Thailand's Net Zero Roadmap

Outlook, Insights, and Sustainability Trends

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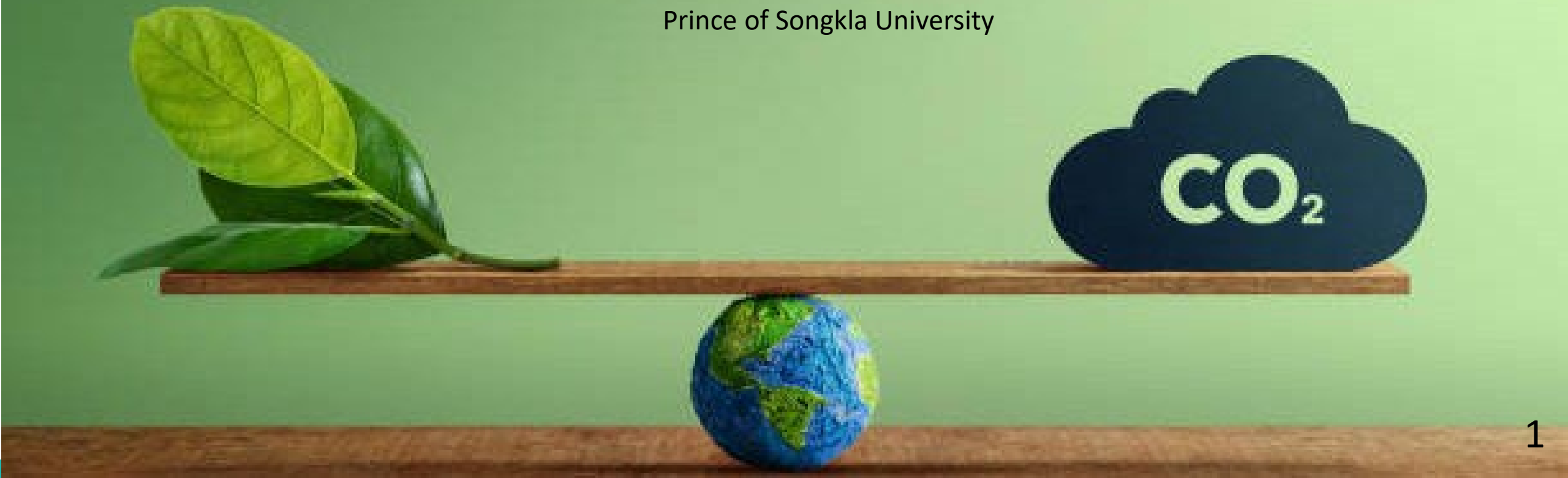

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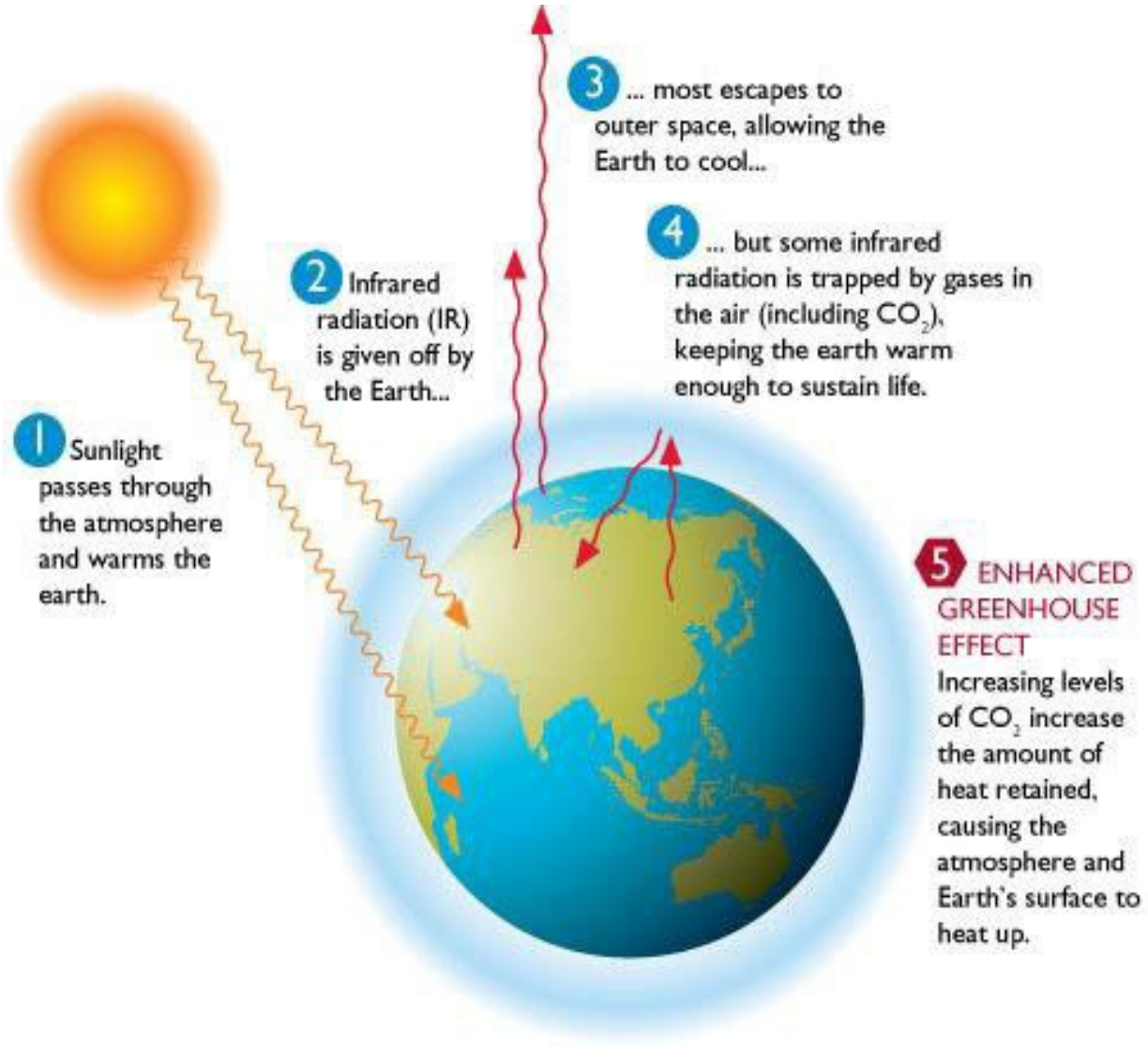
Global Warming: Greenhouse effect on Earth

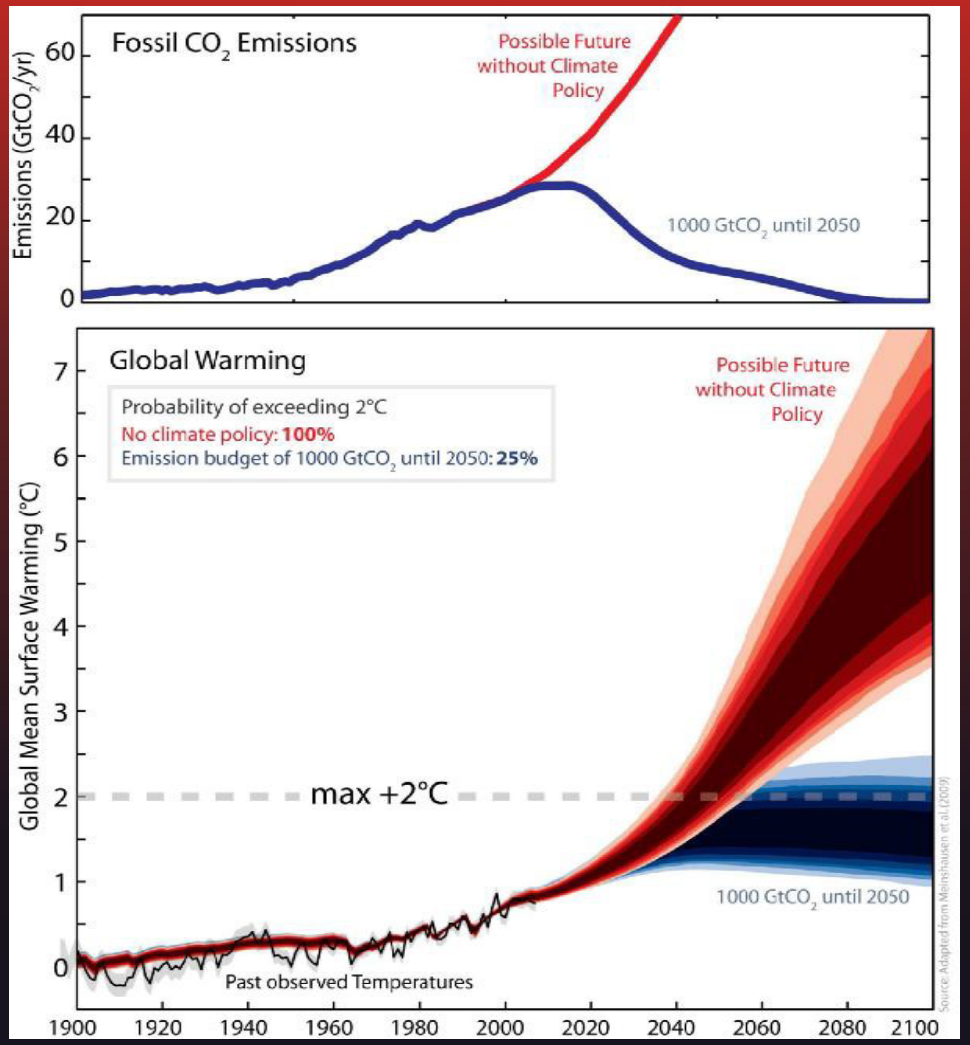


7 GHGs by Kyoto Protocol

GHGs	Global Warming Potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	28 to 36
Nitrous Oxide (N_2O)	265 to 298
Hydrofluorocarbons (HFCs)	12 to 18400
Perfluorocarbons (PFCs)	6,630 to 11,100
Sulfur Hexafluoride (SF_6)	23,500
Nitrogen Trifluoride (NF_3)	16,100

Source: https://naei.beis.gov.uk/overview/ghg-overview

Where are we…?



If no climate policies are implemented (red) global warming will cross 2ºC by the middle of the century. Making sure we don't emit more than 1 trillion of CO_2 in total (blue) would limit the risk of exceeding 2ºC to 25%
Source: Nature, DOI: 10.1038/nature08019, Nature, DOI: 10.1038/nature08017

Present, Global surface temperature was around 1.1 °C above 1850-1900 in 2011-2020.

Source: THE STANDARD

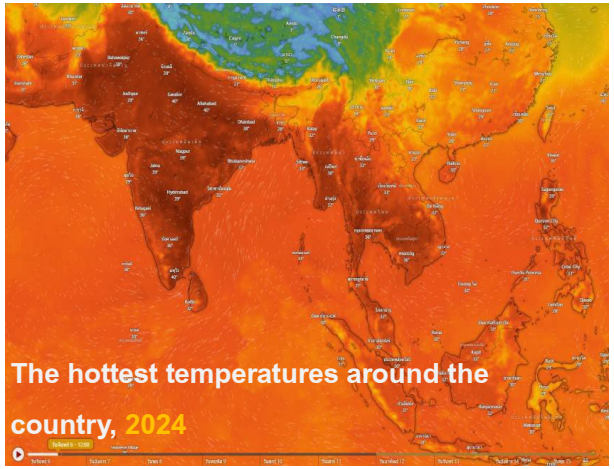
"Climate change results in severe and frequent disasters, which could lead to economic losses of up to 12.5 trillion USD by the year 2050."

Source: World Economic Forum, https://www.weforum.org/

World's Climate Change Circumstantial: Global warming to Global boiling

Dubai airport chaos as UAE and Oman reel from deadly storms, 2024

Antarctica sea ice reaches alarming low for 3rd year in a row 2024



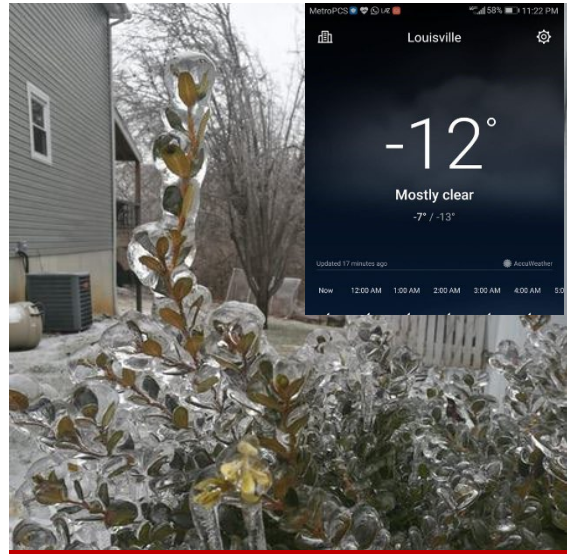
The hottest temperatures around the country, 2024

EUROPEAN HEAT WAVE, 2023

Amazon River Levels Hit Historic Low Amid Rapidly Worsening Brazil Drought, 2023

Flowers in Antarctica are starting to bloom and that is no good news, 2023

Unites States, frequent tornado, hurricane, ice storm, severe weather, wildfire, flood and drought, 2017- 2023

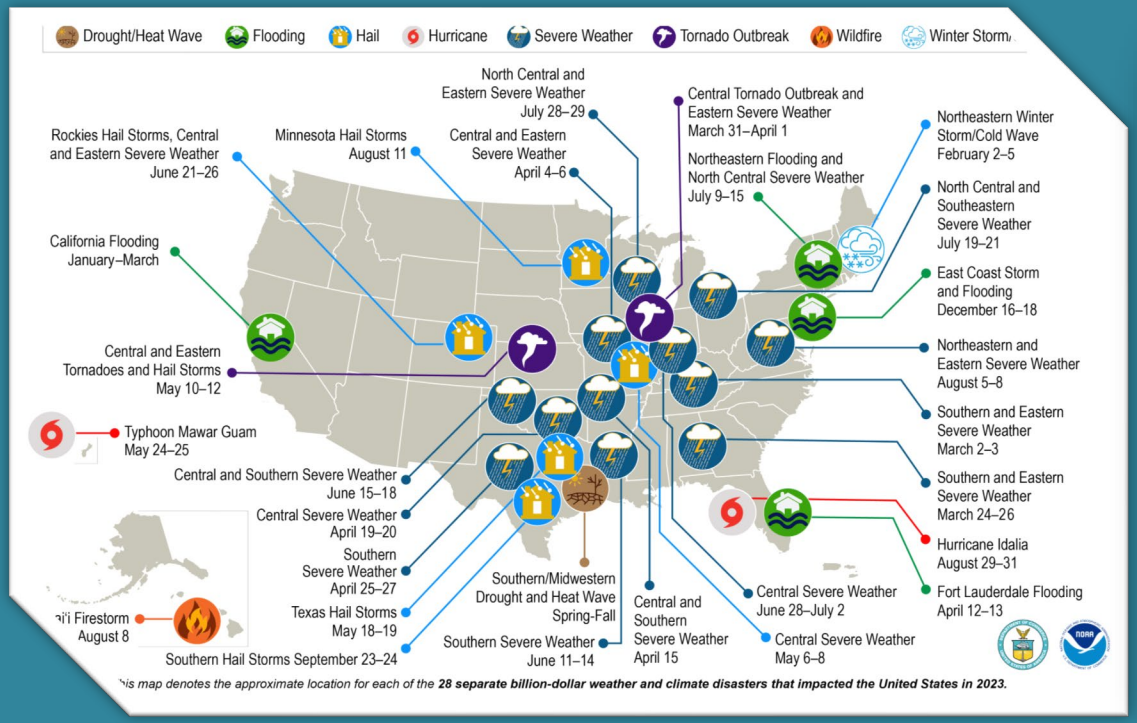


Louisville Kentucky, Ice storm hit KY on February 2021. First Ice Storm Warning in possibly 12 yrs

Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

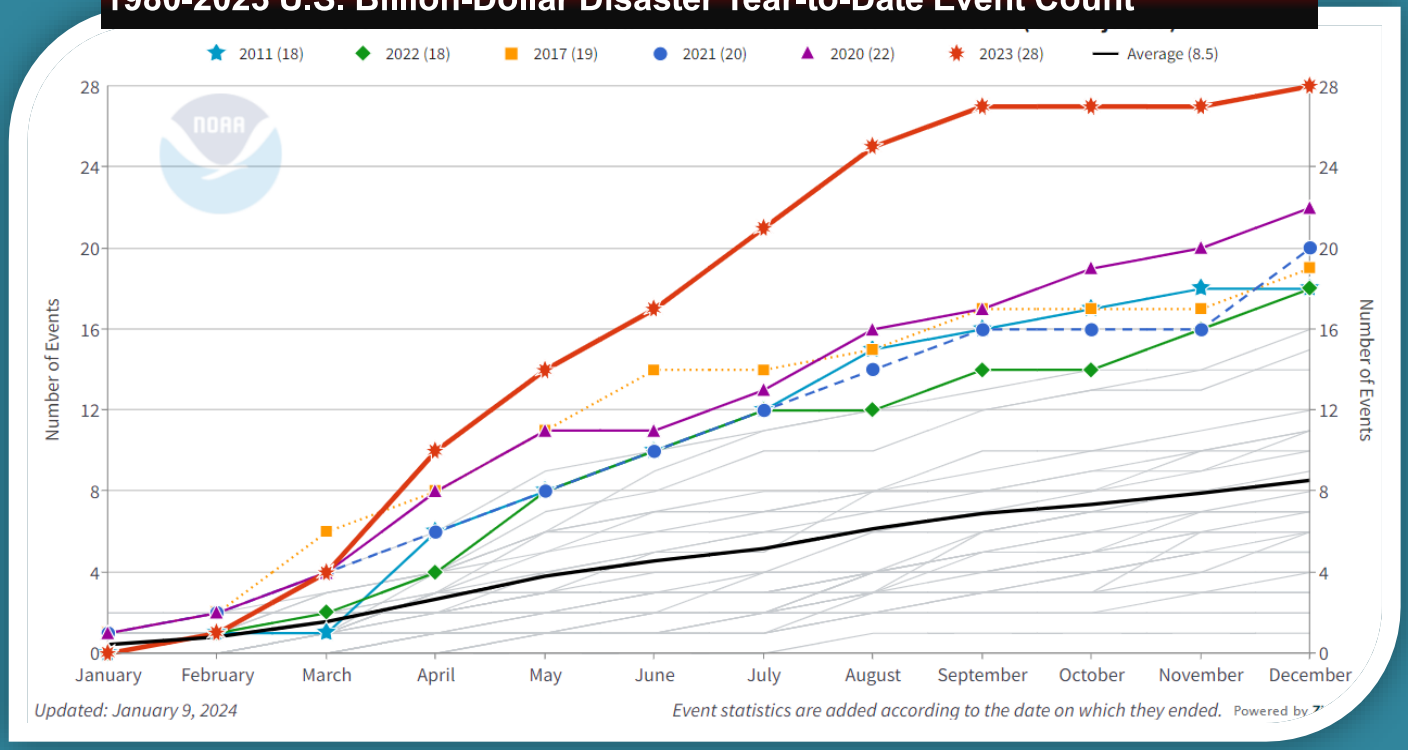
Example Climate Change Disasters and Loss: United State

U.S. 2023 Billion-Dollar Weather and Climate Disasters



In 2023, the United States experienced 28 separate weather or climate disasters that each resulted in at least $1 billion in damages. NOAA map by NCEI.

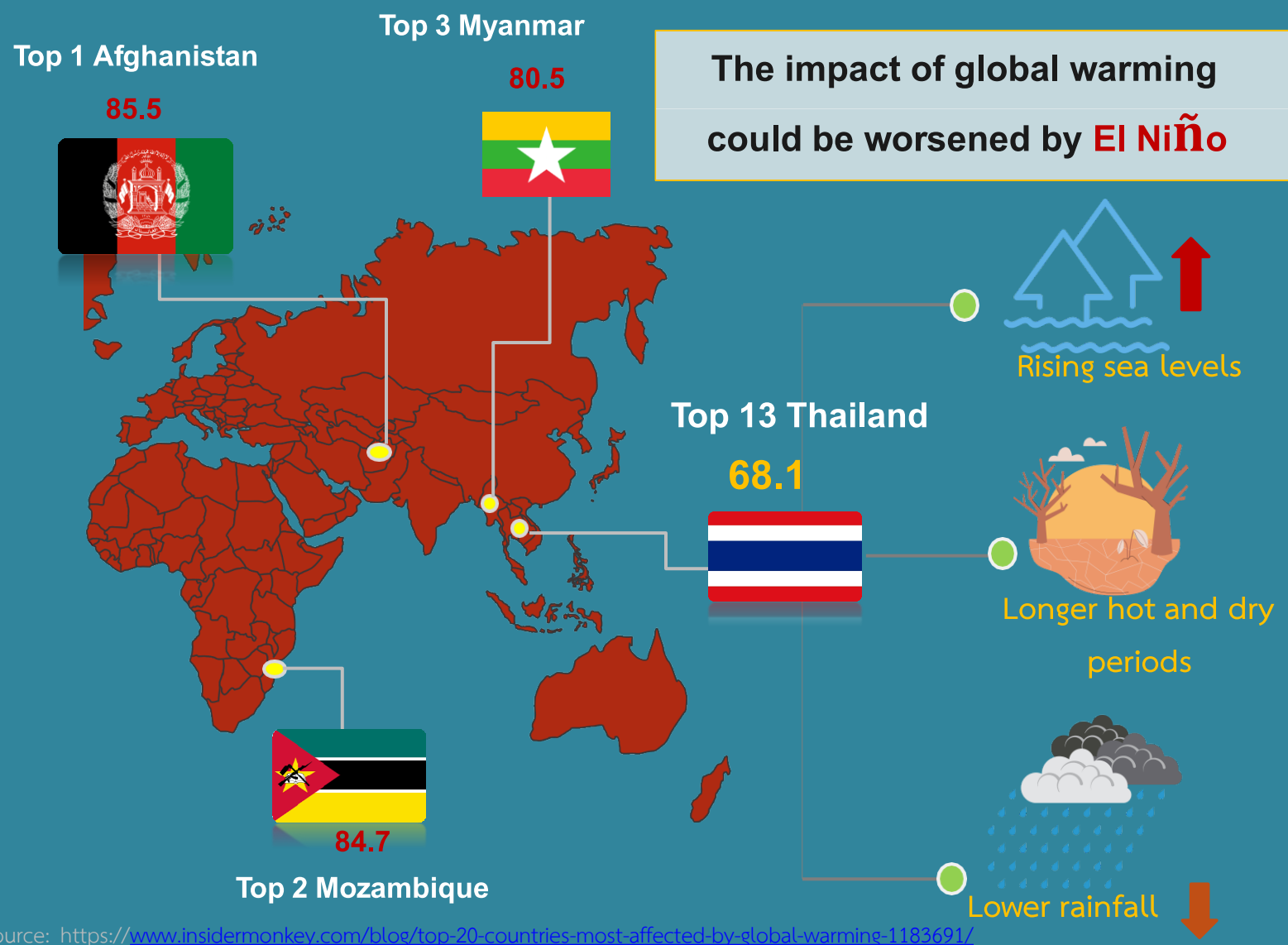
1980-2023 U.S. Billion-Dollar Disaster Year-to-Date Event Count



Month-by-month accumulation of billion-dollar disasters for each year on record. The colored lines represent the top 6 years for most billion-dollar disasters. All other years are colored light gray. NOAA image by NCEI.

Source: https://www.climate.gov/news-features/blogs/beyond-data/2023-historic-year-us-billion-dollar-weather-and-climate-disasters#:~:text=In%202023%2C%20the%20United%20States,Consumer%20Price%20Index%2C%202023).

Top 20 Countries Most Affected by Global Warming



The impact of global warming could be worsened by El Niño

Rising sea levels

Longer hot and dry periods

Lower rainfall

Countries	Global Warming Impact Score
1.Afghanistan	85.5
2.Mozambique	84.7
3.Myanmar	80.5
4.Pakistan	77.9
5.Haiti	76.7
6.Bangladesh	75.7
7.Philippines	75.5
8.Madagascar	72.9
9.India 10.Nepal	72.3
11.Niger	69.9
12.Ethiopia	69.7
13. Thailand	68.3
14.Zimbabwe	68.1
15.South Sudan	68.07
16.Vietnam	66.3
17.Kenya	65.1
18.Uganda 19.Fiji	64.1
20.Sri Lanka	63.7
	61.02
	60.9

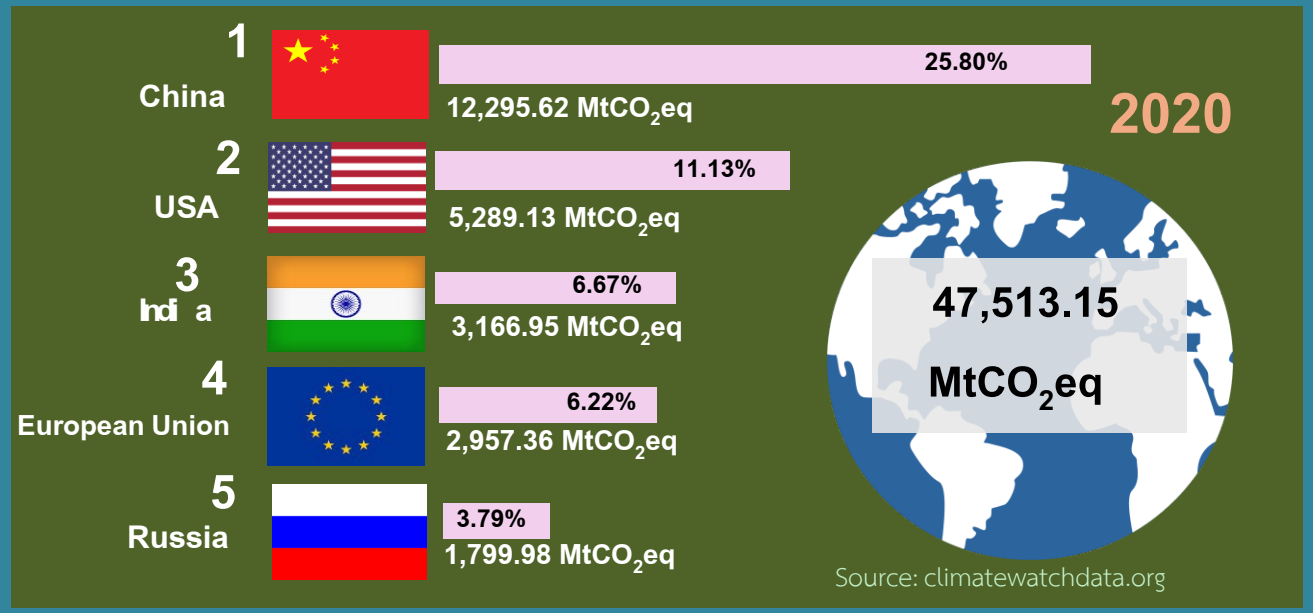
Source: https://www.insidermonkey.com/blog/top-20-countries-most-affected-by-global-warming-1183691/

Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

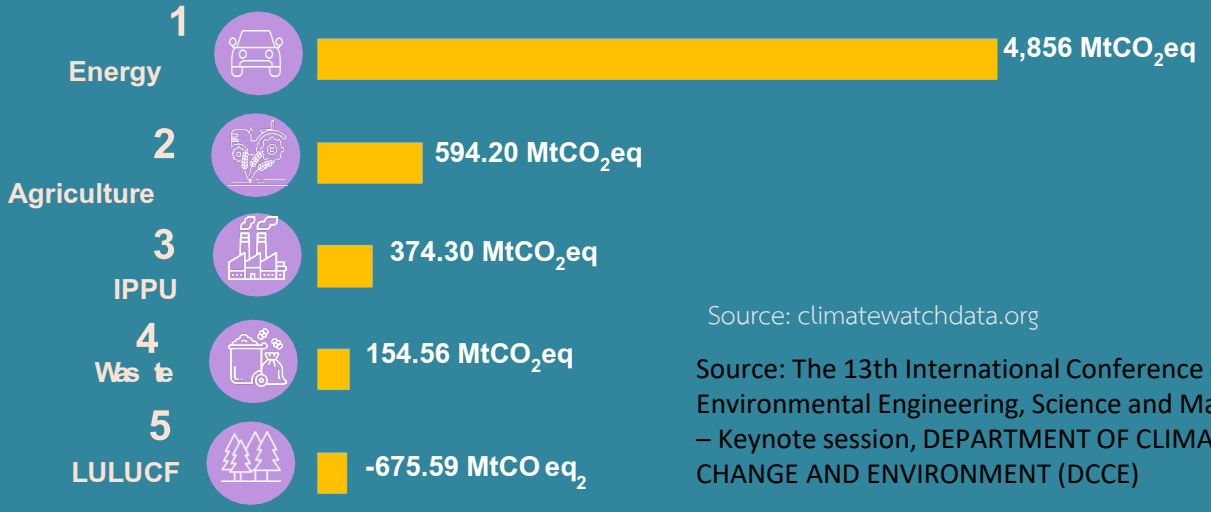
Published on August 16, 2023 by AMNAH ZAIDI in Lists,

The World's GHG Emissions

Top 5 countries emitted GHG



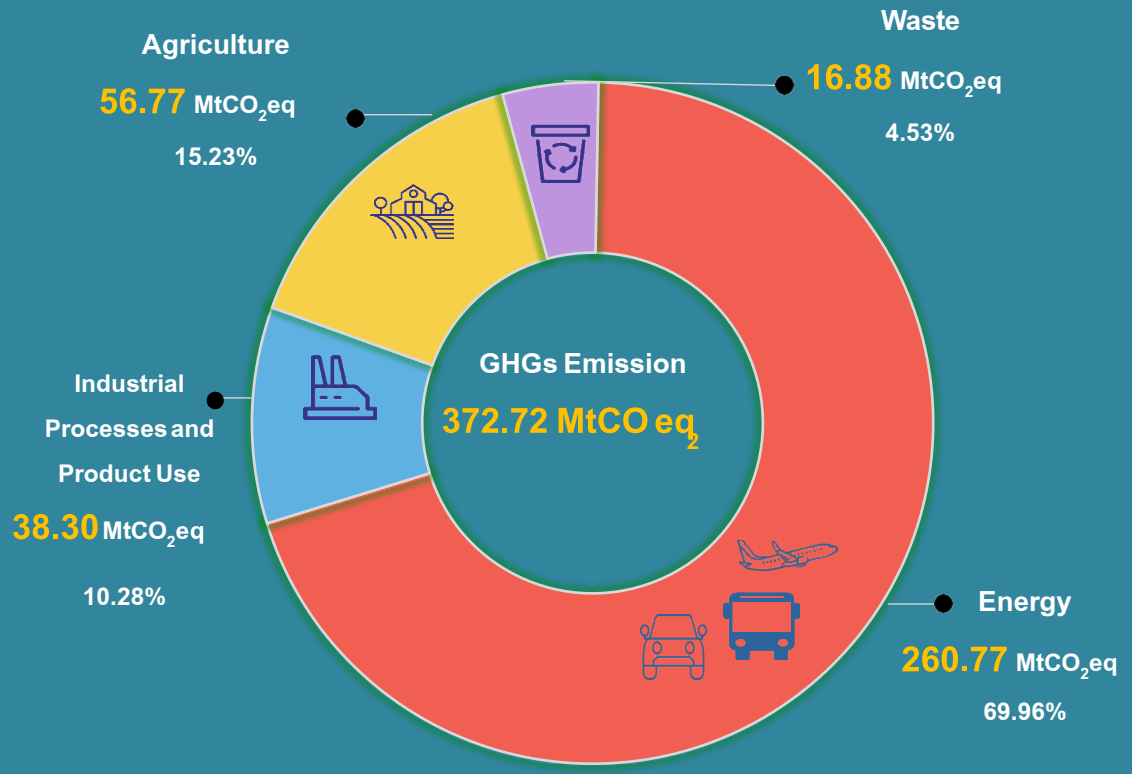
Top 5 sectors emitted GHG



Source: climatewatchdata.org

Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

Thailand's GHGs emission/removal by sector in 2019



-91.99 $MtCO_2eq$

Source: Biennial update report: BUR4

Net GHGs emission/removal

280.73 $MtCO_2eq$

*Thailand ranked 20th for global GHG emitter (0.95%)

Global Climate Change Response

COP28 was held in Dubai, United Arab Emirates, from November 30 to December 12, 2023. Nearly 200 countries participated in this significant climate summit

At COP28, Thailand made significant climate pledges and reaffirmed its commitment to addressing climate change.

2050	2065
Carbon Neutrality	Net Zero

Carbon Neutrality VS Net-Zero Emissions

Carbon Neutrality

Reduce *carbon emissions at the source by minimizing the use of fossil fuels, transition to renewable energy sources, and conserving energy.*

Sequester *carbon dioxide by enhancing natural carbon sinks such as forests, focusing on sustainable forestry practices, and planting trees to absorb carbon dioxide from the atmosphere.*

Compensate *for carbon emissions through carbon credits or offsetting programs,*

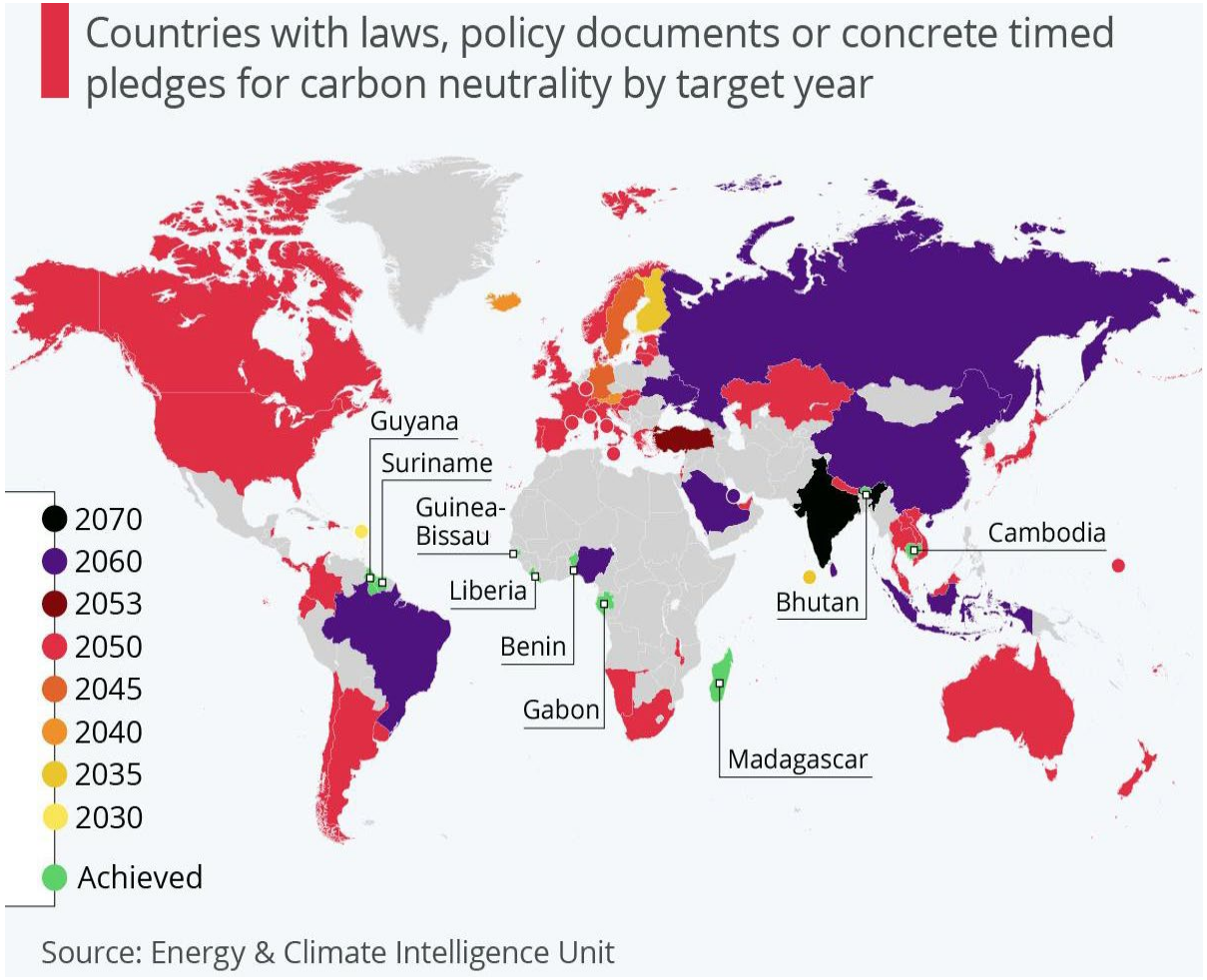
VS

Net-Zero Emissions

Reduce GHGs *Reduce emissions of CO2, CH4, N_2O, HFCs, PFCs, SF6, NF6 as much as possible, aiming to eliminate them entirely.*

Sequester & Compensate GHGs *Capture and store all emitted greenhouse gases*

World and Thailand Carbon Neutrality and Net-Zero plans



Rating the comprehensiveness of national net zero target design (Climate Action Tracker, Dec 2023 Update)		Net zero target design elements									
Country	Rating	1 Target year	2 Emissions coverage	3 International aviation and shipping	4 Reductions or removals outside of own border	5 Legal status	6 Separate reduction & removal targets	7 Review process	8 Carbon dioxide removal	9 Comprehensive planning	10 Clarity on fairness of target
Chile	ACCEPTABLE	2050	✓	✗	✓	✓	✓	✓	✓	✓	✗
Colombia	ACCEPTABLE	2050	✓	✗	✓	✓	✓	✓	–	✓	✓
Costa Rica	ACCEPTABLE	2050	✓	✗	✓	–	✓	–	✓	✓	✗
European Union	ACCEPTABLE	2050	✓	–	✓	✓	✗	✓	✓	✓	✗
United Kingdom	ACCEPTABLE	2050	✓	✓	–	✓	✗	✓	✓	–	–
Canada	AVERAGE	2050	✓	✗	✗	✓	✗	✓	✓	–	✗
Germany	AVERAGE	2045	✓	✗	✗	✓	✓	✓	✗	–	–
Nepal	AVERAGE	2045	✗	✗	✓	–	✗	–	–	–	✗
Nigeria	AVERAGE	2050-2070	–	✗	✓	–	✗	✓	✗	–	✗
South Korea	AVERAGE	2050	✗	✗	✓	✓	✓	–	✓	✓	✗
Switzerland	AVERAGE	2050	✓	✗	✗	–	✓	✗	–	–	✗
Thailand	AVERAGE	2065	–	✗	✓	–	✓	–	✓	✓	✗
United States	AVERAGE	2050	✓	✗	✗	–	✗	–	✓	–	✗

Thailand's Decarbonization Pathway

2021 — 2025 — 2030 — 2035 — 2040 — 2045 — 2050 — 2055 — 2060 — 2065

NDC tracking
60.33 $MtCO_2e$

Peaking
388 $MtCO_2eq$

NDC 1
30-40% BAU

NDC 2

NDC 3

NDC 4

Carbon Neutral

Net Zero

Hydraulic cement

Renewable energy

Low CH_4 paddy fields

Manure Management

Electric Vehicle

Reforestation

CCUS/BECCS technology

Hydrogen technology

Phase out coal

Just Transition

A better, safer, healthier, greener, fairer and more prosperous future

NDC Action Plan 2021 - 2030

Energy & Transport | IPPU | Waste | Agriculture

Domestic Implementation 33.2%	Inter. Support 6.8%	Art. 6 of PA 3 %

- Climate Change Act
- Blended Finance
- Market Mechanism
- Data Center
- Technology, R & D
- Public Awareness

Energy & Transport | IPPU | Waste | Agriculture | Forest

Emission 120 $MtCO_2eq$ ⟷ Removal 120 $MtCO_2eq$

Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

(Draft) NDC Action Plan on Mitigation 2021 - 2030

Targe

(Update May 2024)

40

+

3%

	Energy	Transport	Industry	Waste	Agriculture
Domestic Implementation	**124.6** $MtCO_2eq$ (22.5 %)	**45.6** $MtCO_2eq$ (8.2 %)	**1.4** $MtCO_2eq$ (0.2 %)	**9.1** $MtCO_2eq$ (1.6 %)	**4.1** $MtCO_2eq$ (0.7 %)
184.8 $MtCO_2eq$ (33.3%)	กระทรวงพลังงาน MINISTRY OF ENERGY	สนข.	กรมโรงงานอุตสาหกรรม DEPARTMENT OF INDUSTRIAL WORKS	กรมควบคุมมลพิษ POLLUTION CONTROL DEPARTMENT	สำนักงานเศรษฐกิจการเกษตร
International Support	**32.0** $MtCO_2eq$ (5.8 %)	**2.50** $MtCO_2eq$ (0.4 %)	**1.90** $MtCO_2eq$ (0.3 %)		
37.5 $MtCO_2eq$ (6.7%)					
In process	**0.1** $MtCO_2eq$ (0.2%)			**1.0** $MtCO_2eq$ (0.18%)	

Article 6.2 → 3%

Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

Source: Subcommittee on Climate Change Policy and Planning Integration, 23 April 2024

Technology Roadmap to Net Zero by 2065

- Increase renewable energy in electricity generation
- Increase energy efficiency
- Promote rice cultivation that reduces methane emission
- Promote biogas production from manure (Dome Digester)

Achieve GHG removal 120 $MtCO_2eq$ from forestry and land use sector by

- Natural reforestation
- Economic reforestation
- Increasing of green space in urban/rural areas
- Forest encroachment and burning prevention

Using Green hydrogen in energy, transport and industry sector.

Net Zero GHG Emission

2023

The use of hydraulic cement target 1 $MtCO_2$

2025

2030

- Policy EV 30@30
- Phase down ICE vehicle
- Increase the use of biofuel in transport sector
- Promote the use of battery storage with renewable energy

2037

2040

- Phase down coal in electricity generation
- 68% of electricity generate from renewable energy
- Applying technology CCS/CCU/BECCS

2045

2050

Carbon Neutrality

- 74% of electricity generate from renewable energy
- Phase out coal in electricity generation

2065

Draft Climate Change Act. (as of May 2024)

CHAPTER 1
General

CHAPTER 2
Climate Change Targets

CHAPTER 3
National Climate Change Committee

CHAPTER 4
Climate Change Fund

CHAPTER 5
Climate change master plan

CHAPTER 6
Greenhouse gas data

CHAPTER 7
Climate change mitigation

CHAPTER 8
Emissions Trading Scheme system

CHAPTER 9
Carbon tax system

CHAPTER 10
Carbon credits

CHAPTER 11
Climate change adaptation

CHAPTER 12
Measures to promote operations

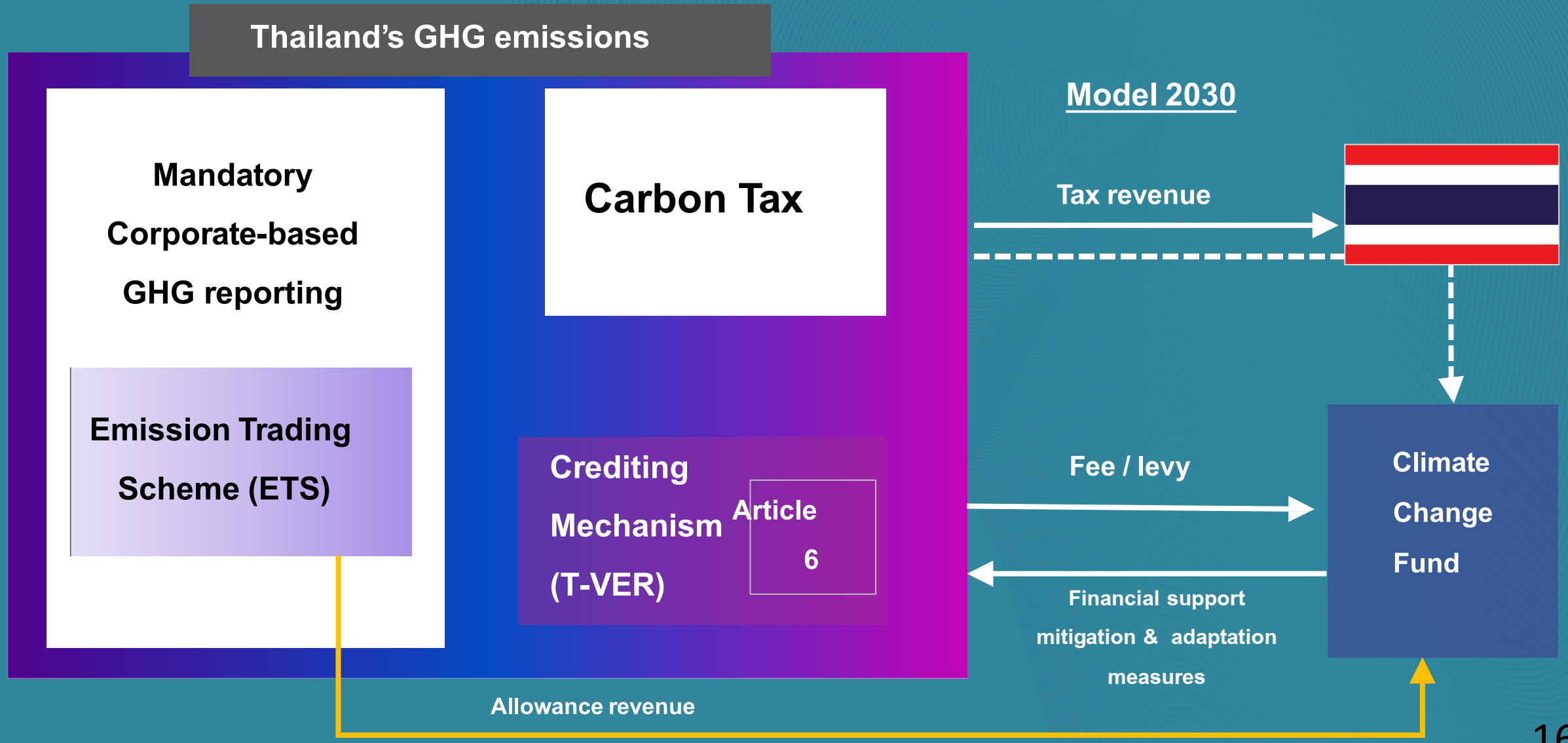
CHAPTER 13
Standards of economic activity grouping

CHAPTER 14
Punishment

Transitory Provisions

Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

Ideas for developing the mechanisms and tools under the draft Climate Change Act



Source: The 13th International Conference on Environmental Engineering, Science and Management – Keynote session, DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)

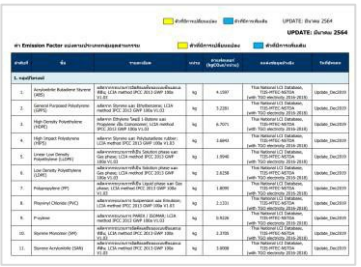
Management of Greenhouse Gases in Thailand

Thailand Greenhouse Gas Management Organization (Public Organization): TGO

องค์การบริหารจัดการก๊าซเรือนกระจก (องค์การมหาชน)

Source: www.tgo.or.th

In response to the intensified and widespread impacts of climate change to the economy and society and in recognition of the imperative to manage and reduce greenhouse gas emissions in Thailand, the Thailand Greenhouse Gas Management Organization or TGO was established in 2007 as an autonomous public organization in accordance with Thai law to manage and expedite development and implementation of greenhouse gas reduction projects and support public, private and international organization partnerships to promote implementation of climate action.



Management of Greenhouse Gases in Thailand

TGO Service Platform

Climate Action Communication

- TGO Activity Promotion
- GHG Situation
- Climate Sciences
- Climate Action Knowledge Hub

CAA TGO Climate Action Academy

- Climate Action Leaders Forum
- Training Program
- Education Program
- Conferences & Seminars

Domestic Measure-based supporting system
NAMA-NDC Tracking

Energy | Transport | Industry | Waste | Forestry | Agriculture

Domestic Project-based Mechanism
T-VER Carbon Credit

LESS Certification

International Crediting Mechanism

CDM DNA | JCM JC Secretariat

Carbon Footprint

Product Carbon Labels | Organization

CF Product | CF Reduction

Organization Carbon Footprint

เสื้อผ้า สิ่งทอ ลดโลกร้อน

City Carbon Footprint

Carbon Neutral
Carbon Market & Carbon Offset

carbon neutral network | Carbon Market | Registry System

Source: www.tgo.or.th

Carbon Footprint Programs under TGO

The quantity of greenhouse gases emitted from daily life activities, product life cycles, and organizational operations is measured in terms of carbon dioxide equivalent. Assessment is conducted to stimulate target setting and management practices for reducing greenhouse gas emissions.

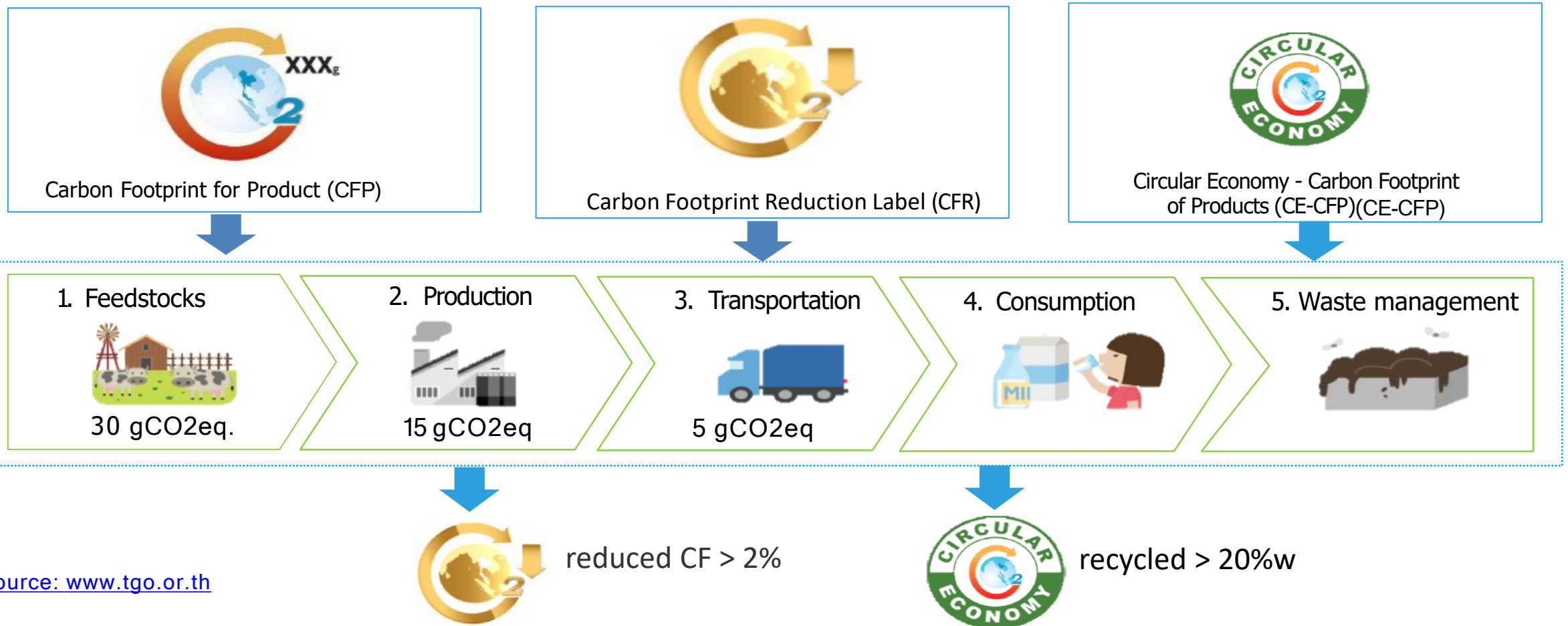
Types of Carbon Footprint Programs

1. Carbon Footprint of Products (CFP)
2. Carbon Footprint for Organizations (CFO)
3. City Carbon Footprint (CCF)

Source: www.tgo.or.th

Carbon Footprint of Products: CFP

Carbon Footprint of Products (CFP) is defined as Greenhouse Gas emissions (GHG) of a product through its life cycle stages, including material acquisition, production process, distribution, usage and waste management at its end of life as well as relevant transportation in each stage of the product. The CFP quantifies the GHG emissions terms of carbon dioxide equivalent (CO2eq) and could be used as labeling information disclosed on products and services for facilitating decision in choosing products and services for consumers that are concerned about their global warming and climate change impacts.



Source: www.tgo.or.th

Example of Carbon Footprint for Product

Food products

Food

835 gCO_2e Instant noodle 180 grams

2.21 $kgCO_2e$ Instant noodle 180 grams

11.8 $kgCO_2e$ Instant noodle 2700 grams

20.2 $kgCO_2e$ Granulated sugar 50 kg

Energy Products

GLOW ENERGY PUBLIC COMPANY LIMITED

583 gCO_2e 1 kWh Electricity

52.9 $kgCO_2e$ Steam production: 1 GJ

343 gCO_2e Water supply: 1 m3

909 gCO_2e Demineralized water1 m3

Animal feed products

Charoen Pokphand Foods

20.5 $kgCO_2e$ Duck feed 548 30 kg

26.8 $kgCO_2e$ Pig feed 550 KP 30 kg

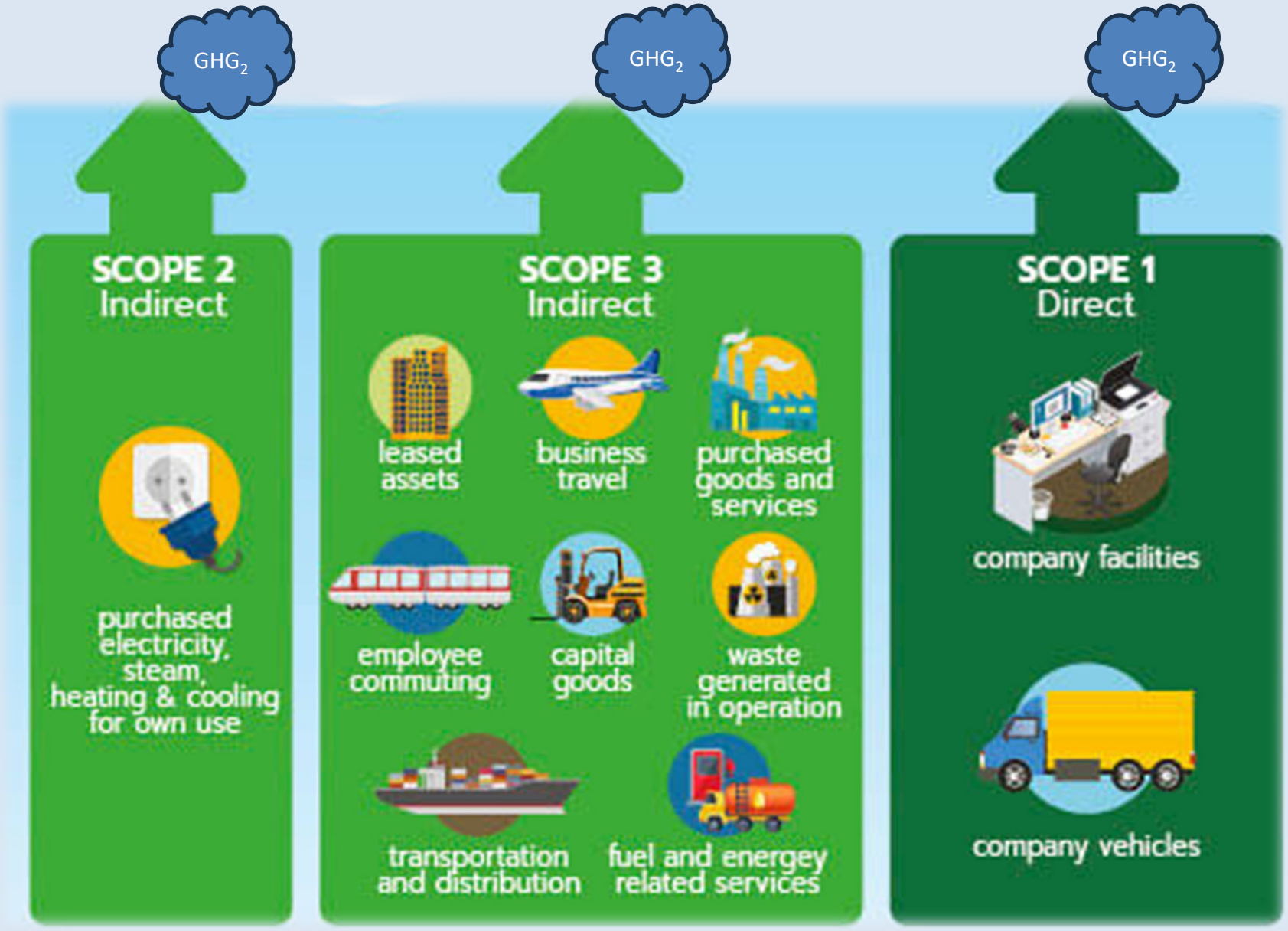
23.4 $kgCO_2e$ Chicken ไฮโปรไวท์ 510 30 kg

22.1 $kgCO_2e$ Goat CP 991-14 30 kg

13.6 $kgCO_2e$ Goat PC 991-14 30 kg

Source: www.tgo.or.th

Carbon Footprint for Organization: CFO



Scope 1, Direct GHG emissions/ removal include GHG emissions/removal from sources owned or controlled by the organization such as stationary combustion, mobile combustion, fugitive emissions and others

Scope 2, Energy indirect GHG emissions are GHG emissions from the generation of purchased electricity, heat or steam consumed by the organization

Scope 3, Other indirect GHG emissions are GHG emissions other than energy indirect emissions resulting from an organization's activities, but arising from sources that are owned or controlled by other organizations.

Source: smartgreeny.com

Example of Organization that certified CFO

Beverage Industry

Simathurakid, CO, LTD
(Whiskey distillation)

Chiang Mai Beverage Company Limited

Energy

Glow Energy PCL

Glow SPP 2 Company Limited

Glow SPP 3 Company Limited

IRPC PUBLIC COMPANY LIMITED

GHECO-ONE COMPANY LIMITED

Other

PTT Phenol Company Limited

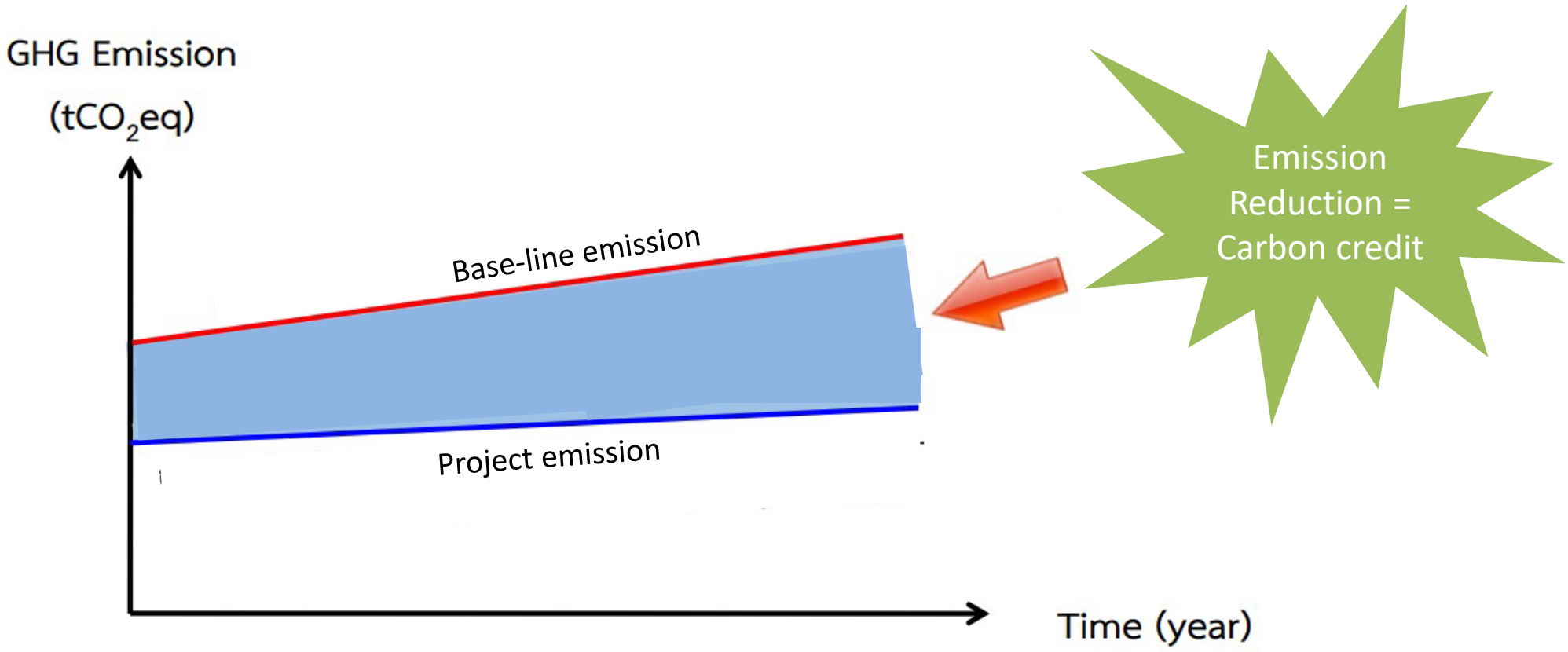
Division of Physical Systems and Environment
Mahidol University

ttb bank headquarters

Knight Club Capital

T-VER and Carbon Credit

Emission Reduction (ER) = Baseline Emission (BE) - Project Emission (PE) - Leakage Emission (LE)



Source: TGO

Qualified Project for T-Ver

Renewable Energy

(1) พลังงานหมุนเวียนหรือพลังงานที่ใช้ทดแทนเชื้อเพลิงฟอสซิล
(2) การเพิ่มประสิทธิภาพในการผลิตไฟฟ้าและการผลิตความร้อน

Factory

(7) การปรับเปลี่ยนสารทำความเย็นธรรมชาติ
(8) การใช้วัสดุทดแทนปูนเม็ด

Transport

(3) การใช้ระบบขนส่งสาธารณะ
(4) การใช้ยานพาหนะไฟฟ้า
(5) การเพิ่มประสิทธิภาพเครื่องยนต์

Waste

(9) การจัดการขยะมูลฝอย
(10) การจัดการน้ำเสียชุมชน
(11) การนำก๊าซมีเทนกลับมาใช้ประโยชน์
(12) การจัดการน้ำเสียอุตสาหกรรม

Energy Efficiency

(6) การเพิ่มประสิทธิภาพการใช้พลังงานในอาคารและโรงงานและในครัวเรือน

Land Use (Agriculture & Forestry)

(13) การลด ดูดซับ และการกักเก็บก๊าซเรือนกระจกจากภาคป่าไม้และการเกษตร

CCUS

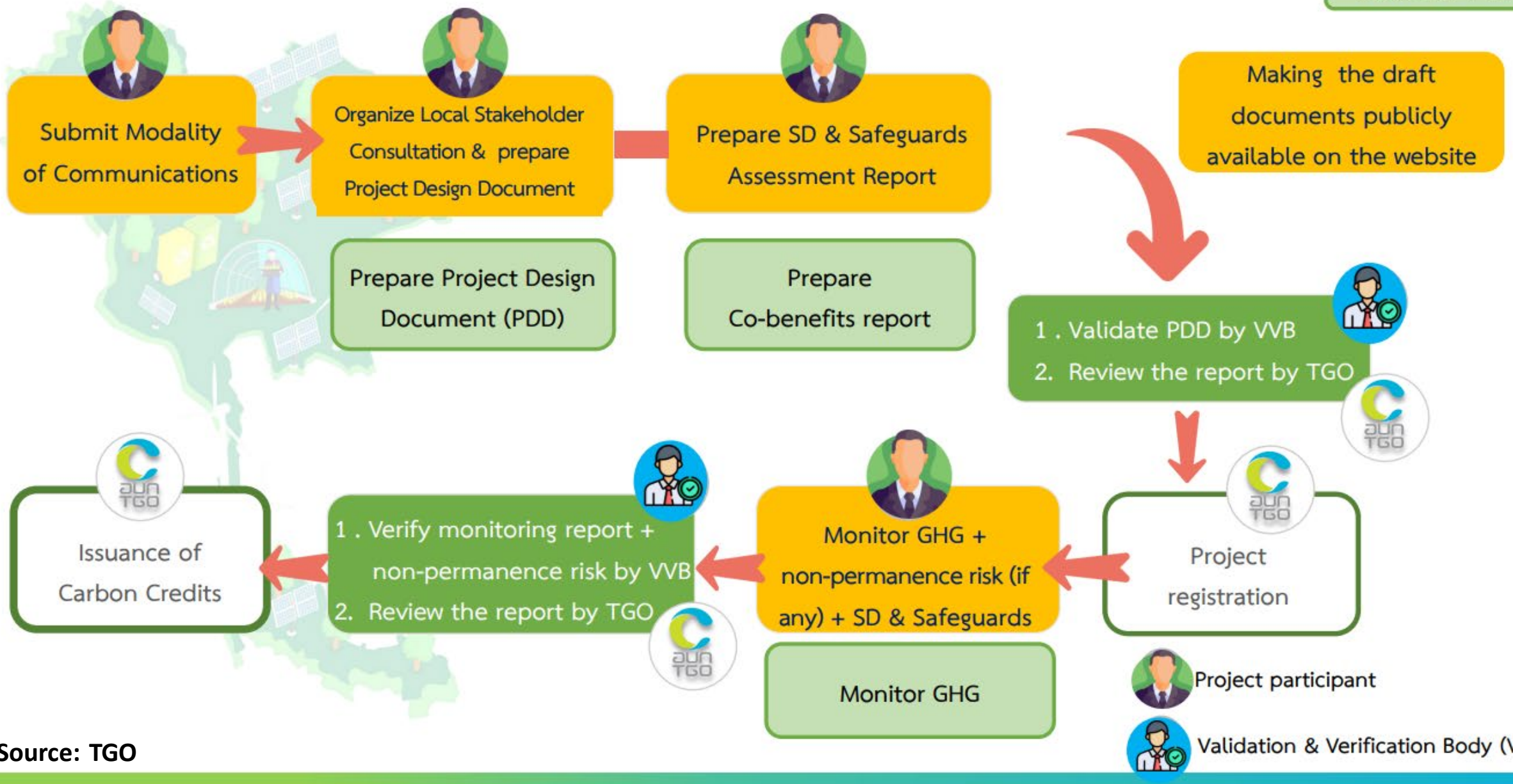
(14) การดักจับ กักเก็บ และ/หรือ การใช้ประโยชน์จากก๊าซเรือนกระจก

Source: TGO

T-VER Registration and Credits Issuance Process

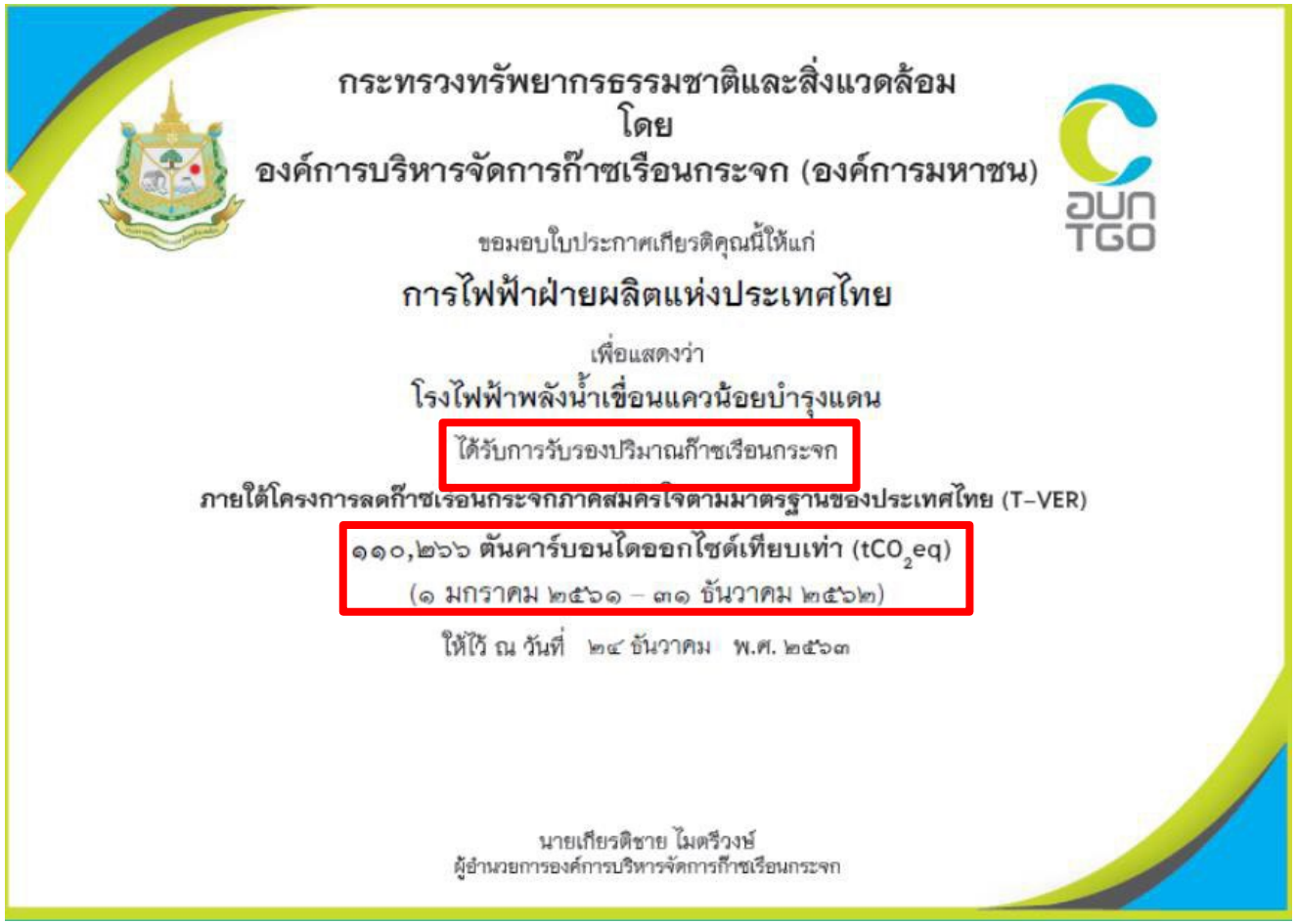
Premium T-VER

Standard T-VER



Source: TGO

Example of Issuance of Carbon Credit Certification



กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม
โดย
องค์การบริหารจัดการก๊าซเรือนกระจก (องค์การมหาชน)

ขอมอบใบประกาศเกียรติคุณนี้ให้แก่

การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย

เพื่อแสดงว่า

โรงไฟฟ้าพลังน้ำเขื่อนแควน้อยบำรุงแดน

ได้รับการรับรองปริมาณก๊าซเรือนกระจก

ภายใต้โครงการลดก๊าซเรือนกระจกภาคสมัครใจตามมาตรฐานของประเทศไทย (T-VER)

๑๑๐,๒๖๖ ตันคาร์บอนไดออกไซด์เทียบเท่า (tCO_2eq)

(๑ มกราคม ๒๕๖๑ – ๓๑ ธันวาคม ๒๕๖๒)

ให้ไว้ ณ วันที่ ๒๔ ธันวาคม พ.ศ. ๒๕๖๓

นายเกียรติชาย ไมตรีวงษ์
ผู้อำนวยการองค์การบริหารจัดการก๊าซเรือนกระจก

As a result of registration, carbon credits will be received according to the certification period requested. Credits can be certified during the remaining project period. Within the 7 or 10-year period, certification of credits can be carried out as often as needed."

Source: TGO

https://www.eng.psu.ac.th

คณะวิศวกรรมศาสตร์
มหาวิทยาลัยสงขลานครินทร์

ผู้เชี่ยวชาญที่ได้รับการขึ้นทะเบียนตรวจประเมิน คาร์บอนฟุตปริ้นท์ขององค์กร (CARBON FOOTPRINT FOR ORGANIZATION)

จาก องค์การบริหารจัดการก๊าซเรือนกระจก - องค์การมหาชน

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คณะวิศวกรรมศาสตร์
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หนังสือรับรองการผ่านหลักสูตรอบรมเชิงปฏิบัติการ เชิงลึกการประเมินคาร์บอนฟุตปริ้นท์ขององค์กร

(CARBON FOOTPRINT FOR ORGANIZATION)

จาก องค์การบริหารจัดการก๊าซเรือนกระจก - องค์การมหาชน

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THANK YOU