CO2 Certificates as Additional Revenue Streams for Green Hydrogen

Indo-German Energy Forum

Philipp Veh, Consultant Perspectives Climate Group
veh@perspectives.cc

15th February 2023

perspectives climate group

Guiding Question & Agenda

How can carbon markets help to make low-carbon hydrogen projects economically more attractive?

- Today's challenges of green hydrogen (and its potential solutions)
- Carbon Markets 101
- Carbon Markets for green hydrogen projects
- Discussion

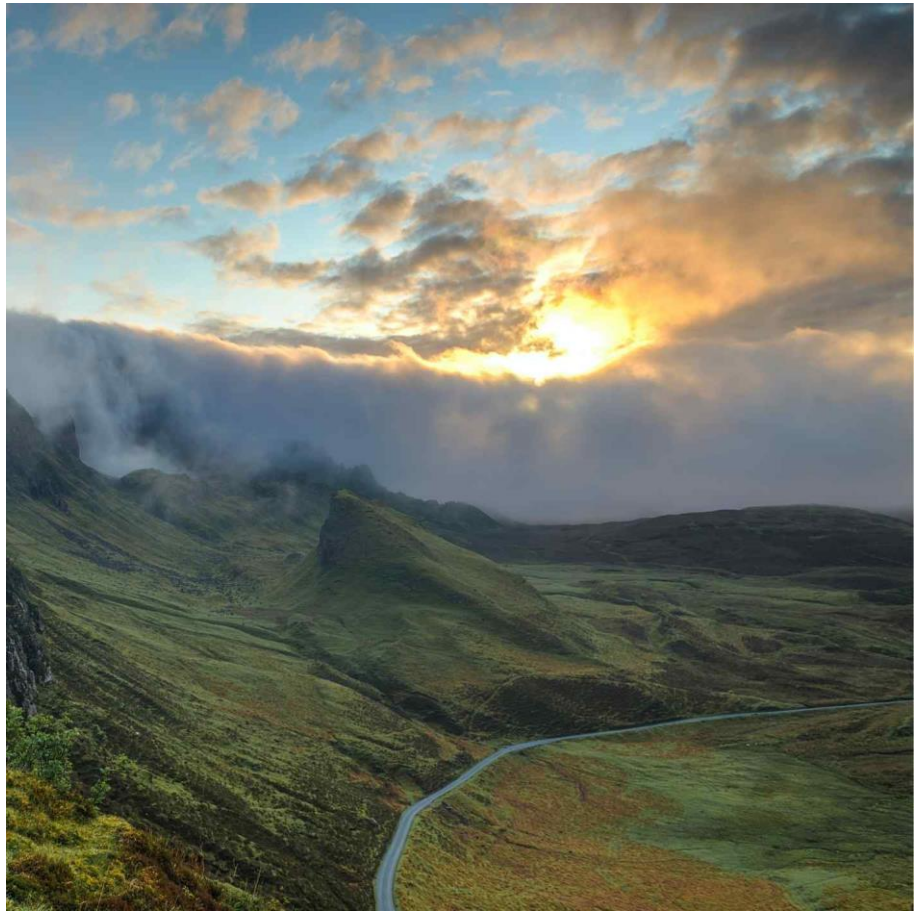
Brief introduction to Perspectives

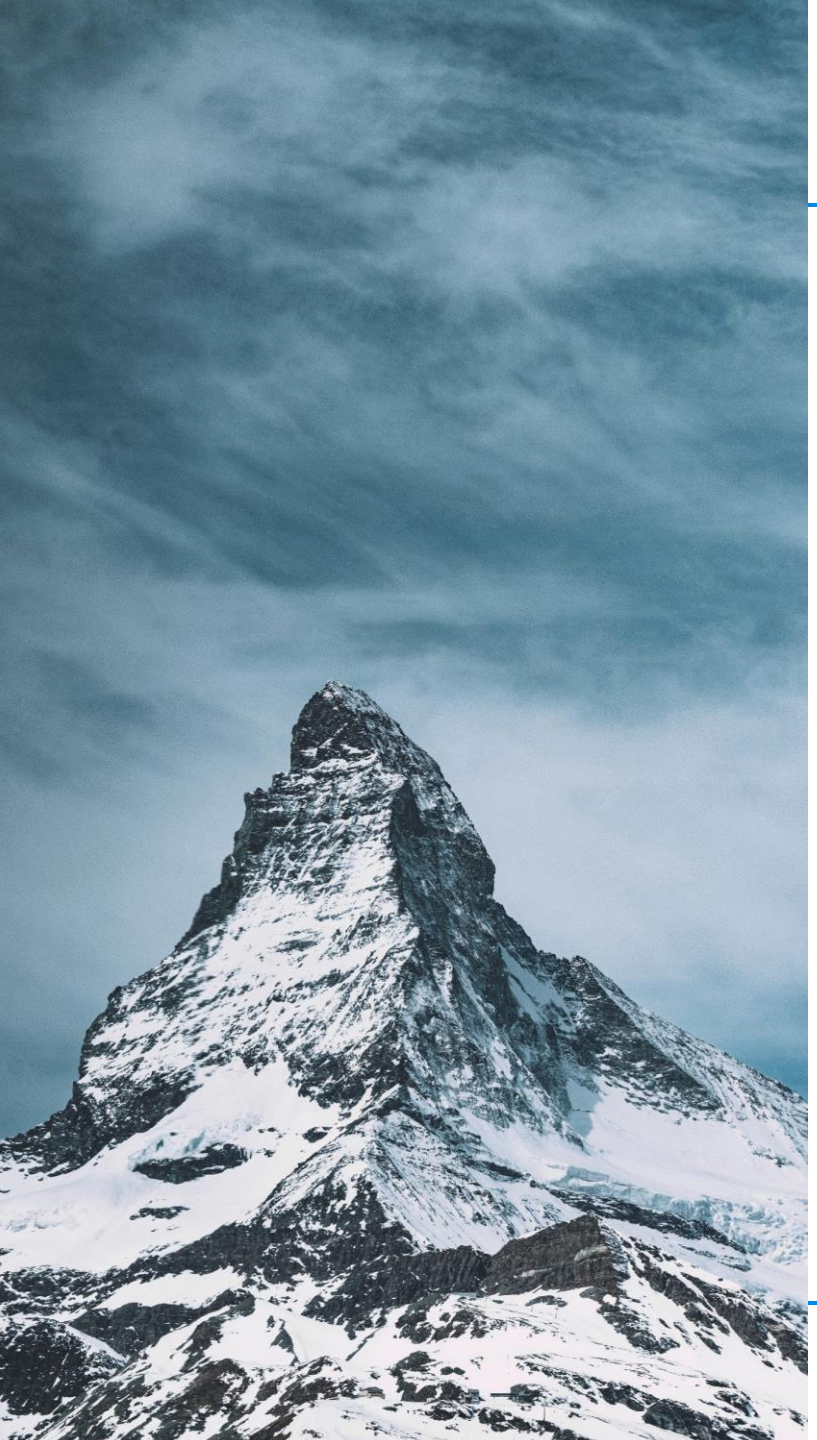
About Perspectives Climate Group

- **Perspectives** is an independent consulting firm providing the private sector, governments and non-governmental organizations (NGOs) with practical solutions for domestic and international climate policies, international carbon markets and climate finance instruments.

- The company is internationally recognized for its outstanding contribution to the establishment and advancement of the **Clean Development Mechanism (CDM),** and other carbon market segments

- The company has established itself over recent years in the **hydrogen sector consulting private companies and developing studies** for various public entities.





Purpose

perspectives climate group

> Shaping a sustainable future by enabling public and private sector investment through carbon market activities and solutions.

Today’s challenges of green hydrogen (and its potential solutions)

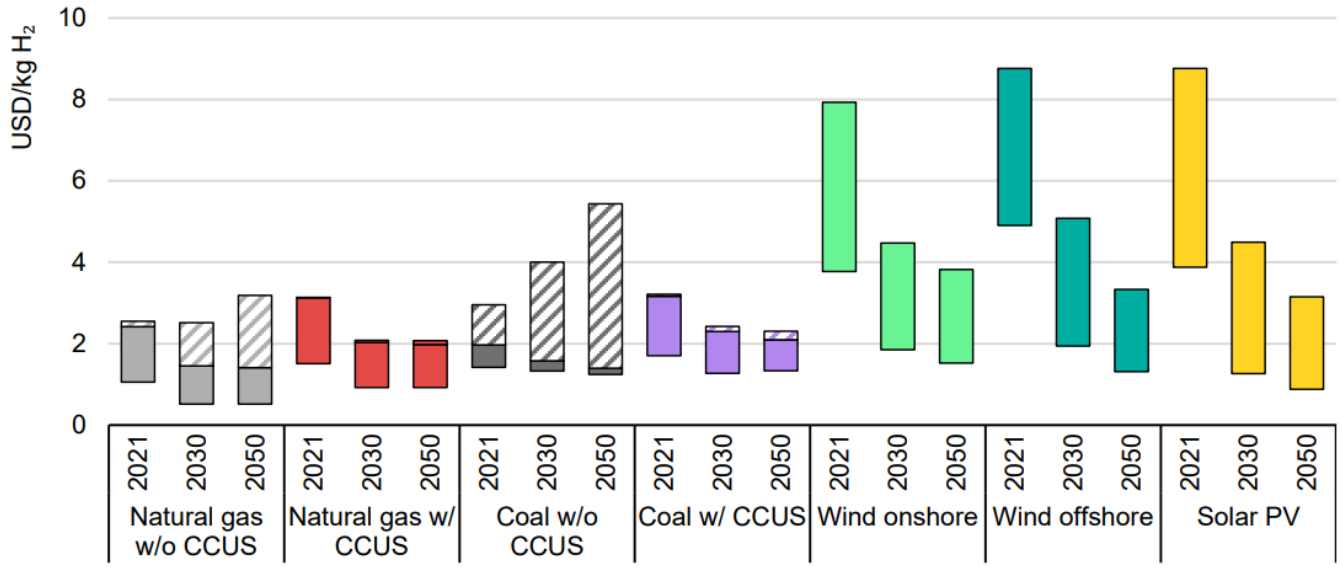
Today's challenges of green hydrogen projects

- Low- carbon hydrogen has the potential to decarbonize hard-to-abate sectors of our economy and can bring about vast economic chances
- "Hydrogen boom" both at political level and in industry
  - Many countries recently announced national hydrogen strategies
  - Numerous private sector announcements in H_2 projects
- **But:**
  - Green hydrogen still more costly than conventional fossil fuels and grey hydrogen
  - Out of 680 clean hydrogen projects (US$ 240 billion) only 10% reached FID

→ Carbon pricing and carbon markets can help to make green hydrogen projects more economically viable and can kickstart a massive ramp-up

LCOH of hydrogen production technologies

Levelised cost of hydrogen production by technology in 2021 and in the Net Zero Emissions by 2050 Scenario, 2030 and 2050



(in tCO_2e/tH_2e)	Natural Gas	Coal	SMR w/o CCS	SMR w CCS 90%	Electrolysis (100% RE)
IEA (2021)	8.5 – 11.3	13,3	11.9 – 14.5	2.8 – 6.2	0

- Green hydrogen technologies are still significantly more expensive than grey/blue hydrogen technologies
- But grey/blue is also significantly more carbon intensive than green hydrogen

Source: IEA, global hydrogen review 2021

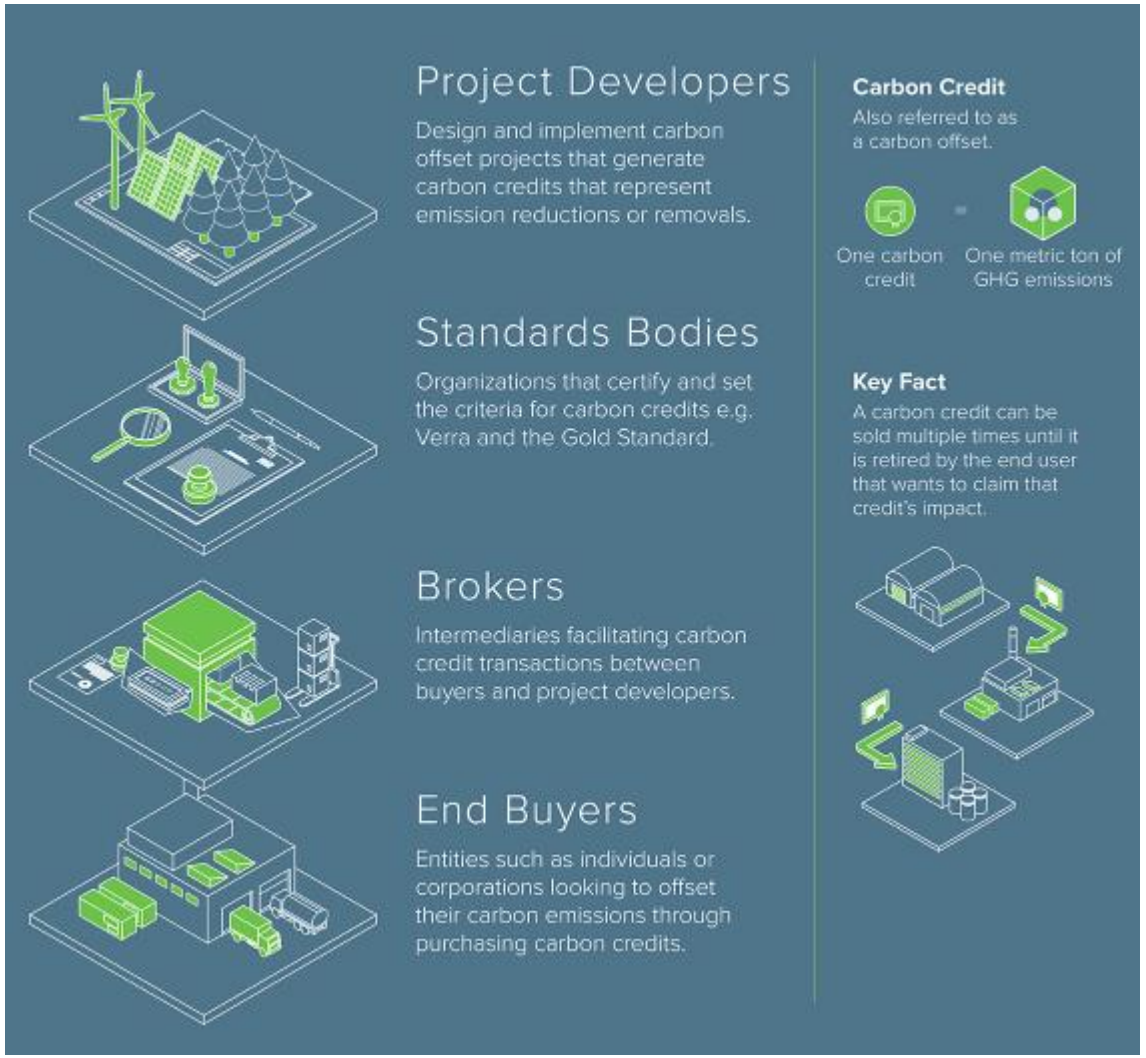
Instruments to make green hydrogen economically viable

- Spur demand by quotas
- Carbon pricing schemes (CBAM)
- Subsidies/Tax incentives (IRA)
- Carbon contracts for difference (H2Global)
- General support by governments
- Carbon Markets

Carbon Markets

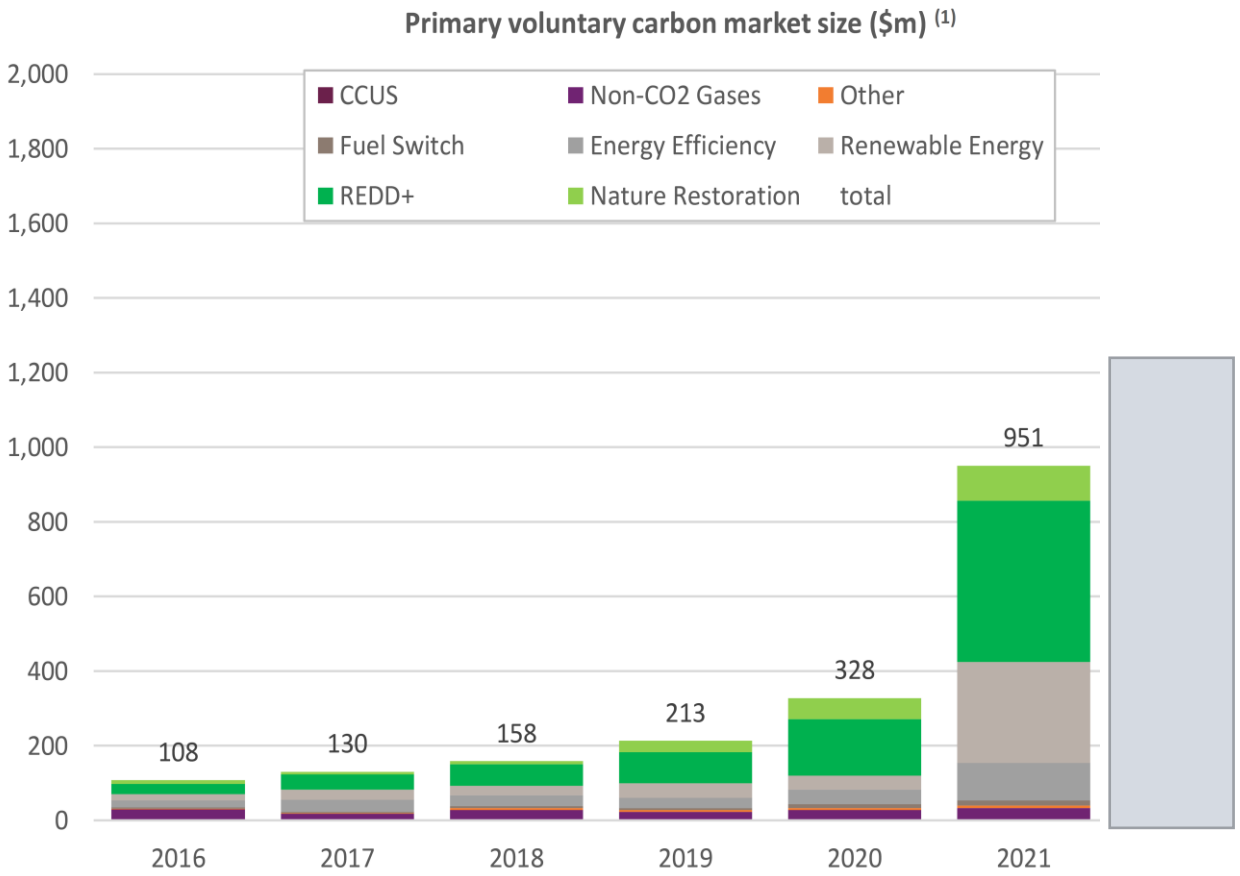
What are Carbon Markets?

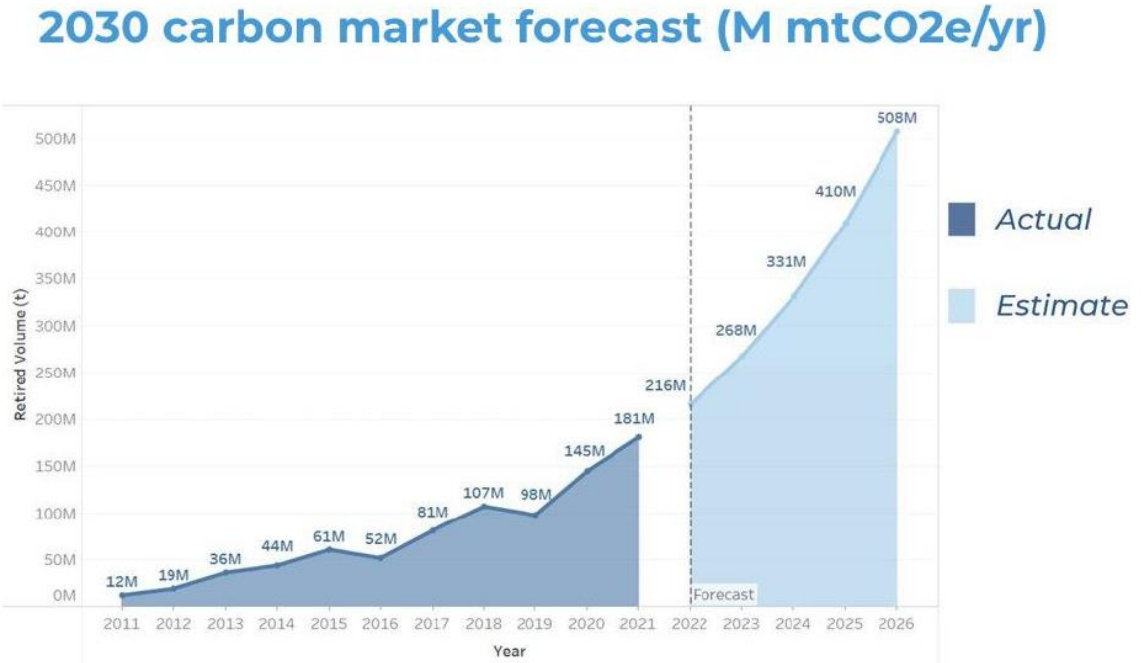
- **Carbon markets are trading systems in which carbon credits are sold and bought**
- **One tradable carbon credit equals one tonne of carbon dioxide or the equivalent amount of a different greenhouse gas**
- **Two types of carbon markets:**
  - Compliance: In regulatory environment (e.g. CDM, PA Art. 6.4, EU-ETS)
  - Voluntary carbon markets (Verra, GoldStandard,)



Source: https://www.visualcapitalist.com/sp/visual-guide-to-carbon-markets/

Current and projected size of voluntary carbon markets





Increasing **net-zero pledges**, **commitments** from the private sector, new **global aviation demand from CORSIA, is driving price and quality benchmark.**

Source: Trove Intelligence (2022, 2023), SouthPole

Function of carbon markets

Case study: Replacement of diesel with green hydrogen

Current situation ("Baseline")

- Diesel in transport

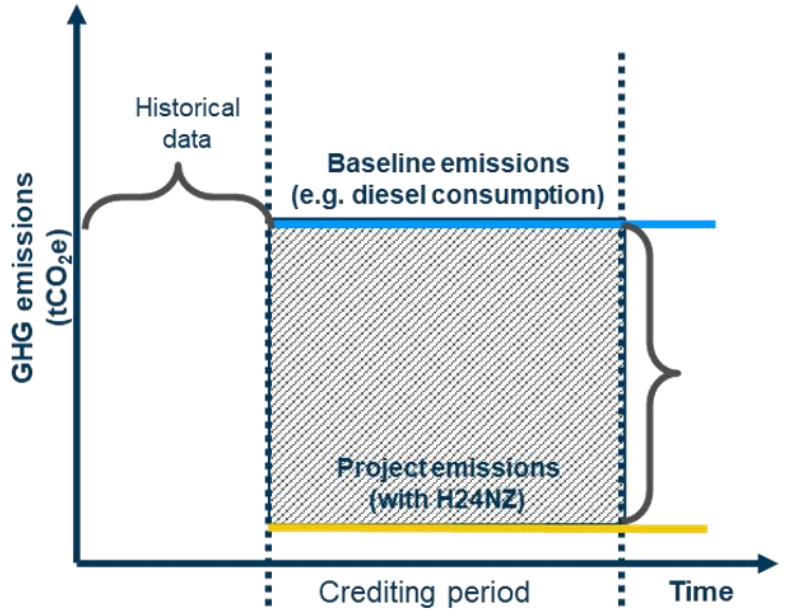
Project idea:

- Production of green H_2
- Replacement of diesel with green hydrogen
- But:
  - CAPEX and OPEX H_2 > CAPEX and OPEX of diesel

Carbon markets = additional revenue stream

- "Carbon credit' = certified GHG-emission reduction (1 t $CO_{2\text{-eq}}$)
- Each carbon credit can be sold →
  - CAPEX + OPEX - credit H_2 ≤ CAPEX + OPEX diesel

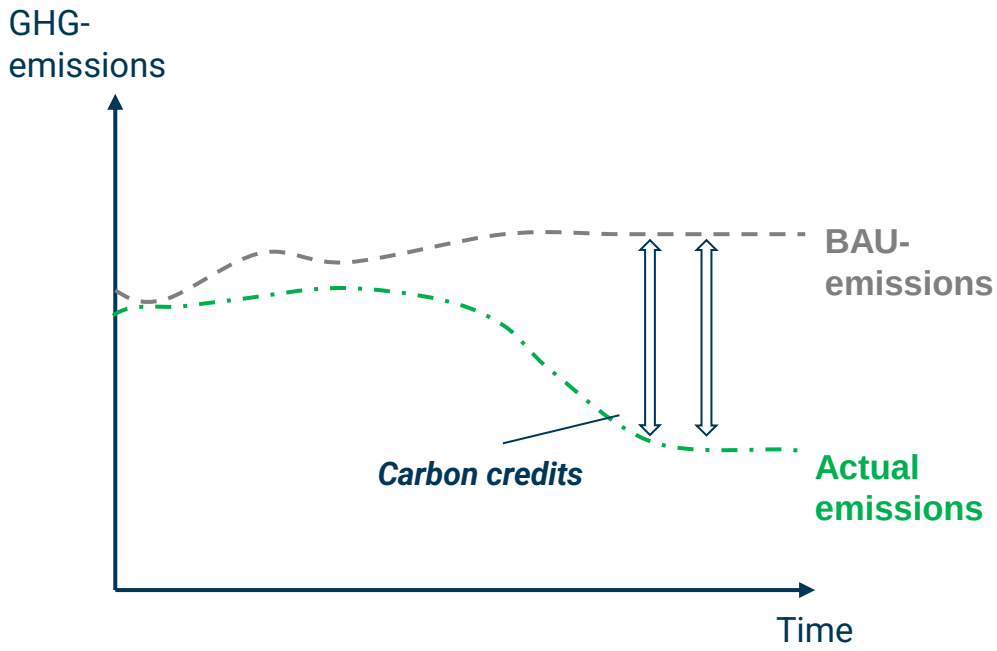
Emission reductions = Baseline emissions - Project emissions = Carbon credits $



Source: Perspectives Climate Group

Methodologies to quantify GHG-benefits

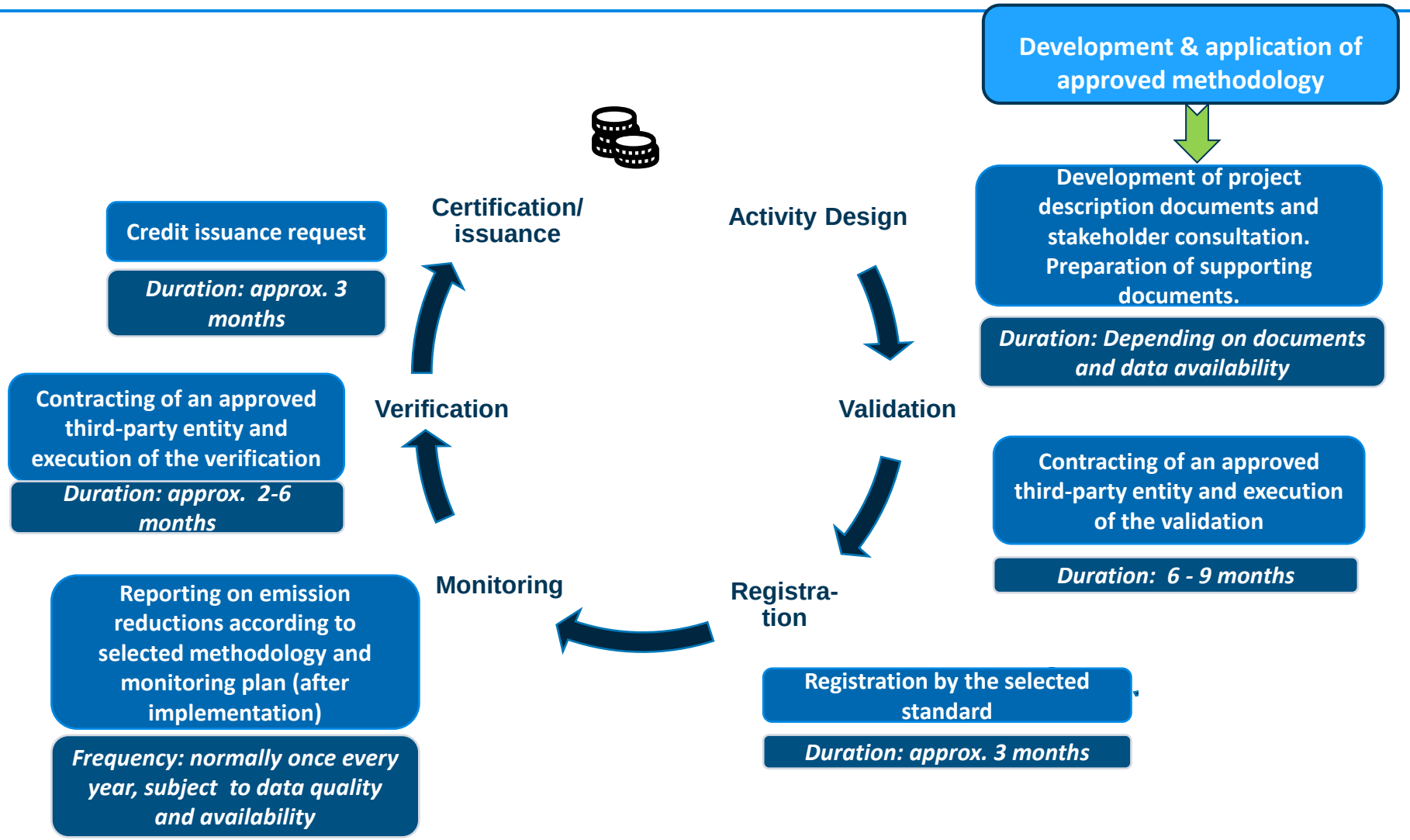
- Carbon methodologies outline detailed procedures for quantifying the actual GHG benefits of a project.
- Methodologies ensure that similar projects calculate the GHG-benefits applying the same approach, and ensure environmental integrity.
- Regulators of carbon markets approve methodologies so that **resulting carbon credits are accepted in their system**



→ Availability of H_2-specific methodologies is essential for harnessing carbon markets
→ To date there are only very few (narrow) H_2-methodologies

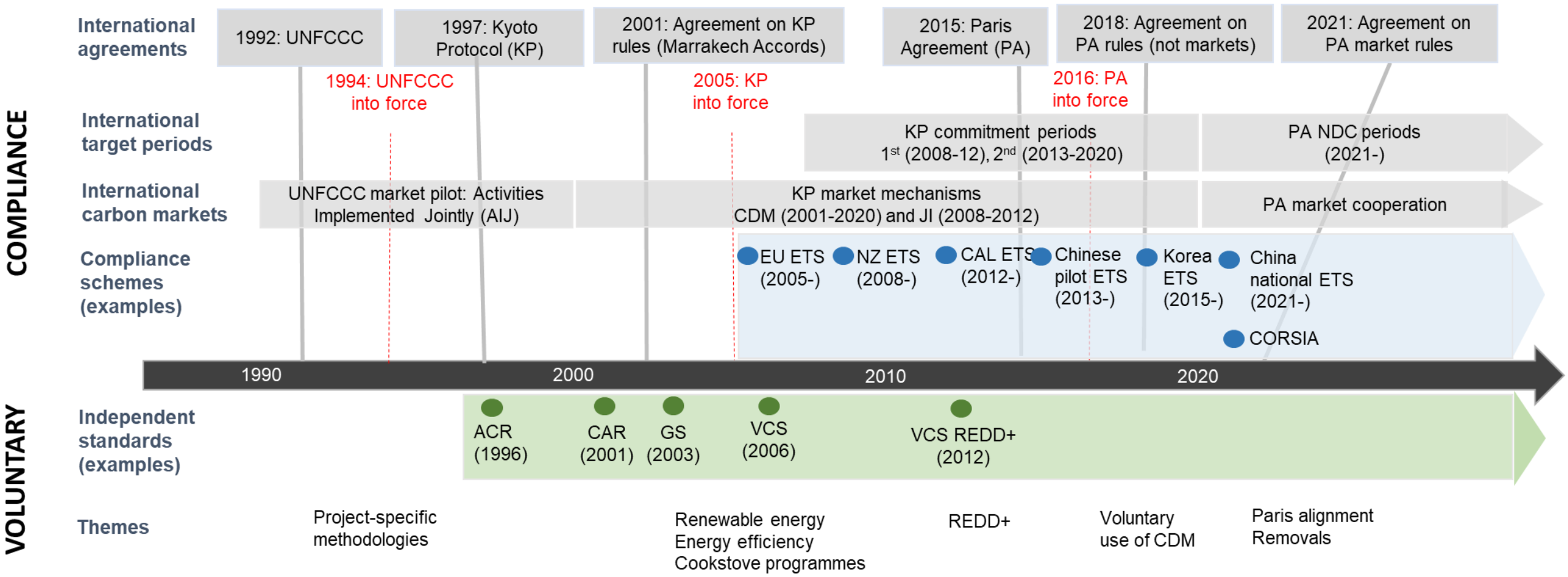
Source: Perspectives Climate Group

Carbon credit cycle

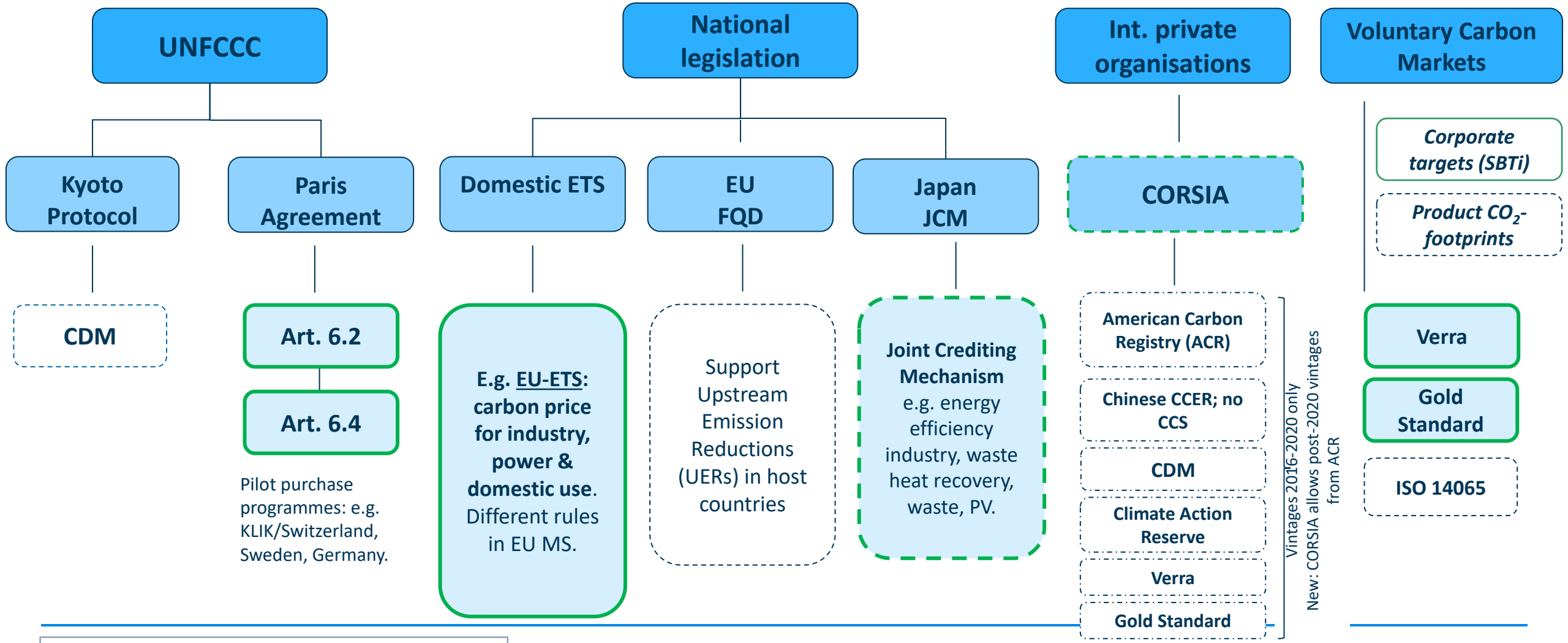


Source: Perspectives Climate Group

The history of international carbon markets



Scattered & highly dynamic carbon markets



Carbon price expectations for different markets (average)

	2020-2025	2026-2030	Trend
VCM without CA	EUR 2-6/t CO2e	EUR 1-4/t CO_2e	Decrease over time as preferred credits become available
VCM with CA	EUR 6-12/t CO_2e	EUR 12-24/t CO_2e	Increase over time as host countries provide CAs only for additional activities which shift to increasingly “high-hanging fruits”
CORSIA	EUR 7-24/tCO_2e	2030: EUR 12-40/t CO_2e	2035: EUR 14-48/t CO_2e (low-high scenarios)
ITMOs	EUR 12-24/t CO_2e	EUR 24-36/t CO_2e	Increase over time as host countries provide CAs only for additional activities which shift to increasingly “high-hanging fruits”
EU-ETS	EUR 50-100 /t CO_2e	2030: EUR 85–120 /t CO_2e	Increase due to ambitious EU targets (“at least -55% by 2030”) – net-zero by 2050

Carbon Markets for low-carbon and green hydrogen projects

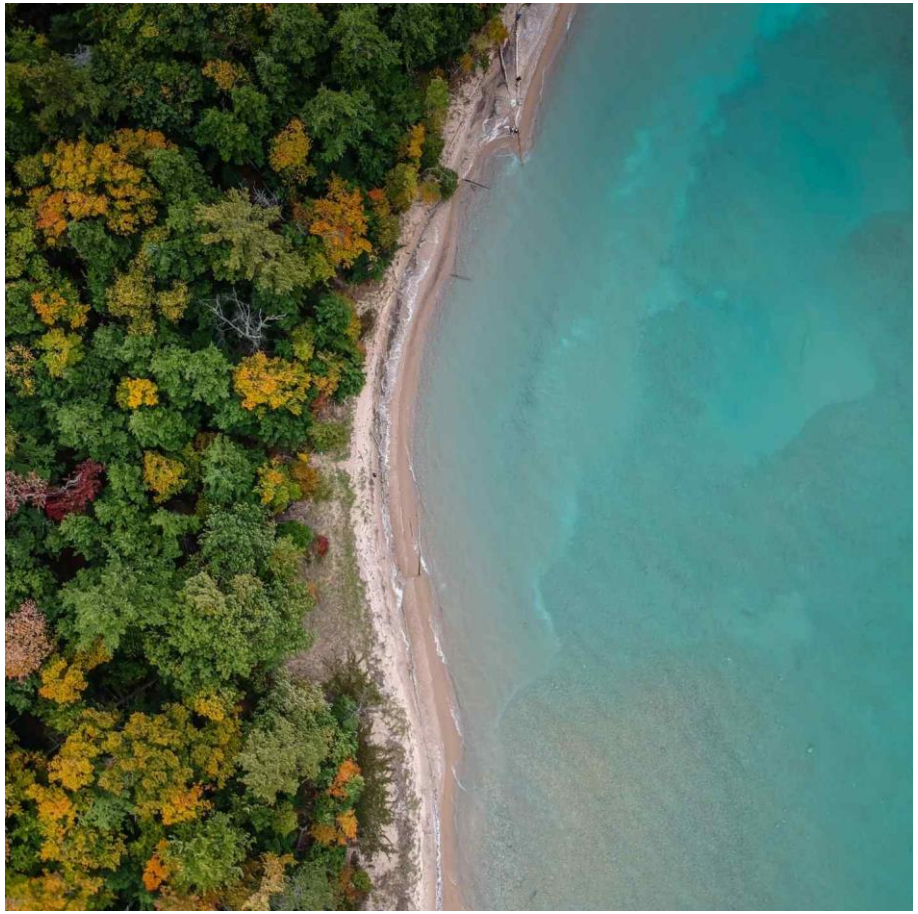
Current state of hydrogen in carbon markets

To date there are just 3 carbon market methodologies for hydrogen

- Emission reduction by hydrogen fuel cell vehicles (CDM)
- Emission reduction by hydrogen production from renewable energy sources (CDM)
- Concept Note Hydragen (Verra)

→ All of them are very „narrow“ and can only be applied to very specific projects

→ No carbon credits generated to date



Hydrogen for Net Zero Initiative

Rationale for a H_2 initiative focused on carbon markets

- Since emission reduction normally takes place at the point of hydrogen use, complete hydrogen supply chain has to be monitored/certified.
- Comprehensive methodological framework is needed → this is what the Hydrogen for Net Zero Initiative aims for

Overarching Goal:

Unlocking the potential of renewable & low-carbon hydrogen by bringing together stakeholders such as industry leaders, technology innovators, investors, NGOs and policy makers to enable them utilizing carbon markets for making their hydrogen investments economically feasible.

Source: https://hydrogenfornetzero.org/

Key Pillars of the initiative

Unlocking carbon finance for H_2-activities

Development of Methodological Frameworks for:
- Voluntary Carbon Markets (VCS/GS)
- Art. 6 of the Paris Agreement

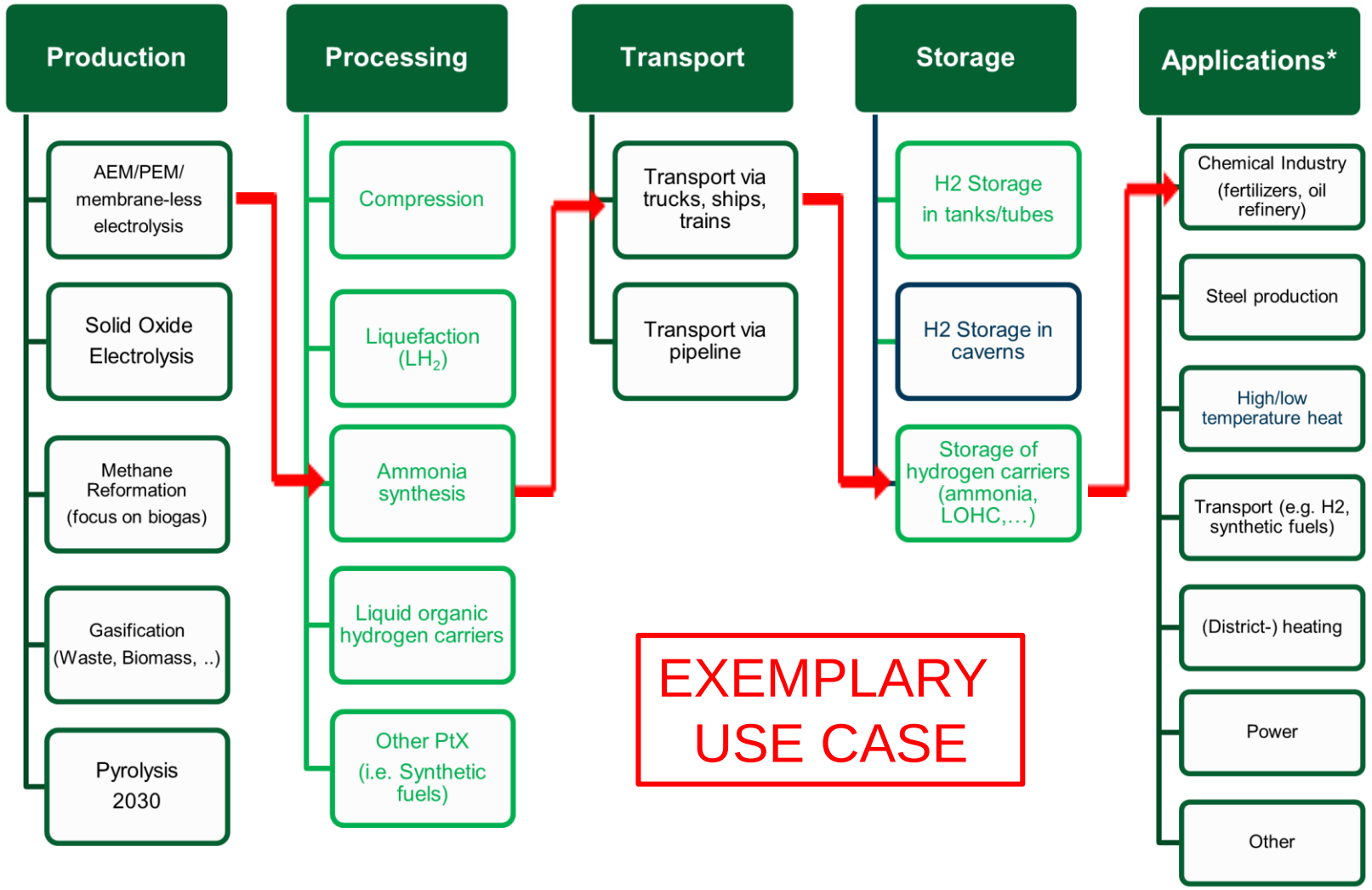
Covering whole H_2 value chain and variety of applications

Standardisation of meth framework amongst key standard setters, pathbreaking for future Art. 6 approach

Stakeholder engagement and information platform

- Updates and progress briefs on H_2 policies, standards, support schemes, etc.
- Strategy papers on highly relevant topics such as integration of hydrogen into corporate NetZero-Strategies
- Stakeholder Exchange Platform incl. roundtables, working groups, exploring joint business opportunities
- External communication & strategy documents

2. Use Cases & Hydrogen Value Chain



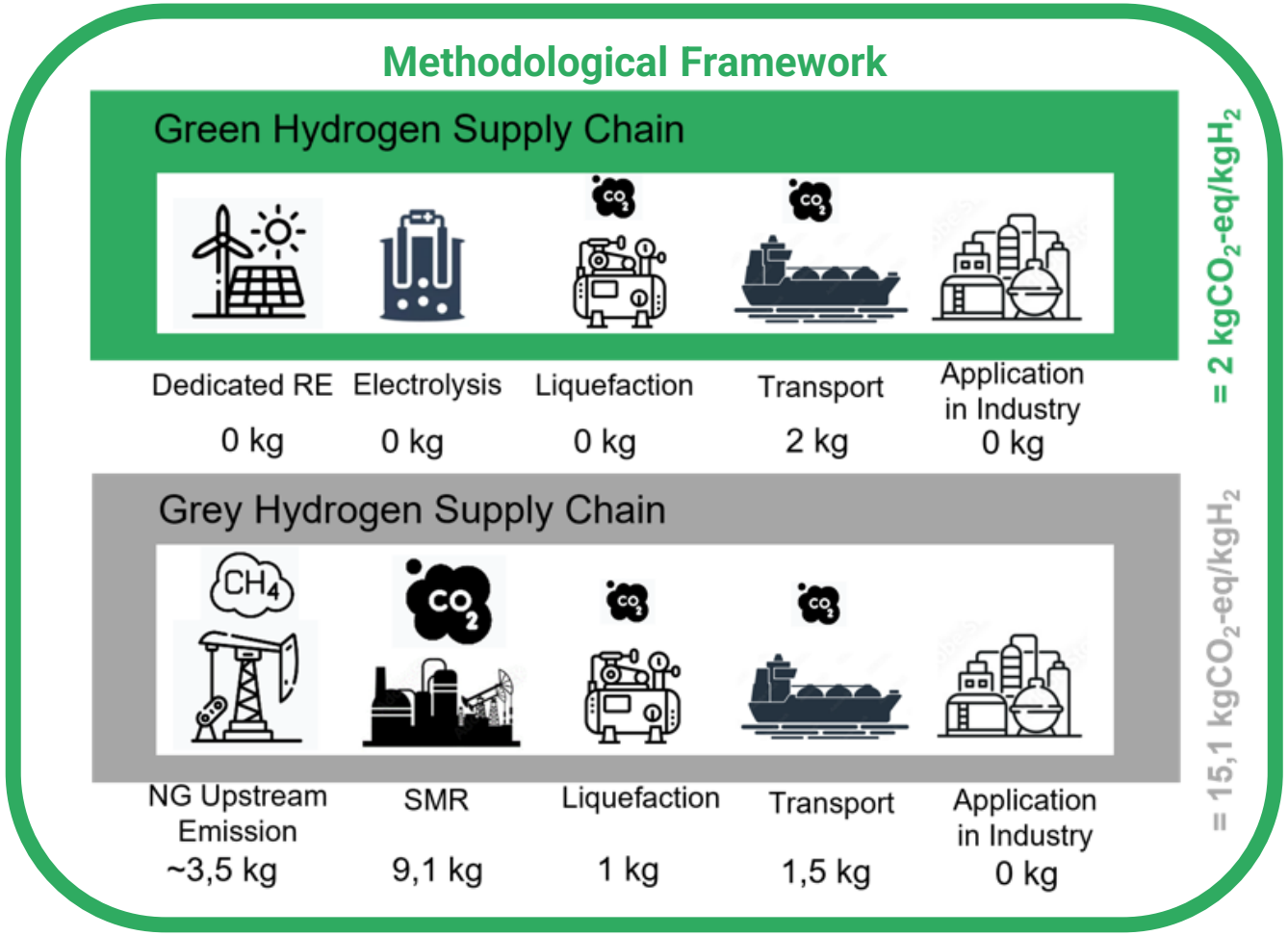
- Framework considers the complete hydrogen value chain
- Founding members and core partners bring in their use cases, for which the first meths & modules will be developed
- Additional modules can be added throughout the lifetime of the H_2NZ Initiative.
- Meth experts of Perspectives & South Pole lead meth development
- Aim to maximize standardization between VCS & GS

* Different electricity sources will be considered in the modules and tools (renewable/non-renewable/grid)

** For the substitution of fossil fuels and for the substitution of carbon-intensive hydrogen

23

Carbon Finance Revenues for Hydrogen Projects



Exemplary project data:

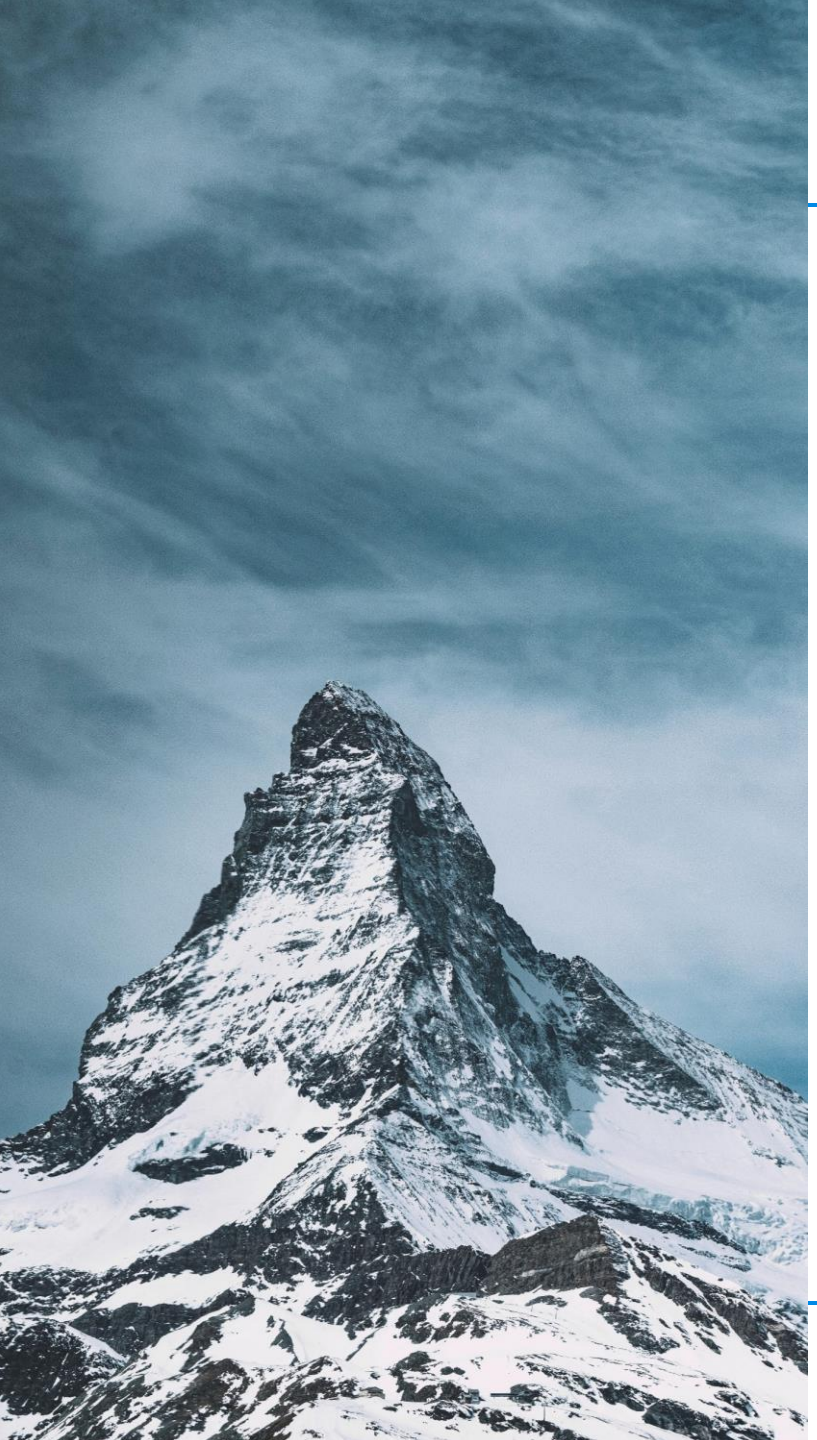
Electrolyser capacity:	100 MW
Full load hours:	90 %
Annual production:	17,000 t
Total emissions (green):	34.000 t
Total emissions (grey):	256,700 t
GHG-mitigation:	222,700 t
→ **Certificates/a:**	**222,700**

Annual revenues from certificate sales:*
2,227,000 – 6,668,100 US$

*With certificate prices projected to range between 10 and 30 US$

Key Take-Aways

- **Green hydrogen is still significantly more expensive than other production forms**
- **Green hydrogen involves significantly less GHG-emission**
- **Carbon markets can monetize this to make green hydrogen investments more economically attractive**
- **There are various carbon market segments to be used for hydrogen projects**
- **But until today there are no comprehensive carbon methodologies for green hydrogen**
- **Concerted action is needed to develop a comprehensive methodological framework and thus unlock carbon markets for green hydrogen projects.**



Thanks for your attention

Philipp Veh, Perspectives Climate Group

14.02.2022