



THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學

How the TIC Industry Helps Organizations to Achieve and Demonstrate Carbon Neutrality

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Opening Minds • Shaping the Future
啟迪思維 • 成就未來

Immaterial

- The spin-out has secured £ 15M funding including Series A

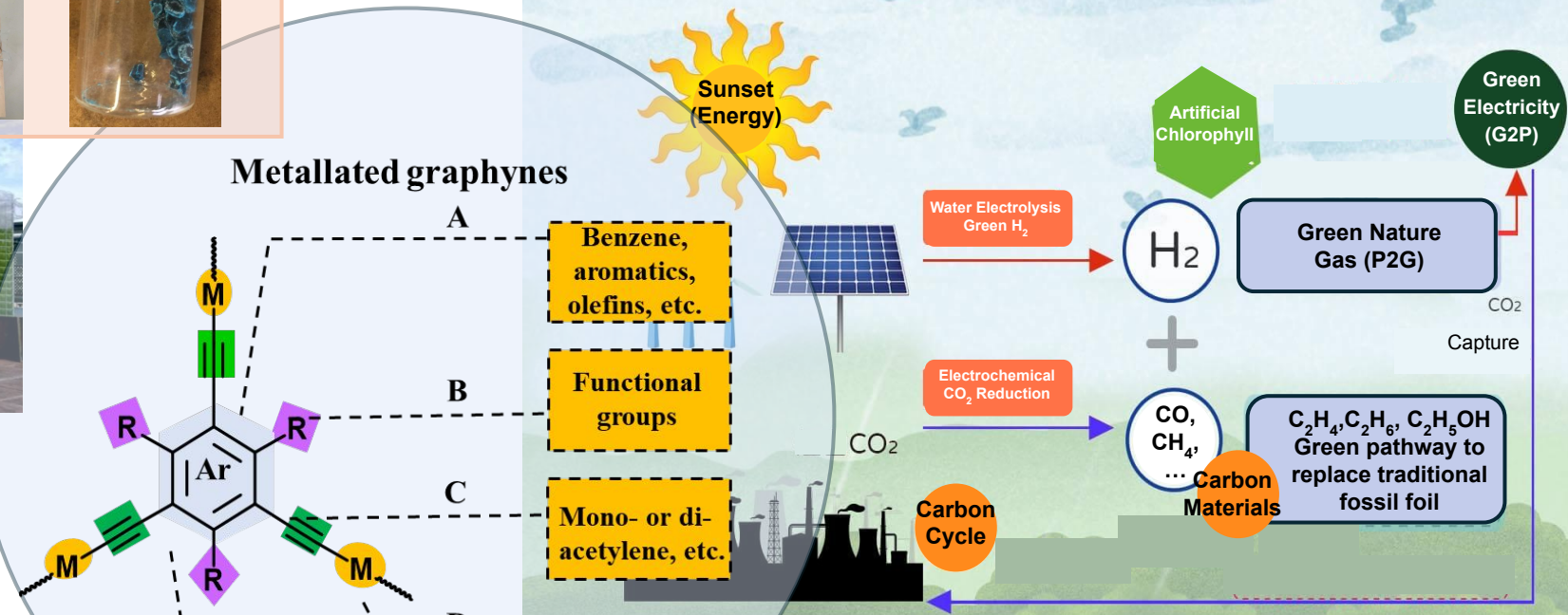


Our Targets:

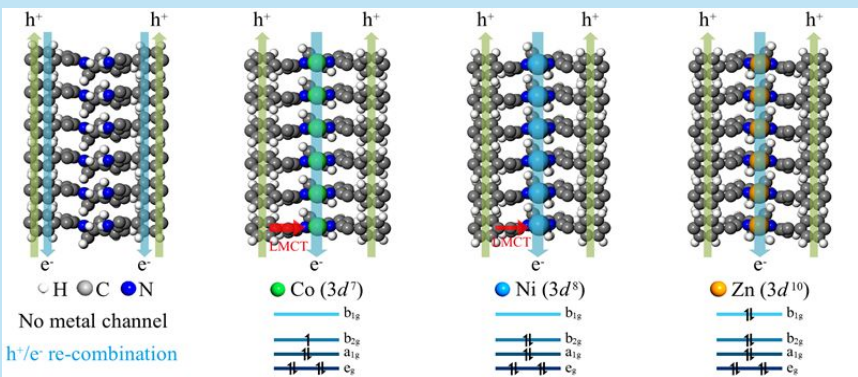
- Developing water electrolysis techniques for efficient green H₂ production
- Developing electrochemical CO₂ reduction techniques for efficient CO₂ conversion



For cultivation of microalgae with novel promoter in laboratory

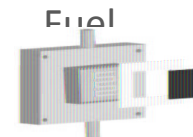


Molecular channel for charge migration

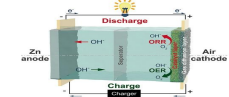


Waste LIBs

Recycling
Cathode Recycling
Catalyst Processing
Electrode Preparation



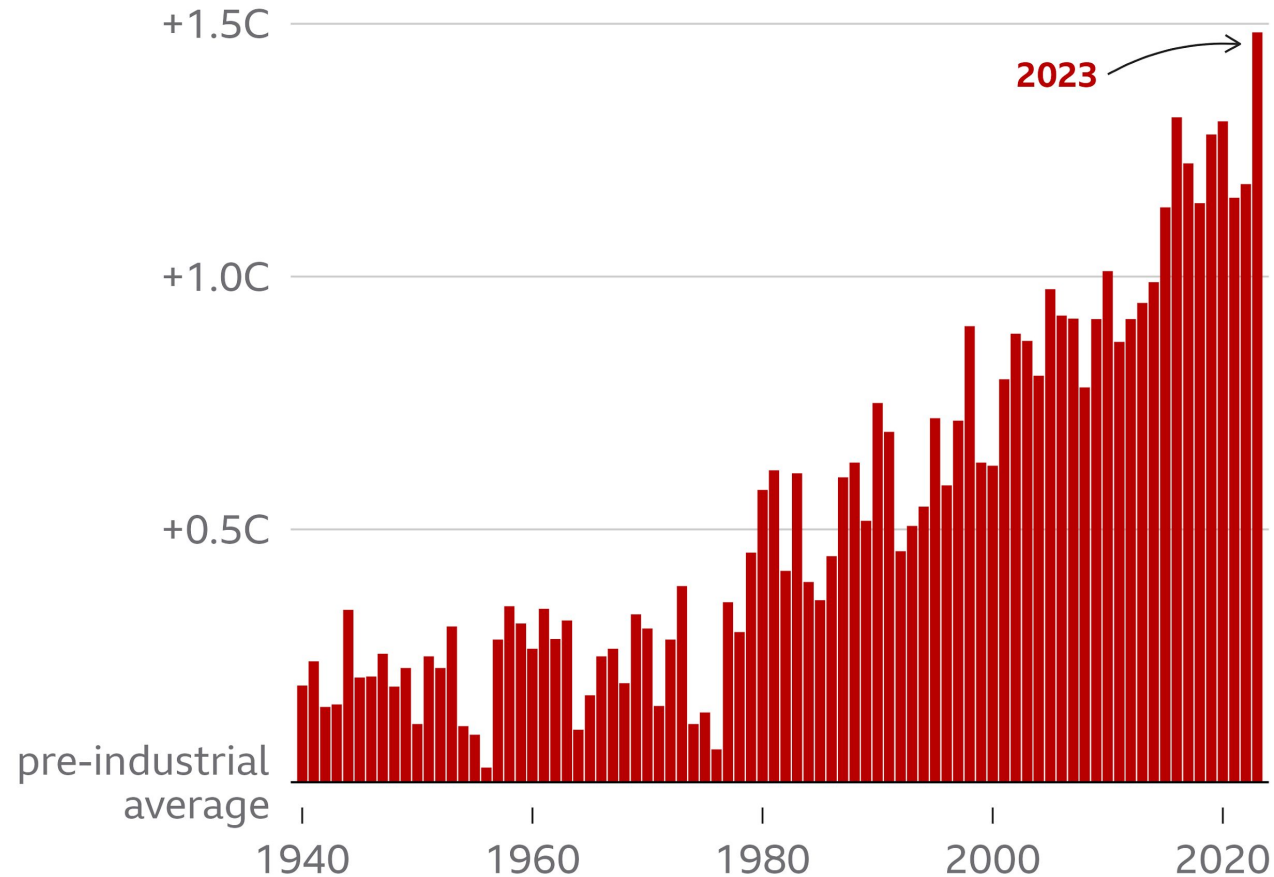
Zinc-Air battery



Climate Change is happening

Hottest year on record

Global average temperature by year, compared with pre-industrial average (1850-1900)



- Climate change is the long-term shift in the Earth's average temperatures and weather conditions
- Over the last decade, the world was on average around 1.2 °C warmer than during the late 19th Century
- That followed 2023 being declared the warmest year on record
- It has now been confirmed that **global warming exceeded 1.5 °C across the 12 month period between February 2023 and January 2024.**

The rise of global temperature has had a huge effect on the environment



A collage of typical climate and weather-related events: floods, heatwaves, drought, hurricanes, wildfires and loss of glacial ice. (Image credit: NOAA)

- More frequent and intense **extreme weather**, such as heatwaves and heavy rainfall
- Rapid melting of glaciers and ice sheets, contributing to **sea-level rise**
- Huge declines in Arctic sea-ice
- Ocean warming

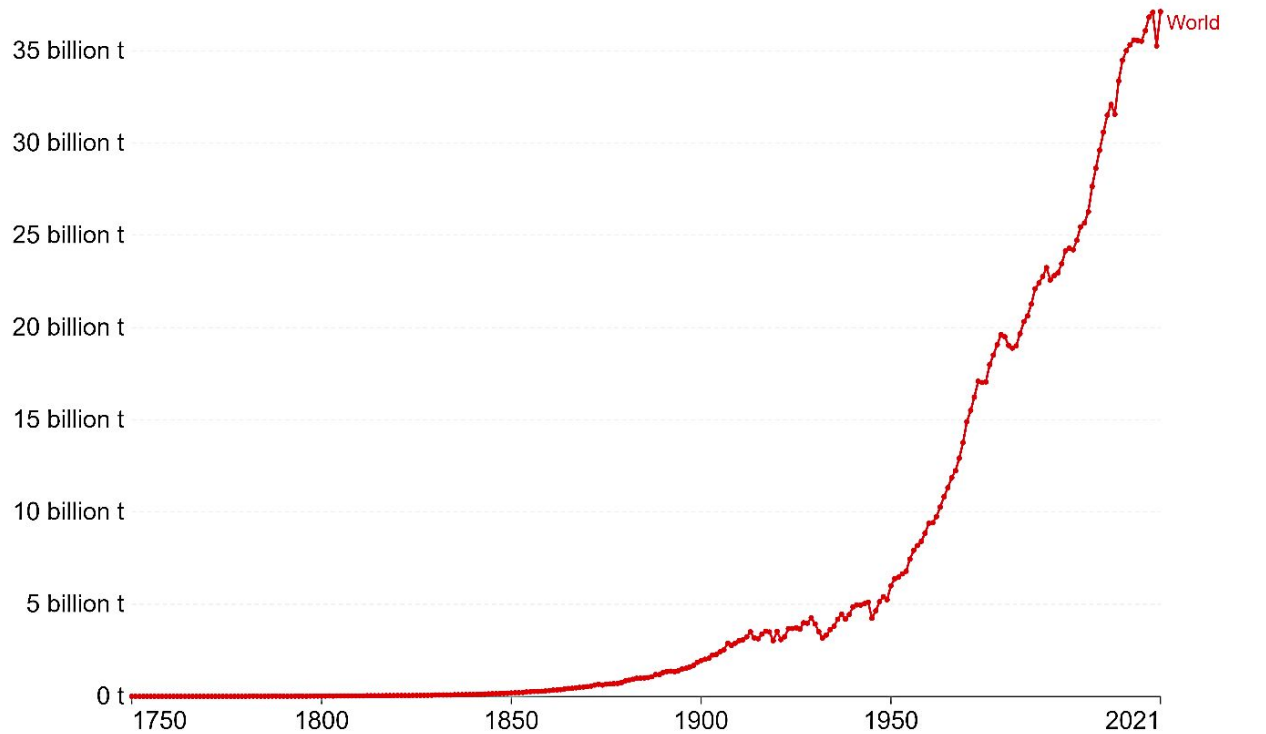
People's lives are suffering:

- For example, parts of East Africa suffered their **worst drought in 40 years**, putting more than 20 million people at risk of severe hunger.
- In 2022, intense European heatwaves led to an abnormal increase in deaths.

The rise of the global surface temperature coincides with the rising CO₂ emission after industrialization

Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land use change is not included.



Source: Global Carbon Budget (2022)

OurWorldInData.org/co2-and-greenhouse-gas-emissions • CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

- Widespread use of fossil fuels: coal, oil, and gas- in homes, factories and transport
- When fossil fuels burn, they release greenhouse gases - mostly carbon dioxide (CO₂).
- CO₂ traps extra energy in the atmosphere near the Earth's surface, causing the planet to heat up
- Since the start of the Industrial Revolution, the amount of CO₂ in the atmosphere has risen by about 50%

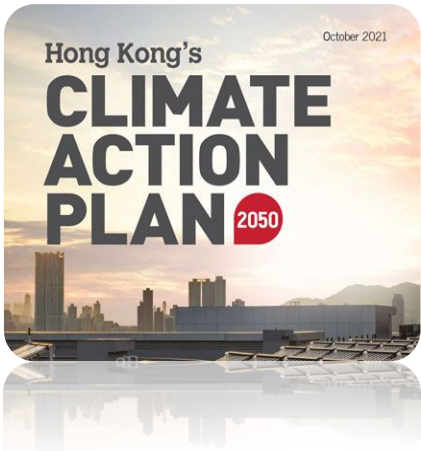
There are other gases that are stronger Greenhouse effect agents than CO₂

GHG	Global Warming Potential (GWP)
CO ₂	1
CH ₄	21
N ₂ O	310
HFCs	140 – 11,700
PFCs	6,500 – 9,200
SF ₆	23,900

Greenhouse Gases (GHG)

"Net Zero" CO₂ Emission

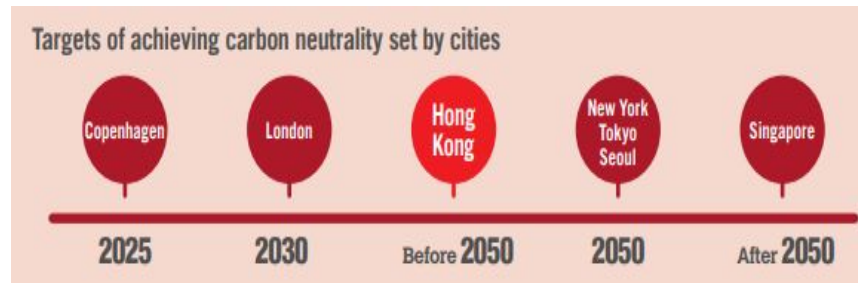
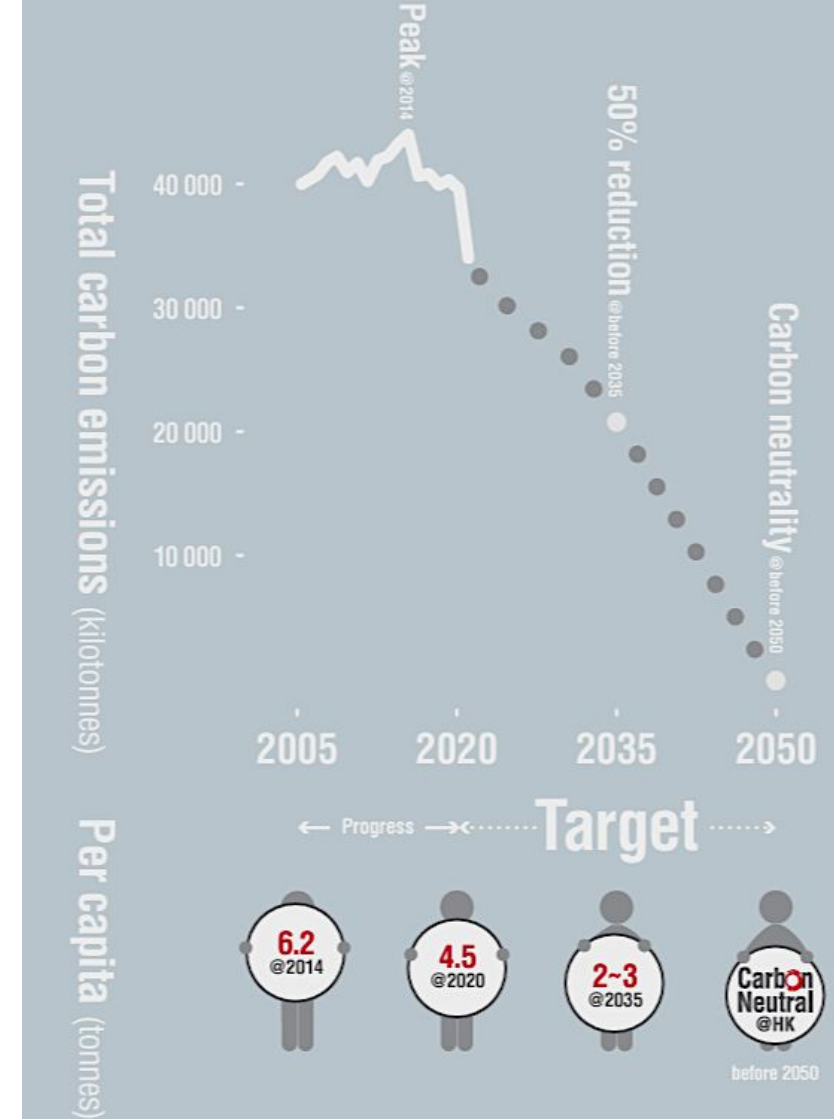
- In a landmark agreement signed in **Paris in 2015**, almost 200 countries pledged to try to keep global warming to 1.5 °C
- To achieve this, "net zero" CO₂ emissions should be reached by 2050
 - Net zero means reducing greenhouse gas emissions as much as possible, and removing any remaining emissions from the atmosphere
 - Most countries have, or are considering, net zero targets
- At a September 2020 UN General Assembly, China's President Xi announced that **China is committed to achieving peak CO₂ emissions before 2030 and carbon neutrality before 2060**
- The most recent UN climate change summit, COP28, was held in the United Arab Emirates.
- For the first time, countries agreed to "contribute" to **"transitioning away from fossil fuels"**, although they are not forced to take action.



Hong Kong's Climate Action Plan

Achieve carbon neutrality by 2050

- In 2021, the Chief Executive announced the pledge to achieve carbon neutrality before 2050
- Hong Kong's carbon emissions **already peaked in 2014** through a series of measures, notably the significant reduction in coal for electricity generation
- In the next 15 to 20 years, the Government will be investing HK\$240 billion to support a series of actions to combat climate change. Major actions will include
 - i. Net-zero Electricity Generation and Energy Saving and Green Buildings
 - ii. Green Transportation
 - iii. Waste Reduction



To achieve Carbon Neutrality:

CO_2 emitted = CO_2 Removed

- To accomplish the net-zero target, governments and business corporations need to formulate and implement effective CO_2 mitigation plans
- These involve making many important decisions and commit enormous resources
- The net-zero pathway set by the corporations needs to be in line with the regulatory targets and requirements
- To demonstrate that a corporation, a product, a process, a service, a company, is carbon neutral, the amount of carbon emitted by it and the amount of carbon removed (or off set) have to be **correctly quantified**.
- The key is the **accuracy** of the quantity values
- The Testing, Inspection and Certification (TIC) industry is to provide **accurate** carbon emission and removal data or assure the accuracy of the data

Accurate climate-related information is crucial for informed decision-making for addressing climate challenges

There are several **important evaluation criteria** that help ensure accurate reporting and transparency.

1. Compliance with Standards:

- Climate-related information should adhere to established standards, guidelines, and protocols. Common guidelines or standards include ISO, Task Force on Climate-related Financial Disclosures (TCFD), International Sustainability Standards Board (ISSB), Global Reporting Initiative (GRI), etc
- These standards ensure consistency, reliability, and comparability across different sources.

2. Accuracy:

- Information must be precise and free from errors or exaggerations.
- Rigorous fact-checking and reliance on credible data sources contribute to accuracy.

3. Verifiability:

- Claims and data presented should be verifiable by independent experts or through publicly available evidence.
- Transparent methodologies and data sources enhance verifiability.

4. Credibility:

- Climate-related information should come from reputable and trustworthy sources.
- Expertise, track record, and peer-reviewed research contribute to credibility.

5. Reliability:

- Reliable information is consistent over time and across different contexts.
- Robust data collection methods and rigorous analysis enhance reliability.

6. Comparability:

- Information should be comparable across regions, time periods, and sectors.
- Common metrics and consistent reporting facilitate meaningful comparisons.

7. Transparency:

- Transparency involves disclosing data sources, assumptions, and limitations.
- Transparent reporting builds trust and allows others to assess the quality of information.

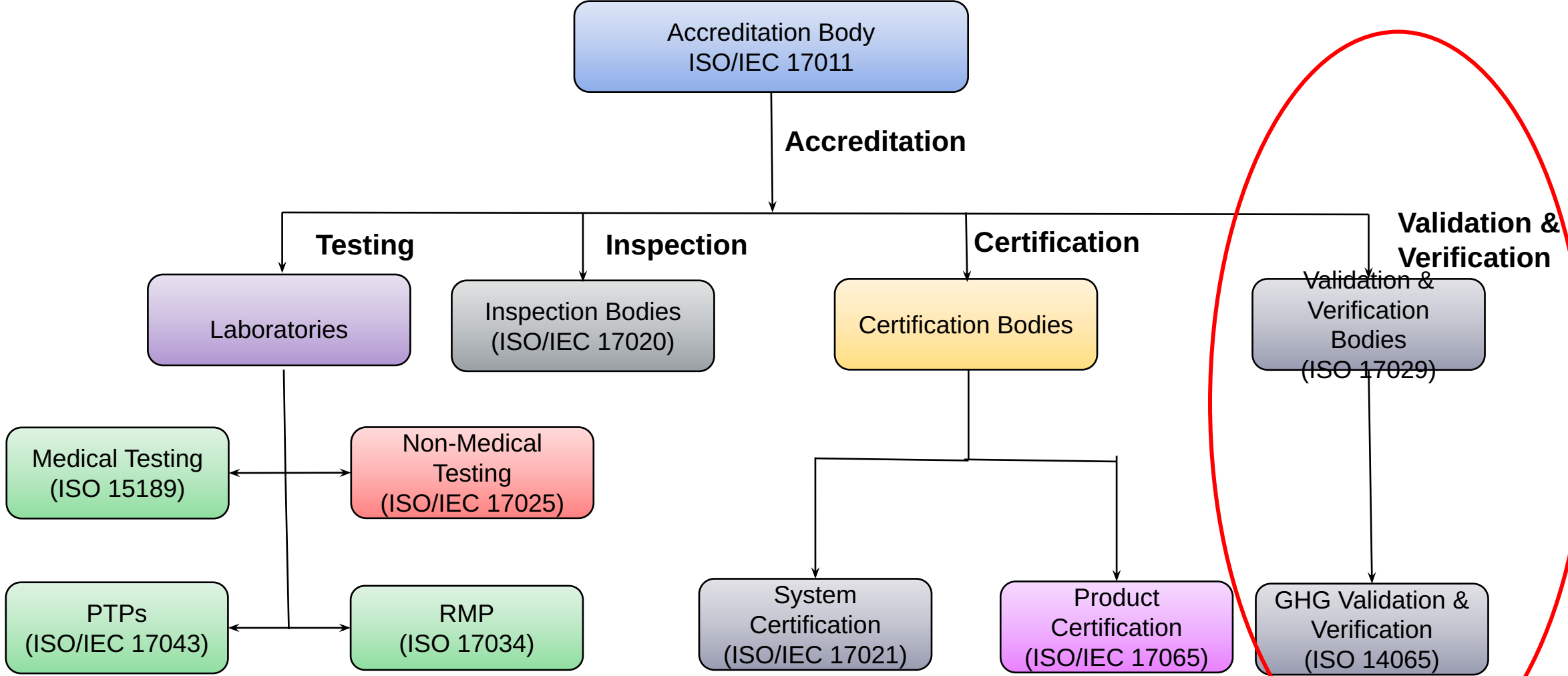
TIC play a pivotal role in verifying that the information is conforming to each of these criteria

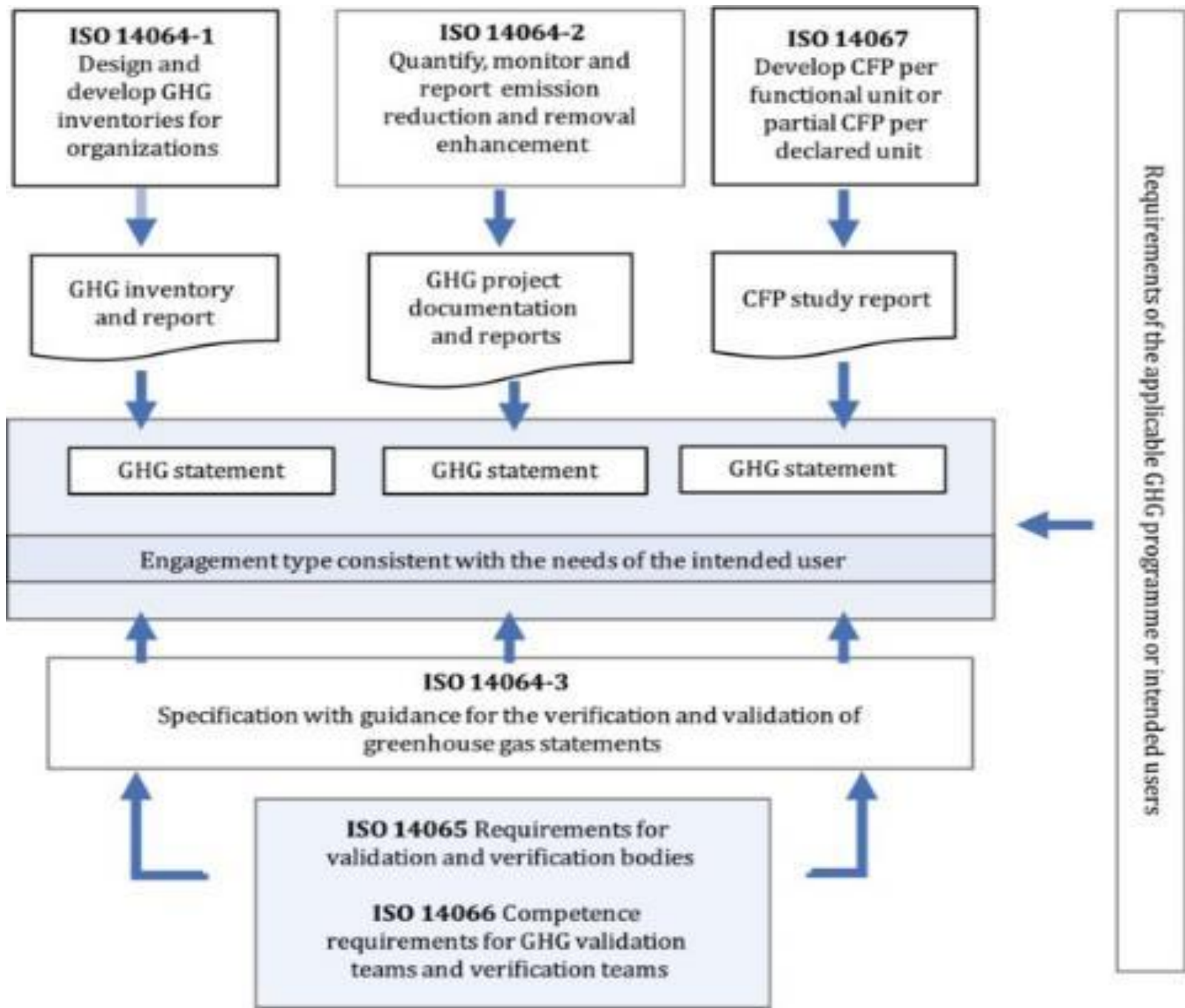
- They are **impartial**, objectivity and free from bias
- They are **competent** and their operation conforms to relevant international standards
- Their **competence** and **conformance** to relevant international standards are **confirmed** by accreditation bodies (*independent, third-party evaluation of a conformity assessment body against recognized standards*)
- **Accreditation bodies** are **recognized** by international accreditation cooperations
- **Hong Kong Accreditation Service** (HKAS) is recognized under the multilateral recognition of the international accreditation cooperation International Accreditation Forum (IAF)

TIC provides stakeholders with internationally recognized climate related financial disclosure, sustainability reporting and ESG Rating

TIC Industry

The key players relating to GHG are the system certification bodies and the validation and verification bodies





ISO14060 Standards to prepare GHG statements

Applications of the ISO 14060 family include:

- Corporate decisions**, such as identifying emission reduction opportunities and increasing profitability by reducing energy consumption;
- Risks and opportunities** management such as climate-related risks and opportunities for business
- GHG market**, such as buying and selling of GHG allowance or credits

Carbon Footprint of Product (CFP) and a product Life Cycle Assessment (LCA) serve as essential tools for understanding the **environmental impact** of products and services

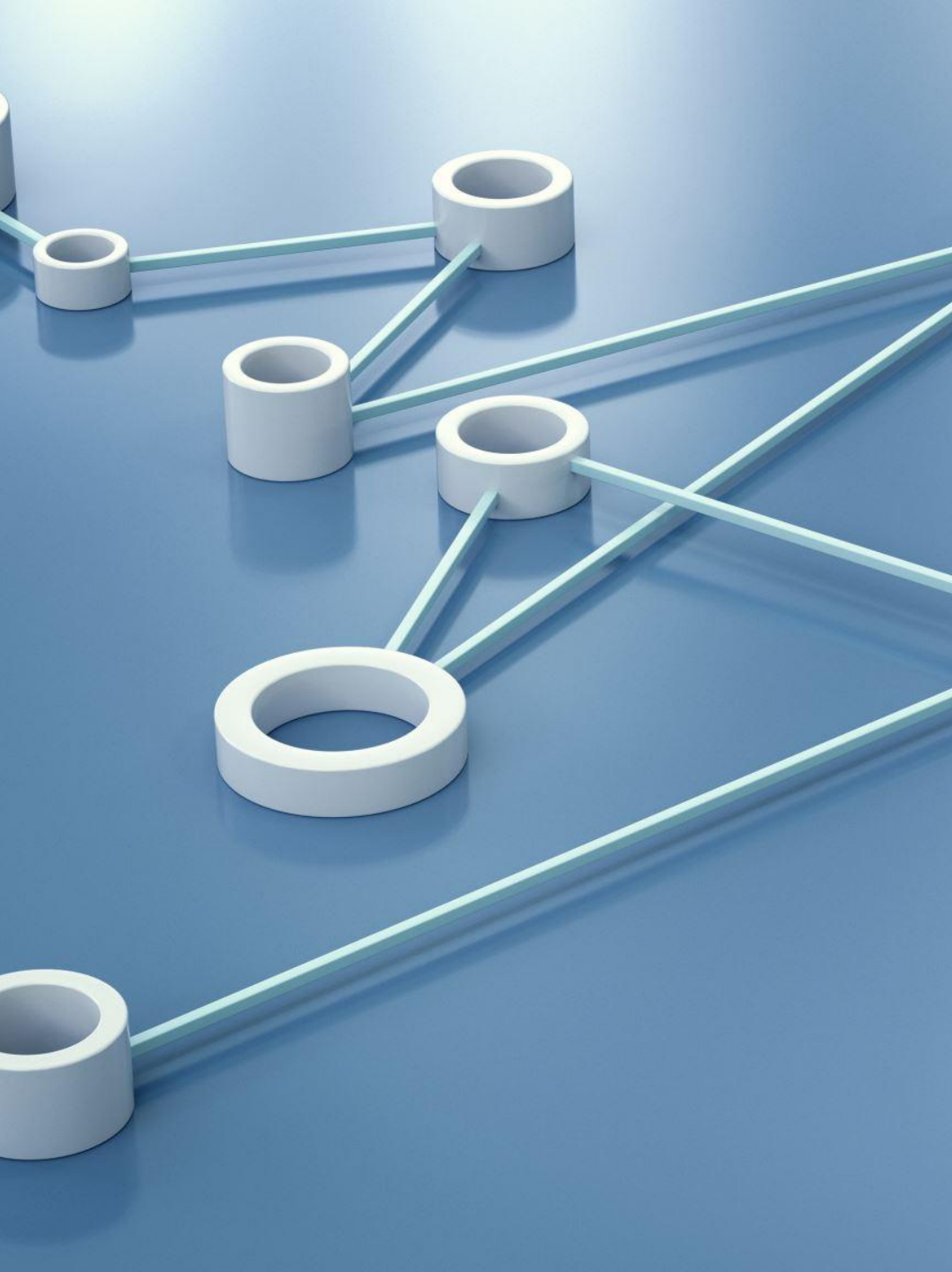
- A **Carbon Footprint of Product (CFP)** is a specific type of LCA that focuses on a single impact category: **global warming potential**.
 - It measures the potential release of greenhouse gas (GHG) emissions over a product's entire life cycle.
 - The CFP adheres to internationally recognized standards and norms, such as ISO 14040/14044 and ISO 14025.
- A **Life Cycle Assessment (LCA)** systematically records and analyzes the environment impact of a product or service throughout the entire life cycle.
 - It considers all relevant phases, including raw material extraction, transport, manufacturing, and disposal.

Carbon trading, also referred to as carbon emissions trading, is a market-based system aimed at reducing CO₂ emissions that contribute to global warming. ***The trade allows for the sale of carbon credits to offset emissions.***

- Carbon trade involves the buying and selling of credits that permit companies or other entities to emit a certain amount of carbon dioxide (CO₂) or other greenhouse gases.
- **Voluntary Carbon Markets (VCM)** are mechanisms that allow individuals, companies, and governments to voluntarily take action on climate change by purchasing carbon credits. VCM enable the generation, buying, and selling of carbon credits on a voluntary basis.
- Participants in these markets can offset their own greenhouse gas emissions by investing in projects that reduce or remove emissions.
- Each carbon credit represents one tonne of CO₂ reduced or removed, **independently verified against robust accounting methodologies**. Projects that generate carbon credits undergo rigorous verification to ensure their impact on emissions reduction.

Major Voluntary Carbon Credits Standards refer to the *guidelines and frameworks that govern the issuance and trading of carbon credits in voluntary markets*

1. The **VERRA Verified Carbon Standards (VCS) Program** is the world's most widely used greenhouse gas crediting programme.
 - It drives finance toward activities that reduce and remove emissions, improve livelihoods, and protect nature.
 - *VCS projects have reduced or removed over one billion tons of carbon and other greenhouse gas emissions from the atmosphere*
2. **The Gold Standard** is another prominent voluntary registry. *It focuses on projects that not only reduce emissions but also contribute to sustainable development goals*, such as poverty alleviation and clean energy access. Gold Standard projects often provide additional benefits beyond carbon reduction, such as health services and education in project communities.
3. **China GHG Voluntary Emission Reduction Program (CCER)** is a significant initiative that allows participants to earn tradable carbon credits by implementing projects aimed at controlling and reducing greenhouse gas (GHG) emissions from human activities.



With TIC providing reliable and accurate GHG data, an organization can

- *demonstrate Carbon Neutrality*
- *design methodologies to reduce and/or off set carbon emissions to achieve Carbon Neutrality*

Master of Science in
**SUSTAINABLE TECHNOLOGY FOR
CARBON NEUTRALITY**
(12060-MFT-MPT)

APPLY NOW - 2024/25 INTAKE

Early Round Application Deadline: 16 Nov 2023
Main Round Application Deadline: 30 Apr 2024



*Empowering Tomorrow's Sustainability:
Mastering Carbon Neutrality with Sustainable Technologies*

Our MSc programme aims at providing a systematic and hands-on training for students to tackle global vibrant and challenging issues related to **carbon auditing, green financing, carbon management and sustainable/renewable energy**

1. To equip students with up-to-date **scientific and technological knowledge** in addressing current and emerging environmental issues and concerns.
2. To develop student's ability in **formulating and implementing latest scientific and management concepts and tools** for addressing corporate's needs for achieving zero-emission goal.
3. To provide rigorous and cross-disciplinary training for cultivating students' ability to create **innovative and multi-faceted solutions** to carbon neutrality, energy transition and low-carbon energy conversion systems.

Programme Highlights

• Recognition

- Graduates would receive **3 professional certificates for GHG management**
 - **SGS Certificate** of ISO 14064 Quantitation and Reporting of Greenhouse Gas Emissions and Removals at Organization Level implementation Training Course
 - **SGS Certificate** of ISO 14057 Quantitation and Reporting of Carbon Footprint of Products (Goods & Services) Training Course
 - **SGS Certificate** of Principles of and Methodologies for Carbon Neutrality
- Graduates will meet the "academic and working experience" and "training" requirements for registration as **Registered GHG Carbon auditors of the Hong Kong Institution of Certified Auditors (HKICA)** with the examination requirement waived





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Thank you for
your attention



Why does 1.5 °C matter...?

The consequences of **2 °C global warming** versus 1.5 °C could include:

- **Extreme hot days** would be on average 4 °C warmer at mid-latitudes, versus 3 °C at 1.5 °C
 - **Sea-level rise** would be 0.1 m higher than at 1.5 °C, exposing up to 10 million more people to events including more frequent flooding
 - More than 99% of **coral reefs** would be lost, compared with 70-90% at 1.5 °C
 - Twice the number of **plants and vertebrates** (animals with a backbone) would be exposed to unsuitable climate conditions across more than half the geographical area where they are found
 - Several hundred million more **people** may be exposed to climate-related risks and susceptible to poverty by 2050 than at 1.5 °C.
- The call to limit temperature rise to 1.5 °C was partly designed to avoid crossing so called "**tipping points**"

ISO 14064-1:

- details principles and requirements for the design, development, management and reporting **organisation-level** GHG inventories.
- requirements for (i) determining GHG emission and removal boundaries, (ii) quantifying GHG emission and removal boundaries, and (iii) identifying specific actions or activities for improving GHG management.
- Requirements and guidance on inventory quality management, reporting, internal auditing and the organization's responsibilities in verification activities.

ISO 14064-2:

- details principles and requirements for determining baselines, and monitoring, quantifying and reporting of **project emissions**.
- Focuses on GHG projects or project-related activities specifically designed to reduce GHG emissions or enhance GHG removals.
- Provides the basis for GHG projects to be verified and validated

ISO 14064-3:

- Details requirements for verifying GHG statements related to **GHG inventories, GHG projects and carbon footprints of products (CFP)**.
- Describe the process for verification or validation, including verification or validation planning, assessment procedures, and the evaluation of organizational, project and product GHG statements.

ISO 14067: 2018

GHG – **Carbon footprint of products (CFP)** – requirements and guidelines for quantification

ISO14065:2020

General principles and requirements for **bodies validating and verifying environmental information**

ISO14066:2011

GHG – Competence requirements for **GHG validation teams and verification team**

The Emissions Trading System (ETS) is a **market-based approach** to controlling pollution by providing **economic incentives** for reducing the emissions of pollutants.

- **EU Emissions Trading System (EU ETS)** is a cornerstone of the EU's policy to combat climate change. It is the **world's first major carbon market** and remains the largest one.
 - The EU ETS operates on a **cap and trade** principle:
 - A **limit (cap)** is placed on the right to emit specified pollutants over a geographic area.
 - Companies can **trade emission rights** within that area.
 - It covers approximately **45% of the EU's greenhouse gas emissions**.
 - The EU ETS aims to reduce emissions cost-effectively and complement the EU's climate goals.
- In 2023, a new **Emissions Trading System 2 (ETS2)**, which covers building, road transport and additional sectors, was created.
- ETS plays a crucial role in incentivizing emission reductions and promoting responsible environmental practices

The CCER program was **launched in 2012** as part of China's efforts to achieve carbon neutrality and promote global climate governance

In **March 2020**, the CCER program received a significant boost when it was approved as a supply mechanism of **Eligible Emissions Units (EEUs)** in the pilot phase (2021-2023) of the **Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)**.

CORSIA, established by the **International Civil Aviation Organization (ICAO)**, aims for zero growth in international aviation carbon emissions from 2020 onward through market-based measures (such as purchasing EEUs).

- **Carbon credits are certificates representing quantities of greenhouse gases that have been kept out of the air or removed from it. While these standards play a crucial role in ensuring the quality and integrity of carbon projects, they also contribute to sustainable development and environmental protection.**
- **The TIC industry can play a role in calculating and verifying these carbon credits.**

Energy Management and Environmental Management Systems

Certification bodies can provide certification service to demonstrate organizations' compliance with

- **ISO 50001** *Energy Management System*
- **ISO 14001** *Environmental Management System*

Compliance with these ISO Standards demonstrates organizations' commitment to achieve carbon neutrality

Validation and Verification of GHG Statements

- A **Greenhouse Gas (GHG) statement** is a formal document that provides information about an organization's greenhouse gas emissions. It is subject to validation and verification by a **Validation and Verification Body (VVB)**.
- Verification provides **reasonable or limited assurance** to intended users that reported information is **accurate**. It confirms the accuracy of GHG emissions data by examining the organization's processes, calculations, and reporting against established criteria.

Note: Verification is for historical data.

- Validation provides **limited assurance** to intended users that a **reasonable basis** exists for the projected or forecasted information. It ensures that the data and assumptions used in GHG statements are **credible**, consistent, and aligned with established standards.

Note: Validation is for future activities.