

CCS credit schemes around the world

METI-JOGMEC-IETA Joint Workshop “Global Carbon Market and CCS
-Towards Decarbonization of ASEAN-”

 **Mitsubishi Research Institute**

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Climate Change Solutions Group, Sustainability division

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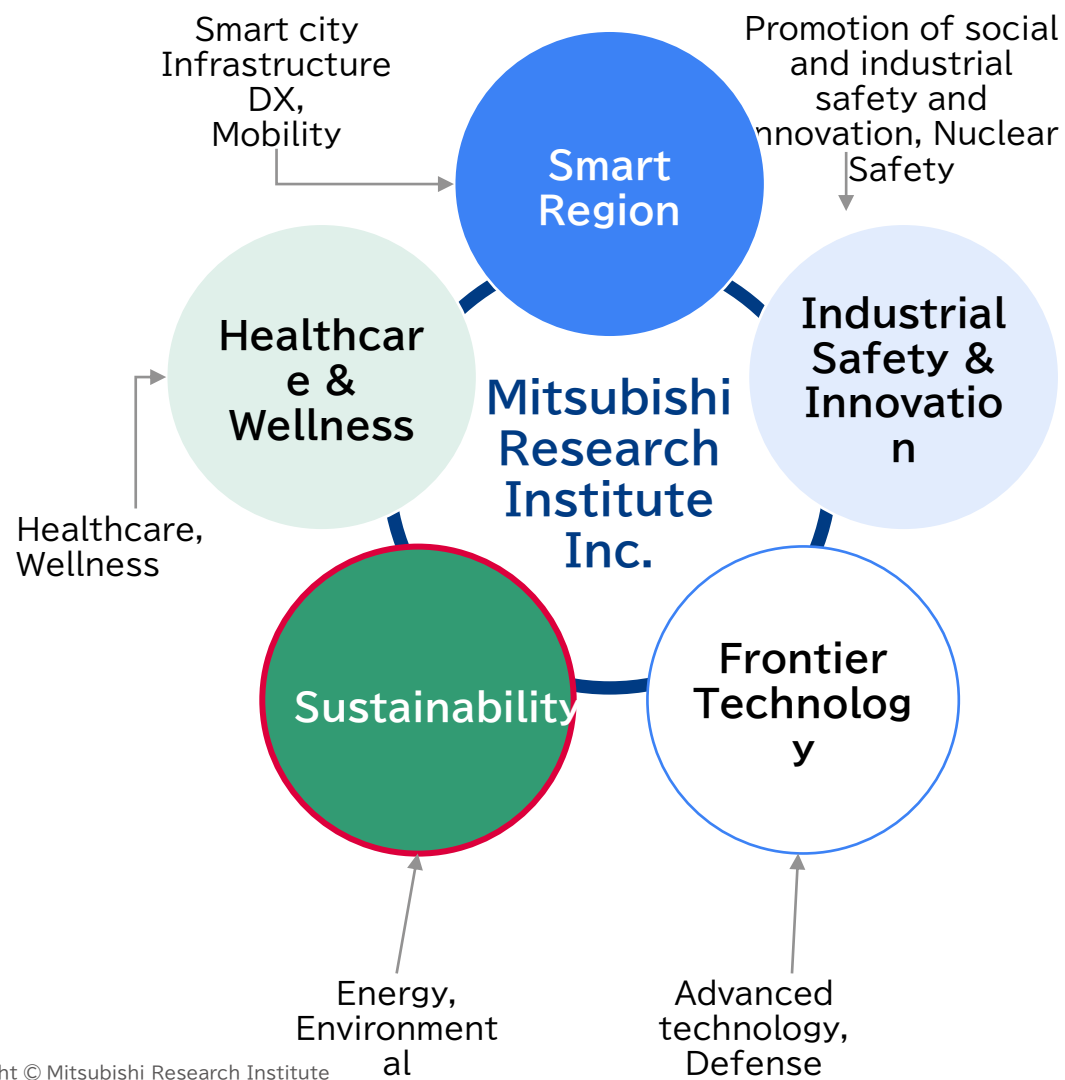
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Introduction

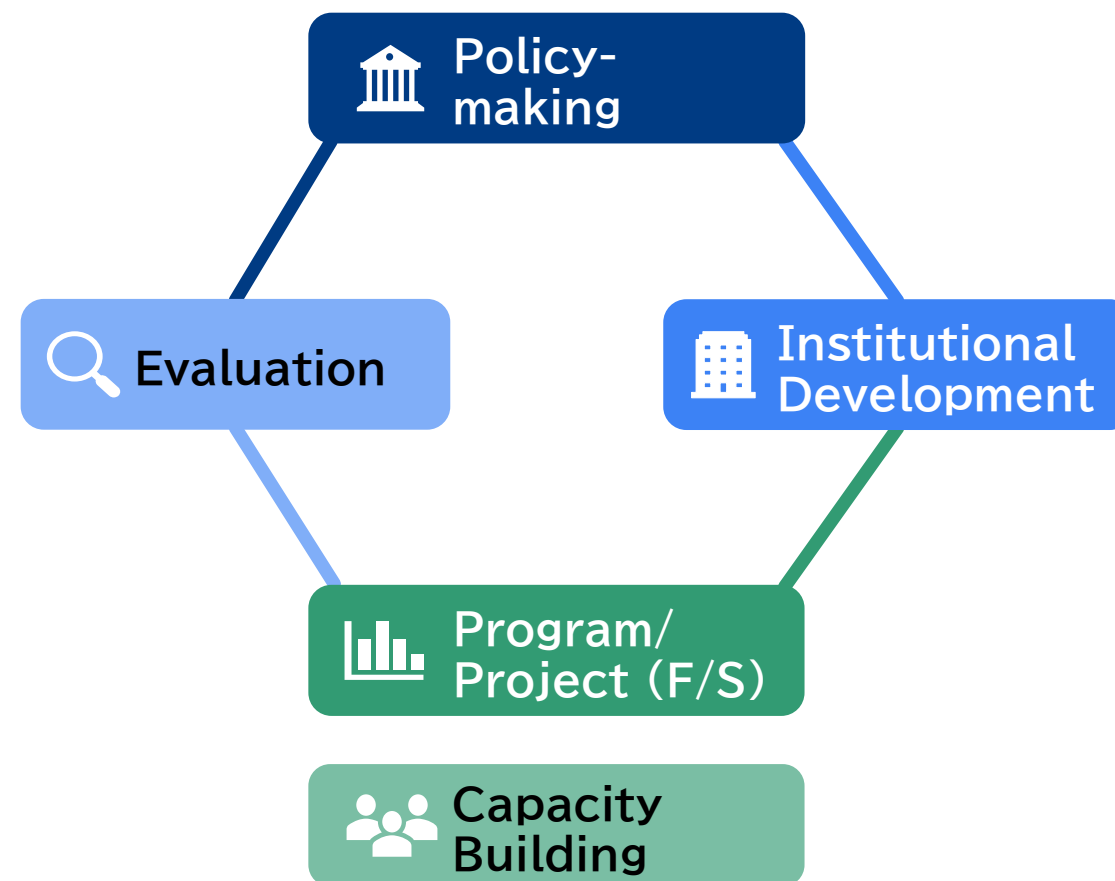
- About Mitsubishi Research Institute
- MRI' s Key Track Record in CCS and Carbon Credit

About Mitsubishi Research Institute

Business Fields



What We Do



MRI's Key Track Record in CCS and Carbon Credit

- With long history of methodology development under CDM and JCM schemes. Including developing two CCS methodologies for CDM, MRI has conducted underlying policy and business environment studies and assisted CCS project development.

Project	Client	Year
Study on global trend in CCUS policies, legal framework, business models and administration of feasibility studies	Ministry of Economy, Trade and Industry of Japan (METI)	2019-2023
Study on global trend in evaluation methods for carbon intensity & carbon sequestration for CCUS activities	Japan Oil, Gas and Metals National Corporation (JOGMEC)	2020-2023
Study on the Potential for the Promotion of Carbon Dioxide Capture, Utilisation, and Storage in ASEAN Countries (Asia CCUS Network activities)	Economic Research Institute of ASEAN and East Asia (ERIA)	2020-2021
Technical, market, business feasibility studies for CCS	Various private companies	2016-2023
Feasibility study of CCS-EOR in Mexico	METI	2015
Feasibility Study on JCM-CCS Project in Indonesia	METI, NEDO	2010-2012
Feasibility Study on CDM-CCS Project	METI	2005

CCS and Carbon Market

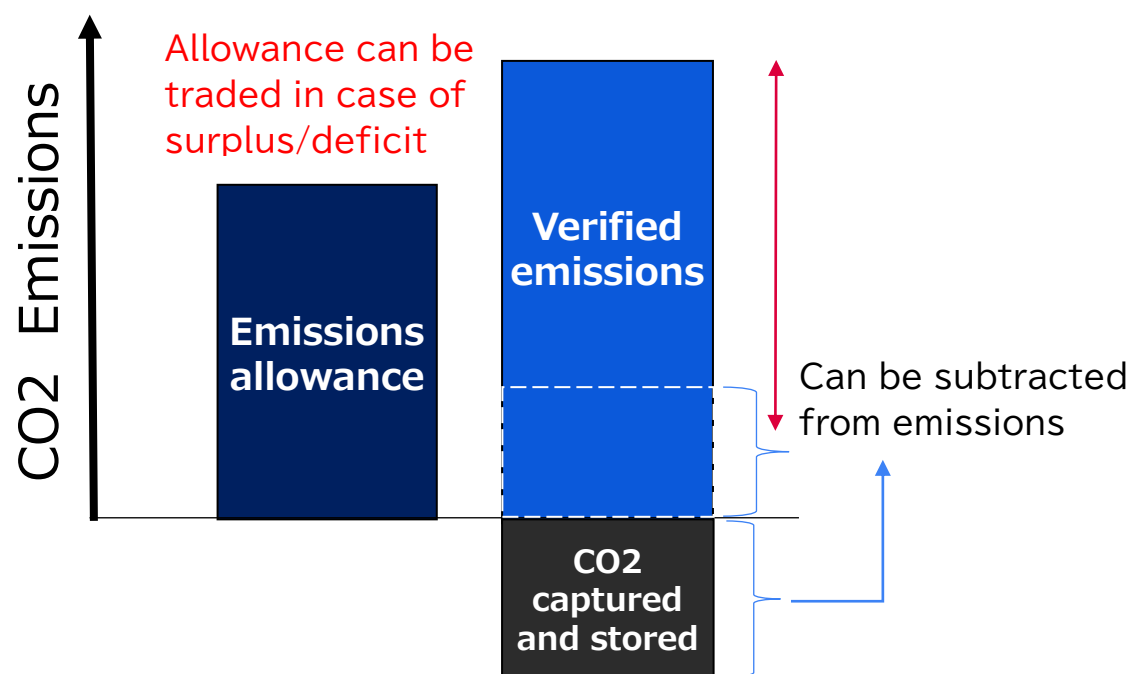
- Cap and Trade/Baseline and Credit
- Overview of Carbon Market
- History of CCS in Carbon Credit Schemes
- CCS under Kyoto Protocol
- CCS Methodologies under CDM
- CCS and Paris Agreement
- Overview of CCS in key carbon credit schemes

CCS and Carbon Market

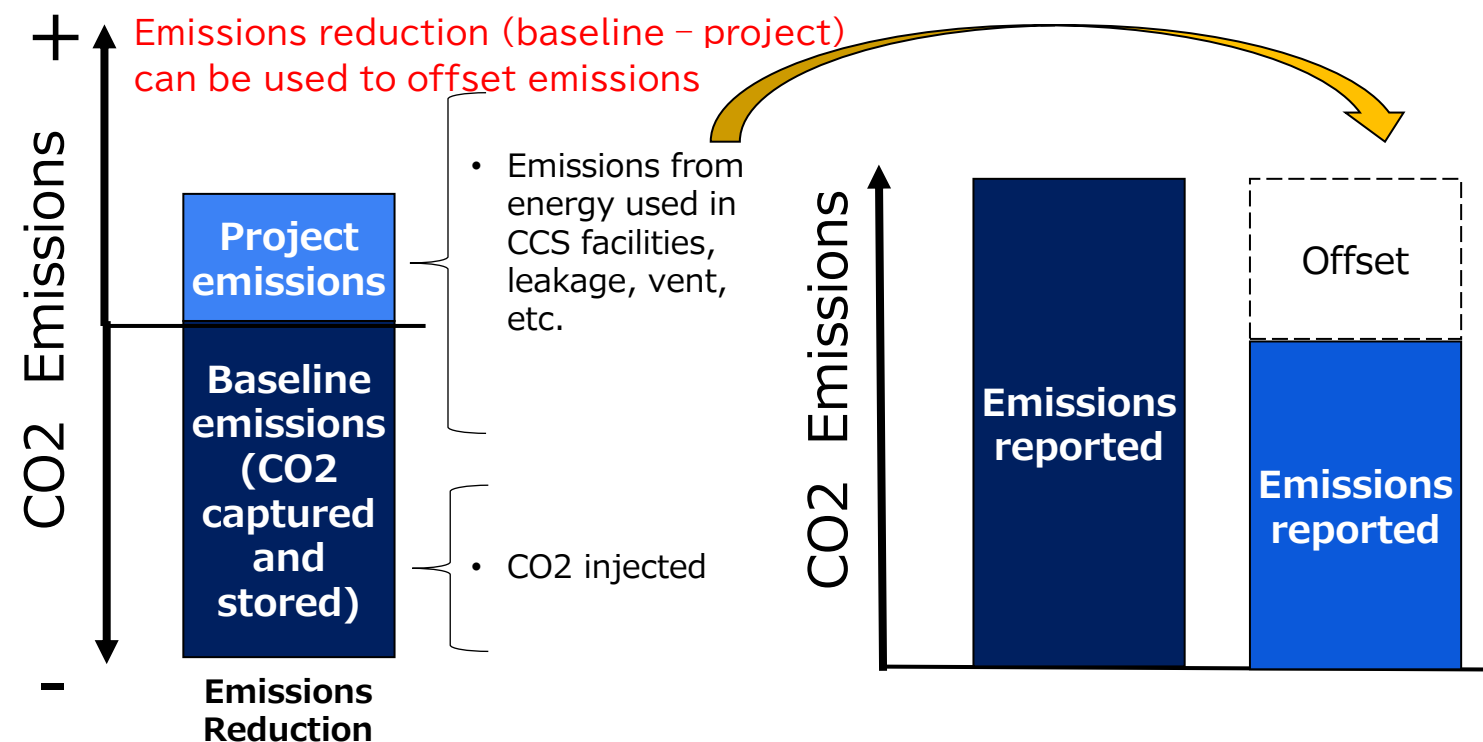
Cap and Trade / Baseline and Credit

- Carbon market is roughly characterized by 1) cap and trade (emissions trading) and 2) baseline and credit schemes.
- The presentation focuses on baseline and credit schemes.

Cap and Trade (facility based)



Baseline and Credit (project based)

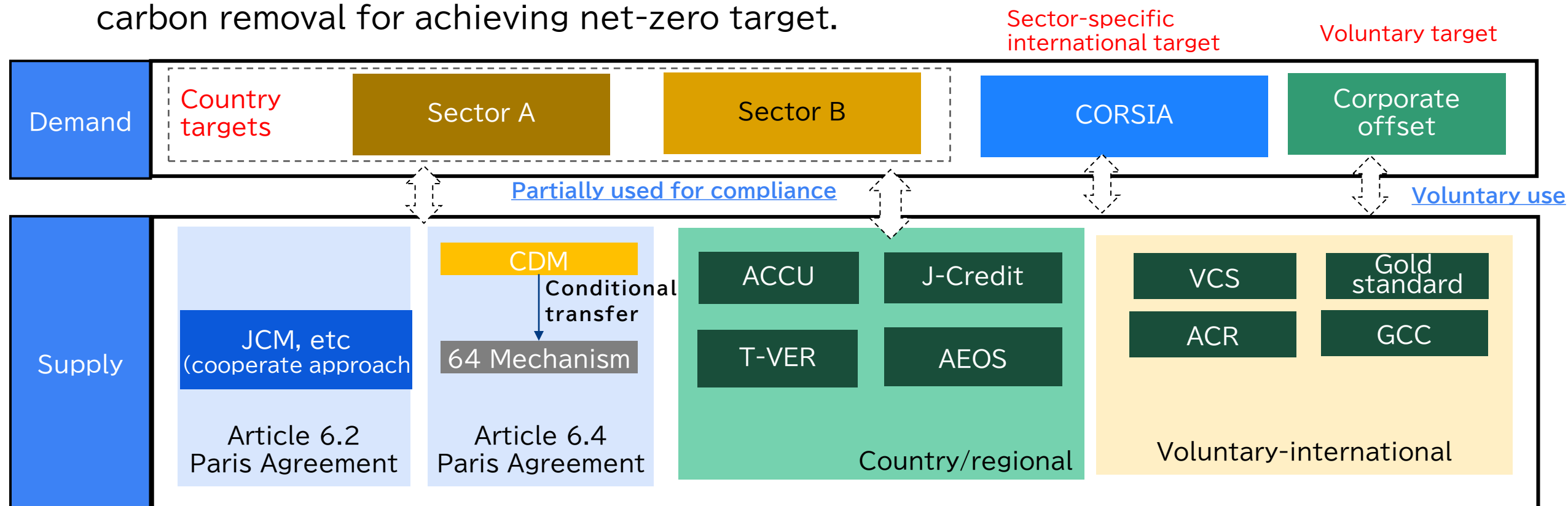


Source) Created by MRI based on various sources

CCS and Carbon Market

Overview of Carbon Market

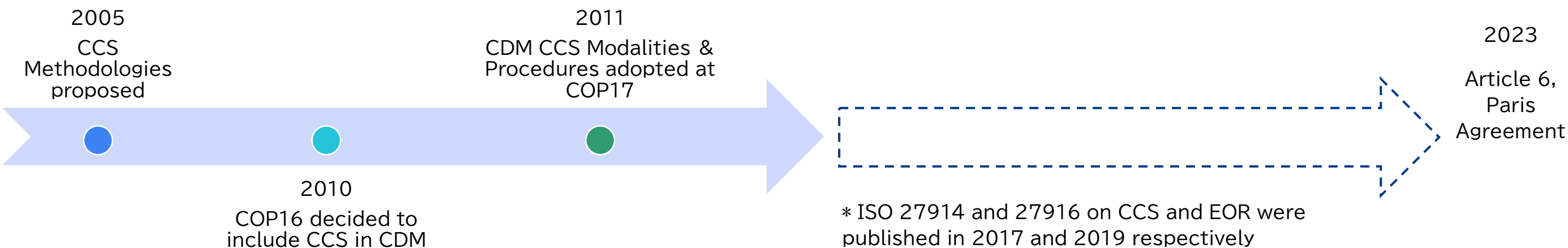
- The landscape of carbon market is quite complex with public schemes such as CORIA using voluntary credits while corporates are using all sorts of credits for voluntary use.
- As carbon credits offset remaining emissions, they will eventually need to be replaced by carbon removal for achieving net-zero target.



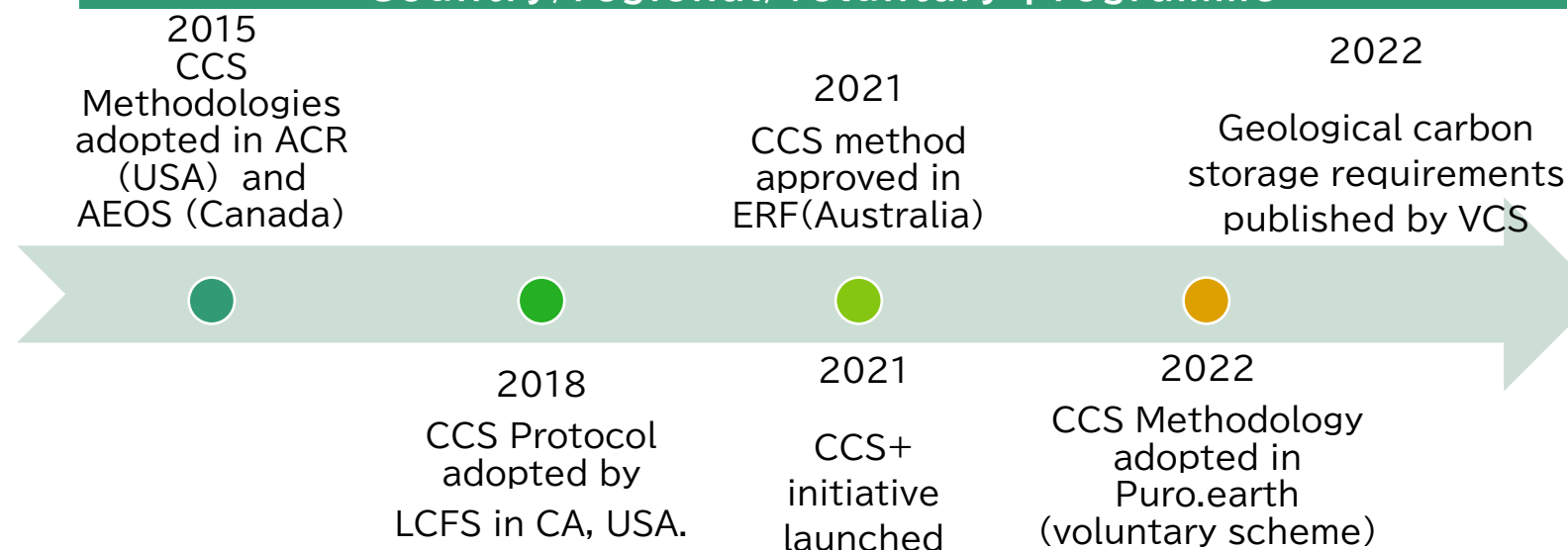
CCS and Carbon Market

History of CCS in Carbon Credit Schemes

UNFCCC Consideration



Country/regional/voluntary programme



ACR: American Carbon Registry
 AEOS: Alberta Emissions Offset Scheme
 ERF: Emissions Reduction Fund
 LCFS: Low Carbon Fuel Standard

CCS under Kyoto Protocol(1/3)

- CCS under the CDM was considered immediately after the Kyoto Protocol entered into force.

Year	Item
1997	<ul style="list-style-type: none"> ■ Adoption of the Kyoto Protocol
2001	<ul style="list-style-type: none"> ■ Adoption of the Marrakech accords (rules and modalities of the Kyoto Protocol). Nuclear power and forest conservatoin are excluded from the CDM, but CCS is not mentioned.
2005	<ul style="list-style-type: none"> ■ The Kyoto Protocol came into effect. The first Conference of the Parties (COP/MOP1) discussed CCS under the CDM. ■ CCS methodologies in CDM were proposed (currently withdrawn).
2006	<ul style="list-style-type: none"> ■ IPCC CCS Special Report (SRCCS) released. Under appropriate site selection and management, leakage of CO2 in 100 year is expected to be 1% or less.
2010	<ul style="list-style-type: none"> ■ At COP/MOP 6, CCS in the CDM is recognized. <ul style="list-style-type: none"> ■ Includes "stringent and robust criteria" for site selection," "stringent monitoring plan," "any project emissions shall be accounted," etc.
2011	<ul style="list-style-type: none"> ■ Modalities and procedures on CCS in CDM adopted (described on the next page)
2012	<ul style="list-style-type: none"> ■ A working group on CCS was established under the CDM Executive Board. WG's task is to review proposed CDM methodologies. <ul style="list-style-type: none"> ■ Since no submission has been made to date, the WG has not been convened. ■ To date, only two organizations have been certified as certification and verification organizations (TUV Nord, EPIC). ■ It is agreed that CCS with transboundary transport will be eligible under CDM, but details are yet to be determined.

CCS under Kyoto Protocol(2/3)

- COP/MOP 7 (Durban, 2011) adopted Decision 10 on modalities and procedures for CCS (later included in the CDM project standard).

Item	Overview
Host Country participation requirement	<ul style="list-style-type: none"> ■ A legal system is in place for site selection procedures, the ownership of subsurface pore space, corrective measures for environmental and personal damage, corrective measures for unintentional leaks, and liability, etc.
Operator Requirements	<ul style="list-style-type: none"> ■ Monitoring should be conducted for 20 years after the end of the crediting period, corrective action should be implemented in case leak occurs, and financial arrangements should be made to enable the host country to fulfill its responsibilities associated with the transfer of liability.
Liabilities	<ul style="list-style-type: none"> ■ Transfer to the host country after the monitoring period has ended and approved by the host country.
Site Requirements	<ul style="list-style-type: none"> ■ There is no significant risk of seepage or risk to human and the environment, not located in international waters (determined by e.g. data, history matching, etc).

CCS under Kyoto Protocol(3/3)

Item	Overview
Compensating for leakage measures	<ul style="list-style-type: none"> ■ 5% of the CER issued is placed on reserve account, to be used to compensate for leakage. ■ To compensate for the leakage, (1) the contribution from the reserve account, (2) the pending account, and (3) CER issued to the account of the project operator, in that order. ■ If the above cannot be covered, it will be covered by other Kyoto units such as CDM.
Verification and certification	<ul style="list-style-type: none"> ■ The second and subsequent verifications shall be submitted within five years after the end of the previous verification period. ■ Carry out history matching and where necessary, update numerical models used. ■ Verification and certification shall continue beyond the end of the last crediting period and shall only cease after the monitoring of the geological storage site has been terminated.
Monitoring	<ul style="list-style-type: none"> ■ Shall not be terminated earlier than 20 years after the end of the last crediting period or after the issuance of CERs has ceased, whichever occurs first. ■ Only be terminated if no seepage has been observed at any time in the past 10 years and if all available evidence indicates that the stored CO₂ will be completely isolated from the atmosphere in the long term

Source) Adapted from Decision 10/CMP.7 Annex: Modalities and procedures for carbon dioxide capture and storage in geological formations under the clean development mechanism

CCS Methodologies under CDM (1/2)

- Two CDM methodologies were proposed, both led by MRI and modalities and procedure were put in place; however, no CCS project ever materialized under CDM.

	NM0167	NM0168
Project	<ul style="list-style-type: none"> White Tiger Oil Field CCS project (Vietnam): up to 7.7Mt-CO₂/yr 	<ul style="list-style-type: none"> The capture of the CO₂ from the LNG complex and its geological storage in the aquifer (Malaysia): 3.08Mt-CO₂/yr
Application conditions	<ul style="list-style-type: none"> A project to store anthropogenic CO₂ in an oil reservoir (onshore / offshore) with a minimum depth of 600 meters below surface. Seepage of CO₂ must not exceed 0.7% of total storage over the crediting period (7 years). In addition, the data to be obtained and the design and monitoring of injection wells etc. are described. 	<ul style="list-style-type: none"> It is stored in a saline aquifers or abandoned oil/gas fields. The reservoir must be deep enough to maintain injected CO₂ in a supercritical phase. Simulations shall be undertaken to demonstrate that CO₂ is to be injected into “appropriately selected and managed geological reservoirs”, in which the fraction retained is very likely to exceed 99% over 100 years, and is likely to exceed 99% over 1,000 years

Source) Proposed CDM Methodologies NM0167 and NM0168 documents, from UNFCCC CDM Website (<https://cdm.unfccc.int/methodologies/index.html> accessed October 21, 2021)

CCS Methodologies under CDM Protocol(2/2)

	NM0167	NM0168
Monitoring (CO2 seepage)	<ul style="list-style-type: none"> ■ In the case that the project continues to meet the minimum standards as stipulated in the applicability conditions, emissions from leakage are considered negligible. ■ Monitoring is conducted to confirm whether leakage exceeds 0.7% of the total stored amount in a crediting period. In the case of significant release, the amount must be determined based on the results of seismic surveys etc. and treated as project emissions. 	<ul style="list-style-type: none"> ■ Will be monitored using seismic monitoring and other monitoring measures. <ul style="list-style-type: none"> ■ Identification of potential escape mechanisms ■ Monitoring by downhole monitoring or 3D seismic surveys ■ Quantification of escape ■ At the end of the last crediting period, emissions due to future CO2 escapes in the long term, e.g. over 1,000 years will be predicted and they will be included in the project emissions.
Other	<ul style="list-style-type: none"> ■ Emissions from produced oil is not counted (as it would replace non-EOR oil). 	

Source) Proposed CDM Methodologies NM0167 and NM0168 documents, from UNFCCC CDM Website (<https://cdm.unfccc.int/methodologies/index.html> accessed October 21, 2021)

CCS and Paris Agreement

- Glasgow Climate Pact at COP26 made a clear decision on phasedown of “unabated coal” in all countries.
- No specific reference to CCS in Paris Rulebook. CDR guideline was discussed at COP27.
- Need to watch for adoption of various rules and transfer of methodologies from CDM including standards and guidelines.

	Article 6.2	Article 6.4
Outline	Cooperative approach	Centralised system under UNFCCC
	Includes preceding bilateral schemes, such as JCM	Successor of CDM
Points related to CCS	<ul style="list-style-type: none"> • Dependent upon each approach • Feasibility studies have been carried out under JCM. 	<ul style="list-style-type: none"> • CDR guideline was discussed
Schedule	<ul style="list-style-type: none"> • Can be operationalized as soon as necessary infrastructure for recording and reporting are in place. 	Work is underway in establishing Supervisory Committee which will adopt various rules.

Source) COP 26 decisions

CCS and Carbon Market

Overview of CCS in key carbon credit schemes (1/2)

	ACR (USA)	AEOS (Alberta, Canada)	ERF (Australia)	Puro.earth (international)	VCS (international)
Purpose	Compliance (California compliance offset program) and voluntary	Compliance offset for TIER	Compliance offset for safeguard mechanism, voluntary	Voluntary	Voluntary (eligible for compliance offset in some areas)
Year CCS method/guideline was approved	2015	2015	2021	2022	2022
Legal framework	US federal/state	Canada federal/province	<ul style="list-style-type: none"> Australia commonwealth /province 	<ul style="list-style-type: none"> US EPA (Class I, II, IV) or EU CCS Directive equivalent 	-
Applicability	CCS and CO ₂ -EOR	CCS and CO ₂ -EOR	CCS	DACCS and BECCS with EOR+	CCS
Projects	5 projects	1 CCS (Quest) 1 CO ₂ -EOR (MEglobal)	Moomba	AspiraDAC project, BECCS Norway	n/a

Source) Adapted from official information of each scheme

CCS and Carbon Market

Overview of CCS in key carbon credit schemes (2/2)

	ACR (USA)	AEOS (Alberta, Canada)	ERF (Australia)	Puro.earth (international)	VCS (international)
Credit buffer	10% (optional) or private insurance	<ul style="list-style-type: none"> • 0%~50% depending on project type for EOR • None for CCS 	3%	10% for all projects (not just CCS)	Determined per project based on risk assessment
Long-term monitoring	Minimum 5 years monitoring after end of project term.	Minimum of 10 years after end of crediting period	15 years of extended accounting period after end of crediting period	n/a	Minimum of 10 years required for combined duration of monitoring post-injection until storage site closure and post-closure.
Site closure	Only reference is made to “transfer of responsibility”	Reference to post-closure monitoring in accordance with the applicable regulation	Reference to extended account period monitoring in accordance with the applicable regulation	n/a	Storage site closure conditions need to be specified and closure plan needs to be documented.

Source) Adapted from official information of each scheme

CCS and Carbon Market

[Reference] CCS in Voluntary Market: Puro.earth

- Established in April 2019 by entrepreneurs from Finland with support from Fortum, a Fin electric power company, as the world's first voluntary crediting scheme dedicated to negative emissions
- Nasdaq Puro.earth in June 2021 and launched the world's first carbon removal indexes in March 2022.

methodologies	Projects selling credits (as of 16/01/2023)
Biochar	25 (12)
Carbonated Building Elements	—
Bio-based Construction Materials	8
Geological carbon storage	(2)
Woody Biomass Burial	(1)
Soil amendment	1(1)
Enhanced weathering	(2)

Source) Puro.earth website, <https://puro.earth/carbon-removal-methods/> (Accessed 16 January 2023)

Note: number in parenthesis refers to pre-corg (credits issued for projects under development)

Summary

Summary

Common issues to consider

- What can be done to enable CCS project formulation by private business entities under credit schemes while protecting integrity
- **Types of eligible CCS activities.** Eligibility of CCS-EOR in transition to net-zero, under some circumstances.
- **Long-term monitoring.** Possibilities of setting conditions in order to limit the temporal and spatial extent of monitoring?
- **Avoidance of double counting.** Either capturer or injector can claim credits.
- **New challenge: Consideration of multiple CO₂ sources added in various phases using common infrastructure.** Repercussions on monitoring regime and CO₂ ownership.

Source) Created by MRI based on IEA, World Energy Outlook (2020)

Envisioning the future, leading change

