Introducing the IETA high level criteria for crediting carbon geostorage

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INTERNATIONAL EMISSIONS TRADING ASSOCIATION - IETA

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WHO WE ARE

IETA is a non-profit group with a vision of a common global carbon price produced by markets of high environmental integrity.

IETA’s diverse membership benefits from a full range of views – industrials, verifiers, lawyers, project developers, investors, standards, traders & consultants – from every market in the world.

We pride ourselves to be involved in and influence policy design, thought leadership, global capacity building, best practice and knowledge transfer.

We value our global Partnerships & Strategic initiatives with UNFCCC, World Bank, OECD, IEA, ICAO, IATA & other multilateral organisations.

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For over 20 years we have been at the cutting edge of climate action

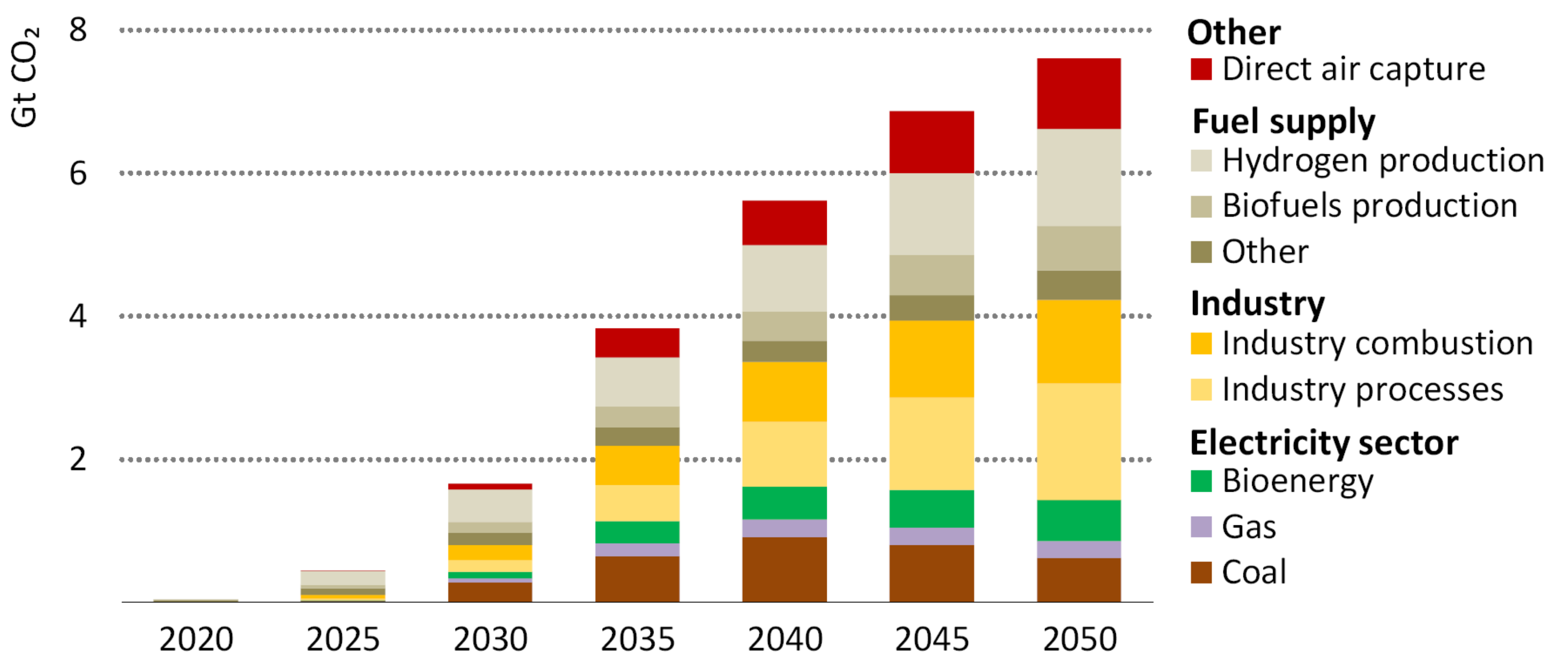
The Paris Framework

- The Paris Agreement embedded the concept of **net zero as the framing concept** for climate action of our times (Article 4.1)
  - **Net zero** is achieved where GHG emissions by sources are **balanced by removals by sinks**
  - **Net zero** highlights the importance of **carbon dioxide removals (CDR)** and **permanent CO_2 capture and storage (CCS)** in meeting long term temperature limitation goals

- IPCC AR6 reaffirmed that:
  - *"Net-zero CO_2 energy systems entail: a substantial reduction in overall fossil fuel use,* ***minimal use of unabated fossil fuels, and use of CCS in the remaining fossil system****..."* – SPM
  - *"The* ***deployment of CDR to counterbalance hard-to-abate residual emissions*** *is unavoidable if net zero CO_2 or GHG emissions are to be achieved"* – SPM

Carbon geostorage is essential to deliver net zero by 2050

Figure 2.21 ▹ Global CO_2 capture by source in the NZE



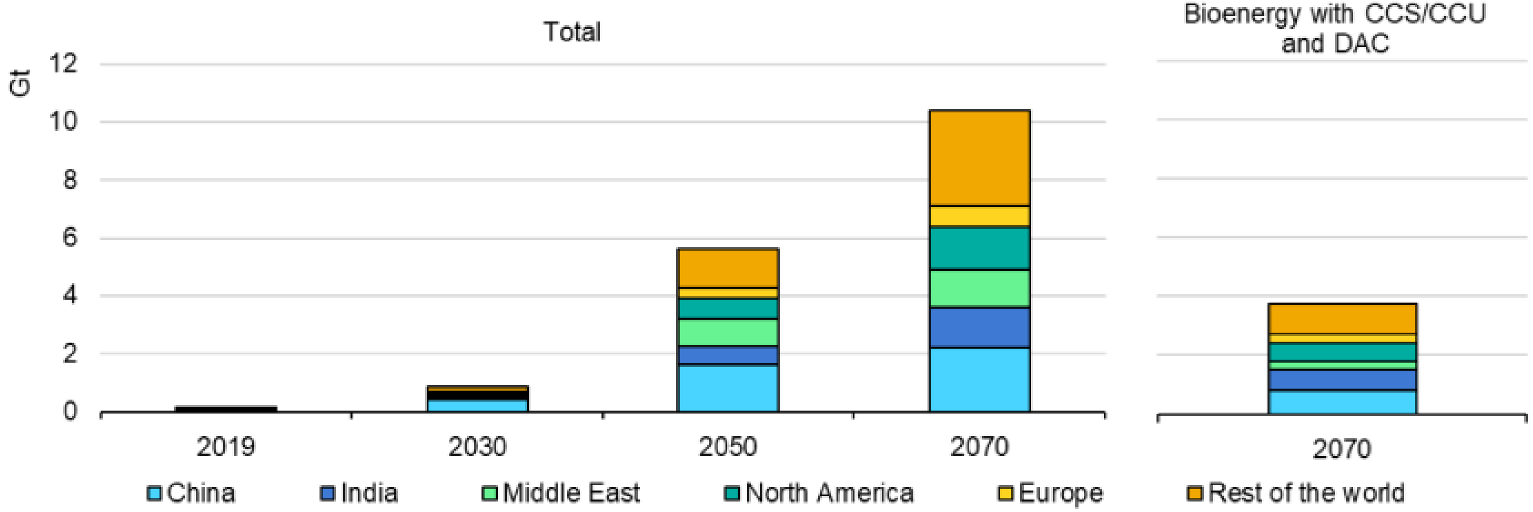
By 2050, 7.6 Gt of CO_2 is captured per year from a diverse range of sources. A total of 2.4 Gt CO_2 is captured from bioenergy use and DAC, of which 1.9 Gt CO_2 is permanently stored.

Source: IEA Net Zero Emissions (NZE) Roadmap 2021

- IEA variously estimates storage in the region 5.5-7.2 $GtCO_2$ in 2050
- Variety of sources of CO_2: fossil, biogenic and scenarios including DACCS

… with all regions contributing

Figure 4.1 Captured CO_2 emissions by country/region in the Sustainable Development Scenario



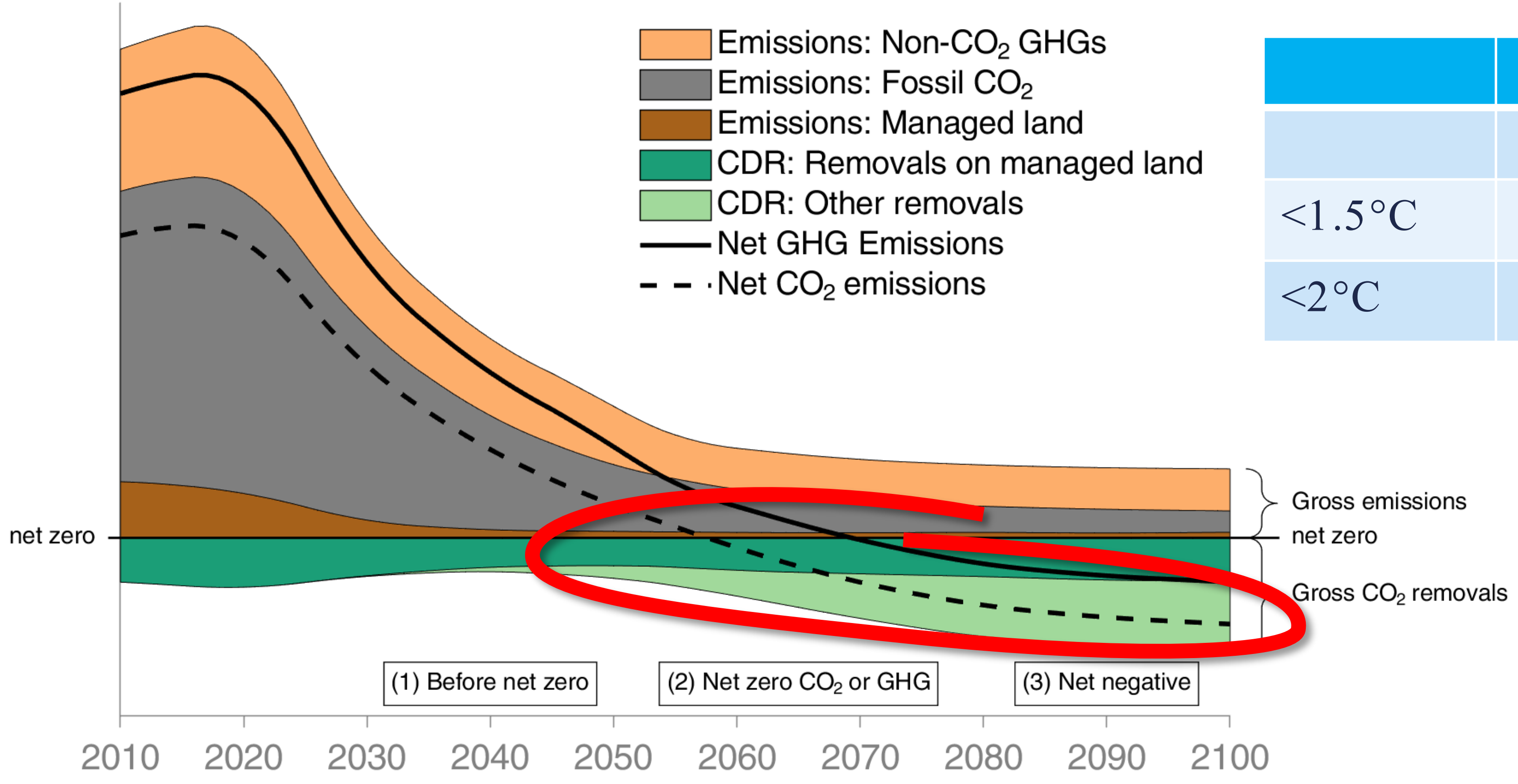
China accounts for around one-quarter of all the CO_2 captured worldwide cumulatively to 2070 in the Sustainable Development Scenario, driven mainly by retrofits to existing power stations and industrial plants.

Source: IEA Energy Technology Perspectives (ETP), 2020

- Most analysis (IEA; IPCC) shows that CCUS is needed in every region to meet Paris Agreement goals
- Activities spread across Europe, North America, Middle East and Asia

... and encompassing tech-based CDR to retain 1.5°C

Greenhouse gas emissions (stylised pathway)



	In 2050 (Gt/yr)		By 2100 (Gt)	
	BECCS	DACCS	BECCS	DACCS
<1.5°C	2.75	0.02	330	30
<2°C	-	-	291	19

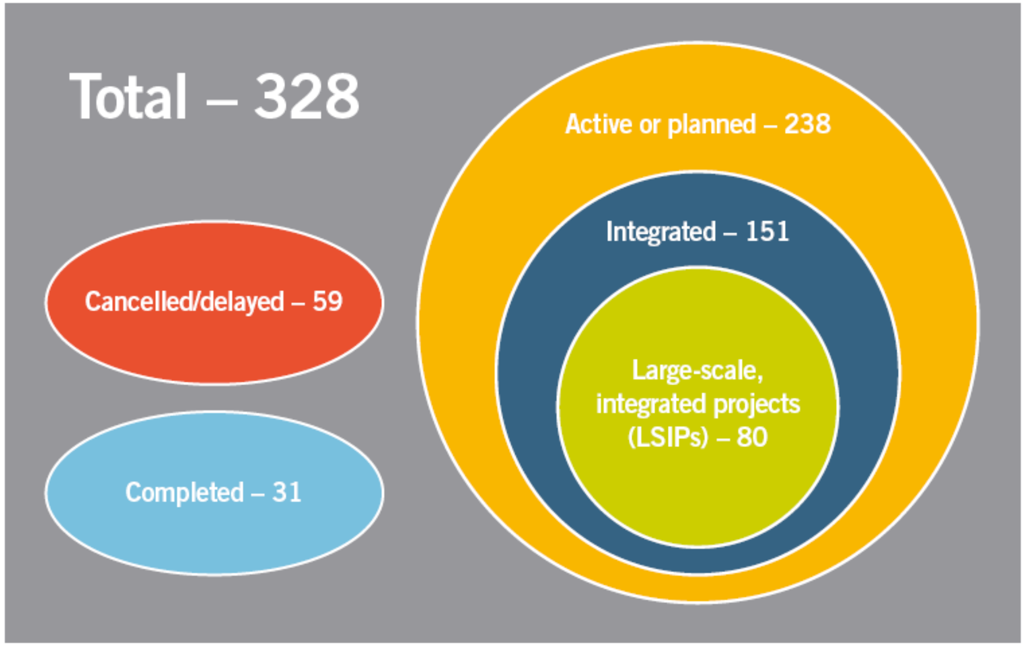
Source: IPCC Sixth Assessment Report, 2022

Activity is ramping up, but needs to accelerate at scale

Currently, global rates of CCS deployment are far below those in modelled pathways limiting global warming to 1.5°C or 2°C" IPCC AR6 – SPM

Source: GCCSI Status Report 2022

FIGURE 2: Hierarchy of total projects identified in the April 2010 Update Survey



Source: GCCSI Status Report 2010

But so far, few standards support deployment

	Name of the mechanism	Credits issued ($MtCO_2e$)	Registered activities	Average price (USD)	Sectors covered
Independent	American Carbon Registry	7.30	15	5.36	Agriculture, CCS/CCU, Energy Efficiency, Forestry, Fuel switch, Industrial gases, Manufacturing, Renewable energy, Transport, Waste
Independent	Climate Action Reserve	4.61	33	2.34	Agriculture, Forestry, Industrial gases, Other land use, Waste
Independent	Gold Standard	34.35	59	5.27	Agriculture, Energy Efficiency, Forestry, Fuel switch, Fugitive emissions, Renewable energy, Waste
Independent	Verified Carbon Standard	140.37	127	1.62	Agriculture, Energy Efficiency, Forestry, Fuel switch, Fugitive emissions, Industrial gases, Manufacturing, Renewable energy, Transport, Waste
International	Clean Development Mechanism	74.00	15	2.02	CCS/CCU, Energy Efficiency, Forestry, Fuel switch, Fugitive emissions, Industrial gases, Manufacturing, Renewable energy, Transport, Waste
International	Joint Implementation Mechanism	-	-	N/A	Agriculture, Energy Efficiency, Forestry, Fuel switch, Fugitive emissions, Industrial gases, Manufacturing, Renewable energy, Waste
Domestic	Alberta Emission Offset System	8.40	17	15.92 - 21.49	Agriculture, CCS/CCU, Energy Efficiency, Forestry, Fugitive emissions, Industrial gases, Manufacturing, Renewable energy, Waste
Domestic	Australia Emissions Reduction Fund	16.30	128	12.02	Agriculture, Energy Efficiency, Forestry, Fugitive emissions, Transport, Waste
Domestic	Beijing Forestry Offset Mechanism	-	-	2.10 - 9.28	Forestry
Domestic	Beijing Parking Offset Crediting Mechanism	-	N/A	N/A	Transport
Domestic	British Columbia Offset Program	1.60	3	6.37 - 11.94	Energy Efficiency, Forestry, Fuel switch, Waste
Domestic	California Compliance Offset Program	46.00	62	13.71	Agriculture, Forestry, Fugitive emissions, Industrial gases
Domestic	China GHG Voluntary Emission Reduction Program	-	-	1.52 - 3.04	Energy Efficiency, Forestry, Fuel switch, Renewable energy, Waste
Domestic	Fujian Forestry Offset Crediting Mechanism	0.16	-	1.52 - 3.04	Forestry
Domestic	Guangdong Pu Hui Offset Crediting Mechanism	0.60	10	2.59	Forestry, Renewable energy
Domestic	J-Credit Scheme	0.30	16	13.54 - 19.78	Energy Efficiency, Forestry, Fuel switch, Renewable energy, Waste
Domestic	Québec Offset Crediting Mechanism	0.11	1	14.6	Waste
Domestic	Republic of Korea Offset Credit Mechanism	17.61	308	20.31 - 36.02	Energy Efficiency, Industrial gases, Renewable energy, Transport, Waste
Domestic	RGGI CO_2 Offset Mechanism	0.01	-	5	Energy Efficiency
Domestic	Saitama Forest Absorption Certification System	-	-	N/A	Forestry
Domestic	Saitama Target Setting Emissions Trading System	1.00	-	4.23	Energy Efficiency
Domestic	South Africa Crediting Mechanism	-	-	N/A	Agriculture, Energy Efficiency, Forestry, Fuel switch, Other land use, Renewable energy, Transport, Waste
Domestic	Switzerland CO_2 Attestations Crediting Mechanism	2.10	8	59.19 - 159.61	Energy Efficiency, Forestry, Fuel switch, Renewable energy, Transport
Domestic	Thailand Voluntary Emission Reduction Program	6.01	156	0.64 - 9.46	Agriculture, Energy Efficiency, Forestry, Renewable energy, Transport, Waste
Domestic	Tokyo Cap-and-Trade Program	-	12	1.62 - 57.77	Energy Efficiency, Renewable energy
Domestic	Joint Crediting Mechanism	0.03	9	N/A	Energy Efficiency, Renewable energy, Transport

Agriculture
CCS/CCU
Energy Efficiency
Forestry
Fuel switch
Fugitive emissions
Industrial gases
Manufacturing
Other land use
Renewable energy
Transport
Waste

Crediting mechanisms:

- Independent
- International
- Domestic

Markets will be essential to bridge distributional imbalances

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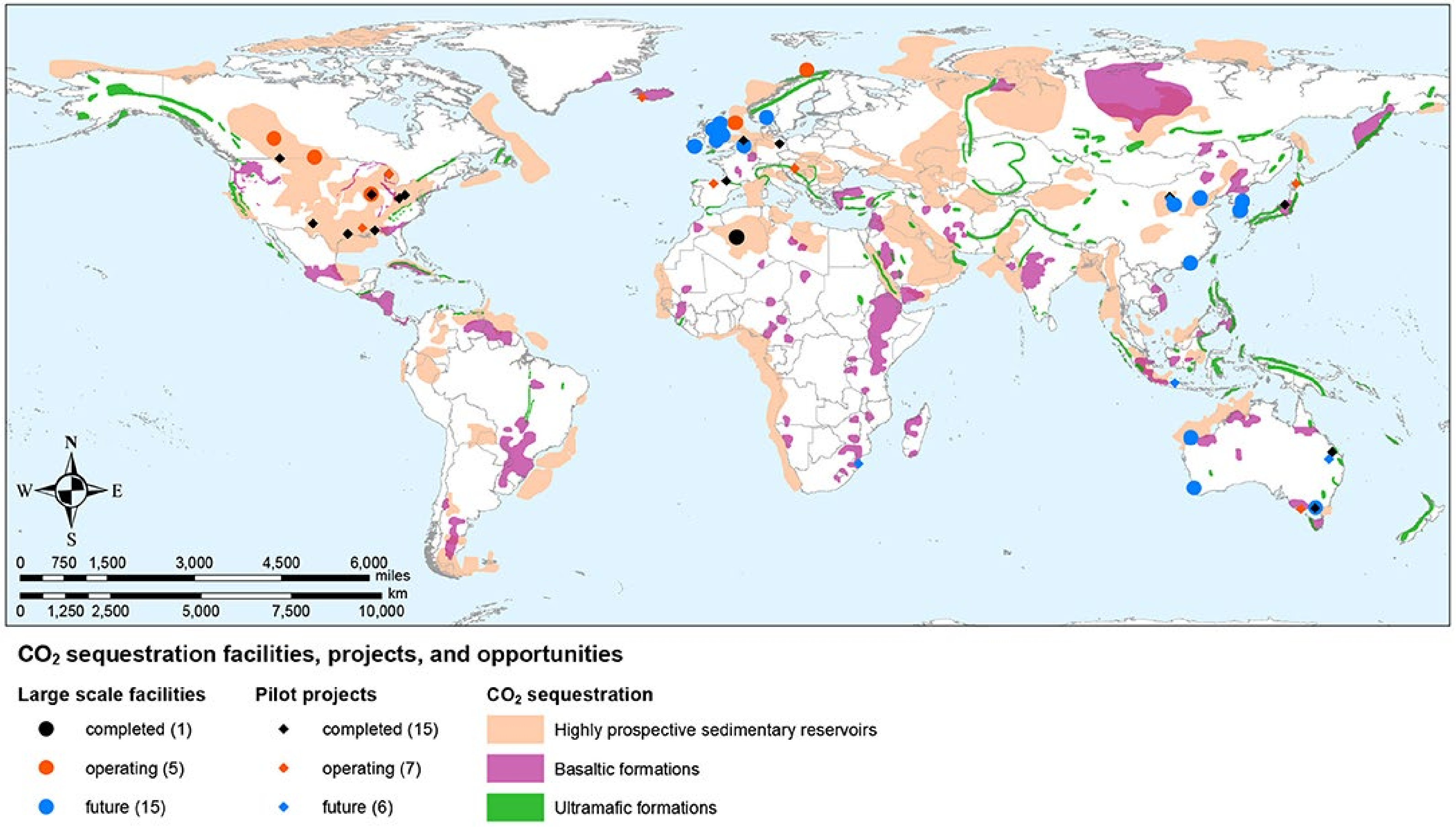
Geologic storage resources are not evenly distributed and not always close to major industrial emission sources



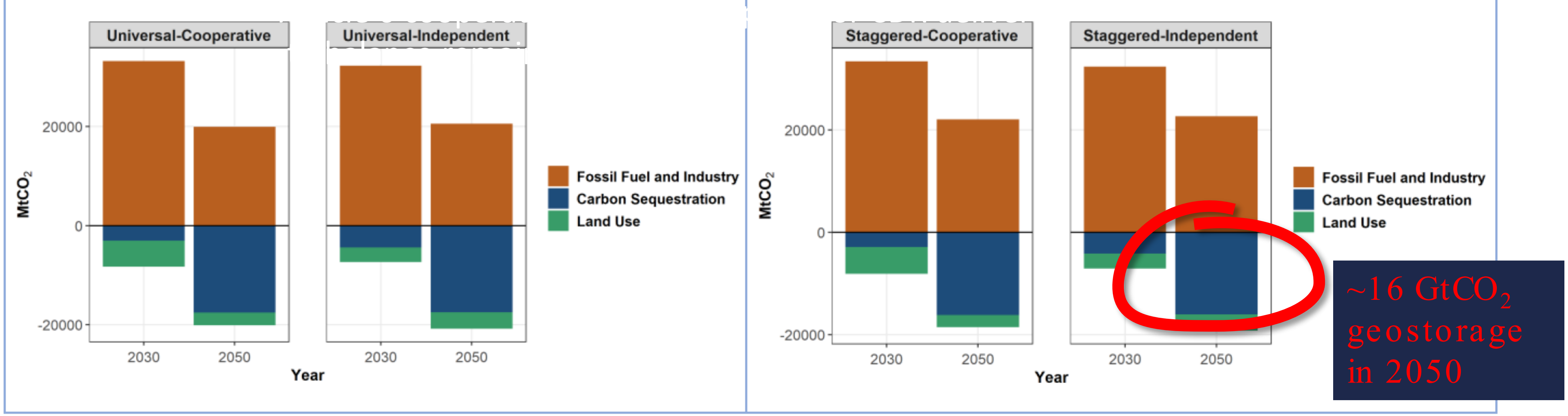
Source: Kelemen, P., Benson S..M., Pilorgé H. Psarras P., Wilcox J. 2019. "An Overview of the Status and Challenges of CO_2 Storage in Minerals and Geological Formations". *Frontiers in Climate*, 1, DOI: 10.3389/fclim.2019.00009

Article 6 cooperation could prompt major CDR delivery to balance remaining emissions

*"In all net-zero scenarios, we find that Article 6 buyer-seller dynamics are heavily influenced by nature-based solutions and **carbon sequestration**"*

Figure 5. Global CO_2 emissions and carbon sequestration in 2030 and 2050

Panel a. Global CO_2 emissions and carbon sequestration in the Universal Net-Zero scenarios	Panel b. Global CO_2 emissions and carbon sequestration in the Staggered Net-Zero scenarios



Source: Yu, S. J. Edmonds, D. Forrister, C. Munnings, J. Hoekstra, I. Steponaviciute and E. Lochner, 2021. *The Potential Role of Article 6 Compatible Carbon Markets in Reaching Net-Zero.* Working Paper. 18 October 2021. International Emissions Trading Association (IETA) and University of Maryland. https://www.ieta.org/resources/Resources/Net-Zero/Final_Net-zero_A6_working_paper.pdf

Markets can lead the way to effective deployment

- The Kyoto Protocol provided signposts for integrating geostorage into market mechanisms
  - Decision 10/CMP.7 (Durban COP17; 2011) was the culmination of 5-6 years of UN negotiations
- The Paris Agreement rulebook further strengthens the backstops for geostorage:
  - NDC – ensures long-term commitment to containment
  - ETF – ensures monitoring
  - ITMO – defines methods and accounting
- The VCM and Article 6 mechanisms can also establish critical guardrails for safe, secure and permanent reductions and removals using enhanced geological sinks and reservoirs

IETA is committed to lead on market development for CCS credits.
We started a process 1 year ago to develop guiding principles.

Public concerns to address in deploying at scale

- ◆ **Effectiveness of CCS**
  - ✓ Insufficient information
  - ✓ Maturity of technology
  - ✓ Comparison with alternative technologies
  - ✓ Energy loss
  - ✓ Storage potential

- ◆ **Emission Reduction Effects (quantification)**
  - ✓ Safe and long term containment
  - ✓ Objective and scientific evaluation of safe and long term containment, and its assurance
  - ✓ Measurement and monitoring of leakage (including permanence)
  - ✓ Evaluation of total reduction effects

- ◆ **Environment impacts (pollution, natural environment and social environment)**
  - ✓ Marine environment
  - ✓ Ground water and air pollution
  - ✓ Hazardous waste
  - ✓ Social impacts, such as accident and disaster

- ◆ **Others**
  - ✓ Policy risk
  - ✓ Impact on local economy (benefit)

Note
Collected information based on experience of 30 CCS experts

Carbon Markets and CCS/CCUS Experts Dialogue

- **Global dialogue series** gathered leading standards agencies, industry/project developers, relevant governments and international experts in 4 x Workshops and forums through 2021-22.
  - **Identified and reviewed status of CCS/CCUS market and crediting standards/protocols** – both existing and under development, and both compliance and voluntary
  - **Considered gaps and key opportunities for convergence** to support heightened consistency across protocols and tools
- **Now establishing a common knowledge base, broad agreement on guiding principles, and high-level criteria and potential guidance** documents – to inform future common standard development, identify best practice

Carbon Markets and CCS/CCUS Experts Dialogue

- **Close collaboration and coordination with leading initiatives and partners**
  - E.g. CCS+ Initiative, GCCSI, IEA-GHG, OGCI, and International CCS Knowledge Centre.

- **Input and collaboration with leading voluntary standards**
  - Included Verra, ACR, GCC, CAR, ISO

- **Conducted regular outreach and input from key national and government officials**, namely those actively involved in CCS/CCUS (removals) and carbon market programs
  - Included Japan, Middle East, Europe, United States, Canada and Australia.

- **Work can continue** in new directions and phases through 2023

High-level criteria set out to address three questions

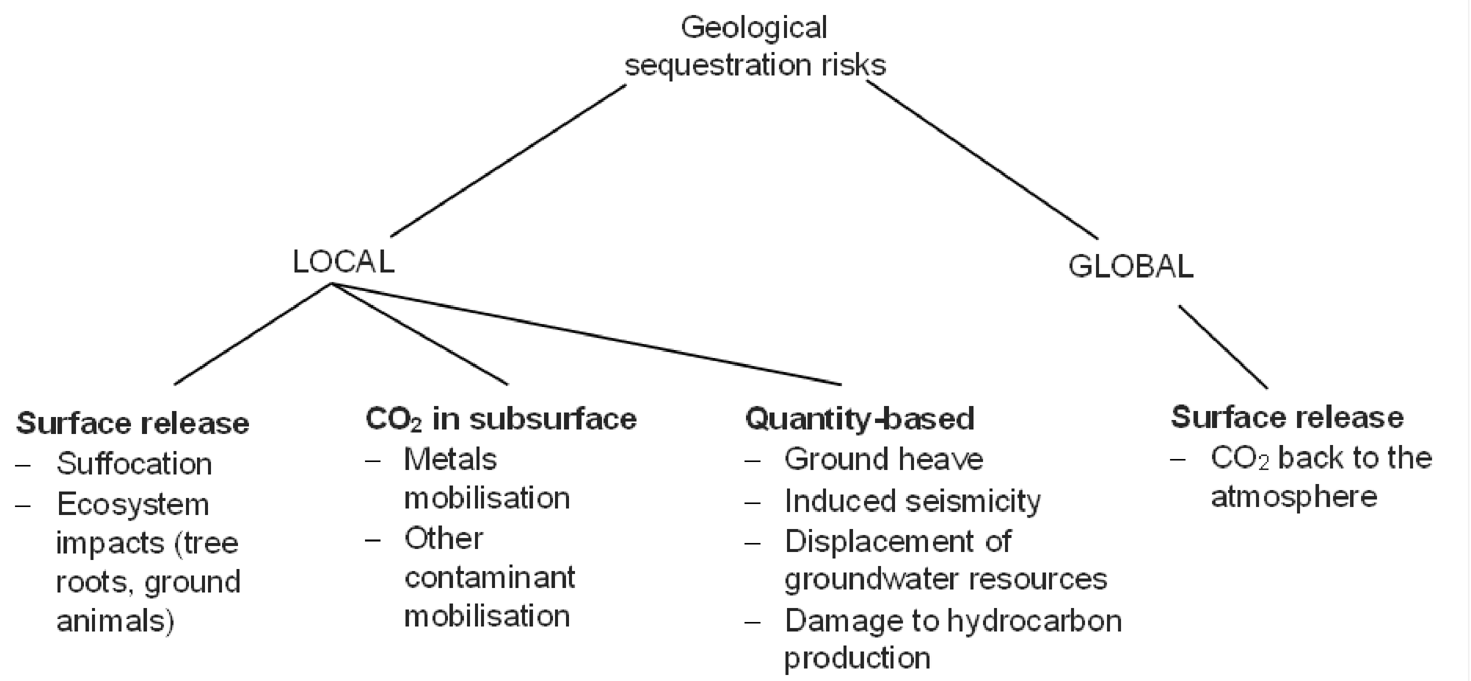
- **What would be the top areas to consider for common principles of CCS/CCUS crediting?**
- **What are the top sources of common criteria on CCS/CCUS to survey for future work/meeting?**
- **What elements may appear on the CCS/CCUS principles or criteria that would be unique from existing crediting criteria?**

CCS crediting methodologies must address both standard & unique issues

Standard crediting issues

1. Applicability conditions
2. Project boundary
3. Baseline
4. Additionality
5. Permanence / reversals
6. Monitoring

Unique issues for geostorage



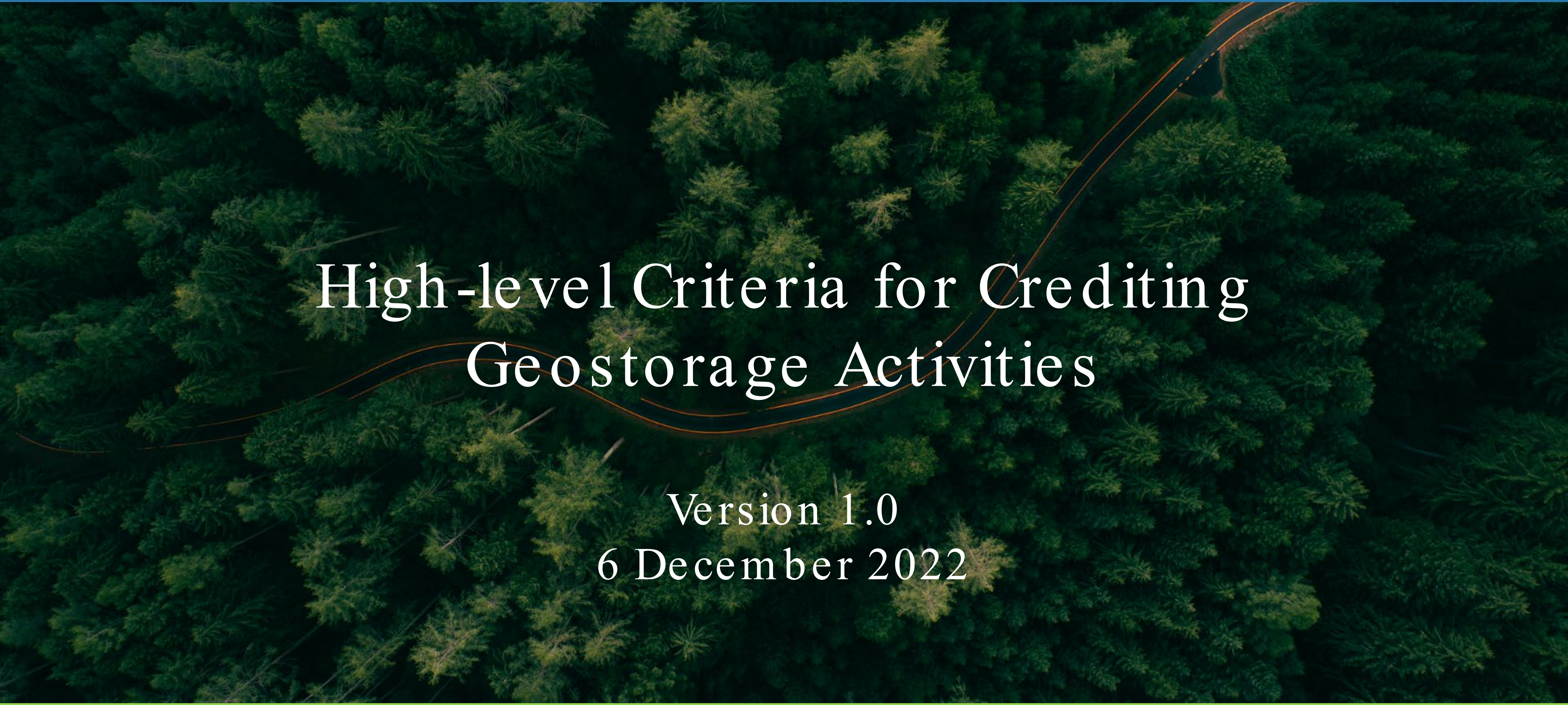
Source: Wilson, E.J and Keith, D.W., 2002

Signposts for how to manage aspects of crediting

- Alberta Government: Quantification Protocol for CO_2 Capture and Permanent Storage in Deep Saline Aquifers
- American Carbon Registry: Methodology for the quantification, monitoring, reporting and verification of GHG emissions reductions and removals from CCS projects
- puro.earth: Puro standard for Geologically Stored Carbon (removals only)
- CCS+ initiative: In progress (documents not yet publicly available)
- United Nations Framework Convention on Climate Change: Modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities (Decision 10/CMP.7)
- IPCC: 2006 IPCC Guidelines for National GHG Inventory Compilation

Methodological components reviewed

- Key terms and definitions
- Applicability/eligibility conditions
- Project boundary
- Site characterisation and selection
- Leakage
- Baseline emissions
- Monitoring
- Permanence and liability for CO_2 reversal
- Environmental and social impacts
- Sustainability



High-level Criteria for Crediting Geostorage Activities

Version 1.0

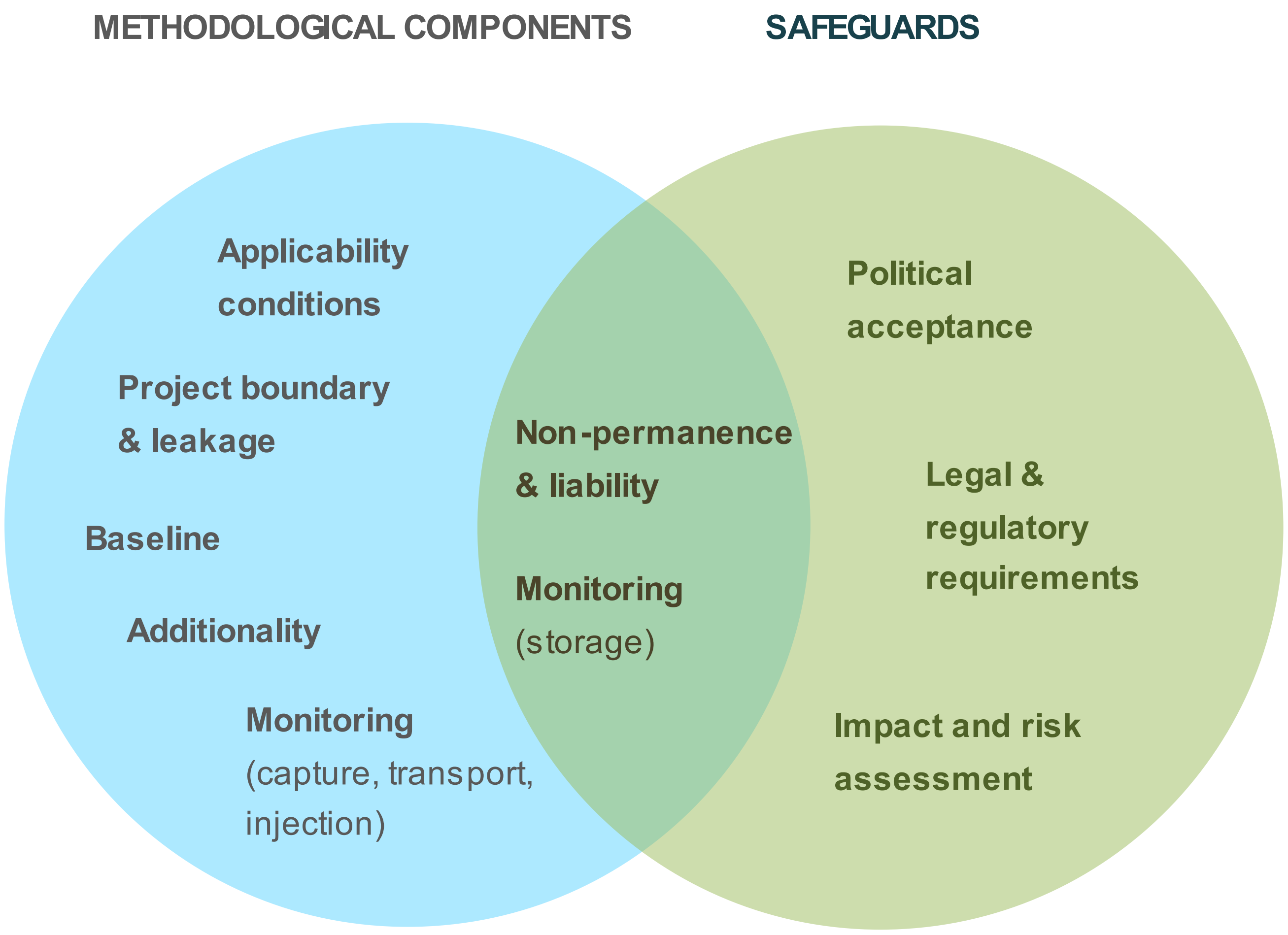
6 December 2022

Proposed approach to high level geostorage criteria

Based on existing methodologies, expert consultation and global reporting standards*, IETA proposes the following criteria to underpin and guide the crediting of carbon geostorage activities in carbon markets:

- **methodological components** describing the rules and procedures for quantifying emission reductions and removals arising from creditable geostorage activities. Six key core methodological components are provided; and
- **safeguards** that identify and manage the specific impacts and potential risks associated with carbon geostorage (including carbon reversal). Ten high-level criteria and supporting 'checkpoints' for safe deployment are provided.

The handling of non-permanence and liability relates to both methodological design and the safeguards for safe carbon geostorage (see right). As such, quantification methodologies must be underpinned by the safeguards described



METHODOLOGICAL COMPONENT		DESCRIPTION
01.	APPLICABILITY CONDITIONS	Defines the specific circumstances, attributes and other conditions that apply to eligible geological CO_2 storage activities. These can include the eligible sources of captured CO_2 (e.g. which types of CO_2 and from which sectors, both of which have implications for baseline selection; see below), the modes of transport, and the allowable storage media. Geographical and technical restrictions can also be applied (e.g. only countries with CCS laws; conditions on geostorage development/operations).
02.	PROJECT BOUNDARY & LEAKAGE	Defines the emissions by sources and removals by sinks that must be measured and accounted for across the capture>transport>storage chain (project boundary). Includes emissions occurring *outside* of the immediate control of the project operator (e.g. upstream emissions), but which are measurable and attributable to the project activity (i.e. 'leakage').
03.	BASELINE	Describes procedures and options to establish the *baseline scenario* and a methodology for calculating *baseline emissions*. The emissions from the project activity must be compared to the baseline to quantify the net emission reductions or carbon removals. Options include projection-based approaches (e.g. historical emissions, or estimated future emissions, without CO_2 capture) or standards-based approaches (e.g. using benchmark emissions of a comparable activity without CO_2 capture).
04.	ADDITIONALITY	Demonstration that the activity delivers emissions reductions/removals that would not have occurred absent of the incentive created by carbon credit revenues. Different approaches and tests exist for demonstrating additionality (e.g. first-of-a-kind (FOAK); regulatory surplus; financial additionality). The primary purpose of CO_2 capture is climate mitigation, which generally means that most projects will be additional. Novelty also means that FOAK or technology penetration rates can be used to rapidly demonstrate project additionality. Financial additionality testing may also be used to discern the value of crediting where other incentives (e.g. tax breaks) or benefits also exist (e.g. commercial CO_2 utilization).
05.	NON-PERMANENCE & LIABILITY	Methodologies should ensure that geological storage sites are appropriately characterized, selected, developed, managed and closed level to mitigate against the risk of carbon reversals (*quality assurance*). Liability to remedy the impacts of any carbon reversals must also be allocated (*liability allocation*). These safeguards can be implemented *either* by applying geographical applicability conditions (i.e. relying on local laws and regulations) and/or through other effective safeguards (see safeguard criteria 05, 06, 07).
06.	MONITORING	Robust monitoring is needed to measure flows and emissions related to aboveground features of the activity and to check for CO_2 leaks in around the storage site. Results of monitoring are used to (i) quantify creditable reductions or removals and (ii) protect natural ecosystems and human health. The latter safeguard can be implemented *either* by applying geographical applicability conditions (i.e. relying on safety monitoring under local laws and regulations) and/or through other effective safeguards (see safeguard criteria 08, 09).

SAFEGUARD AREA	HIGH LEVEL CRITERIA	
POLITICAL ACCEPTABILITY	**01.**	**SIGNIFICANT AND COST-EFFECTIVE FOR NATIONAL CLIMATE MITIGATION**
	02.	**ALIGNED WITH NATIONAL DEVELOPMENT PRIORITIES AND POLICY AIMS**
	03.	**PUBLIC ACCEPTANCE**
LEGAL AND REGULATORY FRAMEWORK FOR SAFE STORAGE	**04.**	**LEGAL BASIS FOR INJECTION AND STORAGE**
	05.	**EFFECTIVE SITE SELECTION AND DEVELOPMENT**
	06.	**ROBUST OVERSIGHT OF SITE OPERATION AND CLOSURE**
	07.	**LIABILITY FOR CARBON REVERSAL**
ENVIRONMENTAL AND SOCIAL SAFEGUARDS	**08.**	**RISK AND SAFETY ASSESSMENT**
	09.	**ENVIRONMENTAL AND SOCIAL IMPACTS**
	10.	**SUSTAINABILITY**

SAFEGUARD AREA	HIGH LEVEL CRITERIA		DESCRIPTION	EXAMPLES OF EVIDENCE / CHECKPOINTS
POLITICAL ACCEPTABILITY	**01.**	**SIGNIFICANT AND COST-EFFECTIVE FOR NATIONAL CLIMATE MITIGATION**	Technologies involving geostorage should be part of a host country's cost-optimized and Paris-aligned national mitigation pathway. The host country mitigation scenarios must have been developed cognizant of the UN Sustainable Development Goals (SDGs).	• Nationally Determined Contributions (i.e. inclusion of geostorage within mitigation scenarios and plans) • Long-term Low Emissions Development Strategies (i.e. inclusion of geostorage) • Techno-economic mitigation studies etc
	02.	**ALIGNED WITH NATIONAL DEVELOPMENT PRIORITIES AND POLICY AIMS**	Technologies involving geostorage should be well aligned with the host country's national development plans, policies and sectoral programmes (e.g. economic development plans, energy sector development, industrial development strategy).	• Nationally Determined Contributions (i.e. demonstration of alignment with broader aims) • National development plans and strategies (e.g. economic development plans, energy sector development, industrial development strategy)
	03.	**PUBLIC ACCEPTANCE**	Activities should only be credited where the host country government and political stakeholders accept the need for geostorage (e.g. undertaking of robust stakeholder consultation as part of national climate policy development).	• Nationally Determined Contributions (i.e. developed with broad public input) • Normal host country public consultation processes and procedures • *OECD Best Practice Principles on Stakeholder Engagement in Regulatory Policy*

SAFEGUARD AREA	HIGH LEVEL CRITERIA		DESCRIPTION	EXAMPLES OF EVIDENCE / CHECKPOINTS
LEGAL AND REGULATORY FRAMEWORK FOR SAFE STORAGE	**04.**	**LEGAL BASIS FOR INJECTION AND STORAGE**	Activities credited under international standards should be compliant with host country laws and regulations. The responsibility for governing the geological pore space into which CO_2 is injected and stored is typically vested into government (but sometimes the surface property owner). In some situations, protection of sub-surface resources may also trigger government permitting and oversight (e.g. groundwater protection). Appropriate permission must therefore be obtained to access and use geologic pore space for the purpose of storing CO_2.	• National laws (e.g. constitution; mineral laws etc that indicate ownership of geological pore space and procedure(s) by which access is conferred to economic operators/private entities). • *CDM CCS Modalities and Procedures* (requirements outlined in Appendix B)
	05.	**EFFECTIVE SITE SELECTION AND DEVELOPMENT**	In permitting the use of geological pore space for CO_2 storage, the pore space owner should ensure protection of natural resources and public health and safety. The safety and security of storage in a proposed geological storage site must be appropriately demonstrated prior to the granting of access and use permission (through e.g. robust site characterisation and selection reports and development, operation and closure plans).	• National laws and regulations (e.g. mineral or petroleum development laws; environmental protection laws; dedicated geological storage law) • *2006 IPCC Guidelines Volume 2, Chapter 5: Carbon Dioxide Transport, Injection and Geological Storage* (Requirements in Section 5.10 include reporting of site characterisation and selection, modelling, monitoring plan design, monitoring etc.) • *CDM CCS Modalities and Procedures* (Appendix B) • *ISO Standard 27914:2017 - Geological Storage*
	06.	**ROBUST OVERSIGHT OF SITE OPERATION AND CLOSURE**	Geological storage activities must be operated respecting the conditions specified in storage site permits with appropriate oversight of a competent body (i.e. modes of development, operation and closure).	• National laws and regulations (clarifying the competent authority and their regulatory powers)
	07.	**LIABILITY FOR CARBON REVERSAL**	Responsibility for CO_2 stored in geological formations must be appropriately allocated to ensure that remedial measures are implemented in the event of a leak/carbon reversal from a geological storage site.	• Liability arrangements (e.g. national laws on environmental liability; mineral/petroleum laws; geological CO_2 storage law) • Liability transfer arrangements (e.g. aligned with the cessation of monitoring described in the *2006 IPCC Guidelines Volume 2, Chapter 5*) • Non-permanence risk tool (NPRT) applied by registry operator

SAFEGUARD AREA	HIGH LEVEL CRITERIA		DESCRIPTION	EXAMPLES OF EVIDENCE / CHECKPOINTS
ENVIRONMENTAL AND SOCIAL SAFEGUARDS	**08.**	**RISK AND SAFETY ASSESSMENT**	Geological domains are inherently heterogenous, each having unique characteristics that influence the safety, durability and non-permanence risk of storage. Risks from CO_2 leaks therefore need to be suitably assessed and managed on the basis of site-specific characteristics within a proposed geological storage site, its surrounding domains and the proposed modes of development and operation. Inherent uncertainty in geological analysis means that this must be based on scenarios of specific features and potential events and processes that could occur at the specific site in order to understand the scale and magnitude of potential impacts (i.e. risks).	• National laws and regulations • *ISO Standard 27914:2017 - Geological Storage* (Section 6: Risk Assessment) • *CDM CCS Modalities and Procedures* (Appendix B)
	09.	**ENVIRONMENTAL AND SOCIAL IMPACTS**	The nature of the impacts of leaking CO_2 of an individual project needs to be understood in the context of the scenarios identified in the risk and safety assessment (e.g. communities, natural ecosystems). Measures must be taken to mitigate and mange such risks and impacts.	• National laws and regulations • *ISO Standard 27914:2017 - Geological Storage* (Section 6: Risk Assessment) • *IFC Performance Standards on Environmental and Social Sustainability (Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts*)
	10.	**SUSTAINABILITY**	Sustainability impacts and benefits of an individual project must be appropriately demonstrated (e.g. tangible co-benefits and/or contributing towards multiple United Nations SDGs). Corporate social responsibility should be part of project deployment (as appropriate to the project setting). For example, implementation could be accompanied by community support programmes and knowledge sharing, education and engagement actions relating to climate change and its mitigation through geologic CO_2 storage.	• *CDM Sustainable Development co-Benefits Tool* • *ISO Standard 37101:2016 - Sustainable development in communities* • Project-level standard requirements for sustainability (e.g. The Gold Standard requirement to deliver on at least 3 SDGs, including climate action (SDG 13))

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