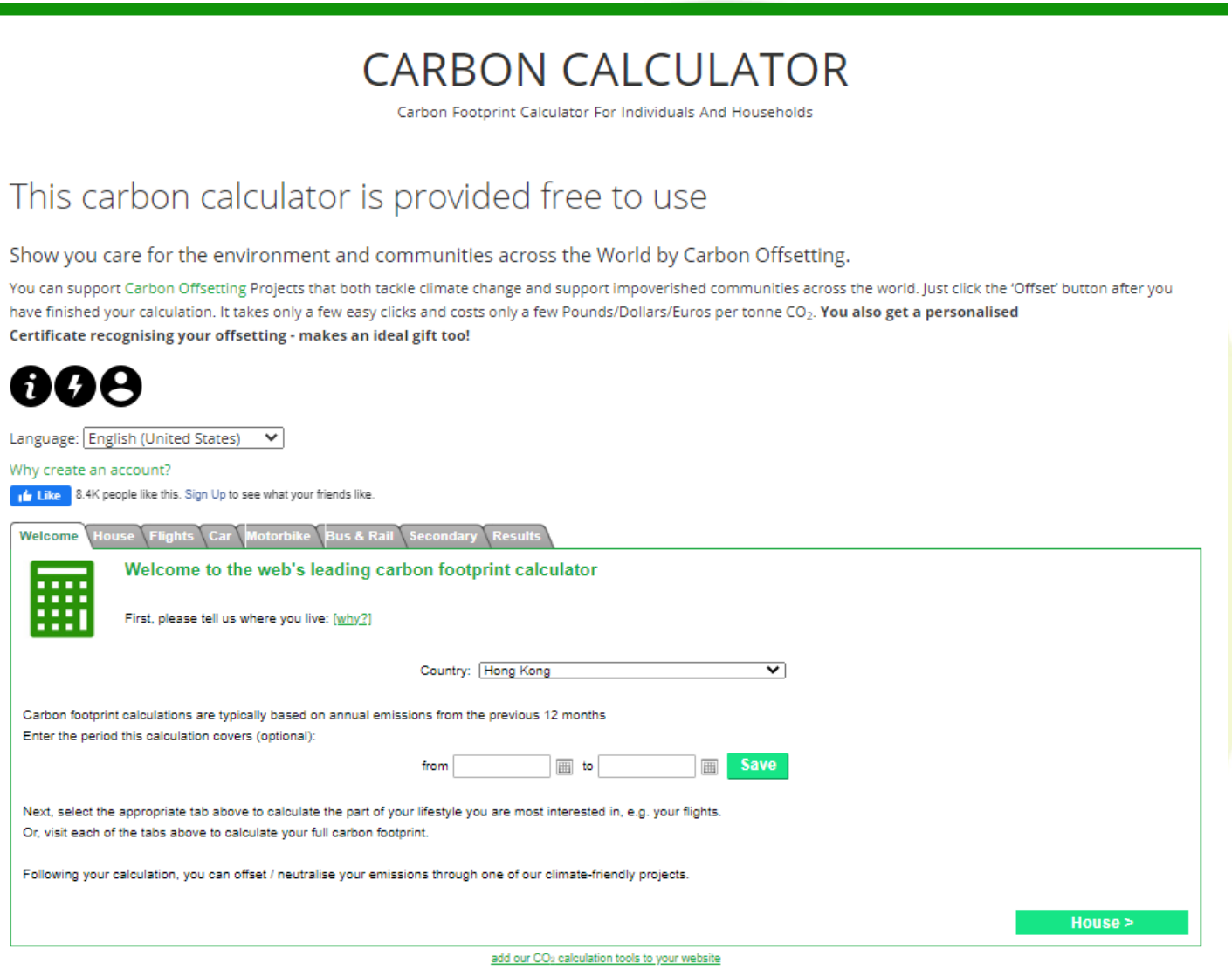
Examples of Carbon Audit Software



Select	Source Description and locatiion	Fuel Type	Unit	Fuel Consumption			Emissions in tonnes of CO_2 -e			
				Last month	This month	Total this year	CO_2	CH_4	N_2O	Total
◉	abc	Diesel Oil	Litre		123.00	123.00	0.32	0.00	0.00	0.32
○	car pool	Charcoal	Kilogram		9,000.00	9,000.00	26.73	1.04	0.08	27.85
○	factory	LPG	Kilogram		2,200.00	2,200.00	6.64	0.00	0.00	6.64

Examples of Carbon Audit Software





https://www.carbonfootprint.com/calculator.aspx

Reporting GHG Emissions

Company and Inventory boundary

- Outline of organizational boundaries
- Outline of operational boundaries
- a list of Scope 3 emissions activities covered (if any)
- Reporting period

Information on Emissions

- Total Scope 1 & 2 emissions
- Emissions data for each scope and all 6 GHGs
- Base year, emissions profile over time, recalculations details (if any)
- Calculation methodologies
- Any exclusions of sources, facilities and / or operations

Optional Information

- Scope 3 emission data
- Ratio performance indicators
- Descriptions of performances
- Reduction programmes
- External assurance

End of Session 1

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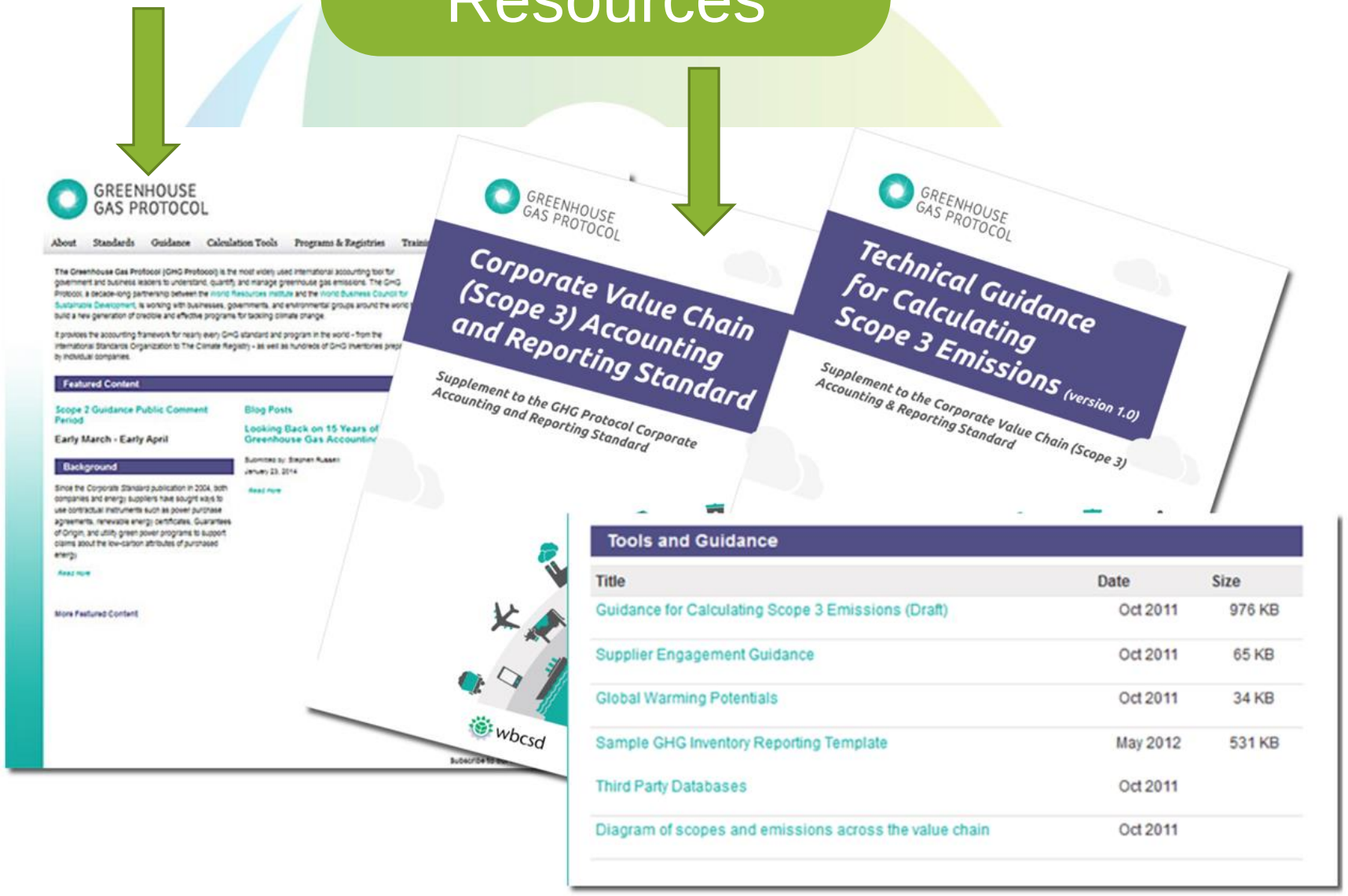
Session 2
Introduction to Scope 3

By Ir Sophia Lau
Director, ASEL Consulting Company

Sophia.lau@asel.com.hk

Resources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Early March - Early April
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Sample GHG Inventory Reporting Template
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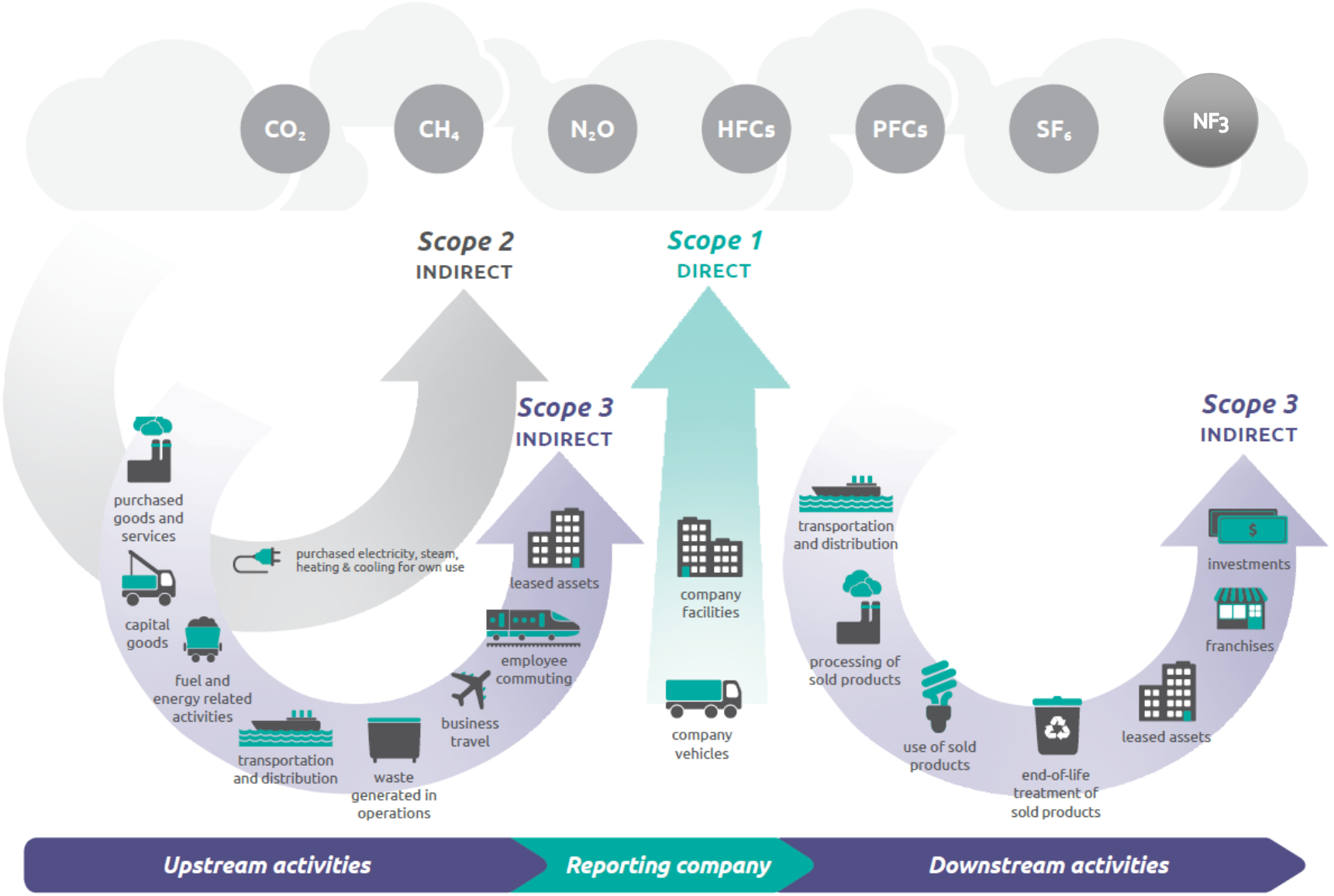
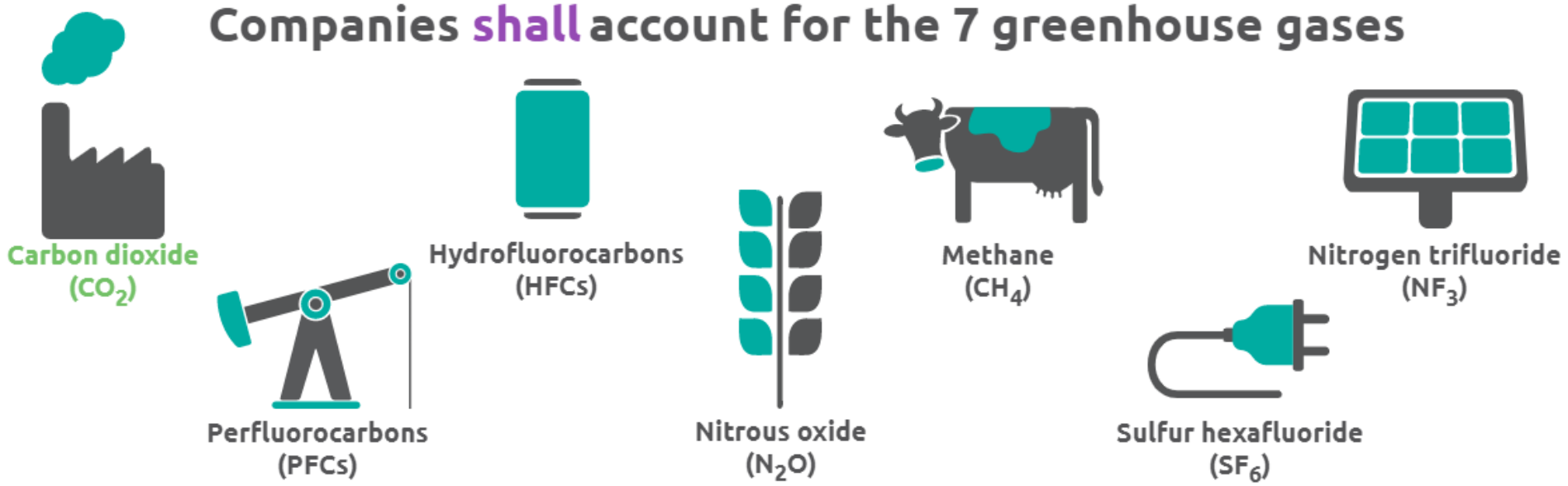
Third Party Databases
Oct 2011
Diagram of scopes and emissions across the value chain
Oct 2011

Overview of GHG Protocol scopes and emissions across the value chain



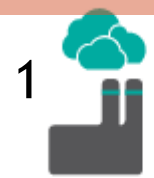
Gases to Include

Seven types of Greenhouse Gases



Scope 3 - 15 Categories

Upstream



1 purchased goods and services

2 capital goods

3 fuel and energy related activities

4 upstream transportation and distribution

5 waste generated in operations

6 business travel

7 employee commuting

8 upstream leased assets

Downstream

9 downstream transportation and distribution

10 processing of sold products

11 use of sold products

12 end-of-life treatment of sold products

13 downstream leased assets

14 franchises

15 investments

Upstream Scope 3 emissions

Categories 1 – Purchased Goods and Services

- Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year
- Typically account for a large percentage of all scope 3 emissions.

Categories 2 – Capital Goods

- Extraction, production, and transportation of capital goods purchased or acquired by the reporting company in the reporting year

Upstream emissions

Categories 3 – Fuel-and energy-related activities

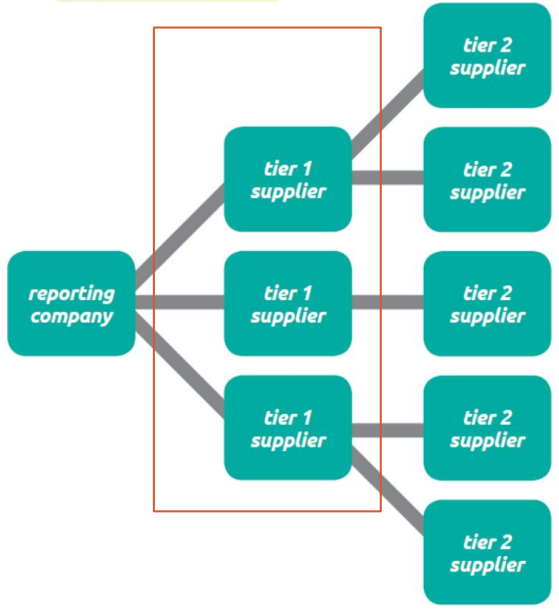
- Extraction, production, and transportation of a) fuels and b) energy purchased or acquired by the reporting company in the reporting year
- Typically account for a large percentage of all scope 3 emissions.
- Not included in scope 1 or scope 2

c) Also cover transmission and distribution loss
d) Electricity that is sold to end users

Categories 4 – Upstream transportation and distribution

- Transportation and distribution of products purchased by the reporting company in the reporting year between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company)

- Transportation and distribution services purchased by the reporting company in the reporting year



Categories 5 – Waste generated in operations

- Disposal and treatment of waste generated in the reporting company's operations in the reporting year
- in facilities not owned or controlled by the reporting company

What are the waste treatment methods in Hong Kong?

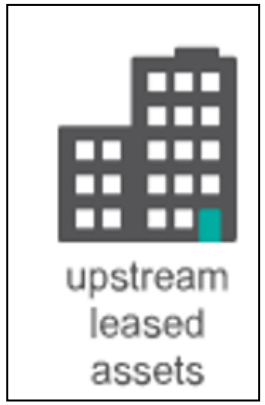
Categories 6 – Business Travel

- Transportation of employees for business-related activities during the reporting year
- in vehicles not owned or operated by the reporting company

What's the impact of COVID-19 to business travel emissions?

Categories 7 – Employee Communting

- Transportation of employees between their homes and their worksites during the reporting year
- in vehicles not owned or operated by the reporting company



Categories 8 – Upstream leased assets

- Operation of assets leased by the reporting company (lessee) in the reporting year and not included in scope 1 and scope 2

Downstream Scope 3 emissions

Categories 9 – Downstream transportation and distribution

- Transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company)

Categories 10 – Processing of sold products

- Processing of intermediate products sold in the reporting year by downstream companies (e.g. manufacturers).

Categories 11 – Use of sold products

- End use of goods and services sold by the reporting company in the reporting year

Please name some examples of sold products.

Categories 12 – End-of-life treatment of sold products

- Waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life

Categories 13 - Downstream leased assets

- Operation of assets owned by the reporting company and leased to other entities in the reporting year, not included in scope 1 and scope 2

Categories 14 – Franchises

- Operation of franchises in the reporting year, not included in scope 1 and scope 2

Categories 15 – investments

- Operation of investments (including equity and debt investments and project finance) in the reporting year, not included in scope 1 or scope 2
- primarily for private financial institutions like commercial banks
- This category is applicable to investors and companies that provide financial services

List of Scope 3 Categories

Upstream or downstream	*Scope 3 category*
Upstream scope 3 emissions Upstream emissions are indirect GHG emissions related to purchased or acquired goods and services.	1. Purchased goods and services 2. Capital goods 3. Fuel- and energy-related activities (not included in scope 1 or scope 2) 4. Upstream transportation and distribution 5. Waste generated in operations 6. Business travel 7. Employee commuting 8. Upstream leased assets
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End of Session 2

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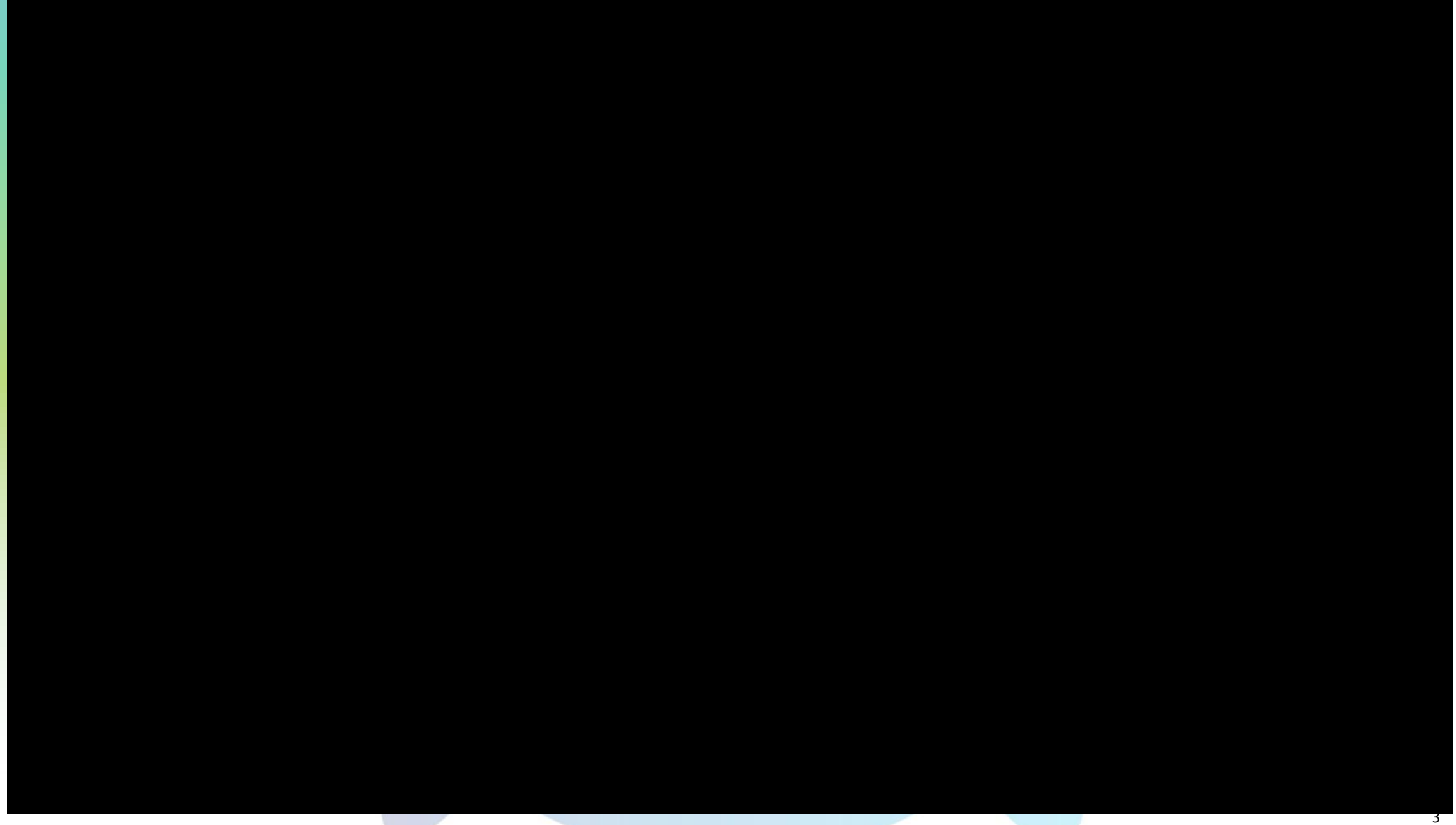
Session 3
Scope 3 Data Collection and Calculation

By Ir Sophia Lau

Director, ASEL Environmental Consulting Company Limited

Sophia.lau@asel.com.hk

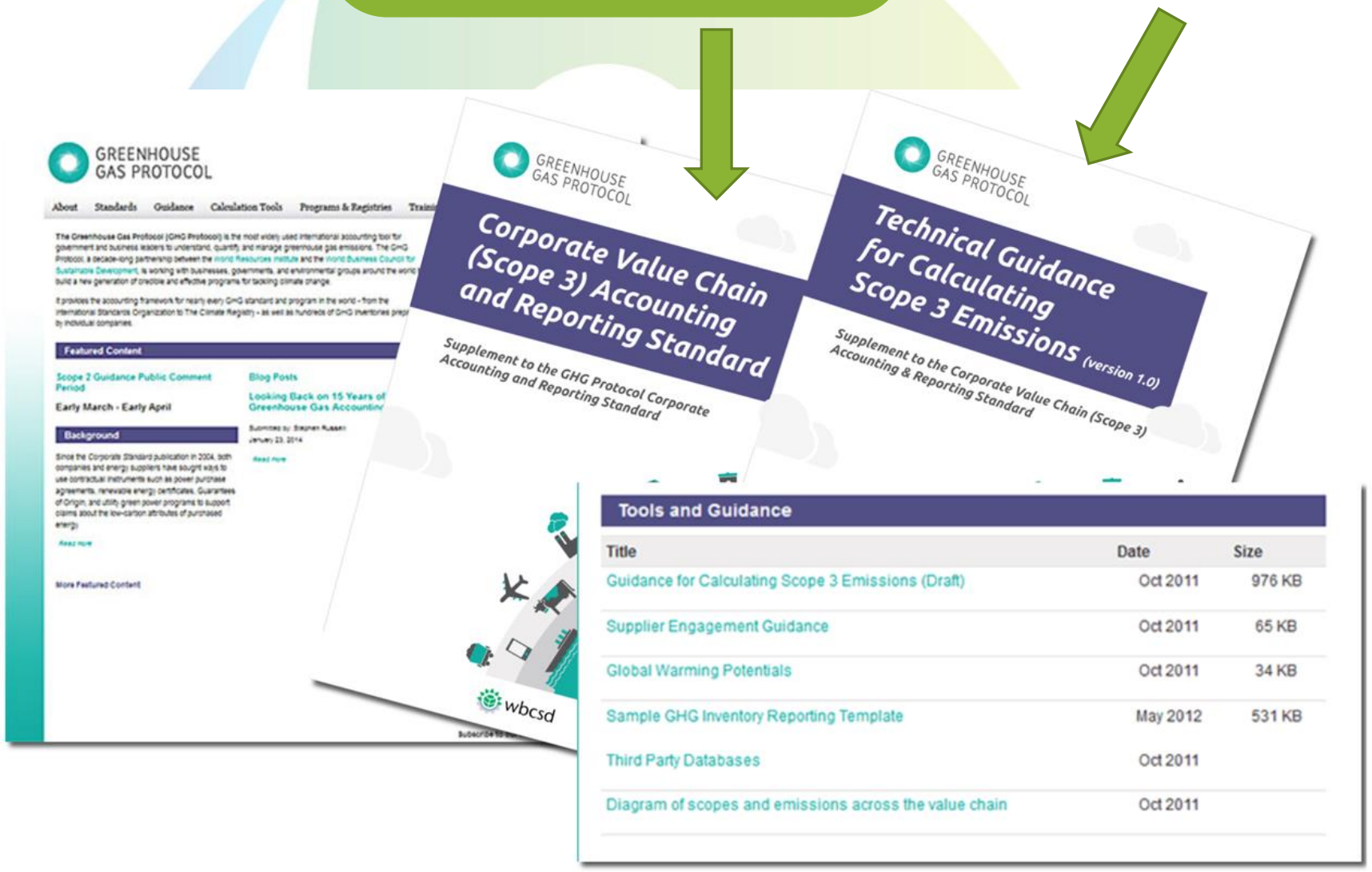
- https://www.youtube.com/watch?v=59DMh6G6VZg



https://www.youtube.com/watch?v=j4trdSuHc5Q

Why do we need to manage our value chain?

Resources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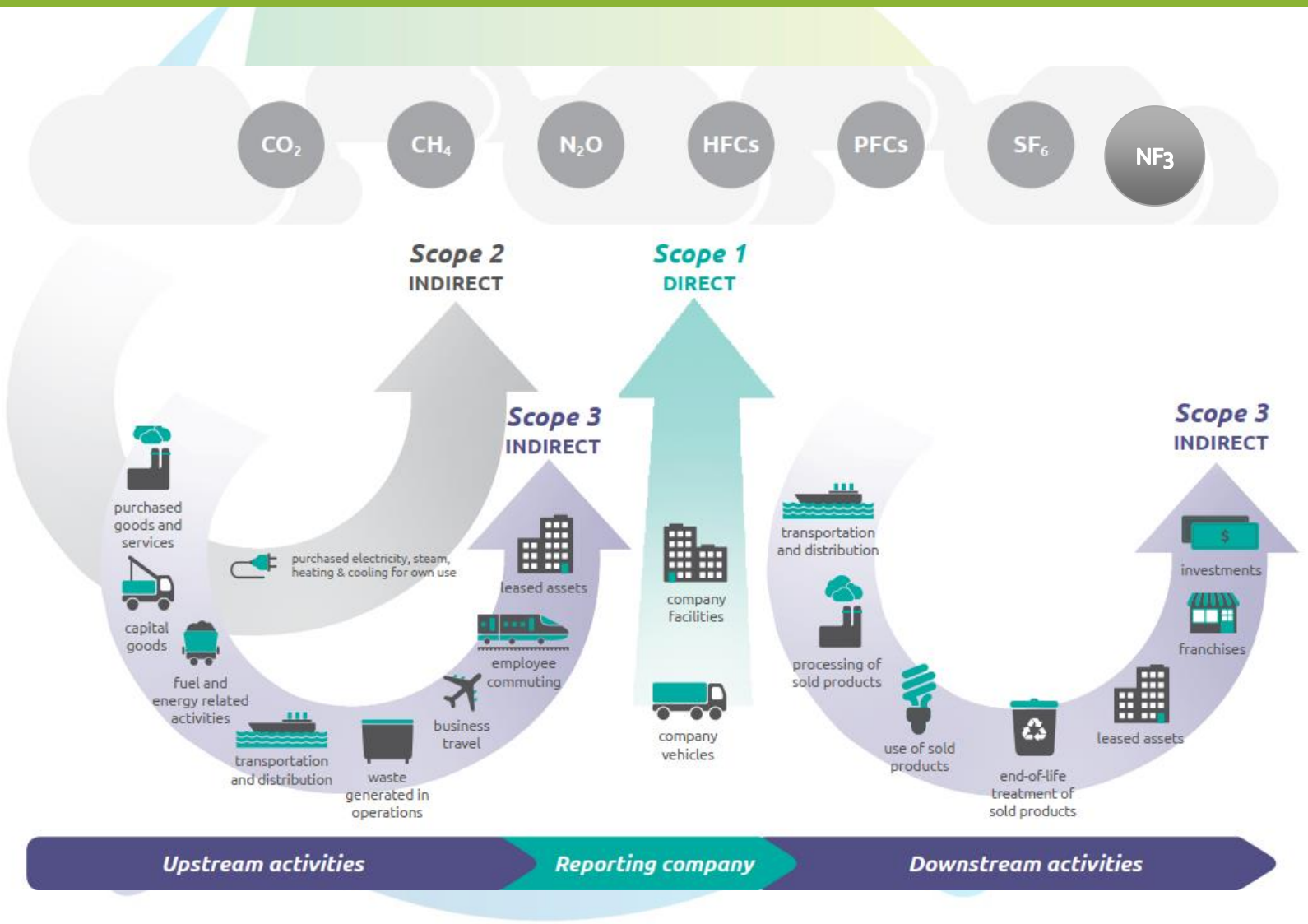
Third Party Databases
Oct 2011
Diagram of scopes and emissions across the value chain
Oct 2011

Corporate-level GHG Protocol reporting options

Reporting Option	*Scope 1*	*Scope 2*	*Scope 3*
Report in conformance with the *GHG Protocol Corporate Standard*	**Required**	**Required**	**Optional**: Companies may report any scope 3 emissions the company chooses
Report in conformance with the *GHG Protocol Corporate Standard* and the *GHG Protocol Scope 3 Standard*	**Required**	**Required**	**Required**: Companies shall report scope 3 emissions following the requirements of the *Scope 3 Standard*

Overview of GHG Protocol scopes and emissions across the value chain



Gases to Include

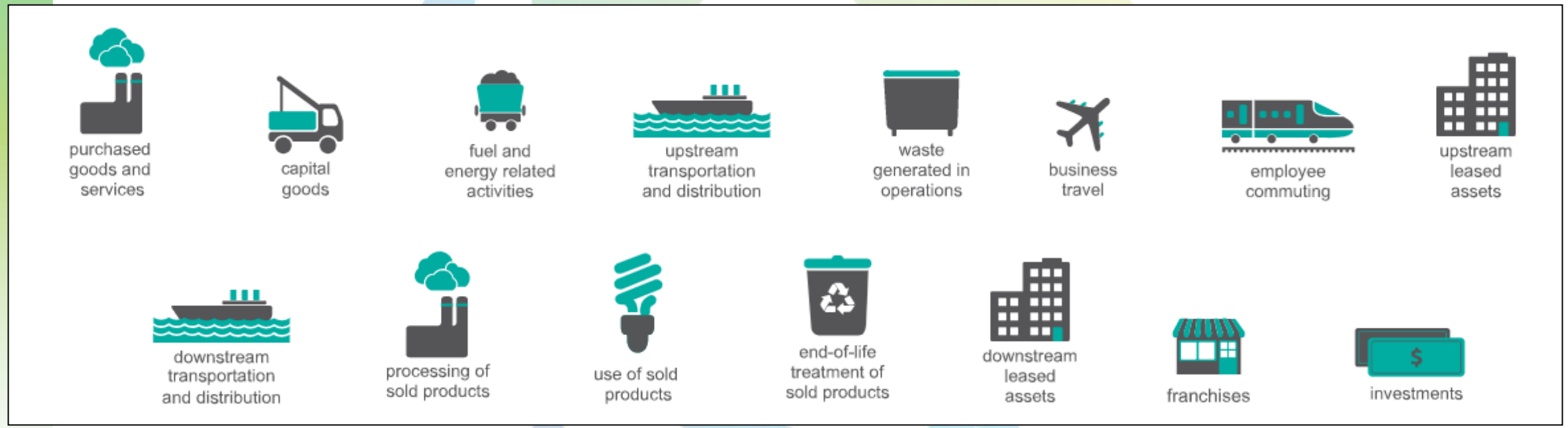
Companies shall account for the 7 greenhouse gases

- Carbon dioxide (CO_2)
- Hydrofluorocarbons (HFCs)
- Methane (CH_4)
- Nitrogen trifluoride (NF_3)
- Perfluorocarbons (PFCs)
- Nitrous oxide (N_2O)
- Sulfur hexafluoride (SF_6)

Companies should include any other relevant GHGs

- **Biogenic CO_2 (should be reported separately)**

Scope 3 – 15 Categories



List of Scope 3 Categories

Upstream or downstream	*Scope 3 category*
Upstream scope 3 emissions Upstream emissions are indirect GHG emissions related to purchased or acquired goods and services.	1. Purchased goods and services 2. Capital goods 3. Fuel- and energy-related activities (not included in scope 1 or scope 2) 4. Upstream transportation and distribution 5. Waste generated in operations 6. Business travel 7. Employee commuting 8. Upstream leased assets
Downstream scope 3 emissions Downstream emissions are indirect GHG emissions related to sold goods and services.	9. Downstream transportation and distribution 10. Processing of sold products 11. Use of sold products 12. End-of-life treatment of sold products 13. Downstream leased assets 14. Franchises 15. Investments

What's next?

1. Identifying Scope 3 Activities

2. Setting up Scope 3 boundary
   - Conduct screening by estimation / calculation

3. Collect Data
   - Data collection prioritization
   - Data selection

4. Detail Calculation

Reporting

1. Identifying Scope 3 Activities (value chain mapping)

1 **Create list of activities**

- Growing and processing fruit
- Transforming fruit into food and beverages products
- Distributing products to consumers
- Use and disposal by consumers

2 **List purchased and sold goods and services**

3 **List suppliers**

- Name
- Type or Sector
- Spend Category
- Perceived Level of Influence

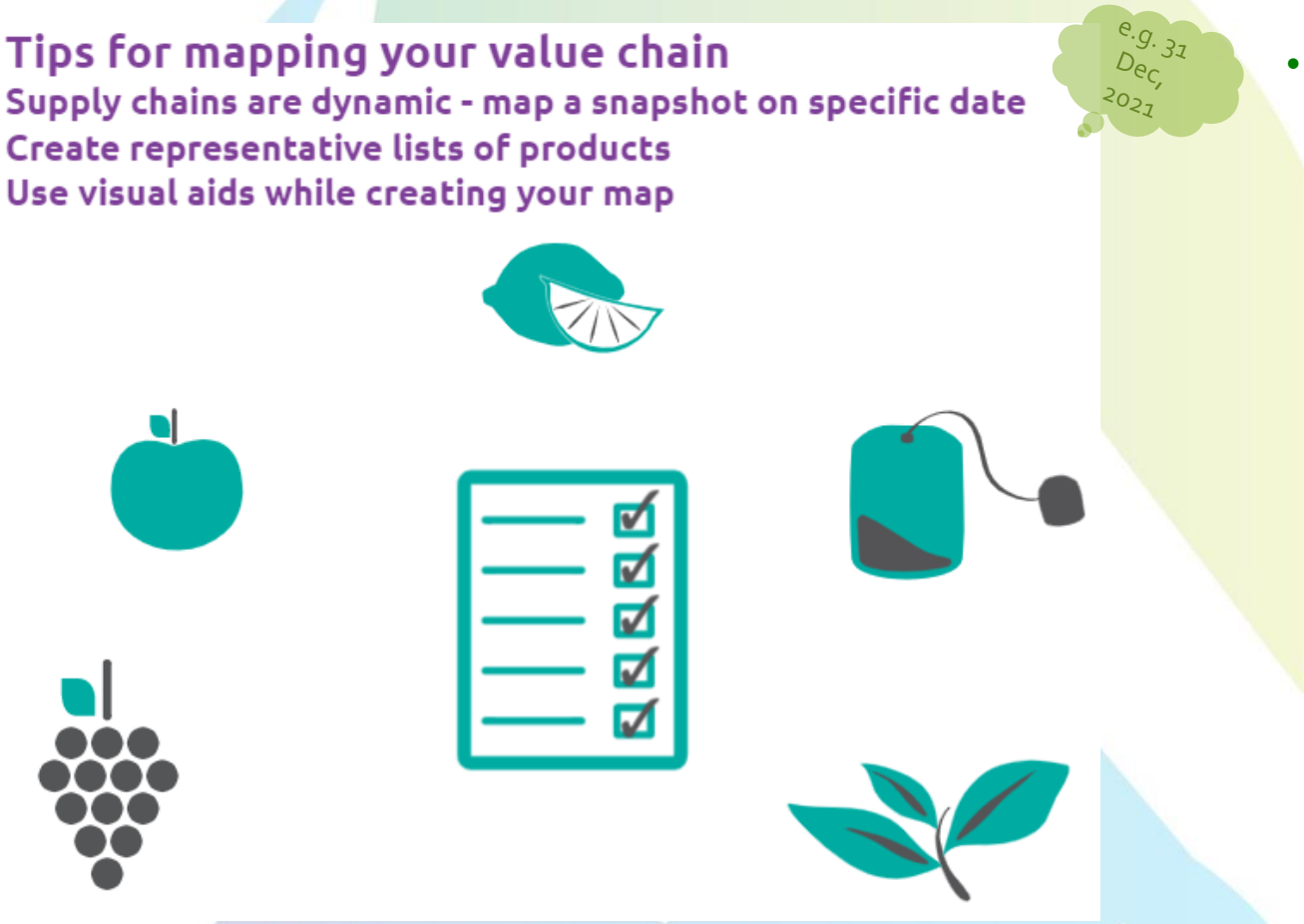
1. Identifying Scope 3 Activities (value chain mapping)

Example of a tea production company

Category	Activity	Supplier/Partner
#1 Purchased Goods and Services		
	Sugar	A, B, C
	Tea	D, E, F
	Herbs	F, G
	Plastic bottle caps	P
	Glass bottles	P
	Tea bags	H
	Boxes	I
	Plastic bags	J
	Office supplies, paper	K
	Office supplies, non paper	K
	Flavorings	L, M
	Lemon juice concentrate	N,O
#2 Capital Goods		
	Truck	
	Packaging Machine	
# 3 Fuel and Energy Related Activities		
	China Manufacturing Facility:	
	Electricity, China	

- Companies may establish their own policy for mapping the value chain, which may include creating representative, rather than exhaustive, lists of purchased products, sold products, suppliers, and other value chain partners. Other relevant value chain partners may include contract manufacturers, lessors, lessees, franchisees, customers, etc.

1. Identifying Scope 3 Activities (value chain mapping)



- Companies should strive for completeness in mapping the value chain, but it is acknowledged that achieving 100% completeness may not be feasible.

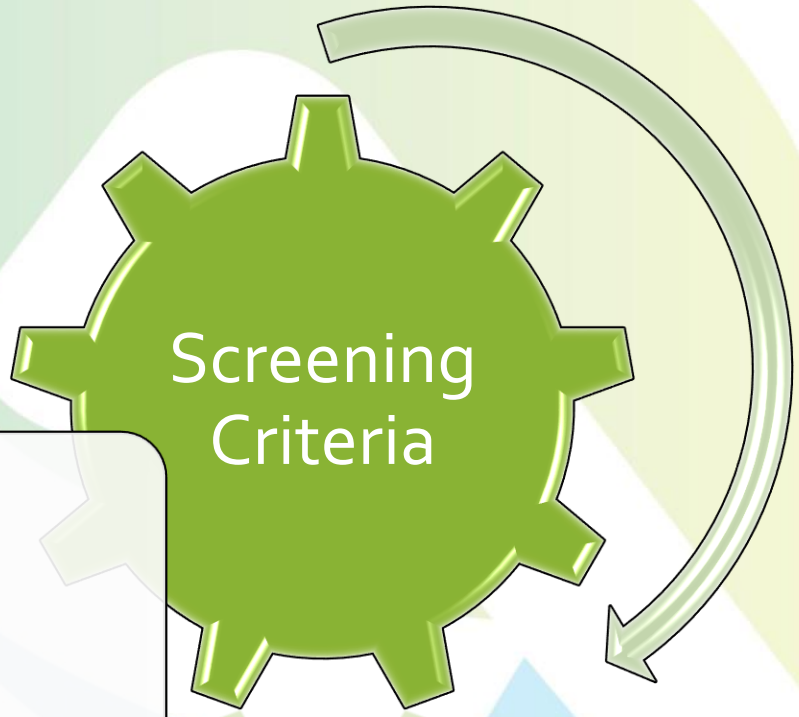
2. Setting up Scope 3 boundary

Scope 3 Boundary Requirements

1. Companies shall account for all scope 3 emissions and disclose and justify exclusions.
2. Companies shall account for emissions from each of the 15 scope 3 categories according to the minimum boundaries (listed in table 5.4 of the Scope 3 Standard).
3. Companies shall account for scope 3 emissions of seven GHGs: CO2, CH4, N2O, HFCs, PFCs, SF6, and NF3.
4. Biogenic emissions i.e. CO2 emissions from the combustion or biodegradation of biomass should be reported separately (e.g. burning of biofuels, emission of landfill gas etc.)

2. Setting up Scope 3 boundary

Criteria for scope 3 screening:



- Size
- Influence
- Risk
- Stakeholders
- Outsourcing
- Sector guidance

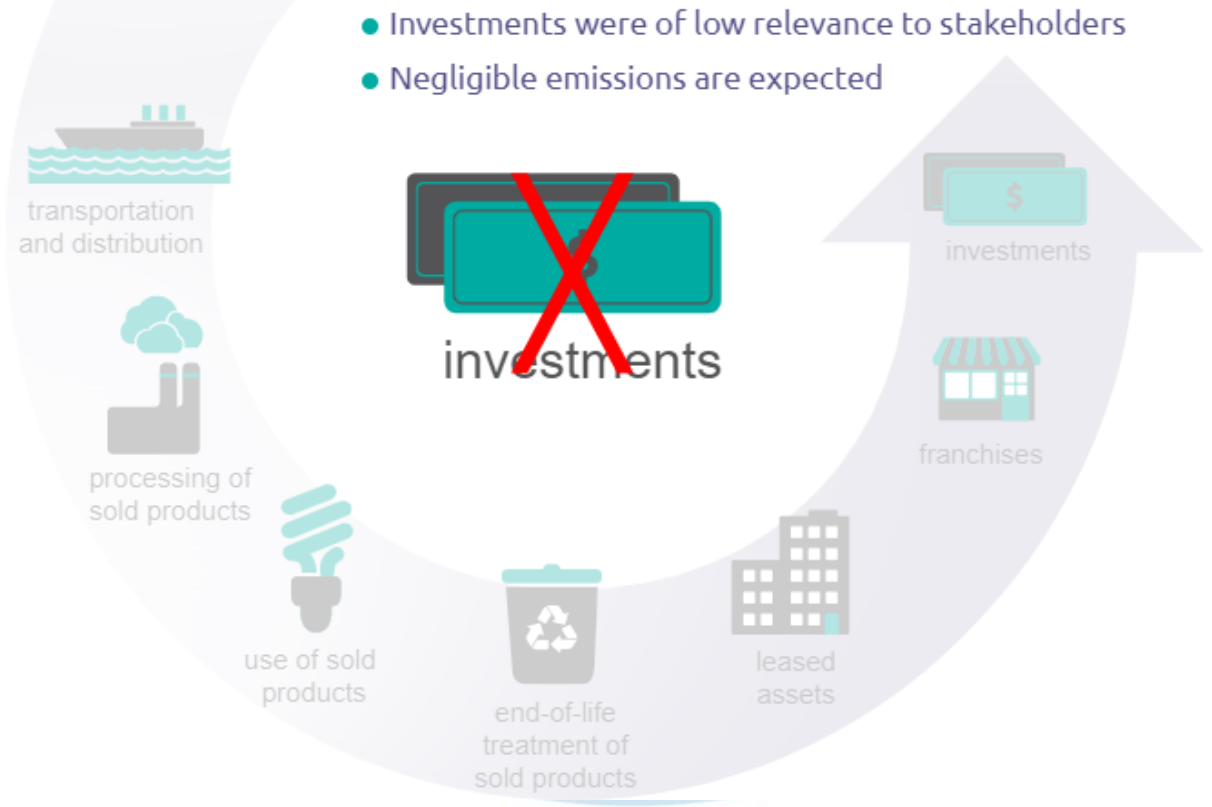
2. Setting up Scope 3 boundary

Excluding Activities

- Some categories may not be applicable to your company.
- Some categories, based on initial estimates, may be insignificant in size and excluded, as for these activities the ability *to collect data and influence GHG reductions is limited.*
- *Best to try to estimate before exclusion*

Excluding Activities

Example

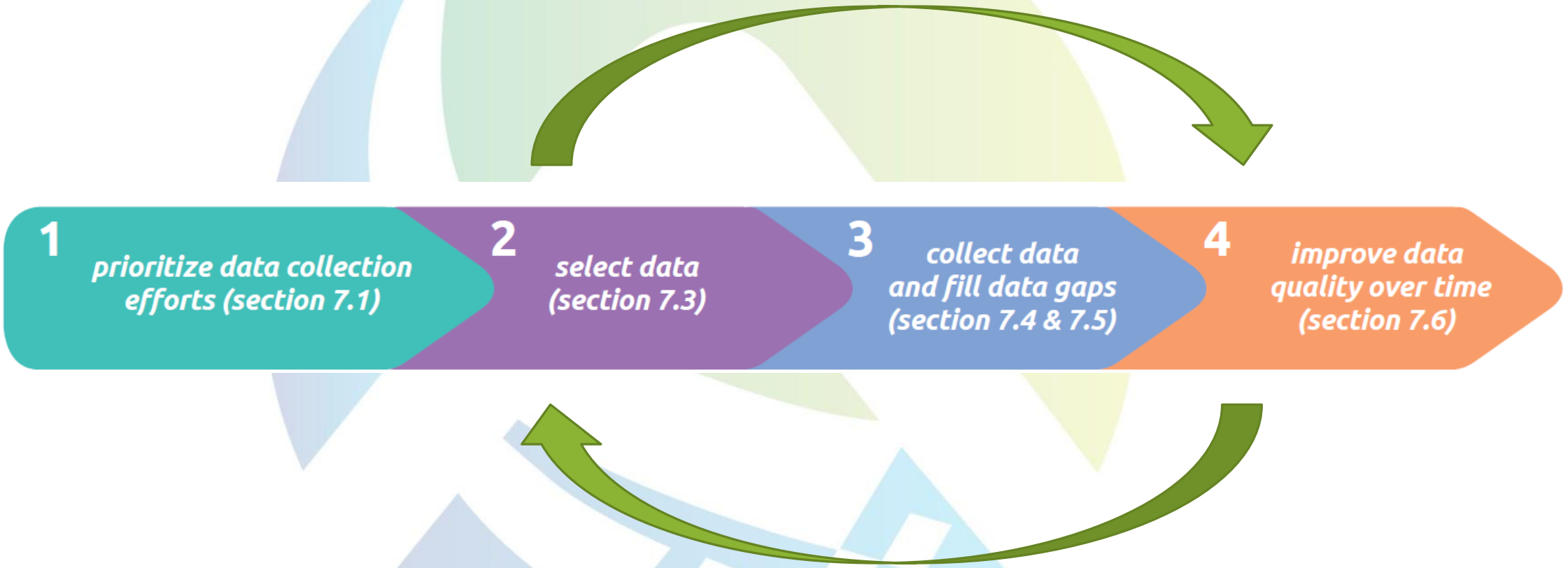


Excluding Category 15

Category 15 Investments was excluded, with justification:

It is assumed that this category is negligible. Investments in the reporting year were predominately in software related businesses where the associated GHG emissions are relatively low. If the investments increase within HP, the team will consider looking closer at each investment for possible inclusion in the Scope 3 GHG emission calculation.

3. Data Collection



This may not be a linear process, could happen at the same time along the data collection process

3.1. Prioritize Data Collection

1 - Most significant GHG emissions produced

2 - Most significant reductions expected

3 - Most relevant to company's business goals

- Will help to more effectively set reduction targets and
- demonstrate GHG reductions over time.

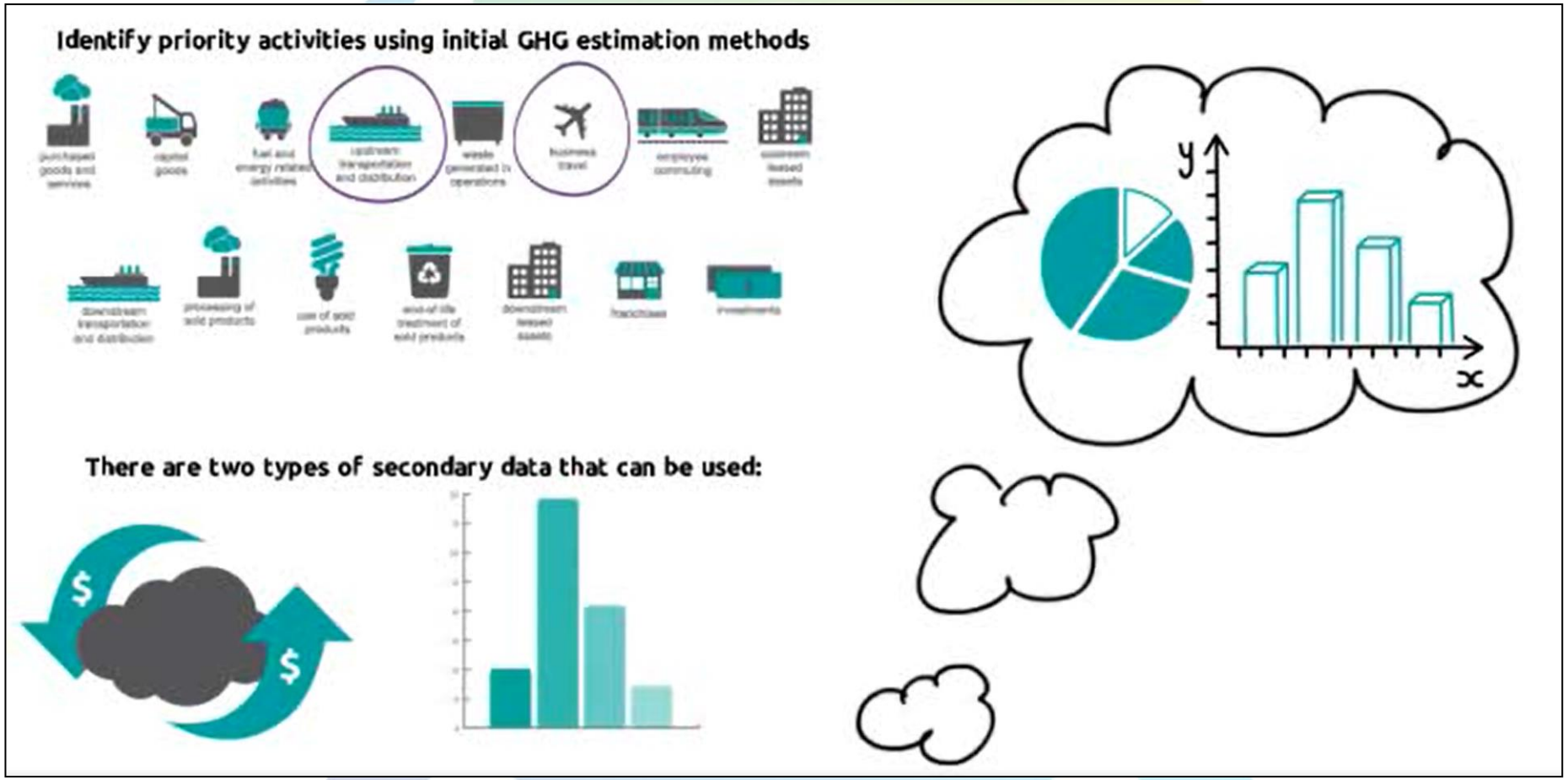
3.1. Prioritize Data Collection – Approaches to Screening

1 Emission-Based Screening

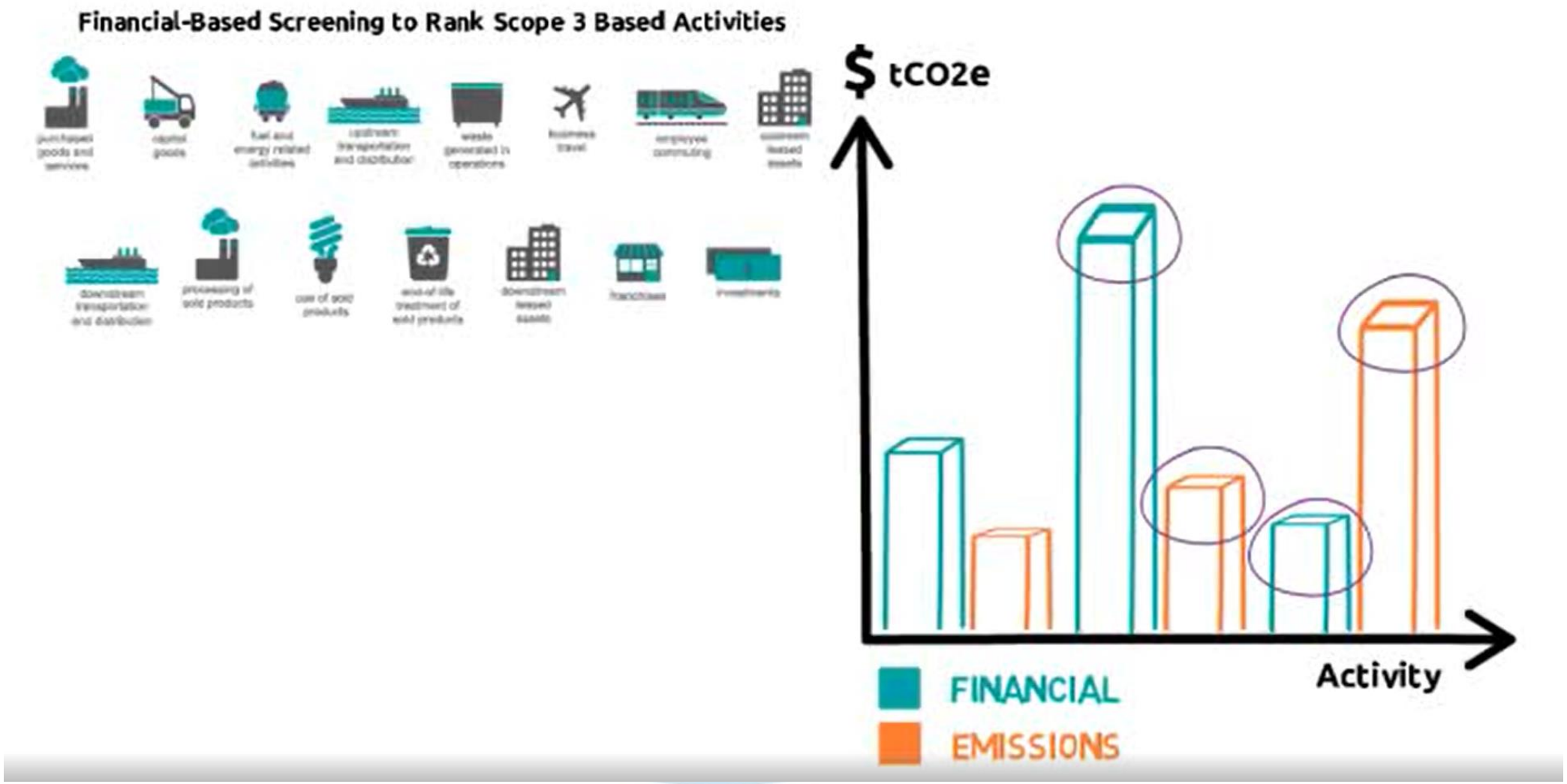
2 Financial-Based Screening

3 Other Criteria Important to Company Stakeholders

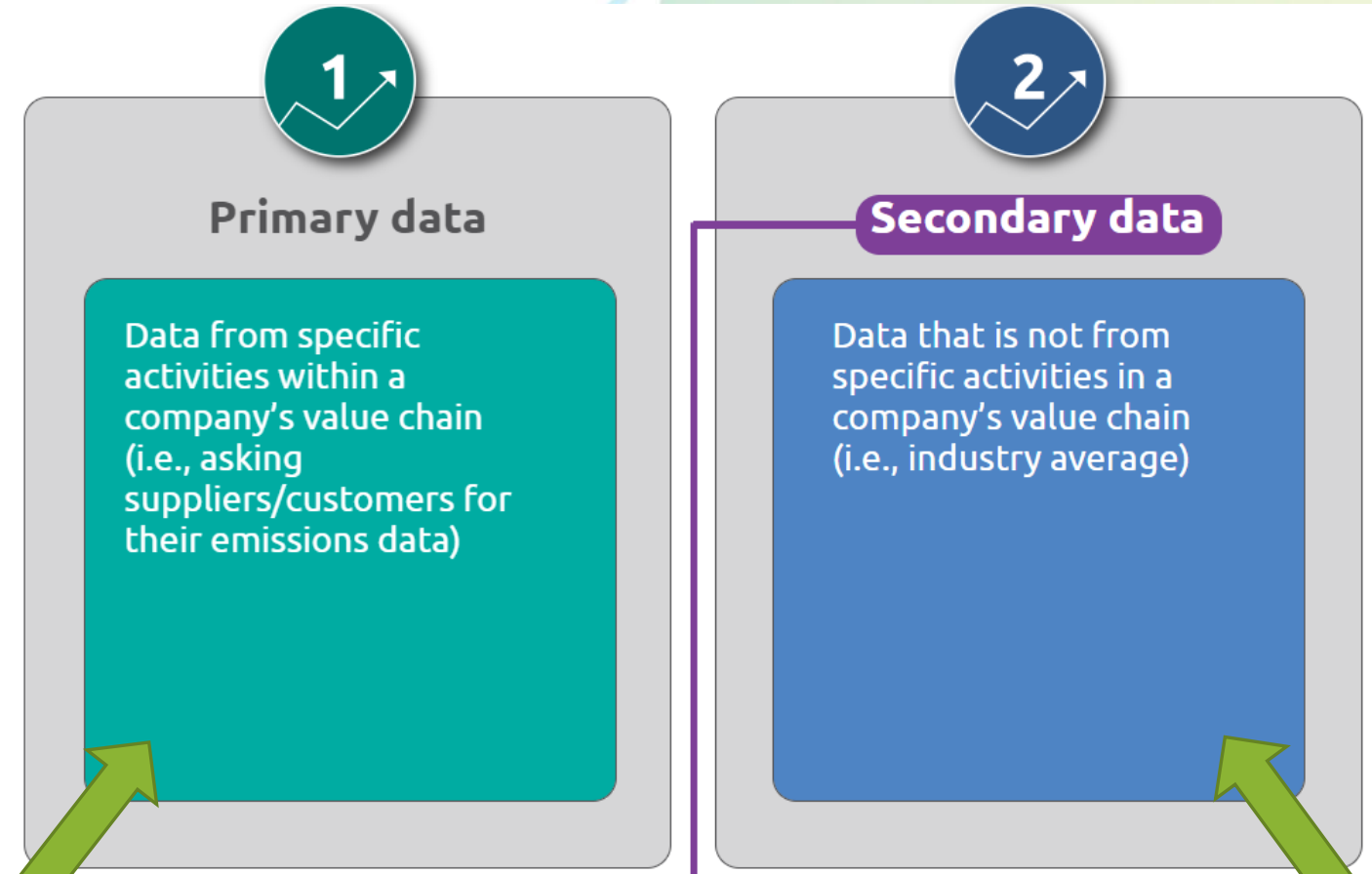
Emission-Based Screening



Financial-Based Screening



3.2 Data Selection



If both primary and secondary data not available, use proxy *e.g. data for production of tea is not available, we may try to use production of coffee as proxy data*

Supplier specific data

Average data (product - based or spend-based)

Common data source

GREENHOUSE GAS PROTOCOL

SimaPro

About SimaPro ▾ Our custon

LCA software for informed change-makers

SimaPro is a powerful solution for those looking to drive sustainable change. Built on robust science and life cycle

EPA United States

US EPA

THIRD PARTY DATABASES

These databases assist users in collecting data for product life cycle and corporate value chain (scope 3) GHG inventories.

eiolca.net

3EID

Input-output (JPY) tables with environmental burden measured as energy or emissions. Includes methodology.

Athena Institute

A set of comprehensive, comparable life cycle inventory databases for building materials and products in a series of reports.

Australian National Life Cycle Inventory Database (AusLCI)

The Australian National Life Cycle Inventory Database (AusLCI) is a major initiative currently being delivered by the Australian Life Cycle Assessment Society (ALCAS). The aim is to provide and maintain a national, publicly-accessible database with easy access to authoritative, comprehensive and transparent environmental information on a wide range of Australian products and services over their entire life cycle. It is an invaluable tool for those involved in environmental assessment and particularly life cycle assessment (LCA), as it provides consistent guidelines, principles and methodologies for the collection of life cycle inventory (LCI) data, along with protocols for LCA processes for different sectors.

eiolca.net

Economic Input-Output Life Cycle Assessment

中国生命周期基础数据库

Chinese Life Cycle Database (CLCD)

ecoinvent

Defra, IEA, IPCC,

Samples of CO_2 Emissions Factors

1. Emissions factor for vehicle fuels (HK based)

Source: Guidelines to Account for and Report on GHG emisions and removals for buildings in HK 2010 Edition

Fuel Type	Emission factors	Unit
Diesel Oil	2.614	kg/litre
Unleaded Petrol	2.360	kg/litre
LPG	1.679	kg/litre

Scope	Emission source	Unit	kg CO_2-e /unit	Data source
Scope 2	Electricity purchased from The Hongkong Electric Company Limited	kWh	0.80	HK Electric Investments Sustainability Report 2018
	Towngas purchased from The Hong Kong and China Gas Company Limited	unit	0.564	Towngas Sustainability Report 2018
Scope 3	Methane generation at landfill in Hong Kong due to disposal of paper waste	kg	4.8	EPD-EMSD Guidelines (2010)
	Electricity used for fresh water processing by WSD	m^3	0.404	WSD Annual Report 2017/18
	Electricity used for sewage processing by DSD	m^3	0.219	DSD Sustainability Report 2017-2018
	General waste disposal	kg	1.5	Carbon Audit Toolkit for Small and Medium Enterprises in Hong Kong

Table [7.2] Examples of activity data and emission factors

Examples of activity data	*Examples of emission factors*
• Liters of fuel consumed	• kg CO_2 emitted per liter of fuel consumed
• Kilowatt-hours of electricity consumed	• kg CO_2 emitted per kWh of electricity consumed
• Kilograms of material consumed	• kg PFC emitted per kg of material consumed
• Kilometers of distance traveled	• t CO_2 emitted per kilometer traveled
• Hours of time operated	• kg SF_6 emitted per hour of time operated
• Square meters of area occupied	• g N_2O emitted per square meter of area
• Kilograms of waste generated	• g CH_4 emitted per kg of waste generated
• Kilograms of product sold	• kg HFC emitted per kg of product sold
• Quantity of money spent	• kg CO_2 emitted per unit of currency spent

Source: GHG Protocol

Criteria to determine Data Quality

Table [7.6] Data quality indicators

Indicator	*Description*
Technological representativeness	The degree to which the data set reflects the actual technology(ies) used
Temporal representativeness	The degree to which the data set reflects the actual time (e.g., year) or age of the activity
Geographical representativeness	The degree to which the data set reflects the actual geographic location of the activity (e.g., country or site)
Completeness	The degree to which the data is statistically representative of the relevant activity. Completeness includes the percentage of locations for which data is available and used out of the total number that relate to a specific activity. Completeness also addresses seasonal and other normal fluctuations in data.
Reliability	The degree to which the sources, data collection methods and verification procedures[2] used to obtain the data are dependable.

Adapted from B.P. Weidema and M.S. Wesnaes, "Data quality management for life cycle inventories – an example of using data quality indicators," Journal of Cleaner Production 4 no. 3-4 (1996): 167-174.

Source: GHG Protocol

Examples – in-house illustration of data uncertainty

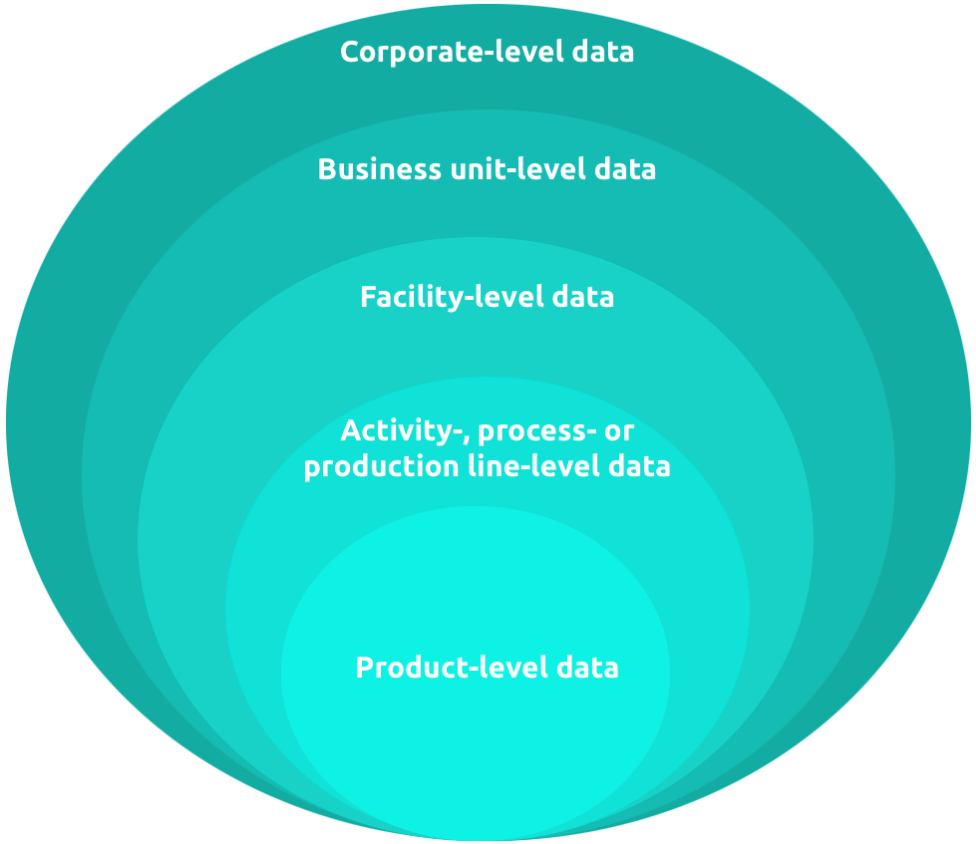
Scope or Category	Uncertainty: Overall	Uncertainty: Activity Data	Uncertainty: Emissions Factors
1: Direct Emissions from Owned/Controlled Operations			
a. Direct Emissions from Stationary Combustion			
b. Direct Emissions from Mobile Combustion			
2: Indirect Emissions from the Use of Purchased Electricity, Steam, Heating, and Cooling			
a. Indirect Emissions from Purchased/Acquired Electricity			
b. Indirect Emissions from Purchased/Acquired Steam			
3: Other Indirect Emissions from Upstream and Downstream Value Chain			
a. Indirect Emissions from Purchased Products (Upstream)			
2. Purchased Goods & Services: Cradle-to-Gate Emissions			
i. Fruit Farming			
ii. Materials & Ingredients			
iii. Co-packing			
iv. Licensed Products			
v. Other Goods & Services			
3. Energy-Related Activities Not Included in Scope 2			
4. Capital Equipment			
5. Transportation & Distribution			
6. Business Travel			
7. Waste Generated in Operations			
9. Leased Assets			
b. Indirect Emissions from Sold Products (Downstream)			
13. Transportation & Distribution			
14. Use (Indirect Emissions from Beverage Refrigeration)			
15. Waste			
17. Other: Processing of Sold Products			
c. Other Indirect Emissions			
16. Employee Commuting			
Total			

Source: https://ghgprotocol.org/

3.3 Collect Data

1. *prioritize data collection efforts (section 7.1)*
2. *select data (section 7.3)*
3. *collect data and fill data gaps (section 7.4 & 7.5)*
4. *improve data quality over time (section 7.6)*

Level of Data



Least accurate

Most accurate

Example – Screening of Suppliers / Customers

Supplier	Raw Material	Activity Data	% total CO_2e
D	Tea	$30,000,000	52.6%
E	Tea	$15,000,000	26.3%
F	Tea & Herbs	$6,500,000	11.4%
G	Herbs	$1,500,000	2.6%
I	Boxes	$1,500,000	2.6%
P	Bottles & Caps	$1,200,000	2.1%
H	Tea Bags	$300,000	0.5%
A	Sugar	$300,000	0.5%
B	Sugar	$262,500	0.5%
C	Sugar	$187,500	0.3%
J	Plastic Bags	$75,000	0.1%
N	Lemon Juice	$36,000	0.1%
L	Flavorings	$35,000	0.1%
K	Office Supplies	$80,000	0.1%
M	Flavorings	$15,000	0.0%
O	Lemon Juice	$4,000	0.0%
		$56,995,000	

Category 10

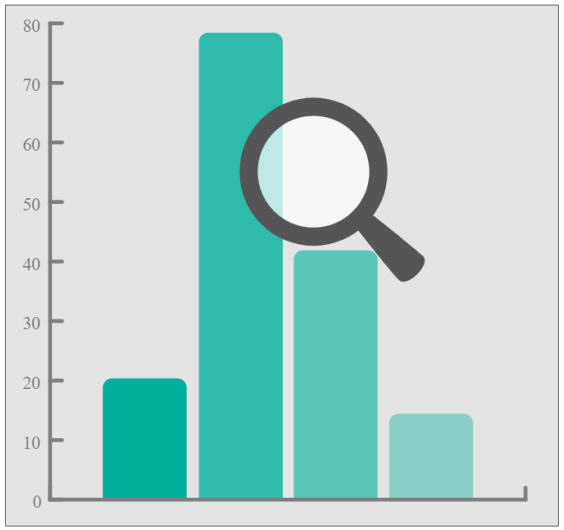
Highest emission & spend activities	Activity data	tCO_2e
Customer #1 - makes liquid tea beverages	7,000,000 kg	11,340
Customer #2 - makes retail tea bag products	2,000,000 kg	1,456
Customer #3 - makes loose tea retail products	1,000,000 kg	654

Category 1

Highest emission & spend activities	Activity data	tCO_2e
Tea	50,000,000	23,738
Herbs	3,000,000	2,136
Boxes	1,500,000	1,217
Glass bottles	1,000,000	545
Sugar	750,000	493
Tea bags	300,000	211
Plastic bottle caps	200,000	141

3.4 Improve Data Quality

1. prioritize data collection efforts (section 7.1)
2. select data (section 7.3)
3. collect data and fill data gaps (section 7.4 & 7.5)
4. improve data quality over time (section 7.6)



Prioritize quality improvement for activities that have:

- Relatively low data quality
- Relatively high emissions

During reporting, Companies are required to provide

- a description of data sources
- data quality
- efforts to improve data quality in their inventory report.

Introduction to Emissions Calculation

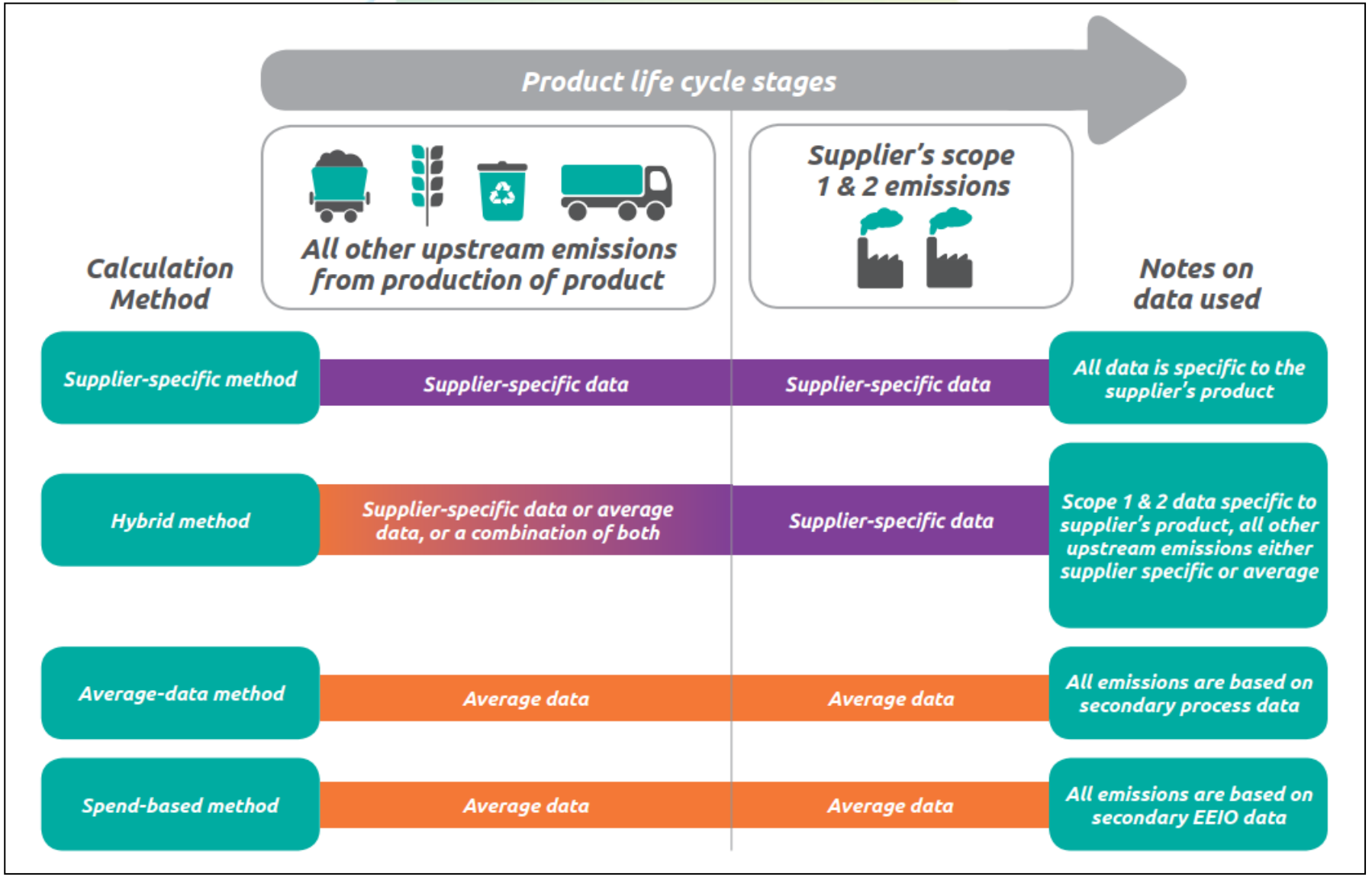
Emissions Calculation

Quantification method	*Description*	*Relevant data types*
Direct measurement	Quantification of GHG emissions using direct monitoring, mass balance or stoichiometry **GHG = Emissions Data x GWP**	Direct emissions data
Calculation	Quantification of GHG emissions by multiplying activity data by an emission factor **GHG = Activity Data x Emission Factor x GWP**	Activity data Emission factors

most often used

Activity Data x **Emission Factor** x **Global Warming Potential** = **Carbon dioxide equivalent (CO_2e) of emissions**

Calculation Example – Products and Services



Calculation Example – Transportation

Upstream Activities

Fuel-based method

Distance-based method

Spend-based method

Upstream Activities

Activity Data	x	Emission Factor	x	Global Warming Potential	=	Carbon dioxide equivalent (CO_2e) of emissions

Fuel use

Distance Travelled

Money Spent

Calculation Example – Waste

Supplier-specific method

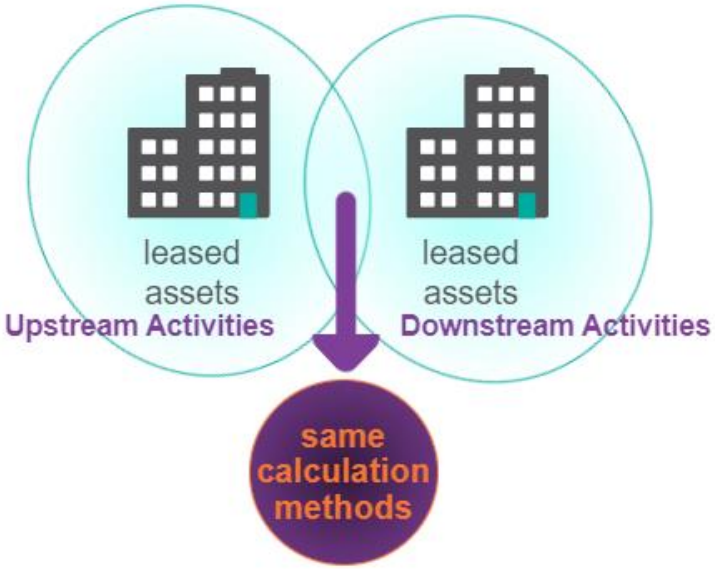
which involves collecting waste-specific scope 1 and scope 2 emissions data directly from waste treatment companies (such as for incineration, recovery for recycling).

Waste-type-specific method

which involves using emission factors for specific waste types and -waste treatment methods.

Average-data method

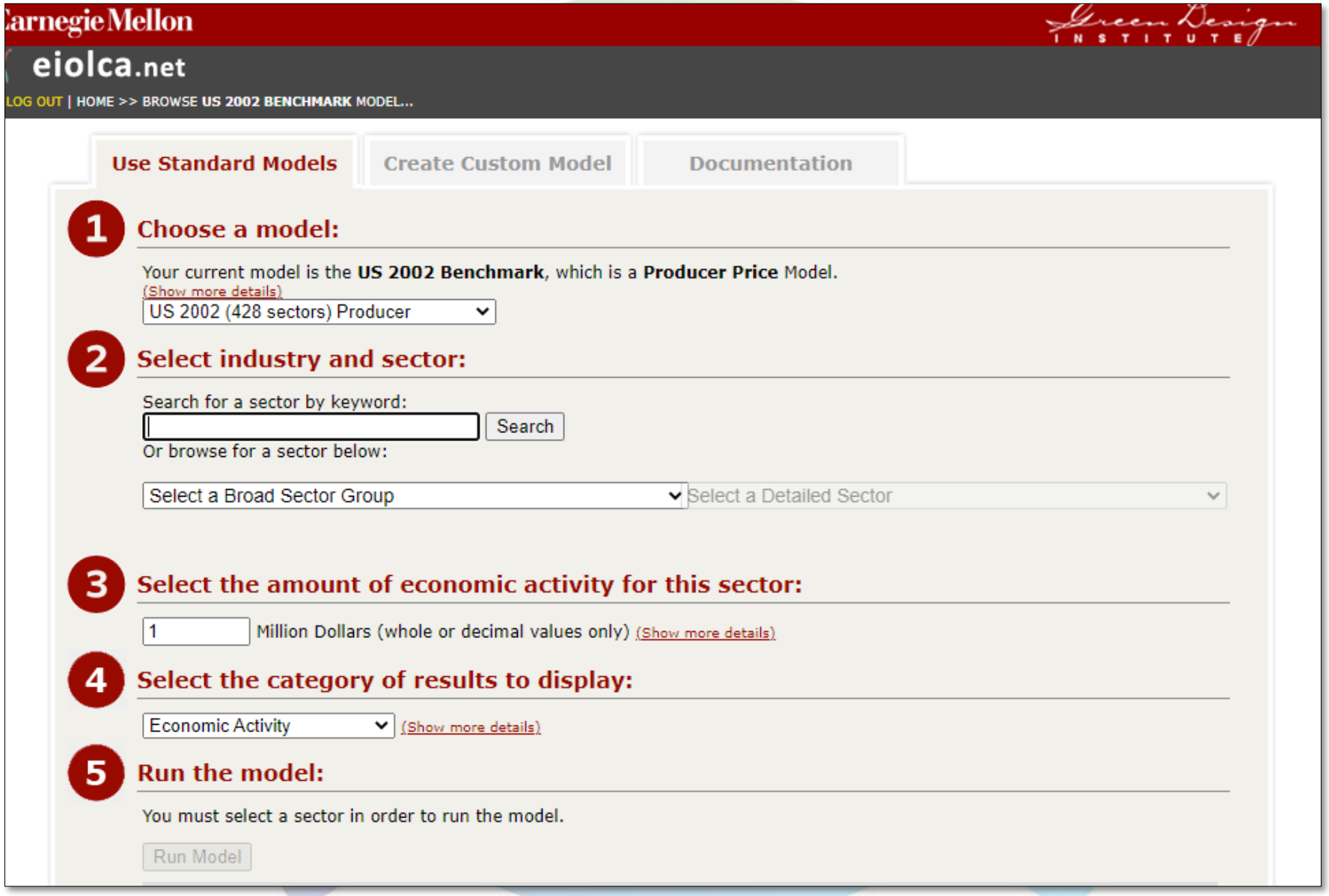
which involves estimating emissions based on total waste going to each disposal method (like landfill) and average emission factors for each disposal method.



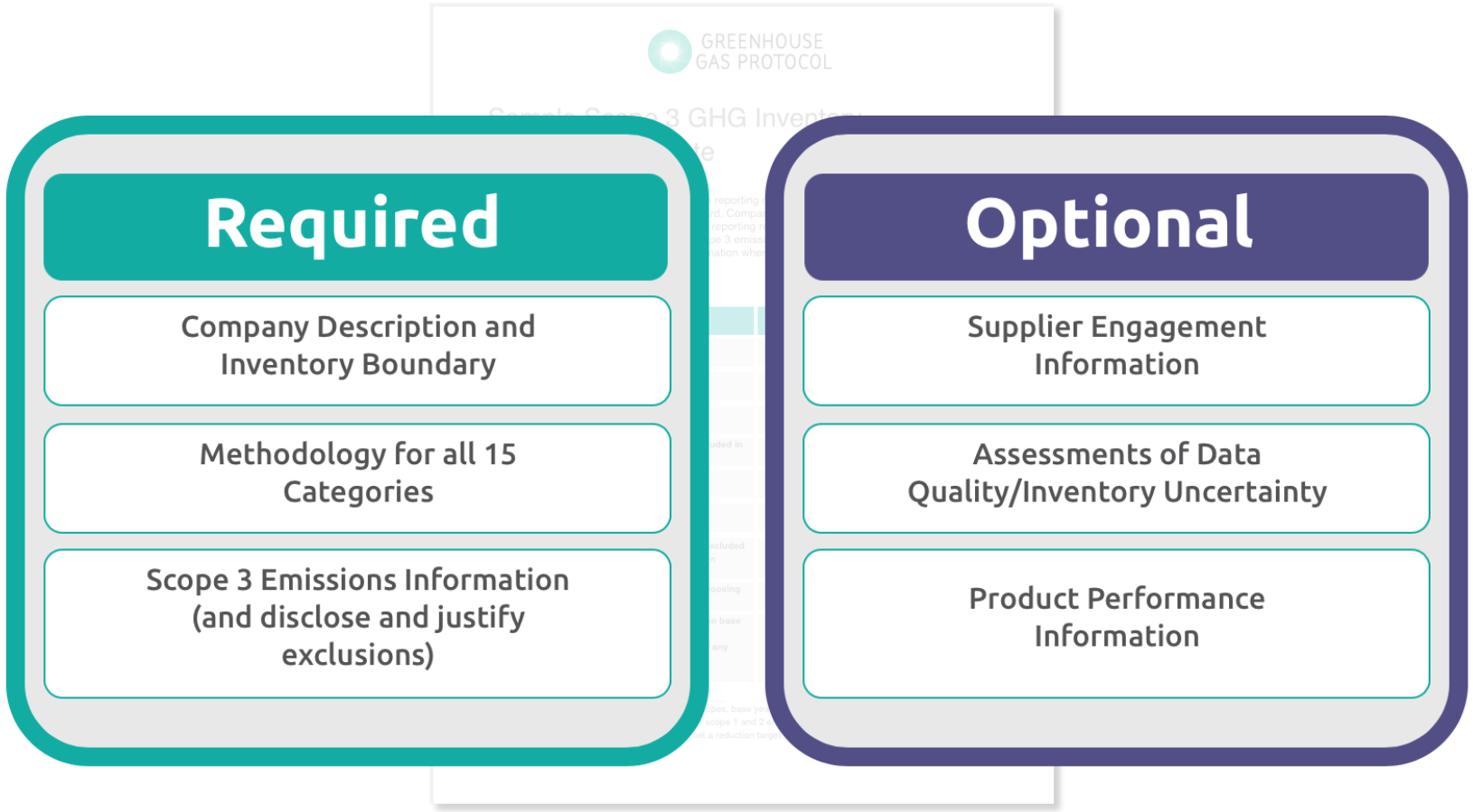
Examples – Emission calculation using secondary data

Background: Production of tea

Category 1 Suppliers: D, E, F							
Activity	Annual Activity Data	Annual Activity Source	Emission Factor	Secondary Data Source	Inflation Factor	GWP	tCO_2e
Tea	$50,000,000 Supplier D - 60% Supplier E - 30% Supplier F - 10%	Terrific Tea, Purchasing	913 t CO2e/M$	eiolca.net Sector: Coffee & Tea Manufacturing	0.52	1	23,738


arnegie Mellon
Green Design
INSTITUTE
eiolca.net
LOG OUT | HOME >> BROWSE US 2002 BENCHMARK MODEL...
Use Standard Models
Create Custom Model
Documentation
1
Choose a model:
Your current model is the US 2002 Benchmark, which is a Producer Price Model.
(Show more details)
US 2002 (428 sectors) Producer
2
Select industry and sector:
Search for a sector by keyword:
Search
Or browse for a sector below:
Select a Broad Sector Group
Select a Detailed Sector
3
Select the amount of economic activity for this sector:
1
Million Dollars (whole or decimal values only) (Show more details)
4
Select the category of results to display:
Economic Activity
(Show more details)
5
Run the model:
You must select a sector in order to run the model.
Run Model

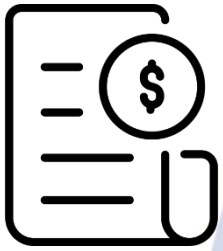
Report Information



Report Information

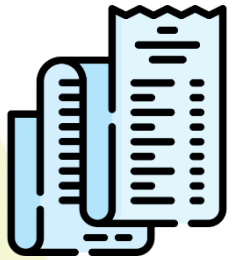
- Scope 1 &2
- All 15 categories under Scope3
- Activities included and excluded (with justification)
- Base year, recalculation if any
- Biogenic emissions / avoided
- Types and sources of data used
- Calculation methodologies and Assumptions used
- Percentage of emissions per category

Source of Primary Data



purchase records

meter readings



direct monitoring

utility bills

mass balance

Questionnaires

stoichiometry

engineering models

1 Primary data

Advantages Primary Data

Primary Data (in comparison to secondary data):

Advantages

- Provides better representation of the company's specific value chain activities.
- Enables performance tracking and benchmarking of individual value chain partners by allowing companies to track operational changes from actions taken to reduce emissions at individual facilities/companies and to distinguish between suppliers in the same sector based on GHG performance.
- Expands GHG awareness, transparency, and management throughout the supply chain to the companies that have direct control over emissions.
- Allows companies to better track progress toward GHG reduction targets.

Disdvantages Primary Data

Primary data (in comparison to secondary data):

Disadvantages

- May be costly.
- If supplied by value chain partners, the source and quality of the data may be difficult to determine or verify.

2 Secondary data

Advantages Secondary Data

Secondary data (in comparison to primary data):

Advantages

- Allows companies to calculate emissions when primary data is unavailable or of insufficient quality.
- Can be useful for accounting for emissions from minor activities.
- Can be more cost-effective and easier to collect.
- Allows companies to more readily understand the relative magnitude of various scope 3 activities, identify hot spots, and prioritize efforts in primary data collection, supplier engagement, and GHG reduction efforts.

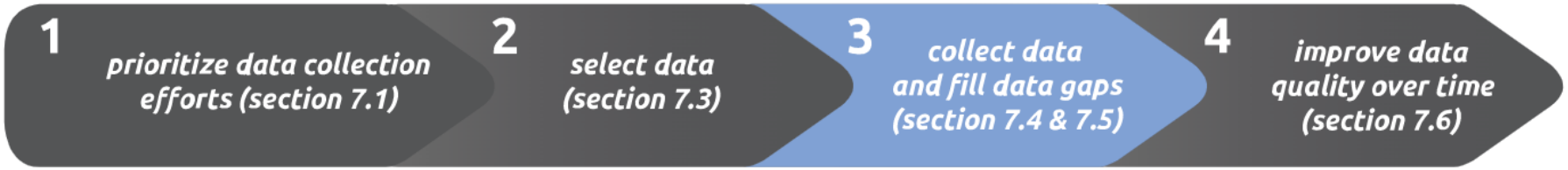
Disadvantages Secondary Data

Secondary data (in comparison to primary data):

Disadvantages

- May not be representative of the company's specific activities.
- Does not reflect operational changes undertaken by value chain partners to reduce emissions.
- Could be difficult to quantify GHG reductions from actions taken by specific facilities or value chain partners.
- May limit the ability to track progress toward GHG reduction.

Challenges for collecting primary data from value chain partners



Lack of supplier knowledge and experience with GHG inventories and accounting

Lack of supplier capacity and resources for tracking data

Large number of suppliers

Confidentiality concerns of suppliers

Language barriers

Lack of transparency in the quality of supplier data

Ways to Engage Supply Chain

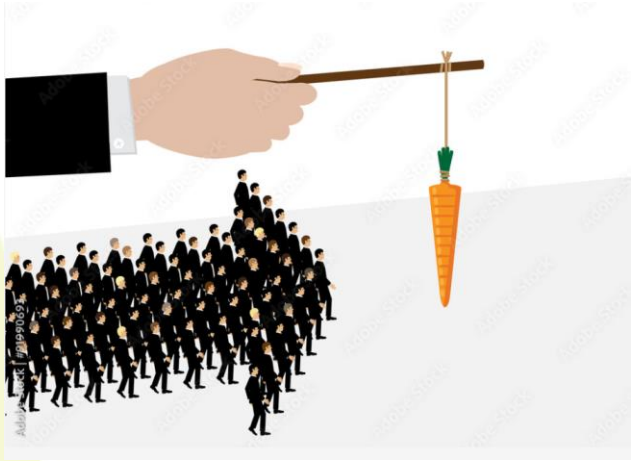
- Set up some supplier events , e.g. Supplier Day, networking does create new opportunities for both suppliers and buyers
- dedicate a day to helping your supply chain understand your vision, values and expectations
- Dedicate an area on your website for suppliers that provides key information, including how the procurement team currently engages with suppliers and the benefits of doing business with you.

Ways to Engage Supply

- Identify the right person in the value chain
- Issue survey to collect information
- Development of user-friendly platform e.g. software for data collection
- Regular communication
- Regular training
- Explain the mutual benefits e.g. company reputation

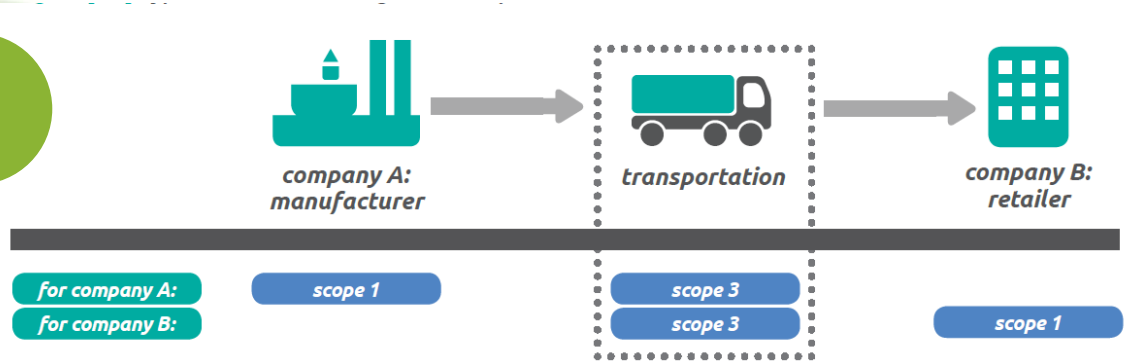
Ways to Engage and Improve performance in Supply Chain

Carrots and Sticks



- Arrangement of campaign, awards, bonus
- Penalty and punishment
- Contract requirement
- Terms and agreement e.g. green lease
- Careful selection of supplier / contractor through tender requirement e.g. score for environmental performance, provision for environmental programme
- Incentivize contractors' staff directly e.g. bonus

Double Counting in Scope 3



Companies may find double counting within scope 3 to be acceptable for purposes of:

- Reporting scope 3 emissions to stakeholders
- Driving reductions in value chain emissions
- Tracking progress toward a scope 3 reduction target

- Companies should acknowledge any double counting when making claims about scope 3 reductions to ensure transparency and avoid misinterpretation of data. *For example, a company may claim that the company is working jointly with partners to reduce emissions, rather than taking exclusive credit for scope 3 reductions.*

  If GHG reductions have a monetary value or receive a GHG reduction program credit, companies should avoid any double counting of scope 3 reductions. To avoid double counting, companies should specify exclusive ownership of reductions through contractual agreements, when possible.

Double Counting ?

The scopes are defined to ensure that two or more companies do not account for the same emission within scope 1 or scope 2. By properly accounting for emissions as scope 1, scope 2, and scope 3, companies avoid double counting within scope 1 and scope 2.

In certain cases, two or more companies may account for the same emission within scope 3. For example, the scope 1 emissions of a power generator are the scope 2 emissions of an electrical appliance user, which are in turn the scope 3 emissions of both the appliance manufacturer and the appliance retailer. *Each of these four companies has different and often mutually exclusive opportunities to reduce emissions.*

Power company - Scope 1

User - Scope 2

Manufacturer - Scope 3

Retailer - Scope 3

Aggregation in Scope 3

Accounting for direct and indirect GHG emissions by multiple companies in a value chain facilitates the simultaneous action of multiple entities to reduce emissions throughout society.

This type of double counting means scope 3 emissions should not be aggregated across companies to determine total emissions in a given region. Note that while a single emission may be accounted for by more than one company as scope 3, in certain cases the emission is accounted for by each company in a different scope 3 category (see section 5.4 of the Scope 3 Standard). For more information on double counting within scope 3, see section 9.6 in the same Standard.

Thank You