GREEN COUNCIL
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Training Workshop:
"Introduction to Carbon Offset for achieving Net Zero"

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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.

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Carbon Offset for Achieving Net Zero

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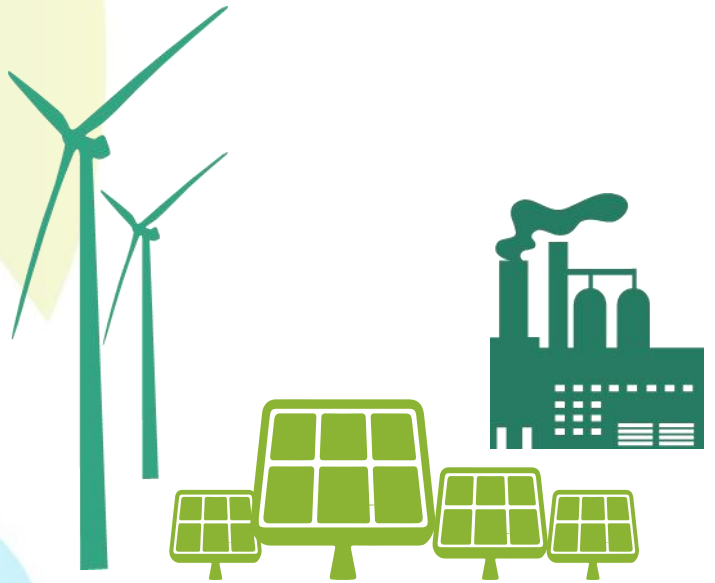
9th April, 2025



Course Outline Today:

1. Introduction
2. Carbon Offsetting
3. How to offset?
4. Overview of Carbon Market
5. Other tradable instruments associated with GHG emission reduction
6. Conclusion

1. Introduction to Carbon Offset for Net Zero

1. What is Net Zero?

2. What is Carbon Offset?

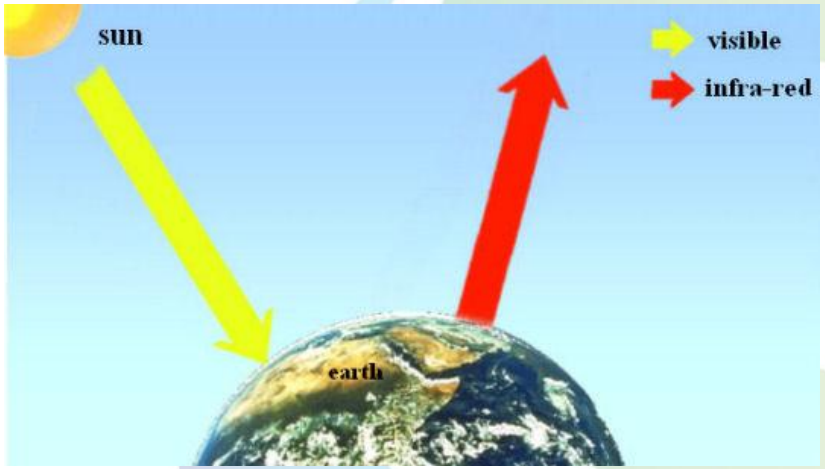
Do you know.....

- What is carbon emission / greenhouse gases ?
- What is climate change?
- What are the impacts?
- Why do we need to reduce carbon, to do carbon offsetting?

Climate Change

The Science

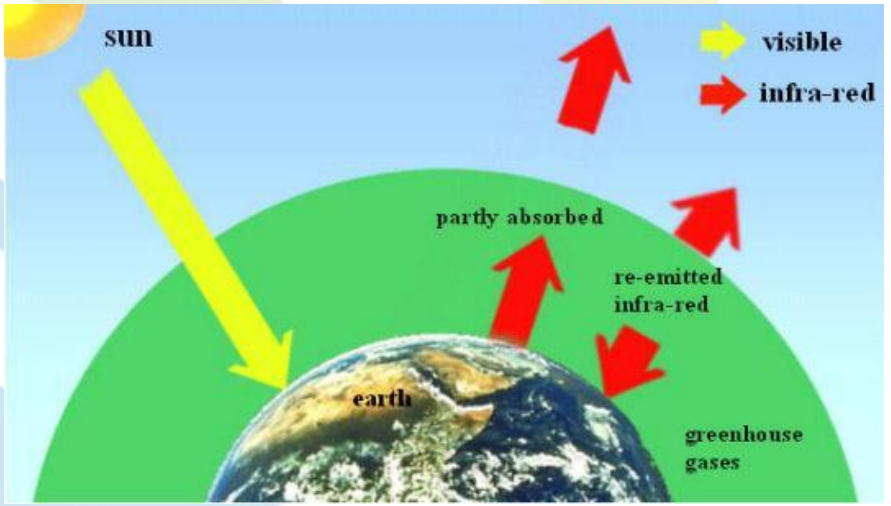
What is Global Warming/Climate Change?



When limited/no greenhouse gases in the atmosphere

With the presence of Greenhouse Gases which cause Greenhouse Effect

→ **Global Warming**

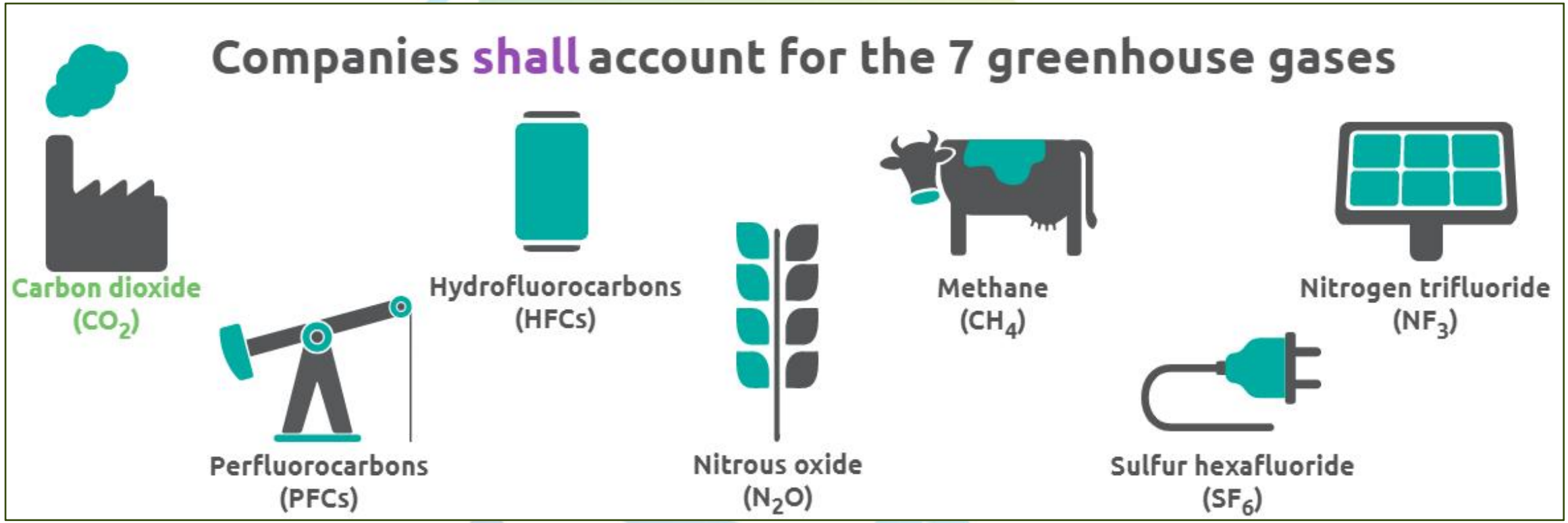


Source: EPD website

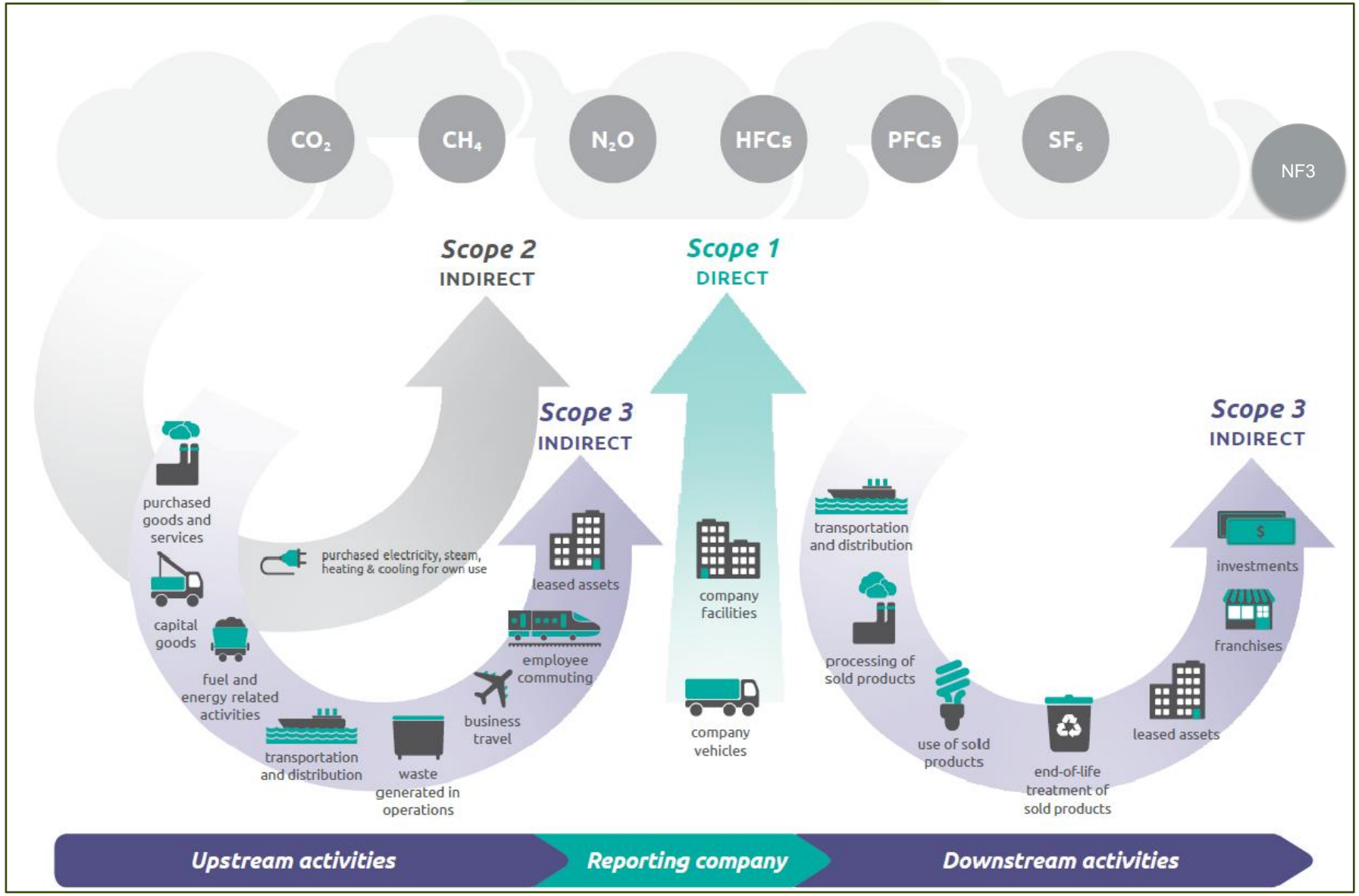
Climate Change

https://www.youtube.com/watch?v=G4H1N_yXBiA

Greenhouse Gases by Types (GHG Protocol)

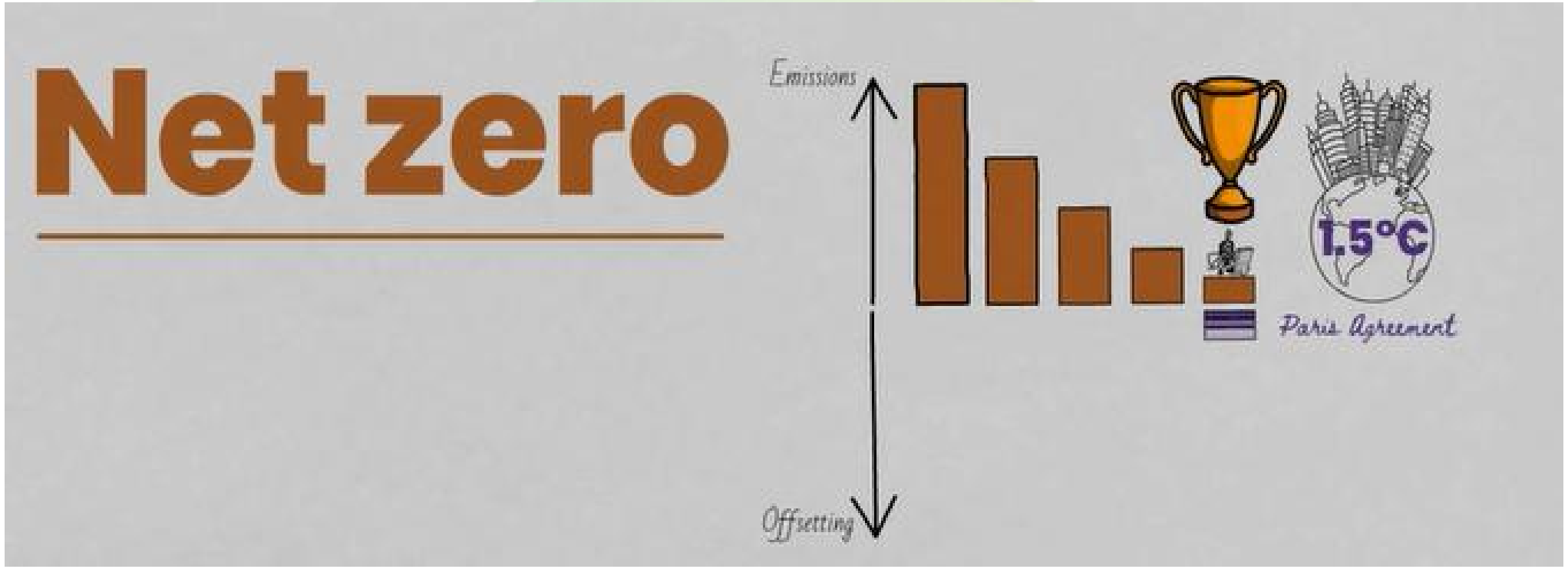


Greenhouse Gases by Scopes (GHG Protocol)



Greenhouse Gases – Scope 3 (GHG Protocol)

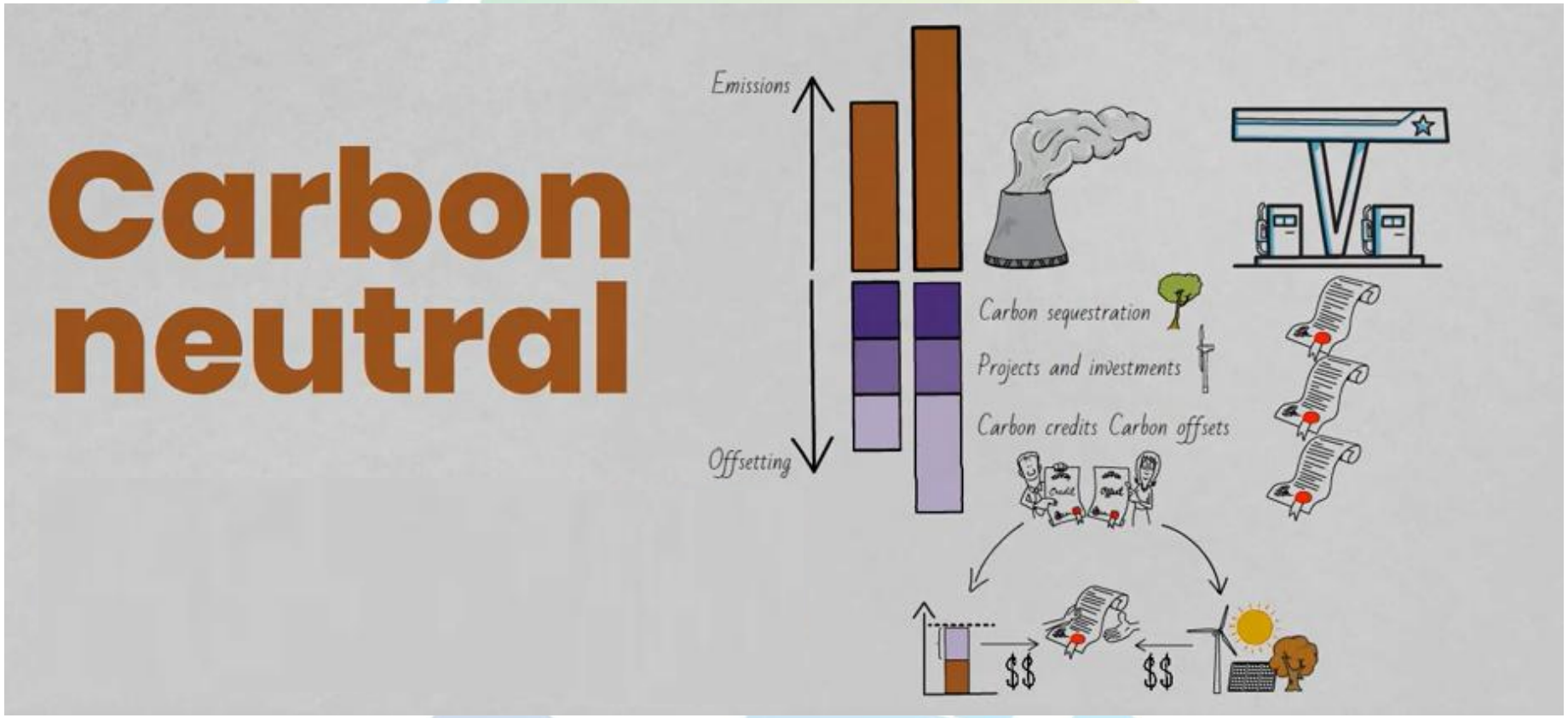
Definition of Net Zero



Net Zero means the cutting carbon emissions to a small amount of residual emissions that can be absorbed and durably stored by nature and other carbon dioxide removal measures, leaving zero in the atmosphere.

https://www.un.org/pt/node/134483

Definition of Carbon Neutral



- **Carbon neutral** means that any CO_2 released into the atmosphere from a company's activities is balanced by an equivalent amount being removed.

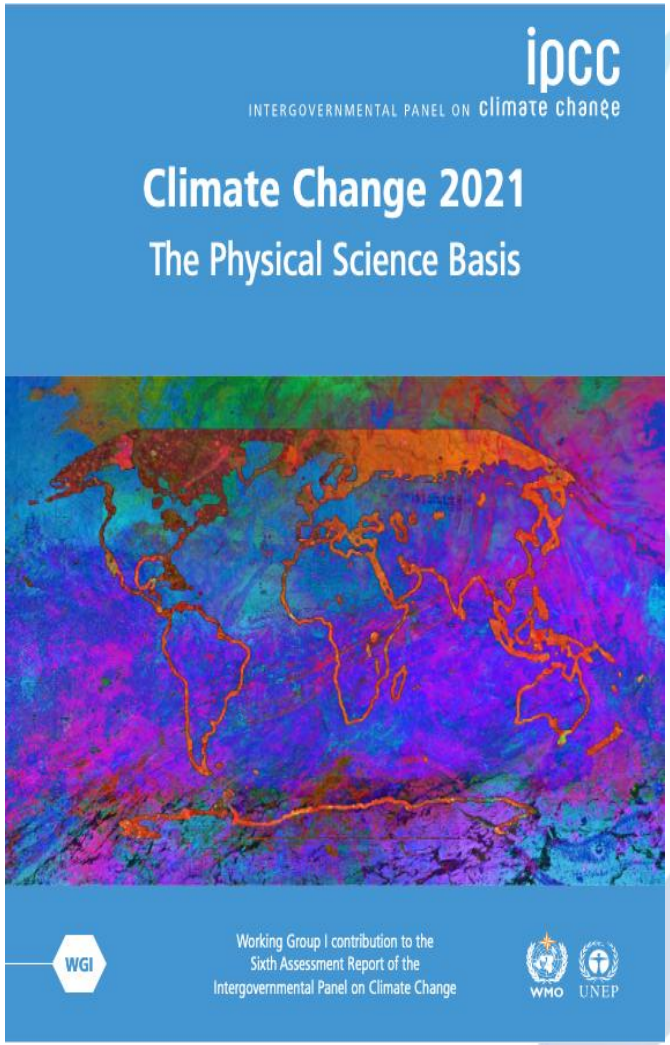
https://www.un.org/pt/node/134483

Definition of Net Zero and Carbon Neutral

What is the difference between **Carbon Neutrality** and **Net Zero**?

Source: https://www.youtube.com/watch?v=Lq0_yFF4-ys

Why Net Zero?



IPCC (The Intergovernmental Panel on Climate Change) AR6 - Sixth Assessment Report

- The science shows clearly that in order to avert the worst impacts of climate change and preserve a livable planet, global temperature increase needs to be limited to 1.5 ℃ above **pre-industrial levels**.
- Currently, the Earth is already about **1.2 ℃ warmer** than it was in the late 1800s, and emissions continue to rise.
- To keep global warming to no more than **1.5℃**– as called for in the **Paris Agreement** – **emissions need to be reduced by 45% by 2030 and reach net zero by 2050.**

Why Net Zero (cont.)

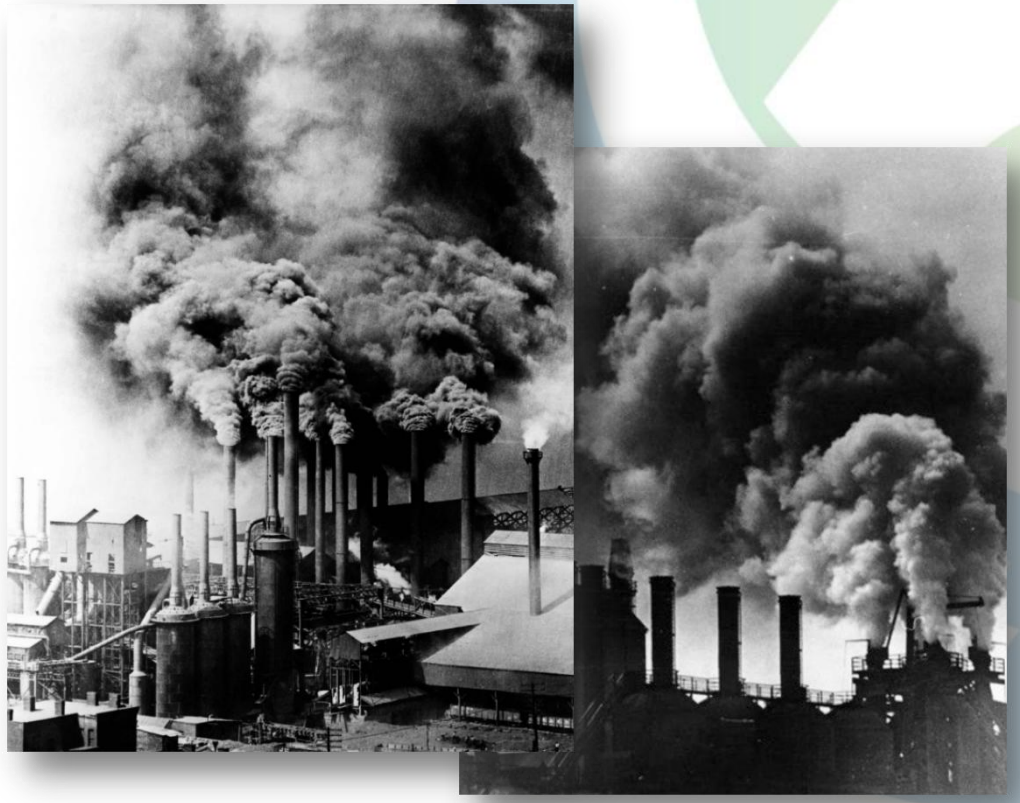
If the 1.5°C goal is surpassed, we will face increased risk of extreme heat, stresses on food production and access to water, and the range of insect-borne diseases such as malaria and dengue fever, among other threats. (BBC 2024)

What is “Pre-industrial”

“global temperature increase needs to be limited to 1.5 ℃ above pre-industrial levels.”

In IPCC 5th Assessment Report, the “pre-industrial” generally refer to 1850 – 1900.

During industrial revolutions

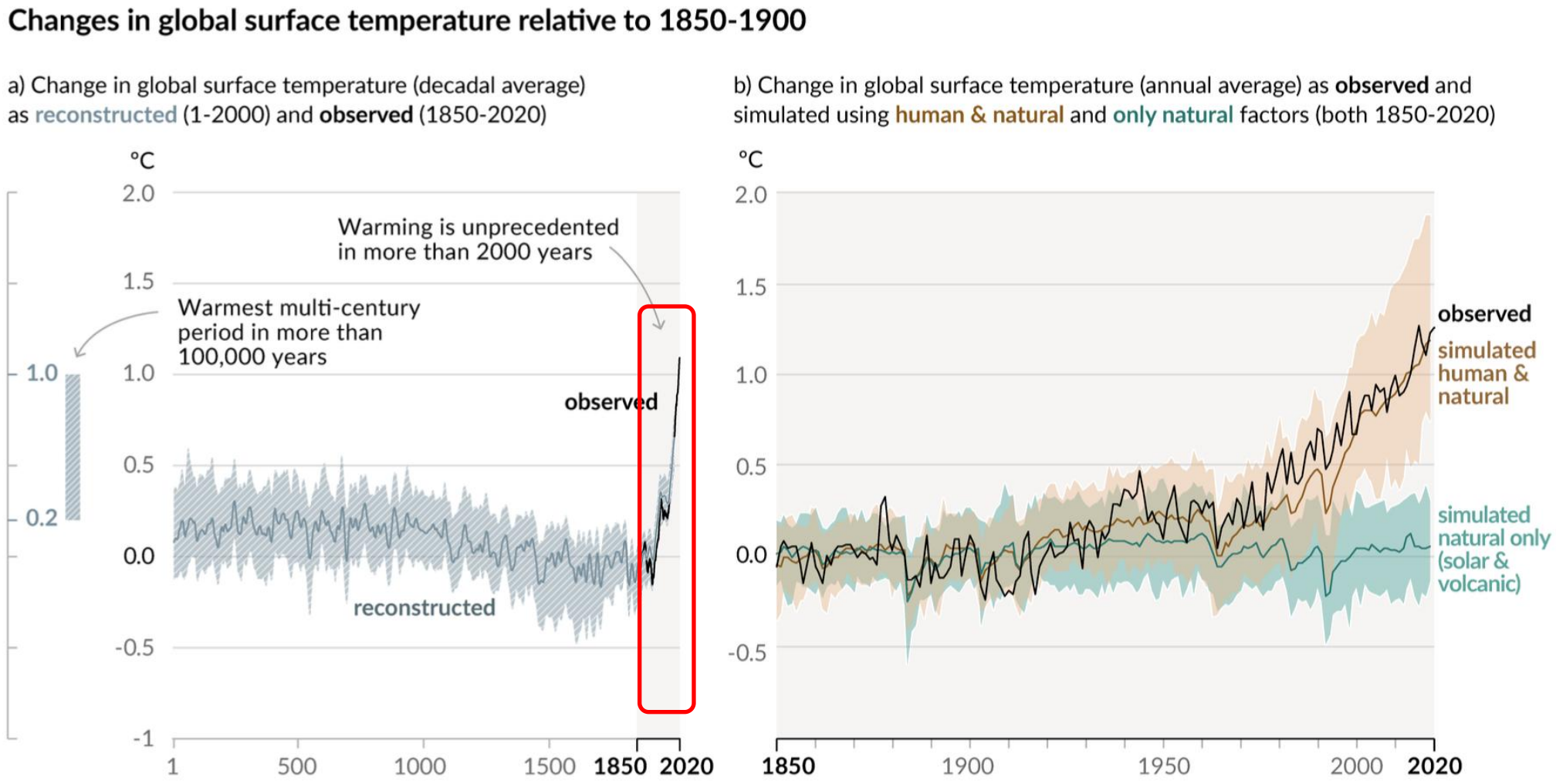


Smokestacks in Pittsburgh, Pennsylvania, 1890s © Bettmann/CORBIS

How industrial revolution boosted the economy

What is “Pre-industrial”

Any unintended consequences from industrial revolution?

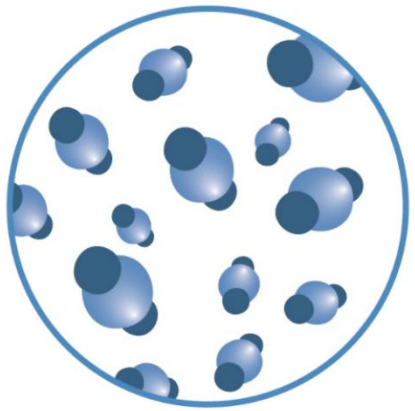


(IPCC AR6)

Carbon Dioxide emission is proven to be a key driver of rising global temperature

Impacts of Climate Change

Any unintended consequences from industrial revolution?

CO_2 concentration	Sea level rise	Arctic sea ice area	Glaciers retreat
			
Highest	**Fastest rates**	**Lowest level**	**Unprecedented**
in at least	in at least	in at least	in at least
2 million years	**3000 years**	**1000 years**	**2000 years**

(IPCC AR6)

Impacts of Climate Change (cont.)

Any unintended consequences from industrial revolution?

Extreme heat

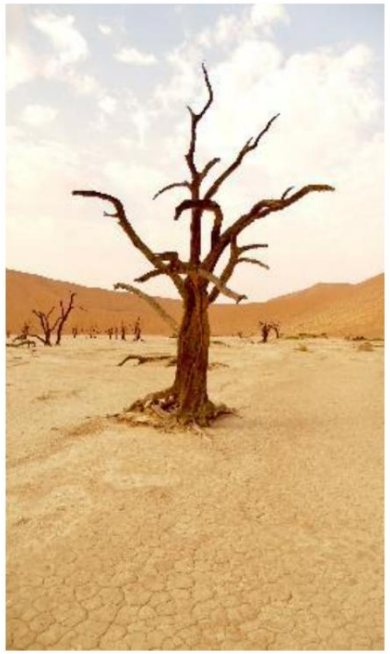
More frequent

More intense

Heavy rainfall

More frequent

More intense



Drought

Increase in some regions

Fire weather

More frequent

Ocean

Warming

Acidifying

Losing oxygen

(IPCC AR6)

Impacts of Climate Change (cont.)

Any unintended consequences from industrial revolution?

[Credit: Yoda Adaman | Unsplash]

> It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.

(IPCC AR6)

Impacts of Climate Change (cont.)

Any unintended consequences from industrial revolution?

[Credit: Hong Nguyen | Unsplash]

> Climate change is already affecting every region on Earth, in multiple ways.
>
> The changes we experience will increase with further warming.

(IPCC AR6)

Impacts of Climate Change (cont.)

Any unintended consequences from industrial revolution?

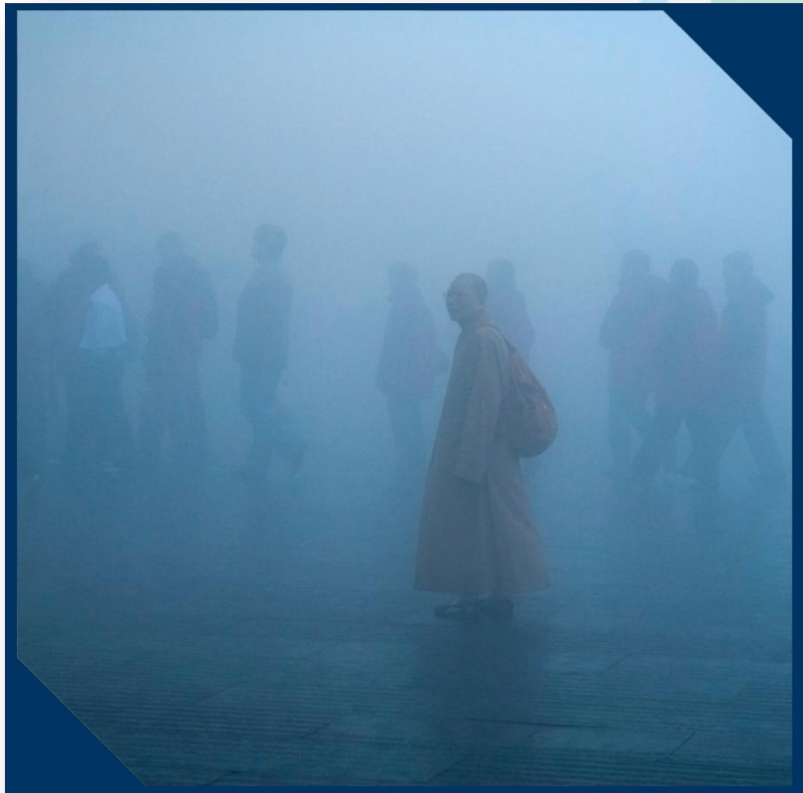
[Credit: Shari Gearheard | NSIDC]

> There's no going back from some changes in the climate system. However, some changes could be slowed and others could be stopped by limiting warming.

(IPCC AR6)

Impacts of Climate Change (cont.)

Any unintended consequences from industrial revolution?

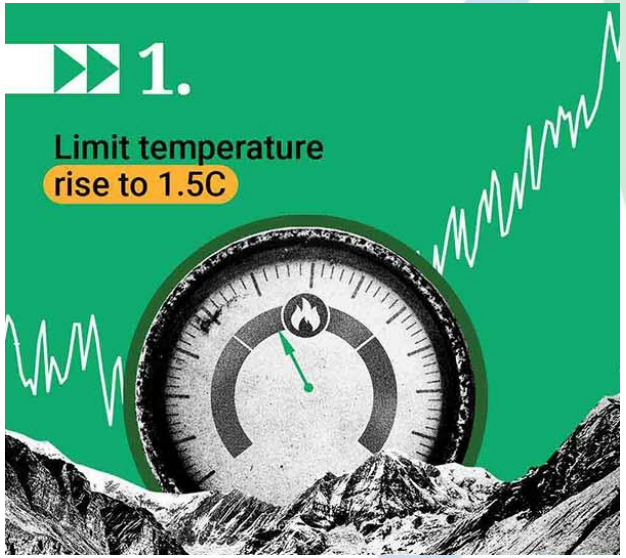


[Credit: Evgeny Nelmin | Unsplash]

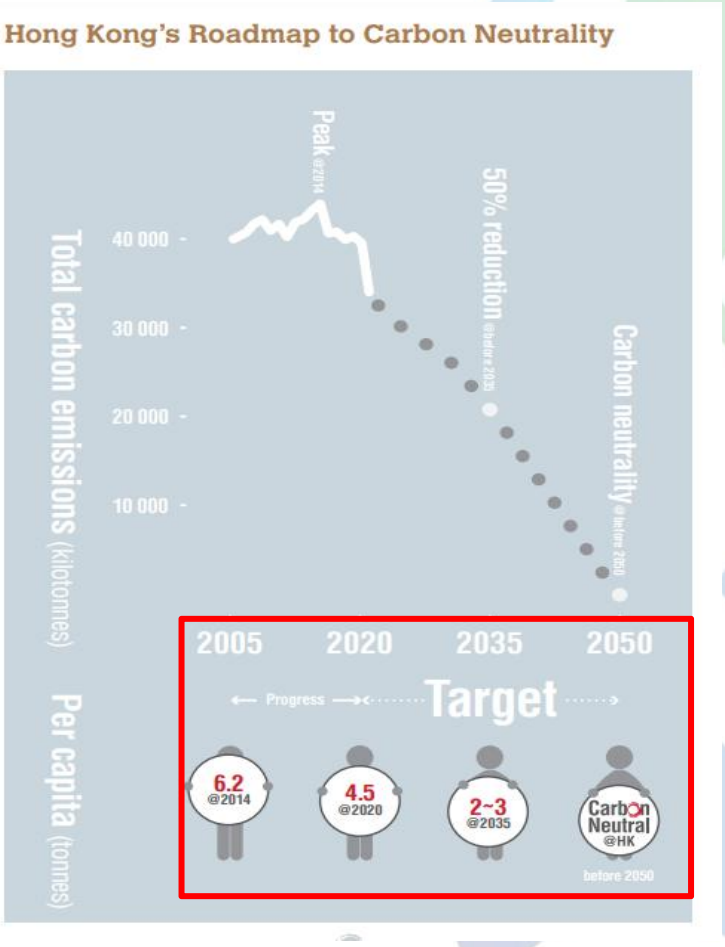
> To limit global warming, strong, rapid, and sustained reductions in CO2, methane, and other greenhouse gases are necessary.
>
> This would not only reduce the consequences of climate change but also improve air quality.

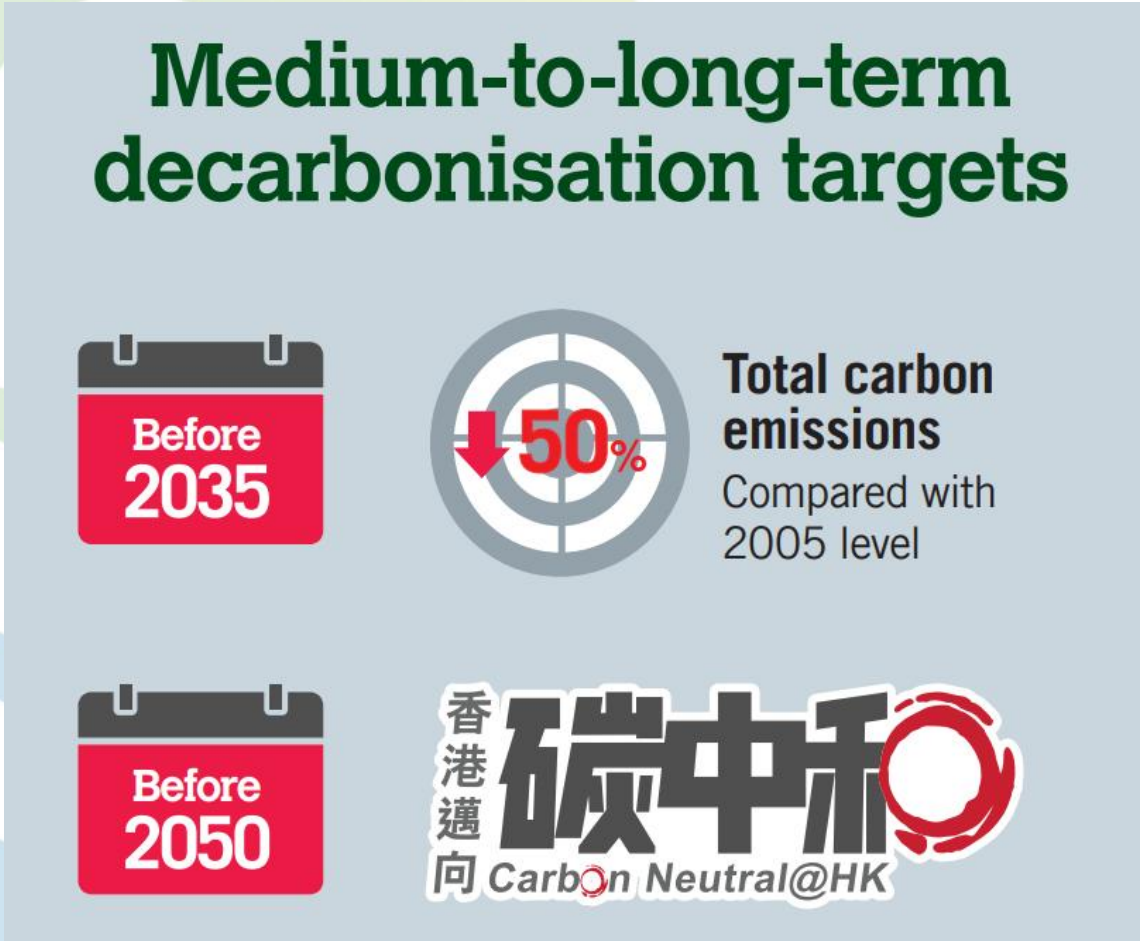
(IPCC AR6)

Countries joined efforts to reach Net Zero Goal and signed the Paris Agreement in 2015.



In Hong Kong


Hong Kong's Roadmap to Carbon Neutrality
Peak @2014
50% reduction @below 2020
Carbon neutrality @before 2050
Total carbon emissions (kilotonnes)
Per capita (tonnes)
40 000
30 000
20 000
10 000
2005
2020
2035
2050
Progress
Target
6.2 @2014
4.5 @2020
2~3 @2035
Carbon Neutral @HK
before 2050

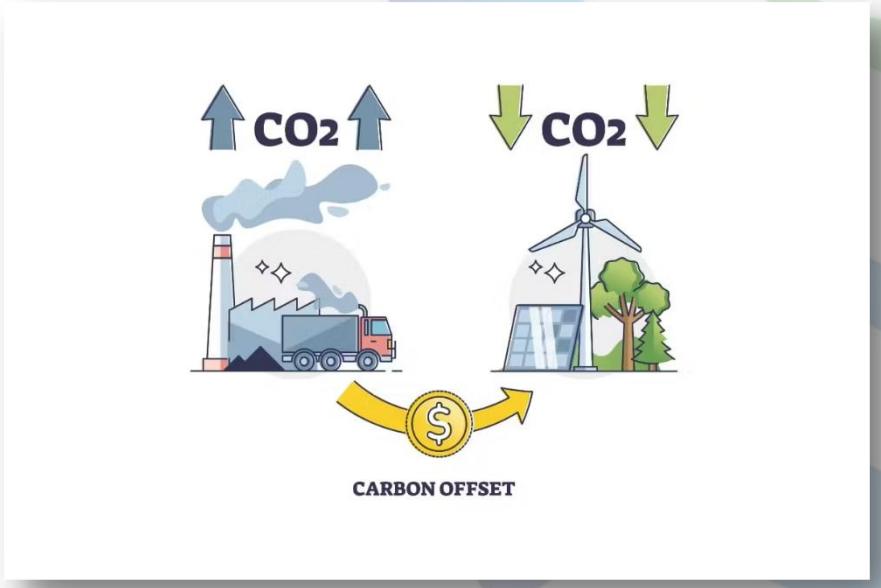

Medium-to-long-term decarbonisation targets
Before 2035
50%
Total carbon emissions
Compared with 2005 level
Before 2050
香港邁向碳中和
Carbon Neutral@HK

2. Carbon Offset

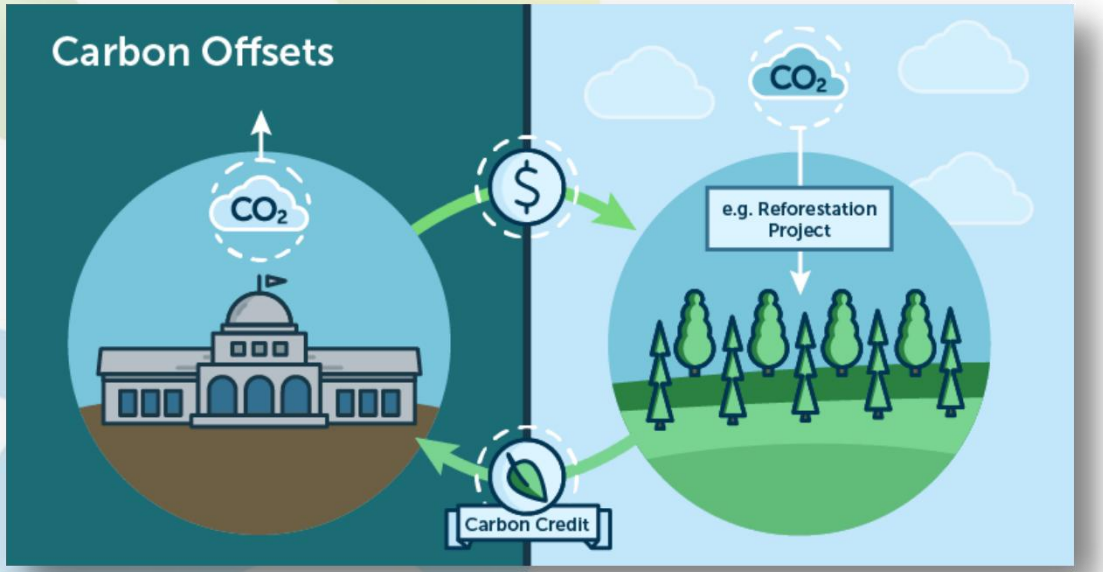
What is Carbon Offsetting

Offsetting is a climate action that enables individuals and organizations to compensate for the emissions they cannot avoid, by supporting worthy projects that reduce emissions somewhere else.

(United Nations, Carbon Offset Platform)



Carbon offset project

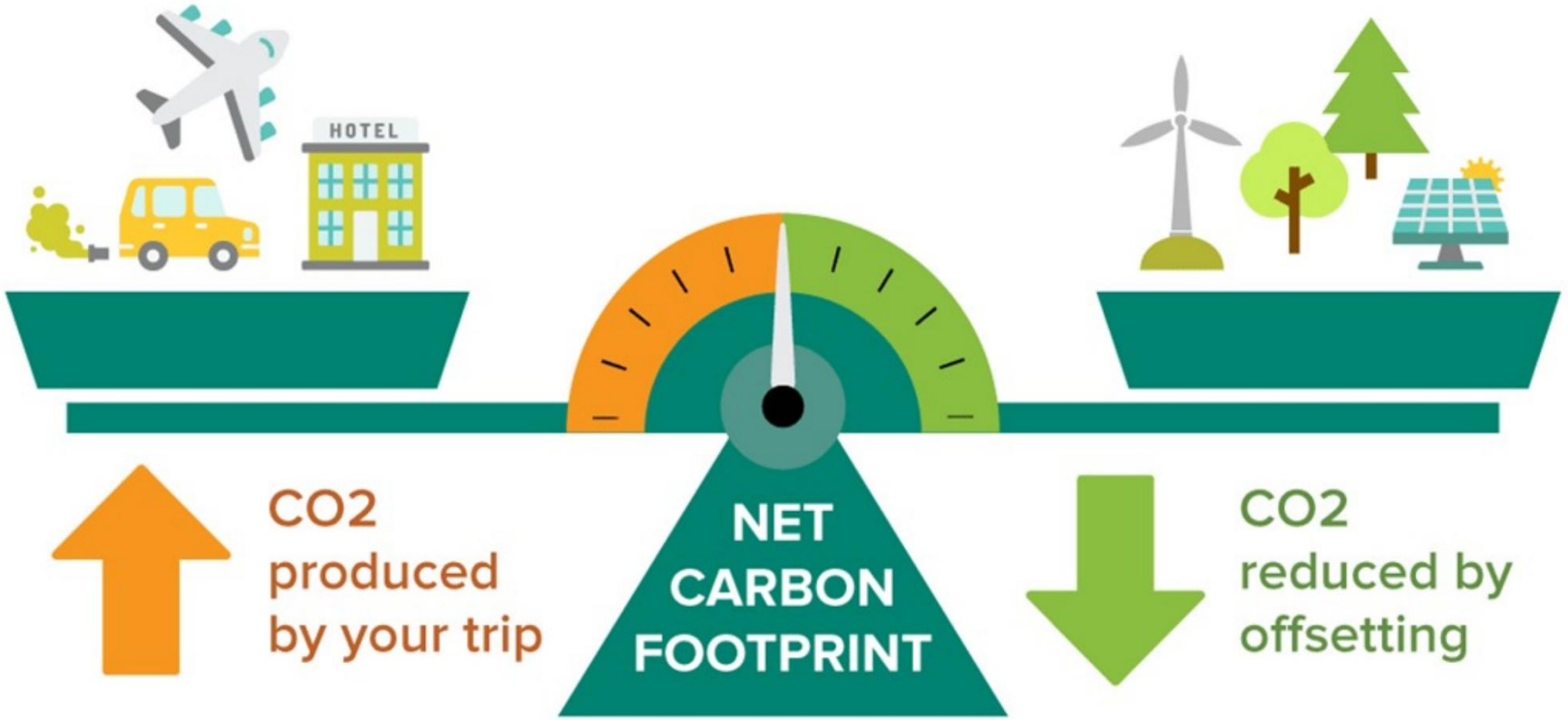


What is Carbon Offsetting (cont.)

- Carbon offsetting refers to a reduction in GHG emissions – or an increase in carbon storage and carbon removal – that is used to compensate for emissions that occur elsewhere.

- GHGs mix globally in the atmosphere, it **does not matter** where exactly the reduction takes place.

CARBON OFFSETS ALLOW YOU TO BALANCE OUT YOUR EMISSIONS



SUSTAINABLE TRAVEL INTERNATIONAL

What is Carbon Offsetting (cont.)

Carbon Credits

- A carbon credit is a tradable certificate representing the avoidance or removal of greenhouse gas emissions, measured in tonnes of carbon dioxide equivalent (tCO2e).

- Carbon credits are issued by certified climate action projects to correspond with measurable, verifiable emission reductions, provided their purportedly climate-positive activities adhere to certain standards

- Offsets and carbon credits are often used **interchangeably.**

What exactly is 1 tonne of CO_2?

Carbon dioxide is an **invisible, odourless and colourless** gas.
Mass: 1,964 g/litre or 1.964 kg/m^3.

HKG ✈ SYD Return, 1 Passenger(s) Economy	1.28 tonnes	
HKG ✈ CDG Return, 1 Passenger(s) Economy	1.65 tonnes	
HKG ✈ LHR Return, 1 Passenger(s) Economy	1.66 tonnes	

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

In 2020, Hong Kong per capita emissions is 4.5 tonnes CO2-e (EPD)

carbonvisuals.com

Source: Offset your flights | Cathay Pacific

Carbon Offset Markets

- Two main types of market where carbon credits can be traded:

Compliance carbon markets and Voluntary carbon markets (VCM)

- Compliance/ Mandatory carbon market refers to systems established or regulated by governments and mandated emission sources for participants to meet binding emission reduction targets

- VCMs are based on specific organisations certifying emission reductions. VCMs are crucial in helping the decarbonisation process as the current compliance markets only cover 11% of global emissions (FSDC 2023)

Compliance Carbon Markets

- Compliance carbon markets are where carbon allowances are traded and regulated by national, regional, international, or industry regulatory bodies. These carbon trading markets, seeking to achieve the common goal of net-zero GHG emissions.

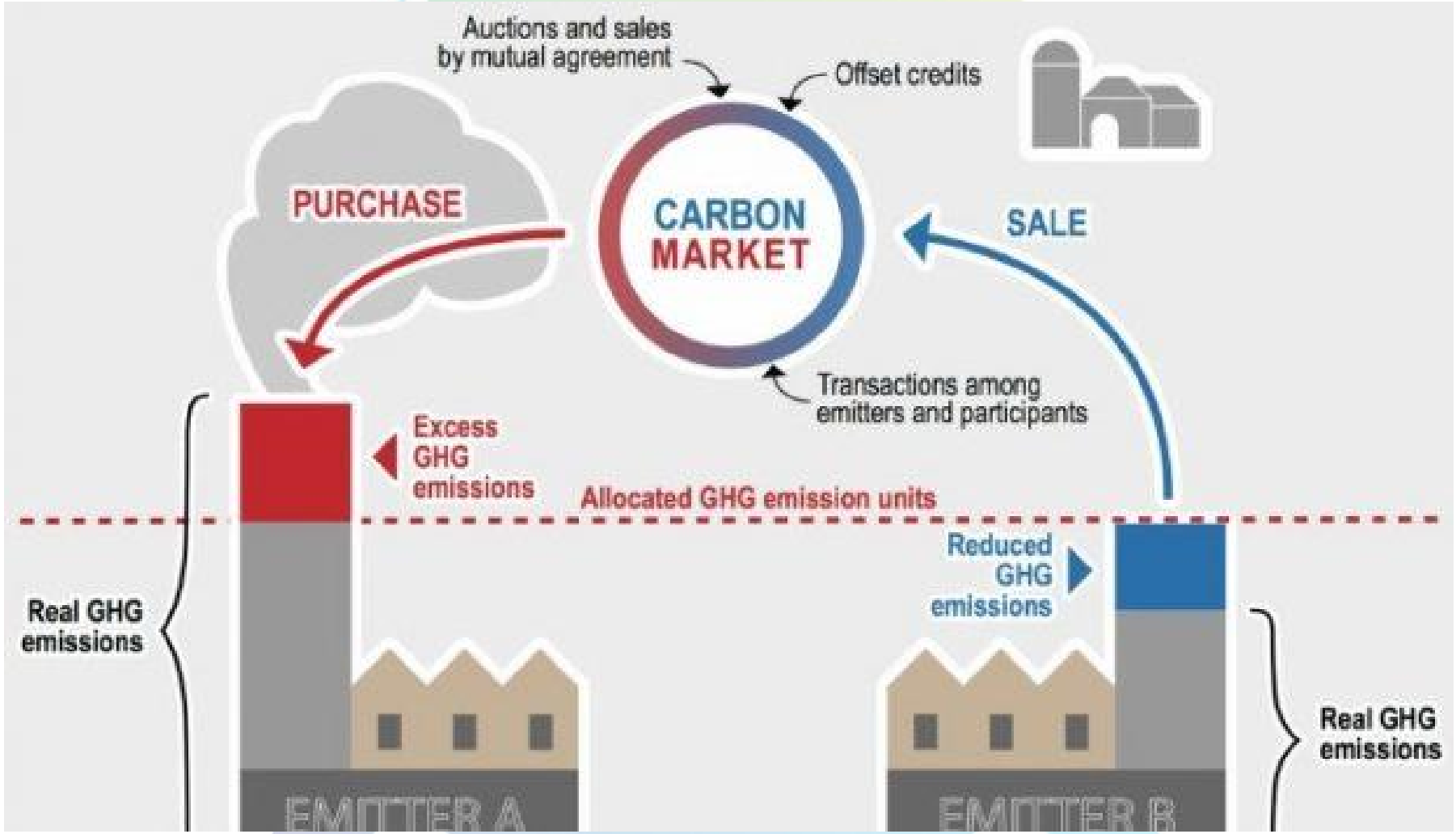
- One of the standard set-ups of a compliance carbon market is an emission trading system (ETS) or cap-and-trade (CAT)

- ETSs and CAT are market-based instruments that control carbon emission limits by providing economic incentives to companies to reduce emissions.

Compliance Carbon Markets

- The government usually allocates or sells a limited number of emission quantities in one or more sectors over a period.
- Companies covered under the cap will be allowed to emit a given emission quantity and purchase additional allowance from other companies or the carbon market to compensate for any unavoidable or residual emissions.
- On the other hand, companies with an excess limit can sell their limit or save it for later.

Emission Trading System (ETS)



Examples of industries which are difficult to decarbonize

Cement

Power Sector

Aviation

Livestock Farming

Public Transportation

Voluntary Carbon Markets (VCM)

- VCMs function outside of the compliance market and are operated on a voluntary basis, including registration, buying, and selling of carbon credits.
- Allow a higher degree of participation from the private sector, enabling *businesses, not-for-profit organisations, governments, and individuals* to take part in relevant activities. Buyers, who are usually corporations, are able to voluntarily purchase carbon credits from sellers who engage in carbon emission reduction work
- This way, corporates can compensate for their carbon footprint by purchasing carbon credits, which purchasing is done largely through funding projects

Carbon Credit Life Cycle and Buyer Purchase Options

Contributing funding, expertise, project management, etc. develop projects	Direct investment in a crediting project Contract for credit delivery with a project developer	Purchase in a one-off transaction directly from the project developer	Purchase from a credit broker Purchase from an exchange	Purchase credits from a retailer (who procures and retires credits on your behalf)

(GHG Management Institute & Stockholm Environment Institute)

Carbon Offset Standards and Certification

The Integrity Council for the Voluntary Carbon Market (ICVCM) is a non-profit, independent governance body that aims to set and maintain a global standard for high integrity in the voluntary carbon market, unlocking private climate and carbon finance that would not otherwise be deployed.

INTEGRITY COUNCIL

https://icvcm.org/

Carbon Offset Standards and Certification

- With a wide range of project types, ensuring the quality and accreditation of projects and the corresponding carbon credits generated has become a top priority.

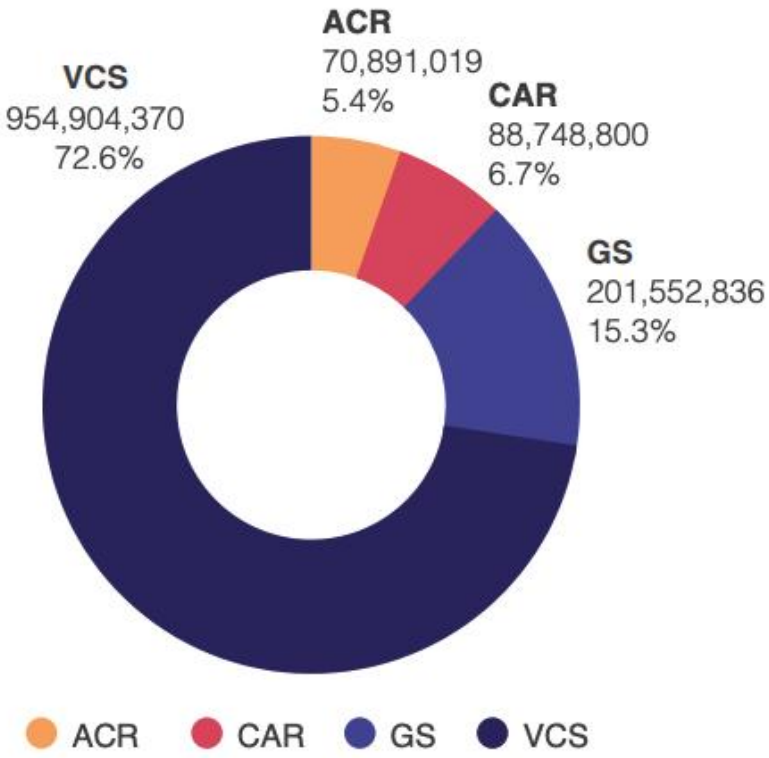
- Carbon standards are governed by organisations that are often NGOs in the VCM space *(carbon registries) or government,* aiming to create rules and requirements for measurement, monitoring, reporting, verification and certification.

- Different registries may differ in terms of the goals and services provided, as well as, the methodologies adopted, detailed requirements, and industries and sectors covered.

Carbon Offset Standards and Certification

- The volume of carbon credits issued in global markets was dominated by **4** fully-fledged carbon registries.
    - **Verified Carbon Standard (VCS or Verra)**
    - **Gold Standards (GS)**
    - **American Carbon Registry (ACR)**
    - **Climate Action Reserve (CAR)**
- VCS and GS are the major standards worldwide accounting for 72.6% and 15.3% of credits. ACR (5.4% of credits) is mainly active in North America and CAR (6.7% of credits) is active only in the US.

Figure 6. Offset Credits Issued by Registry (As of Mar 2022)



Source: Berkeley Carbon Trading Project

Carbon Offset Standards and Certifications (cont.)

Name of Program	Eligible Project location	Eligible Project type	Average Price in USD (as of 2021)	Credit issued (as of 2022)
Verified Carbon Standard	All locations except in countries with emission caps	All project types eligible with VCS approved methodology, except projects from new industrial gas facilities	$4.2 /tCO2e	295.1 MtCO2e
Gold Standard	All locations except in countries with emission caps	Renewable energy and energy, efficiency projects, additional rules and requirements for Hydro power larger than 20MW	$3.9 /tCO2e	43.8 MtCO2e
American Carbon Registry	No restriction of project location	No restrictions. All projects that meet the ACR technical standards are eligible for registration.	$11.4 /tCO2e	8.8 MtCO2e
Climate Action reserve	United States	Current eligible projects: conservation based forest management; reforestation; avoided conversion; tree planting projects by municipalities; utilities and universities; livestock, and Landfills methane capture	$2.1 /tCO2e	4.8 MtCO2e

Examples of Major Carbon Crediting Programs

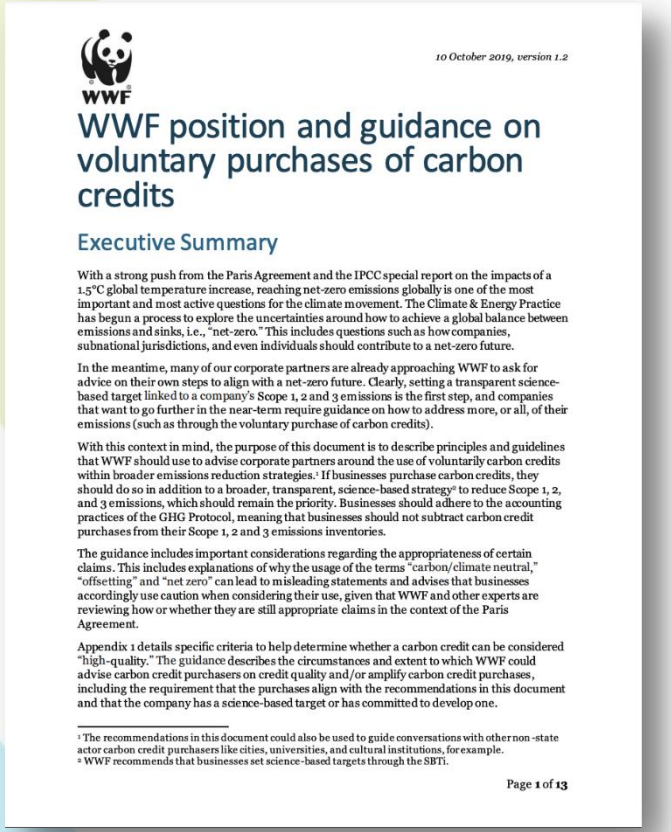
"Compliance" carbon crediting programs (run by governmental bodies)	Geographic Coverage	Label used for carbon credits
Article 6.4 of the Paris Agreement[6]	Global	Article 6.4 Emission Reduction Units (A6.4ERs)
California Compliance Offset Program	United States	Air Resources Board Carbon Offset Credit (ARBOC)
Korean Offsetting Program[7]	Global	Korean Offset Credit (KOC)
Regional Greenhouse Gas Initiative (RGGI)	Northeast United States	RGGI CO_2 Offset Allowance (ROA)
Australian Emission Reduction Fund (ERF)	Australia	Australian Carbon Credit Unit (ACCU)
"Independent" carbon crediting programs (run by NGOs)	**Geographic Coverage**	**Label used for carbon credits**
American Carbon Registry	Multiple countries	Emission Reduction Tonne (ERT)
Climate Action Reserve (CAR)	Multiple countries	Climate Reserve Tonne (CRT)
The Gold Standard	International	Verified Emission Reduction (VER)
Plan Vivo	International	Plan Vivo Certificate (PVC)
Verra - Verified Carbon Standard (VCS)	International	Verified Carbon Unit (VCU)

(GHG Management Institute & Stockholm Environment Institute)

Criteria in Selection carbon Offsets

- WWF suggests that quality VCM credits should have the following characteristics: ***honest; measurable; additional; permanent; non-leakage; monitored, reported, and verified; and comply with social and environmental safeguards.***

- These characteristics are widely used by various market participants of the VCMs.



10 October 2019, version 1.2

WWF

WWF position and guidance on voluntary purchases of carbon credits

Executive Summary

With a strong push from the Paris Agreement and the IPCC special report on the impacts of a 1.5°C global temperature increase, reaching net-zero emissions globally is one of the most important and most active questions for the climate movement. The Climate & Energy Practice has begun a process to explore the uncertainties around how to achieve a global balance between emissions and sinks, i.e., "net-zero." This includes questions such as how companies, subnational jurisdictions, and even individuals should contribute to a net-zero future.

In the meantime, many of our corporate partners are already approaching WWF to ask for advice on their own steps to align with a net-zero future. Clearly, setting a transparent science-based target linked to a company's Scope 1, 2 and 3 emissions is the first step, and companies that want to go further in the near-term require guidance on how to address more, or all, of their emissions (such as through the voluntary purchase of carbon credits).

With this context in mind, the purpose of this document is to describe principles and guidelines that WWF should use to advise corporate partners around the use of voluntarily carbon credits within broader emissions reduction strategies.[1] If businesses purchase carbon credits, they should do so in addition to a broader, transparent, science-based strategy[2] to reduce Scope 1, 2, and 3 emissions, which should remain the priority. Businesses should adhere to the accounting practices of the GHG Protocol, meaning that businesses should not subtract carbon credit purchases from their Scope 1, 2 and 3 emissions inventories.

The guidance includes important considerations regarding the appropriateness of certain claims. This includes explanations of why the usage of the terms "carbon/climate neutral," "offsetting" and "net zero" can lead to misleading statements and advises that businesses accordingly use caution when considering their use, given that WWF and other experts are reviewing how or whether they are still appropriate claims in the context of the Paris Agreement.

Appendix 1 details specific criteria to help determine whether a carbon credit can be considered "high-quality." The guidance describes the circumstances and extent to which WWF could advise carbon credit purchasers on credit quality and/or amplify carbon credit purchases, including the requirement that the purchases align with the recommendations in this document and that the company has a science-based target or has committed to develop one.

[1] The recommendations in this document could also be used to guide conversations with other non-state actor carbon credit purchasers like cities, universities, and cultural institutions, for example.
[2] WWF recommends that businesses set science-based targets through the SBTi.

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Criteria in Selection carbon Offsets

1. ***Honest:*** Each carbon credit legitimately measures at least one ton of CO2 equivalent and is based on a credible and conservative baseline.

2. ***Measurable:*** Carbon credits must be calculated based on robust scientific data using accurate quantification methods and must be expressed in quantitative terms, using standardized GHG metrics

3. ***Additional:*** Carbon credits must represent emission reductions or removals that would not have otherwise occurred without the added incentive resulting from the carbon market

Criteria in Selection carbon Offsets

4. ***Permanent:*** Carbon credits must represent emission reductions or removals that will not be reversed after the issuance of that unit.

5. ***Non-leakage:*** The generation of carbon credits should not lead to an increase in emissions elsewhere, or safeguards must be in place to monitor and mitigate any increase that occurs

6. ***Monitored, Reported and Verified*****:** The underlying emissions reductions of carbon credits should be monitored and reported and must be verified by a credible third-party verification system.

7. ***Comply with social and environmental safeguards*****:** The generation of carbon credits should not violate laws, regulations, or treaties, or result in social or environmental grievances, and countries must show how emission units meet the international best practice standard for social and environmental safeguards.

Pros and Cons of Offsetting - PROs

1. Emissions Reduction:

   Carbon offsets provide a way to compensate for emissions that are difficult to eliminate directly.They incentivize the development and implementation of projects that reduce or remove greenhouse gas emissions.

2. Flexibility and Cost-Effectiveness:

   Carbon offsets offer a flexible and cost-effective approach to addressing climate change.They allow organizations and individuals to offset their emissions by investing in external emissions reduction projects.

Pros and Cons of Offsetting - PROs

3. Catalyzing Clean Energy and Sustainability:
   - Carbon offset projects often involve investments in renewable energy, reforestation, and other sustainable initiatives.
   - This can drive the development and deployment of clean technologies and nature-based solutions.

Pros and Cons of Offsetting - PROs

4. Engaging Diverse Stakeholders:

   Carbon offset projects can engage a wide range of stakeholders, including businesses, communities, and individuals. This can promote broader participation and awareness in climate action efforts.

5. Raising Awareness and Driving Action:

   Purchasing carbon offsets can raise awareness about climate change and encourage individuals and organizations to take action.

   It can inspire further emissions reduction efforts and investment in sustainability initiatives.

Pros and Cons of Offsetting - CONs

1.Additionality and Integrity Concerns:

There are concerns about the additionality of some offset projects, meaning they may not truly represent additional emissions reductions.

Ensuring the integrity and credibility of carbon offsets is crucial to avoid greenwashing and ineffective climate action.

2.Measurement and Verification Challenges:

Accurately measuring and verifying the emissions reductions from carbon offset projects can be complex and difficult to standardize.

This can lead to uncertainties about the actual climate impact of some offset projects.

Pros and Cons of Offsetting - CONs

3. Equity and Distribution Concerns:

- The distribution of the benefits and costs of carbon offset projects may not always be equitable, particularly for local communities. There are concerns about the potential for carbon offsets to disproportionately benefit developed countries or large corporations. (Source: Nature Climate Change)

4. Distracting from Direct Emissions Reductions:

- Overreliance on carbon offsets may divert attention and resources away from the primary goal of directly reducing greenhouse gas emissions across all sectors. Carbon offsets should be viewed as a complementary tool, not a substitute for ambitious emissions reduction efforts. (Source: Science)

Pros and Cons of Offsetting - CONs

5. Leakage and Permanence Risks:

- There are risks of carbon leakage, where emissions reduction in one area may be offset by increased emissions elsewhere.

- The long-term permanence of some carbon offset projects, such as forestry, can also be uncertain. (Source: IPCC)

Pros and Cons of Offsetting - CONs

Examples

A fire in Oregon, US burnt down trees at the Green Diamond forest carbon-offset project
• 3.3m tonnes of CO_2 originally stored in tress released back to atmosphere

Brazilian forest-based carbon offset projects failed -- loggers cut down trees after the offsets were sold to US and European corporations

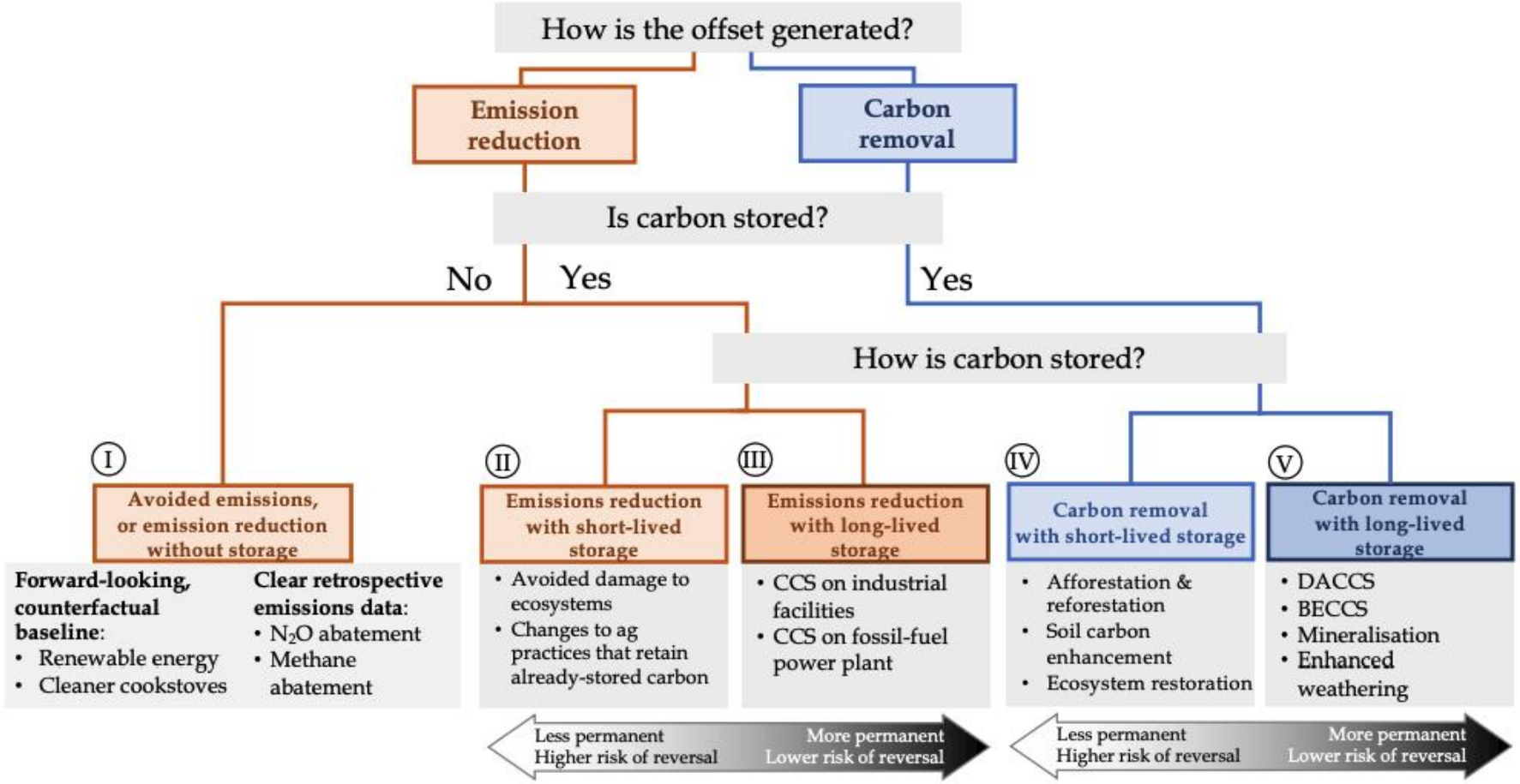
Carbon Offset Markets

	Compliance Market	Voluntary Market
Purpose	to comply with the total amount of carbon emission agreed or set by international agreement/pledge	Voluntary, to fulfill one's responsibility
Buyer	Government, cooperation or organization	Government, cooperation, organization or individual
Offset amount	Comply with total amount of carbon emission agreed/set by international agreement/pledge	Buy carbon offset for own emission
Price	Fixed price for 1 ton CO_2 equivalent (CO_2e) offset in at the time of purchase	Variable, depend on bilateral transaction

Different types of Carbon Offsetting Projects

Five types of carbon offset based on **(1) whether carbon is stored and (2) the nature of storage**

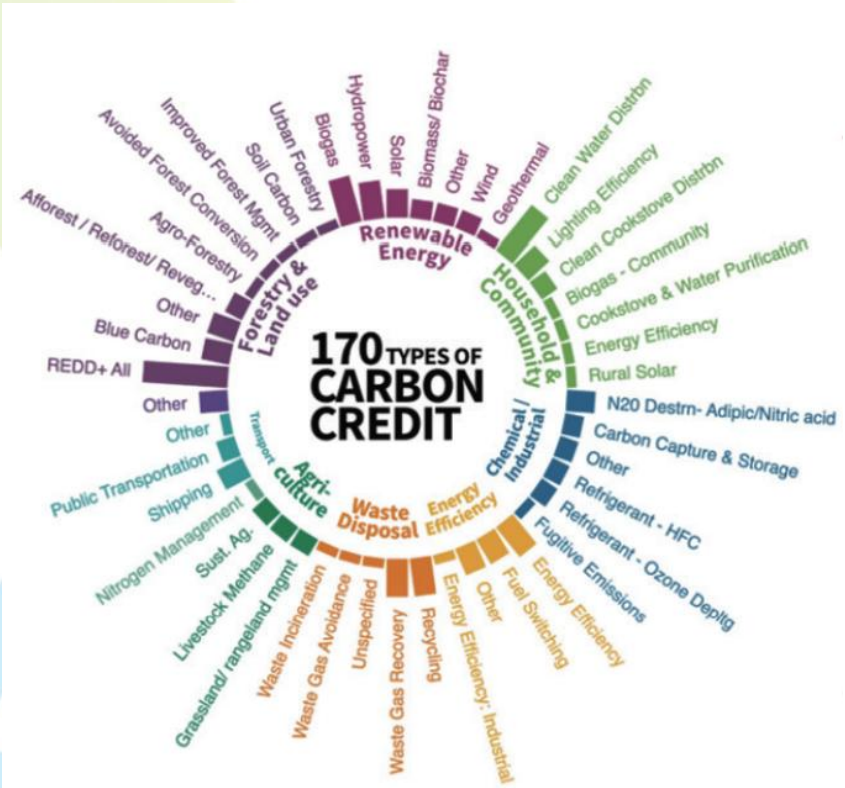
Figure 1: *Taxonomy of Carbon Offsets*



Different types of Carbon Offsetting Projects

- Carbon offset credits can be produced through activities that reduce GHG emissions or increase carbon sequestration. These activities are typically undertaken as discrete **projects**.

- There are many different project types that can be used to generate carbon offsets, including renewable energy projects (such as wind or solar power), energy efficiency projects (such as upgrading building insulation or lighting), forestry projects (such as reforestation or avoiding deforestation), and methane capture projects (such as capturing methane emissions



Different types of Carbon Offsetting Projects

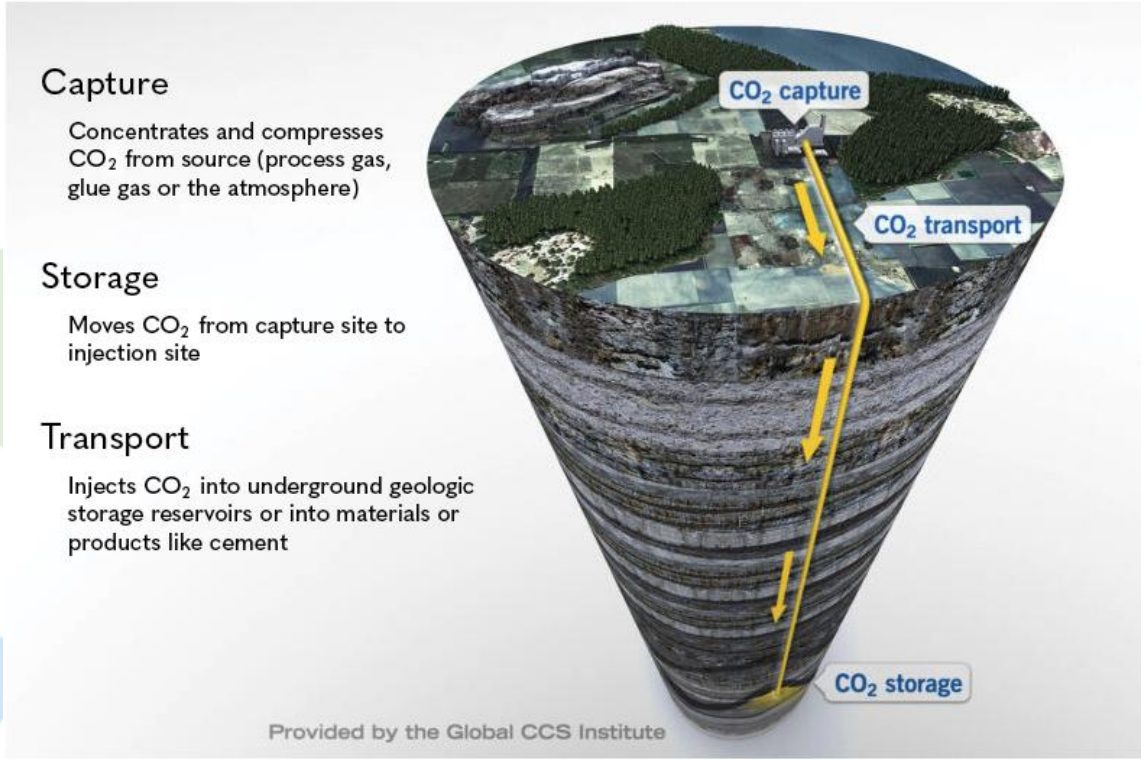
- *Voluntary Registry Offsets Database*, developed by the Berkeley Carbon Trading Project, contains all carbon offset projects, credit issuances, and credit retirements listed globally by four major voluntary offset project registries, covering allmost all of the world's voluntary market offsets.
- Project categories include the followings (non-exhaustive):

  a) *Agriculture*
  b) *Carbon Capture & Storage*
  c) *Chemical Processes*
  d) *Forestry & Land uses*
  e) *Household & Community*
  f) *Industrial & Commercial*
  g) *Renewable energy*
  h) *Transportation*
  i) *Waste management*

Examples of different carbon offset project

Capture & Storage

- Carbon capture and storage (CCS) is a key technology for supporting the energy transition and achieving a net zero future.
- Capture of carbon dioxide (CO2) → transportation → safe storage underground.



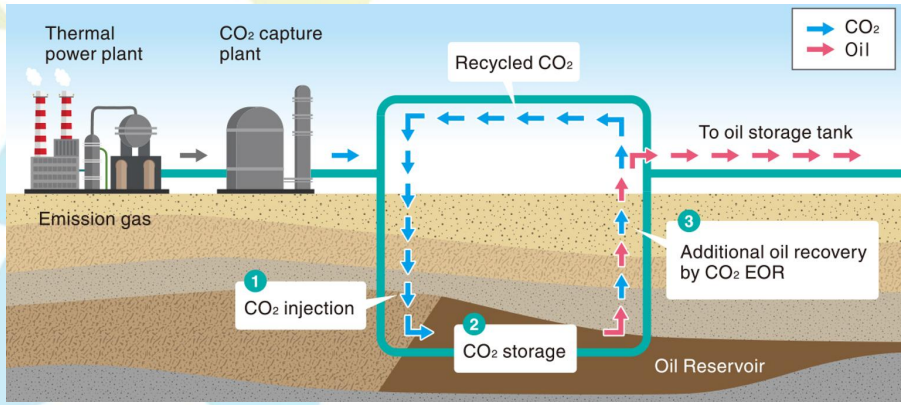
Reference: CCS Image Library – Global CSS Institute

Examples of different carbon offset project

Capture & Storage

Petra Nova Plant, Texas, USA

- launched in 2017 and is a collaboration between NRG Energy and JX Nippon Oil & Gas Exploration.
- Captures CO2 emissions from the W. A. Parish power plant by using a chemical solvent to separate the CO2 from flue gas. The CO2 is then transported via pipeline for storage in an underground oil reservoir.
- The Petra Nova project can capture around 90% of the CO2 emissions produced by the power plant, **equivalent to 1.6 million tons of CO2 per year**, which is then used for enhanced oil recovery (EOR).
- Verified by VCS

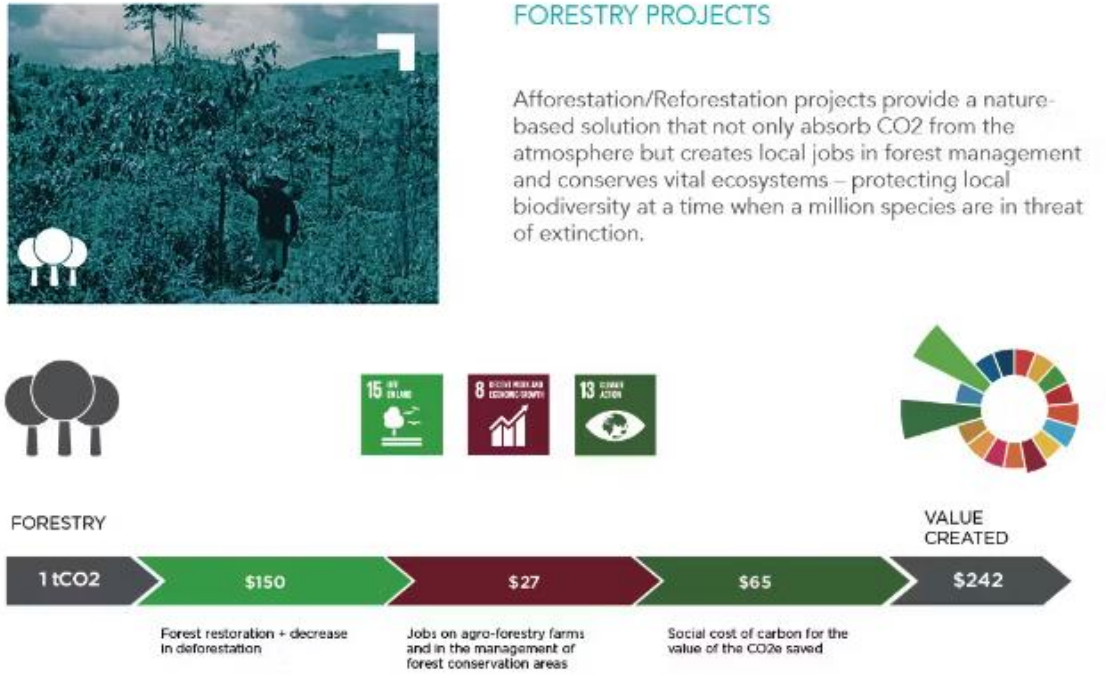


Examples of different carbon offset project

Forestry & land use

- Afforestation/reforestation projects provide a nature-based solution that not only absorb CO2 from the atmosphere but create local jobs in forest management and conserve vital ecosystems.

- Projects can include tree planting, single-species plantations, silvicultural systems and agriculture.



Examples of different carbon offset project

Forestry & land use

The Generation Forest Group Projcet, Panema

- Implemented in the Republic in Panama in 2016
- reforest 1,100 hectares of degraded land which was formerly used mainly for cattle ranching and pasture during its project lifetime
- **Achievement (2016-2021):**
- Net estimated emission removals 57,019 tCO2e
- Improved skills of community member: 36 indigenous people trained in reforestation and forest management

- Verified by VCS

Examples of different carbon offset project

300 MW Solar PV Plant, Rajasthan, India

- Launched in 2019 India
- generates electricity using renewable solar energy.
- The project replaces emissions of greenhouse gases (GHG's) estimated to be approximately 693,327 tCO2e per annum, displacing 741,845 MWh/year amount of electricity from the generation-mix of power plants connected to the Indian electricity grid
- conducted 6 training sessions to educate and build capacity. 42 individuals were successfully employed

- Verified by Gold Standard

Examples of different carbon offset project

Transportation

EV Charing Network Carbon Credits, US

- Launched in 2020 by Electrify America
- create the “Fueling Stations of the Future” by investing in a range of current and future charging technologies that will provide ultra-fast charging and ubiquitous access to EV drivers along United States highways, in metro areas, and through new mobility programs
- GHG emission reductions are achieved through the displacement of conventional fossil fuel vehicles as a result of the electricity delivered by the project chargers.
- Estimated Annual Emission Reductions: 7989 tCO2e

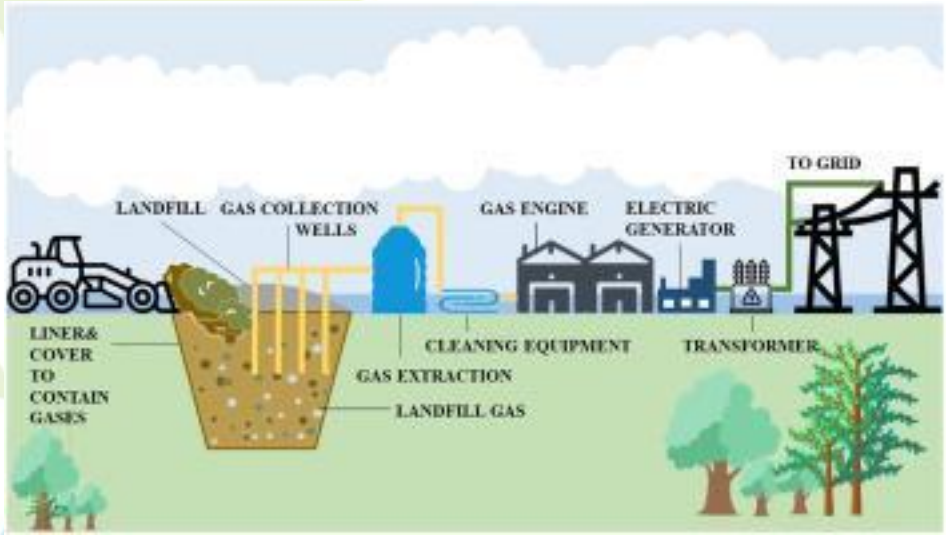
- Validated by VCS

Examples of different carbon offset project

Waste management

Landfill-Gas-to-Energy Project, Xi'an, China

- Launched in Xi'an in 2010
- installation of power generator modules (or gensets) at the landfill, to allow the increasing volumes of landfill gas from the incoming waste to be captured and utilized for power generation
- The landfill gas will then be combusted in landfill gas reciprocating engines to produce electricity. The produced renewable energy will be exported to the Chinese national grid.
- Estimate annual Emission Reduction: 109496 tCO2e



- Verified by VCS

3. How to offset

Carbon Offset Mechanism

Investment

The organization contributes economically to a project to reduce emissions that generates carbon offsets.

Emissions offset projects may include:

- Reforestation
- Renewable energy
- Methane capture / combustion

Emission offset

The organization receives carbon credits for its contribution to the emission reduction project.

An organization wants to offset GHG emissions that could not be reduced directly.

CO_2

Carbon Credit Life Cycle and Buyer Purchase Options

Contributing funding, expertise, project management, etc. develop projects	Direct investment in a crediting project Contract for credit delivery with a project developer	Purchase in a one-off transaction directly from the project developer	Purchase from a credit broker Purchase from an exchange	Purchase credits from a retailer (who procures and retires credits on your behalf)

(GHG Management Institute & Stockholm Environment Institute)

Offsetting Platforms - examples

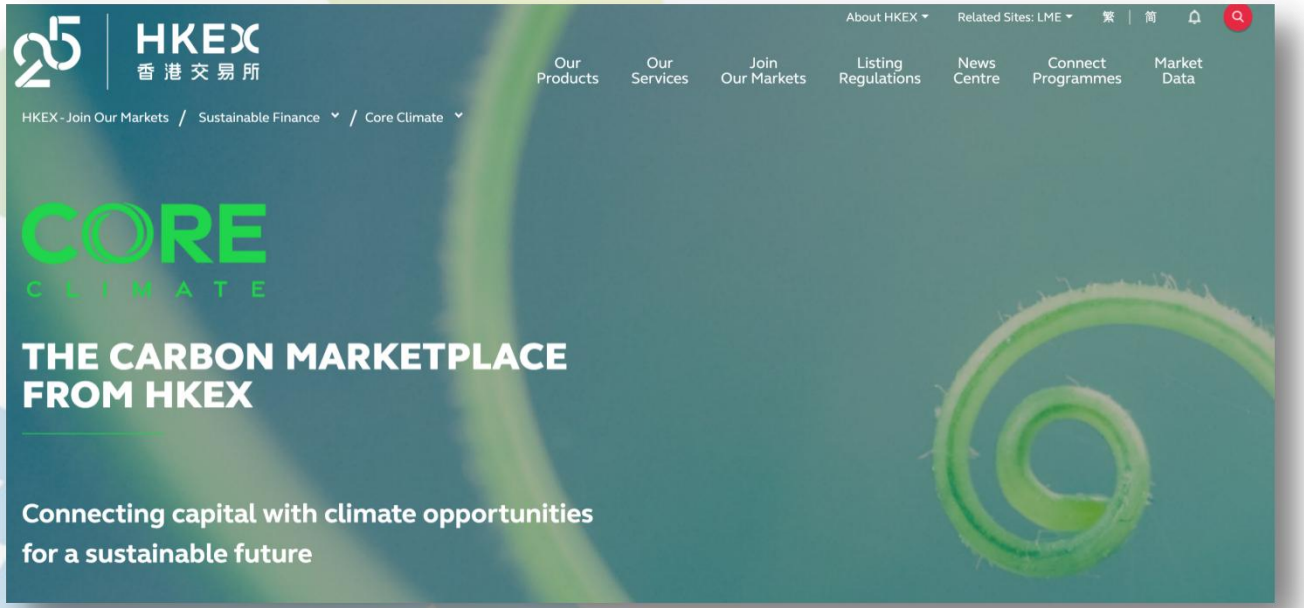
Core Climate

Launched by Hong Kong Exchanges and Clearing Limited (HKEX) in October 2022, Core Climate is an international carbon marketplace facilitating the trading of voluntary carbon credits to support the global transition to net zero

Certification Standards: All projects are verified against recognized standards such as the Verified Carbon Standard by Verra and the Gold Standard's Verified Emission Reductions (GS-VERs).

Settlement Currencies: Offers trading with settlement options in Hong Kong Dollars (HKD) and Renminbi (RMB)

Project Diversity: Provides carbon credits from over 50 internationally certified projects across Asia, South America, and West Africa, including forestry, solar, wind, and biomass initiatives.



https://www.hkex.com.hk/Join-Our-Market/Sustainable-Finance/Core-Climate?sc_lang=en

Offsetting Platforms - examples

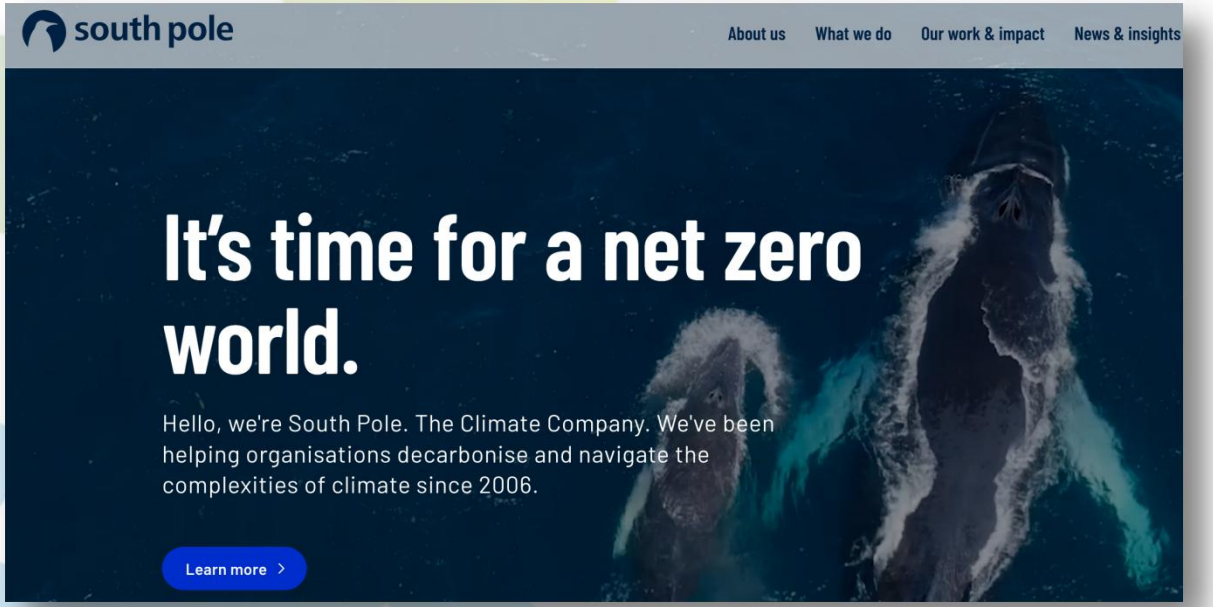
South Pole

Founded in 2006 and headquartered in Zurich, Switzerland, South Pole is a leading climate solutions provider. The company operates globally with over 800 employees across more than 20 countries.

Carbon Offset Solutions: Provides access to a diverse portfolio of carbon offset projects, enabling businesses to compensate for their emissions through internationally recognized standards.

Climate Strategy Advisory: Assists organizations in developing and implementing decarbonization strategies to achieve net-zero emissions.

Engagement with Local Initiatives: Participated in the Hong Kong International Airport Carbon Capacity Building Programme, co-organized by Airport Authority Hong Kong and Business Environment Council.



https://www.southpole.com/what-we-do

Offsetting Platforms - examples

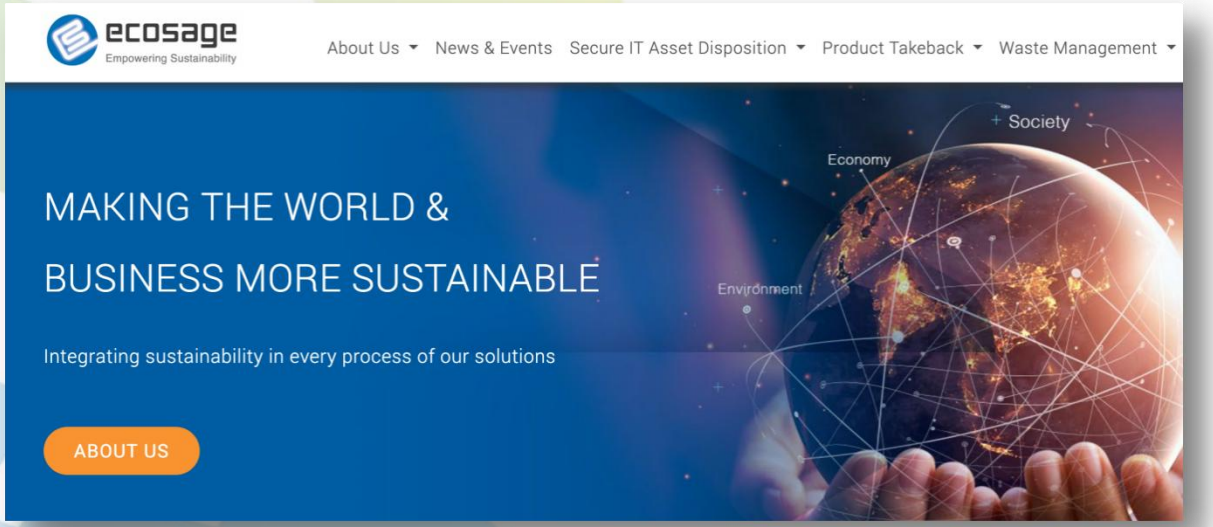
EcoSage

Founded in 2005, EcoSage is Hong Kong's first certified circularity and sustainability solution provider.

Carbon Neutral Solutions: Emphasizes recycling and reuse to reduce carbon footprints. Offers proprietary and third-party verified carbon offset solutions to assist clients in achieving carbon neutrality.

Industry Applications: Serves sectors including government, finance, retail, education, logistics, manufacturing, hospitality, and venues.

Product Takeback and Reverse Supply Chain: Offers solutions for product destruction and reverse logistics, ensuring responsible handling of returned or end-of-life products.



https://ecosage.com.hk/

4. Overview on Carbon Market

Carbon Market

Global Level

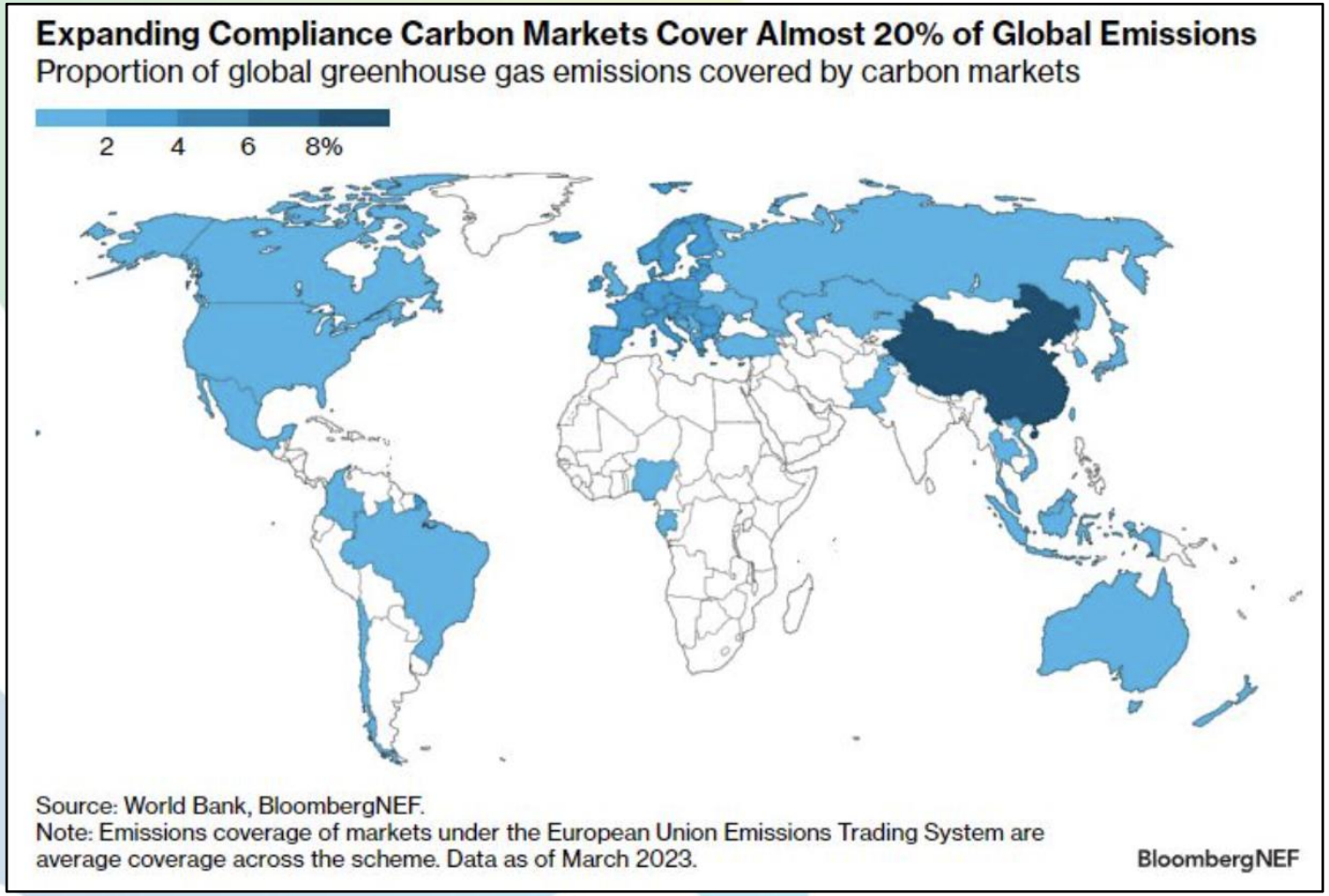
- **Market Types:** Two types: compliance and voluntary carbon markets.
- Compliance carbon markets are typically government-regulated emissions trading systems (ETS), where governments allocate carbon allowances to companies.
- Voluntary carbon markets, on the other hand, involve companies voluntarily purchasing carbon credits to offset their greenhouse gas emissions.

- **Current Development:** The global carbon market is rapidly expanding. In Asia, countries and regions such as China, South Korea, Japan, New Zealand, Australia, and Singapore have seen the emergence of carbon trading platforms in recent years.

Carbon Market

Global Level

- **Market Size:** In 2021, compliance carbon markets covered 17% of global greenhouse gas emissions, with the total value of allowance trading reaching



https://about.bnef.com/blog/ten-things-to-watch-in-global-carbon-markets-in-2024/

Carbon Market

National Level -- China

- **China's National Carbon Emissions Trading Market (ETS)**
- Officially launched on July 16, 2021, it is the world's largest carbon market in terms of covered greenhouse gas emissions.
- Currently, it includes over 2,000 key emission entities from the power generation sector, covering approximately 4.5 billion tonnes of carbon dioxide emissions.

Carbon Market

National Level -- China

- **China's Emission Trading Schem**
- The China national ETS regulates more than 2,000 companies from the power sector with annual emissions of more than 26,000 tCO2, including combined heat and power, as well as captive power plants in other sectors.
- particularly coal generation. It includes nearly all coal plants above 50 megawatts (MW), as well as some gas plants.
- The system’s coverage will expand to other sectors over time.

Carbon Market

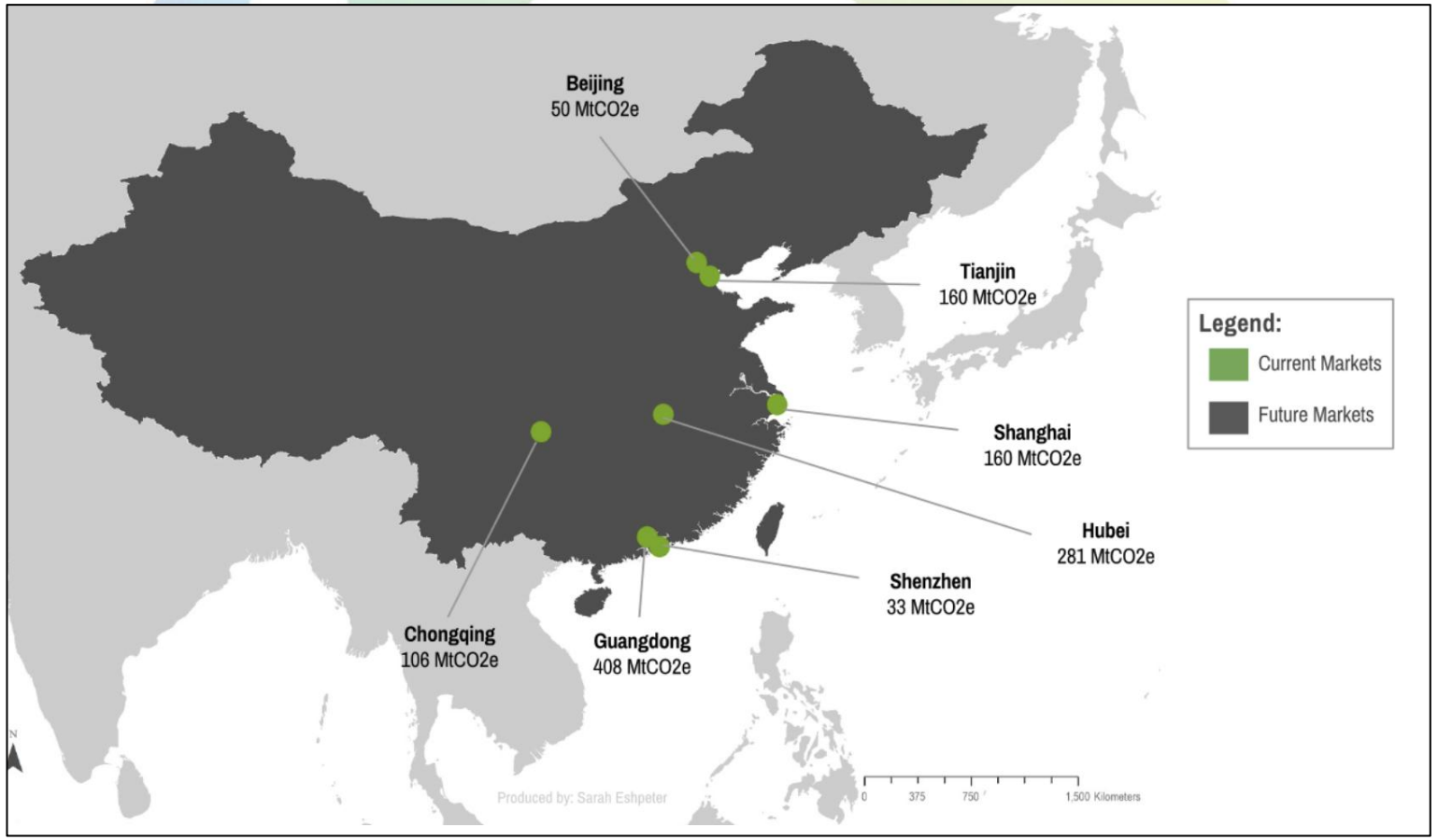
National Level -- China

- **Regional Pilot Carbon Markets**
- Since 2013, seven provinces and cities—Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong, and Shenzhen—have successively launched pilot carbon emissions trading programs.
- These pilot regions have accumulated extensive experience in carbon market mechanism design, trading rule formulation, and market regulation.
- China's national ETS began operating in 2021, with the objective of contributing to the effective control and gradual reduction of carbon emissions.

Carbon Market

National Level -- China

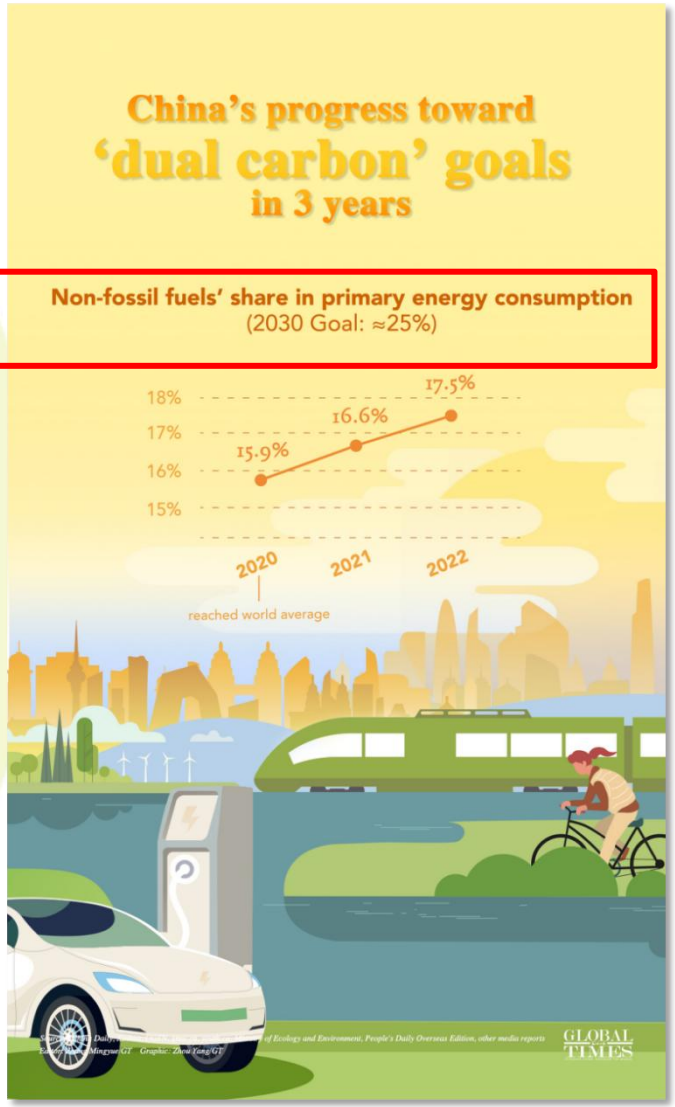
- **Regional Pilot Carbon Markets**



Carbon Market

National Level -- China

- **Market Development**
- With the advancement of China's "Dual Carbon" goals (peaking carbon emissions by 2030 and achieving carbon neutrality by 2060) the carbon market plays a crucial role in driving corporate emission reductions and promoting low-carbon economic development.

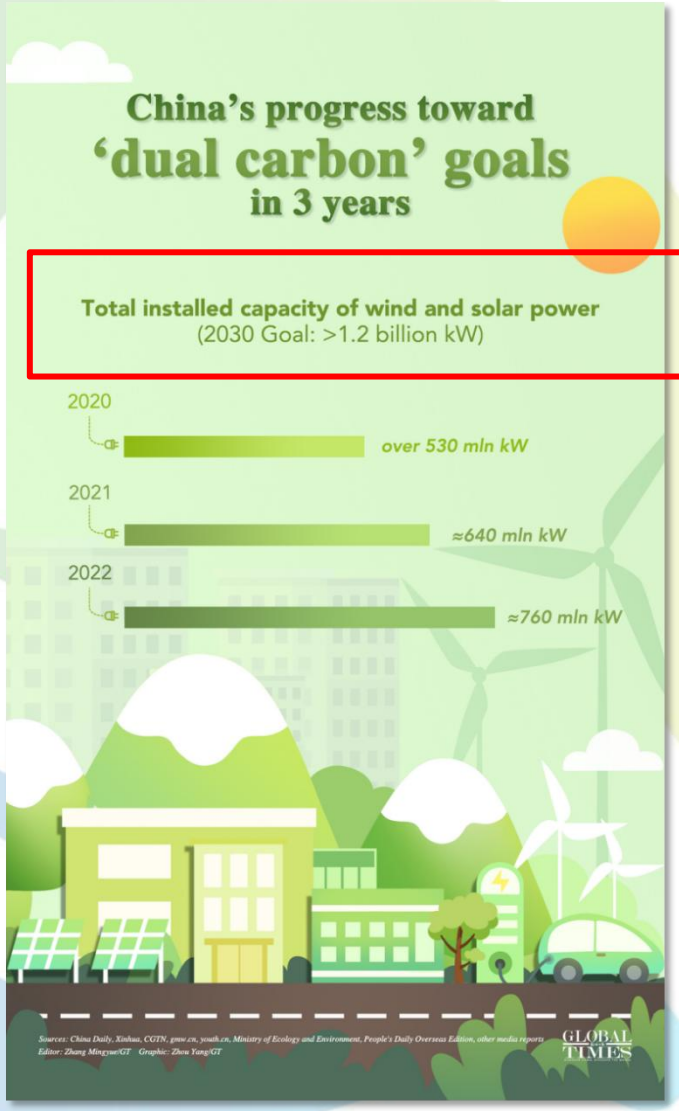


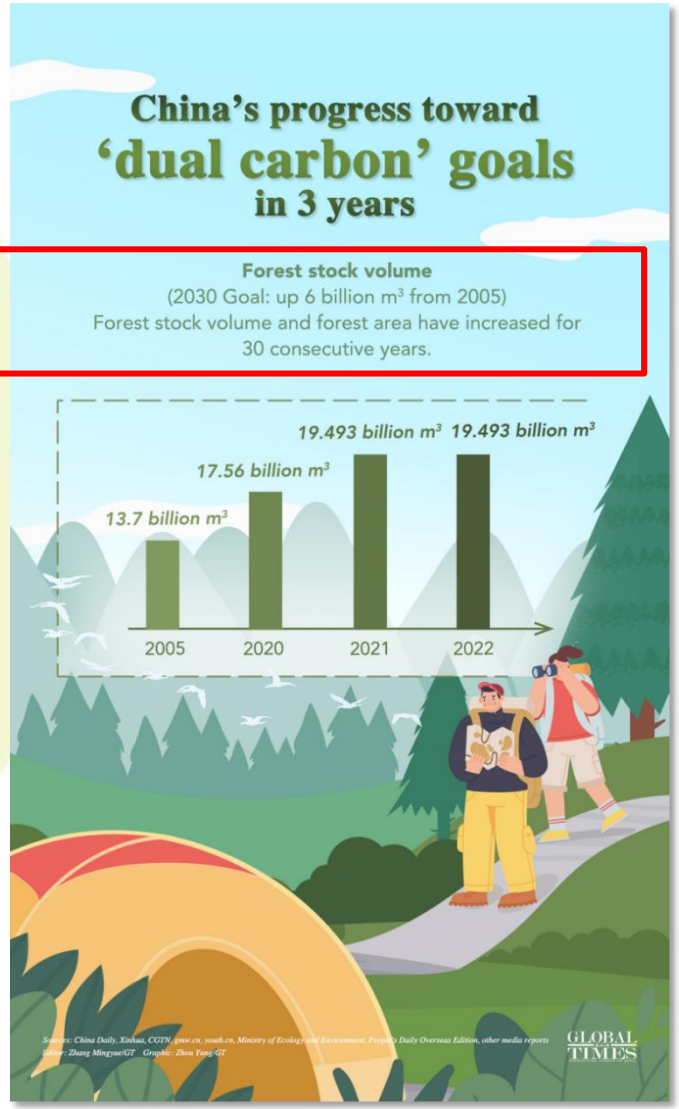
https://www.globaltimes.cn/page/202309/1298711.shtml

Carbon Market

National Level -- China

- **Market Development**
- In the future, China's carbon market is expected to further expand its coverage to include more industries.



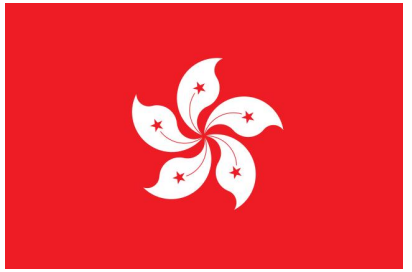


Carbon Market

Hong Kong SAR

- On 28 Oct, 2022, HKEX launches Core Climate Hong Kong's International carbon marketplace
  - supporting global transition to net zero
  - seeks to connect capital with climate-related products and opportunities in Hong Kong, Mainland China, Asia and beyond
  - Core Climate participants will be able to source, hold, trade, settle and retire voluntary carbon credits through the Core Climate platform
  - The ambition is to provide an easy-access, one-stop, integrated carbon marketplace that includes trading, custody and settlement functions for corporates, investors and project owners across the climate value chain, contributing to the realisation of global carbon neutrality goal

Carbon Market

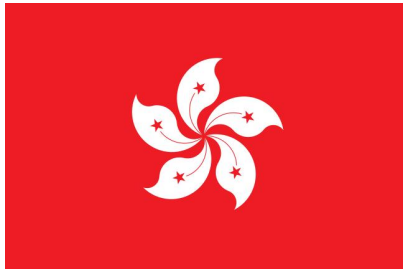


Hong Kong SAR

- Carbon credits on the platform will come from internationally-certified carbon projects from around the world, including carbon avoidance, reduction and removal projects.
- All projects listed on Core Climate are verified against international standards, such as the Verified Carbon Standard by Verra.

- The Hong Kong International Carbon Market Council (ICMC) - The Council actively gathers insights from members on the development of Hong Kong's international carbon market, understanding what kind of carbon market our stakeholders need and how they want to fund new climate projects, technologies and businesses.

Carbon Market



Hong Kong's Target: Post-Net Zero (2020-Present)

Offset Targets & Strategies:

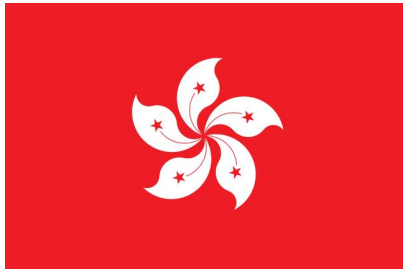
(1) Short-Term (2020–2030)

- Target: Offset 5–10% of residual emissions (e.g., aviation, shipping) via:
- Local projects: Expanded landfill gas capture (e.g., T·PARK sludge treatment).
- Regional cooperation: Purchasing offsets from Greater Bay Area renewable projects (wind/solar).

(2) Long-Term (2030–2050)

- Target: Offset 15–20% of hard-to-abate emissions (e.g., aviation, port operations) through:
- International carbon markets: Investing in UN-certified (CERs) or voluntary (VERs) credits.
- Direct Air Capture (DAC): Pilot projects with Shenzhen/Macao.

Members of The Hong Kong International Carbon Market Council (ICMC)

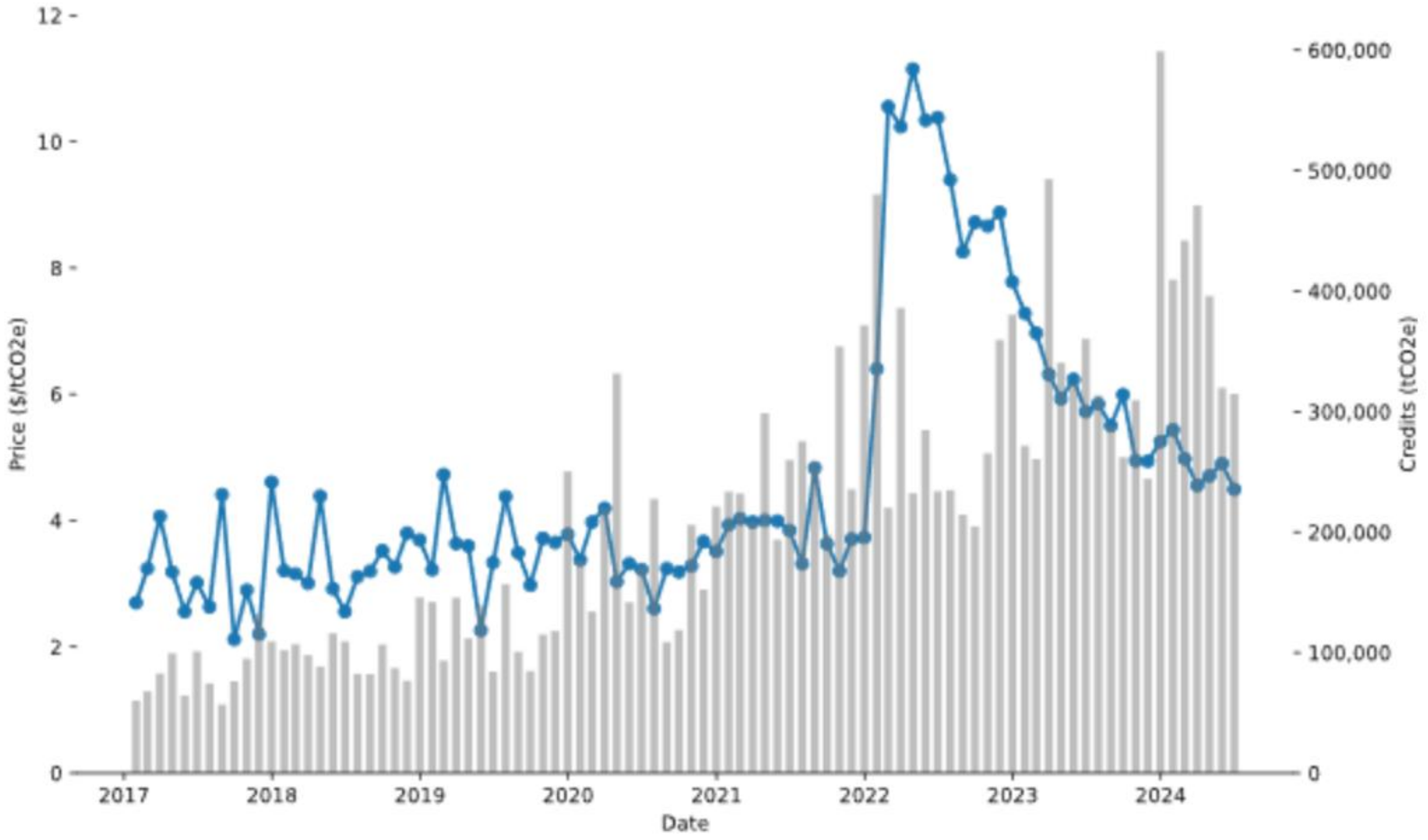


- Australia and New Zealand Banking Group Limited Hong Kong Branch
- Bank of China (Hong Kong) Limited
- BNP Paribas Hong Kong Branch
- Cathay Pacific Airways Limited
- China Energy Conservation and Environmental Protection Group
- China Forestry Group Corporation
- Industrial and Commercial Bank of China (Asia) Limited
- Standard Chartered Bank (Hong Kong) Limited
- State Power Investment Corporation Limited
- Tencent Holdings Limited
- The Hongkong and Shanghai Banking Corporation Limited
- The Hong Kong and China Gas Company Limited (Towngas)

https://www.hkex.com.hk/Join-Our-Market/Sustainable-Finance/Core-Climate/ICMC?sc_lang=en

Carbon Price Worldwide

The **average price** and **total retirement volumes** of caron credits



"At the beginning of **2022**, the price increases sharply, peaking at around **$11/tCO2e**. The rise in price could be attributed to the high demand for removal-based credits (World Bank, 2022). However, the price declining back to **$4/tCO2e** by the middle of **2024**. The initial decline of carbon price followed the Russia's invasion of Ukraine, which caused a spike of energy price and investors' liquidation of carbon products."

(WFE Research Team 2024)

Carbon Price Worldwide

Nominal prices in the **largest ETSs** since 2017

(World Bank 2024)

Carbon Price Trend China

The carbon price in China surpassed 100 RMB/$tCO2_e$ in 2024, approximately 13.8 USD/$tCO2_e$

(Bloomberg 2024)

5. Other tradable instruments associated with GHG emission reduction

Enegy Attributes Certificates (EAC)

EACs :

- EACs are the instrument used in renewable markets to account for renewable energy(RE) and its attributes, whether that RE is produced at the organization's facility or purchased from elsewhere.
- Purpose: reduce emissions
- Types of EACs are GECs, RECs, iREC
- Note: Per the SBTi Corporate Net-Zero Standard: Companies may use EACs as a measure to reduce scope 2 market-based emissions

Carbon Credit:

- An carbon credit is a specific activity, or set of activities, intended to reduce GHG emissions, increase carbon storage, or enhance GHG removals from the atmosphere.
- Can only be used for residual emissions (SBTi)
- Purpose: compensate for scope 3 emissions.
- Note: Clarification statement to the SBTi Board of Trustees Statement on use of [carbon credit], for abatement purpose limited to scope 3

Renewable Energy Certificate (REC)

Definition:

- Renewable Energy Certificates (RECs), also known as green tags or renewable energy credits, are market-based instruments designed to incentivize clean energy production.
- Introduced in the early 2000s as part of climate change mitigation efforts, RECs certify that one megawatt-hour (MWh) of electricity was generated from renewable sources and fed into the grid.

How to Work:

- RECs represent the environmental attributes of clean energy—such as its reduced carbon footprint—allowing the certificate holder to claim these benefits.
- When RECs are traded, what changes hands is not the electricity but the right to label a corresponding amount of power as "renewable."
- This system enables utilities or corporations to support green energy production indirectly, even if the power they consume comes from conventional sources.

Renewable Energy Certificate (REC)

- **Prices**

A) Sharp Price Decline in 2024

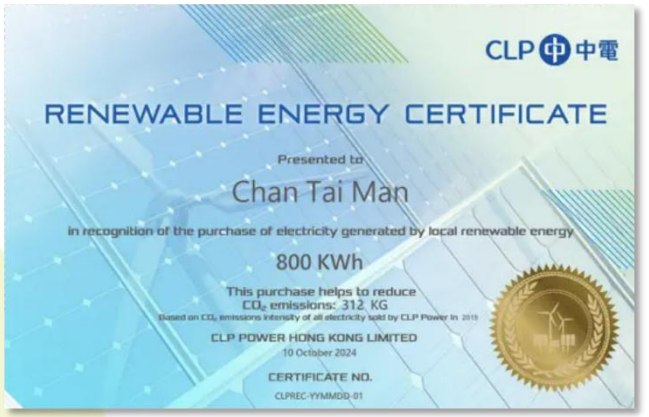
- By the end of 2024, the trading price of some RECs had dropped to ¥0.15–¥1.0 per certificate
- (1 certificate = 1 MWh) significantly lower than the ¥9–¥28 range in 2023².
- Anhui Tianchang City: REC procurement settled at ¥0.89/certificate.
- Hefei Thermal Power Group: Implemented a price cap of ¥1.0/certificate².

B) 2023 Price Trends

Data from the Beijing Power Exchange Center reveals:

- 2022: Average price of ¥28.10/certificate (1.45 million certificates traded).
- 2023: Average price of ¥19.22/certificate (23.64 million certificates traded).
- First Half of 2024: Average price of ¥9.6/certificate (57 million certificates traded)².

Renewable Energy Certificate (REC)



RECs in Hong Kong

Purpose:

- Encourages RE investment by creating a market for clean energy attributes.
- Helps corporations meet sustainability goals by enabling them to support RE indirectly.

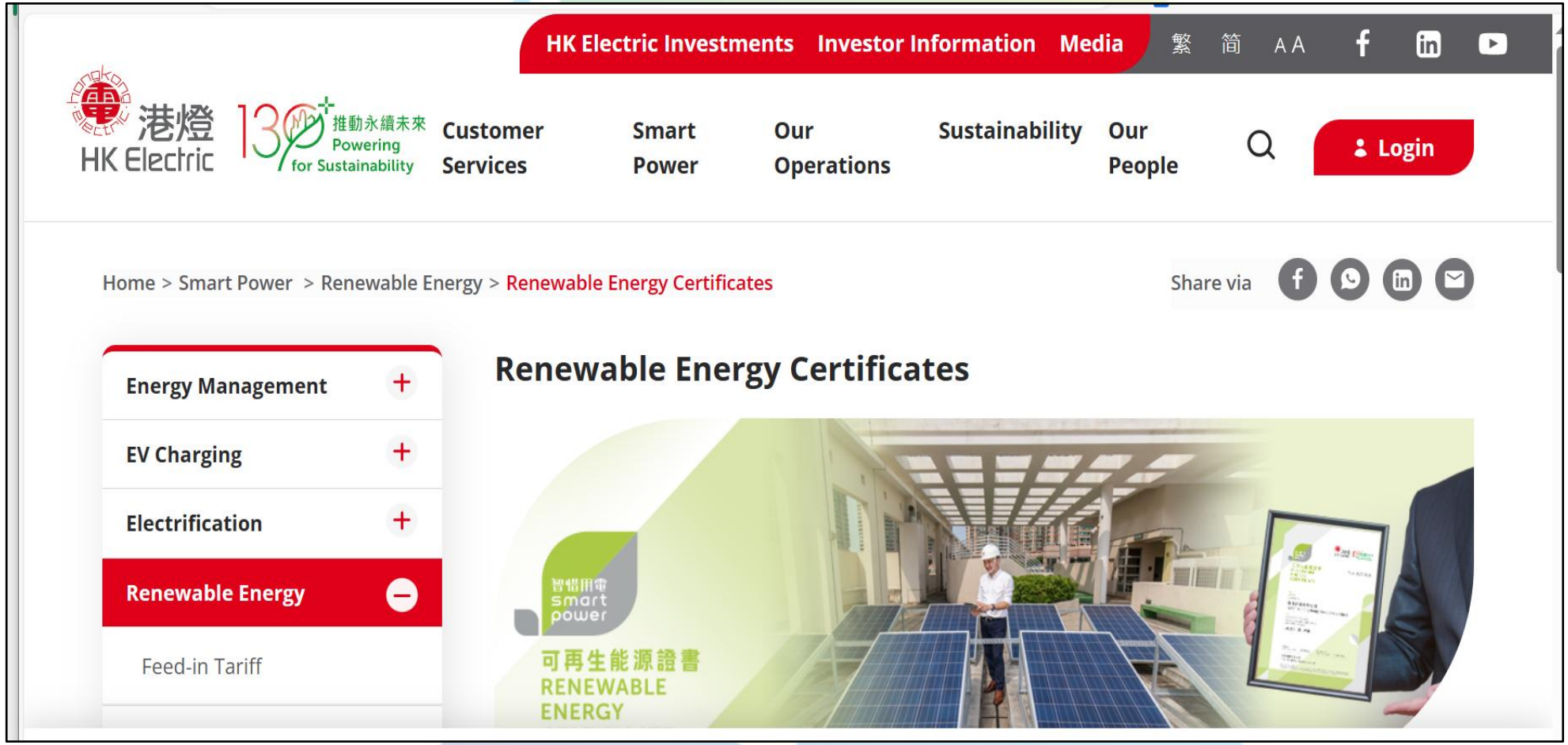
How to Work:

- Power companies generate electricity from RE sources (e.g., solar, wind).
- They issue RE Certificates corresponding to each unit of RE-produced electricity (e.g., per MWh).
- Buyers (businesses/organizations) purchase these certificates to claim carbon-free operations or offset their carbon footprint, even if their actual power supply comes from conventional sources.

Renewable Energy Certificate (REC)

Renewable Energy Certificate (REC)

Renewable Energy Certificate (REC)



International Renewable Energy Certificate (i-REC)

- **Major Types of Buyers**

Compliance Market RECs

- An I-REC is an electronic tracking certificate that represents the environmental attributes of electricity generated from renewable energy sources once transmitted into the grid.
- Cancellation of an I-REC upon redemption by an end-user removes the certificate from the market and associated accredited registry, as approved by the I-REC Standard Foundation.
- Each I-REC represents 1 MWh of electricity generated from renewable energy sources.

International Renewable Energy Certificate (i-REC)

https://vimeo.com/141543977 https://www.ecohz.com/i-recs

Green Electricity Certificate

Definition

- A Green Electricity Certificate (GEC), also known as a Renewable Energy Certificate (REC), is a tradable environmental commodity that certifies that a certain amount of electricity (typically 1 megawatt-hour, or 1 MWh) was generated from renewable sources (e.g., wind, solar, hydro, biomass).

- REC or GEC or iREC are all EAC (energy attributes certificate) just they have different names under different system

Green Electricity Certificate

- **China’s National Carbon Markets**
- China National Carbon Market: Officially launched on July 16, 2021, and operated by the Shanghai Environment and Energy Exchange (SEEE), it is the world's largest carbon market in terms of covered emissions.

https://www.ccn.ac.cn/cets

Green Electricity Certificate

- **China's Carbon Markets**

A) Key Sellers & Buyer:

- Power generation firms with surplus allowances (e.g., HuaDian Energy sold 298k tons at ~¥90/ton for ¥260 million) 15
- Other A-listed companies like GanNeng Co. (29k tons at ¥92.6/ton) and ShanYing International (planned 100k tons sale)
- Primarily power plants and industrial emitters with compliance shortfalls.

B) 2024 Annual Trading & Prices:

- Total volume: 189 million tons of carbon allowances (CEA)
- Total value: ¥18.114 billion (~$2.5 billion)
- Year-end 2024 closing price: ¥97.49/ton
- November 2024 peak: ¥106.02/ton

https://www.ccn.ac.cn/cets

Policy Change: China only Trades with Green Electricity Certificate

Regulatory Control

- Operator of the International Renewable Energy Certificate (I-REC) verification system for green electricity consumption, announced it will stop verifying new I-RECS for China at the end of 2024. This announcement was made following a new policy release from China's National Administration in September 2024

国家能源局 National Energy Administration

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目录项的基本信息

公开事项名称：国家能源局关于印发《可再生能源绿色电力证书核发和交易规则》的通知

索引号：000019705/2024-00202　　主办单位：国家能源局

制发日期：2024-08-26

国家能源局关于印发《可再生能源绿色电力证书核发和交易规则》的通知

国能发新能规〔2024〕67号

各省（自治区、直辖市）能源局，有关省（自治区、直辖市）及新疆生产建设兵团发展改革委，各派出机构，国家电网有限公司、中国南方电网有限责任公司、内蒙古电力（集团）有限责任公司，有关中央企业，水规总院、电规总院、各有关协会：

为贯彻落实党的二十大和二十届二中、三中全会精神，健全绿色低碳发展机制，按照《国家发展改革委 财政部 国家能源局关于做好可再生能源绿色电力证书全覆盖工作 促进可再生能源电力消费的通知》（发改能源〔2023〕1044号）有关要求，我们制定了《可再生能源绿色电力证书核发和交易规则》，现印发给你们，请遵照执行。

国家能源局

2024年8月26日

Relevance between Carbon Offset & Net Zero

Human Activities

Generate

GHG Emissions

Contribute to

Climate Change

Increase the need of

Net Zero

Increase the demand of

Carbon Offset

Offset

Some industries are hard to decarbonize, where carbon offset serves as an approach to algin with their sustainability transition strategies

Updates from World Bank

- There are now 75 carbon pricing instruments in operation worldwide
- Over half of the collected revenue was used to fund climate and nature-related programs
- According to the 2024 report, 24% of global emissions are now covered
- Report findings show large middle-income countries including Brazil, India, Chile, Colombia, and Türkiye are making strides in carbon pricing implementation.
- While traditional sectors like power and industry continue to dominate, carbon pricing is increasingly being considered in new sectors such as aviation, shipping and waste.

https://www.worldbank.org/en/news/press-release/2024/05/21/global-carbon-pricing-revenues-top-a-record-100-billion

Conclusion

Carbon offset mechanisms play an indispensable role in achieving global net-zero emission targets. Their primary functions are manifested in three key aspects

- 1. Effectively neutralize residual emissions that are difficult to eliminate in the short term by funding renewable energy, forest conservation, and carbon removal projects.
- 2. Provide critical financial support for climate-beneficial projects in developing countries while delivering sustainable development co-benefits such as biodiversity protection and local livelihood improvements.
- 3. Offer businesses a compliant and cost-effective emission reduction pathway, enabling them to fulfill climate responsibilities without compromising business growth.

Conclusion

4. Carbon offset and carbon markets are valuable tools in the fight against climate change.

- Promote emission reductions
- Encourage sustainable practices
- Provide a mechanism for accountability and transparency

5. However, it is crucial to continuously improve and refine these mechanisms to address limitations and ensure their effectiveness in achieving long-term climate goals.

Thank you for your time today!