

Introduction of accounting approaches for CDM



A Research Project on Accounting Rules on
CO₂ Sequestration for Creation of National GHG Inventories (ARCS)

Kenshi Itaoka

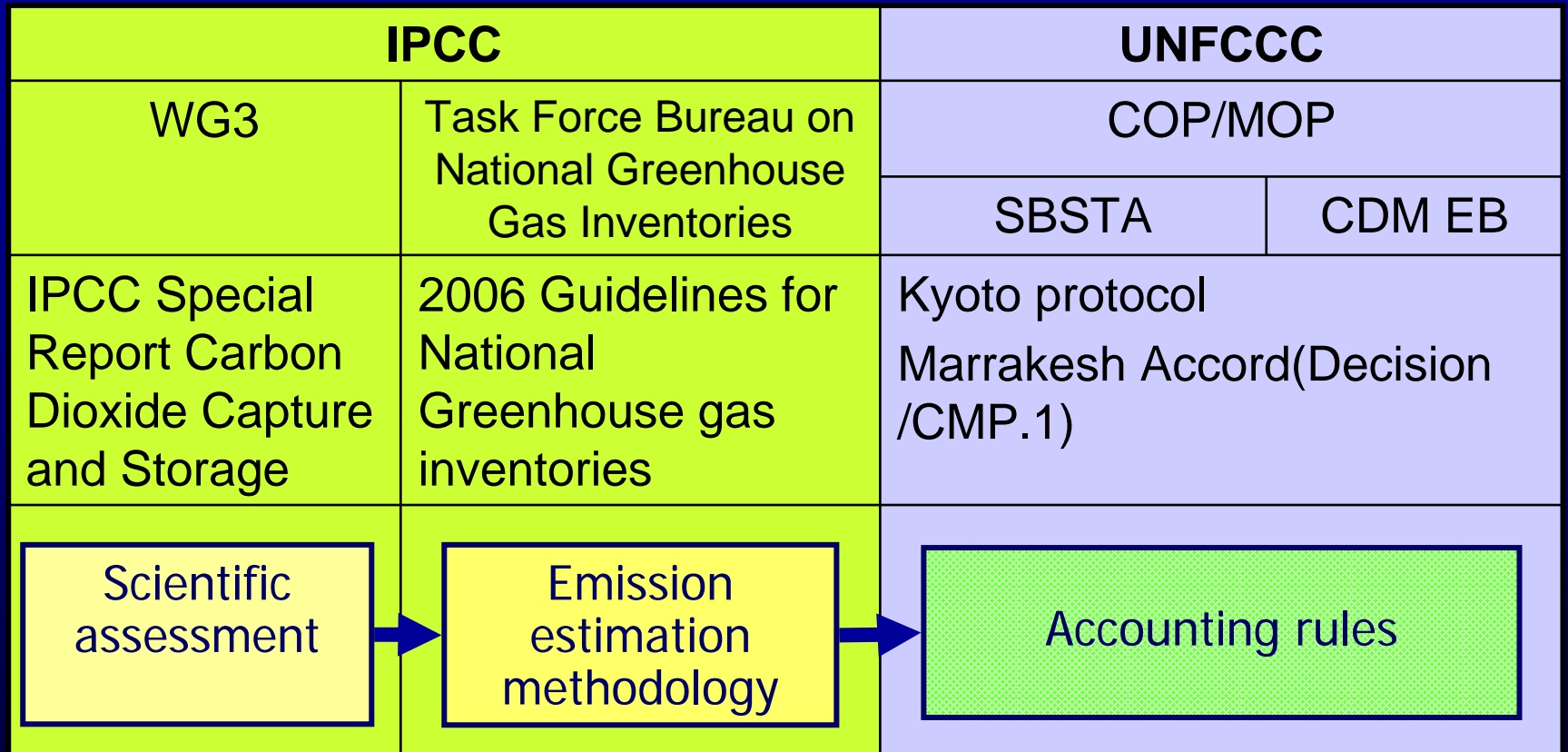
Mizuho Information & Research Institute

Workshop on CDM Methodological Issues in regard to CCS in Paris

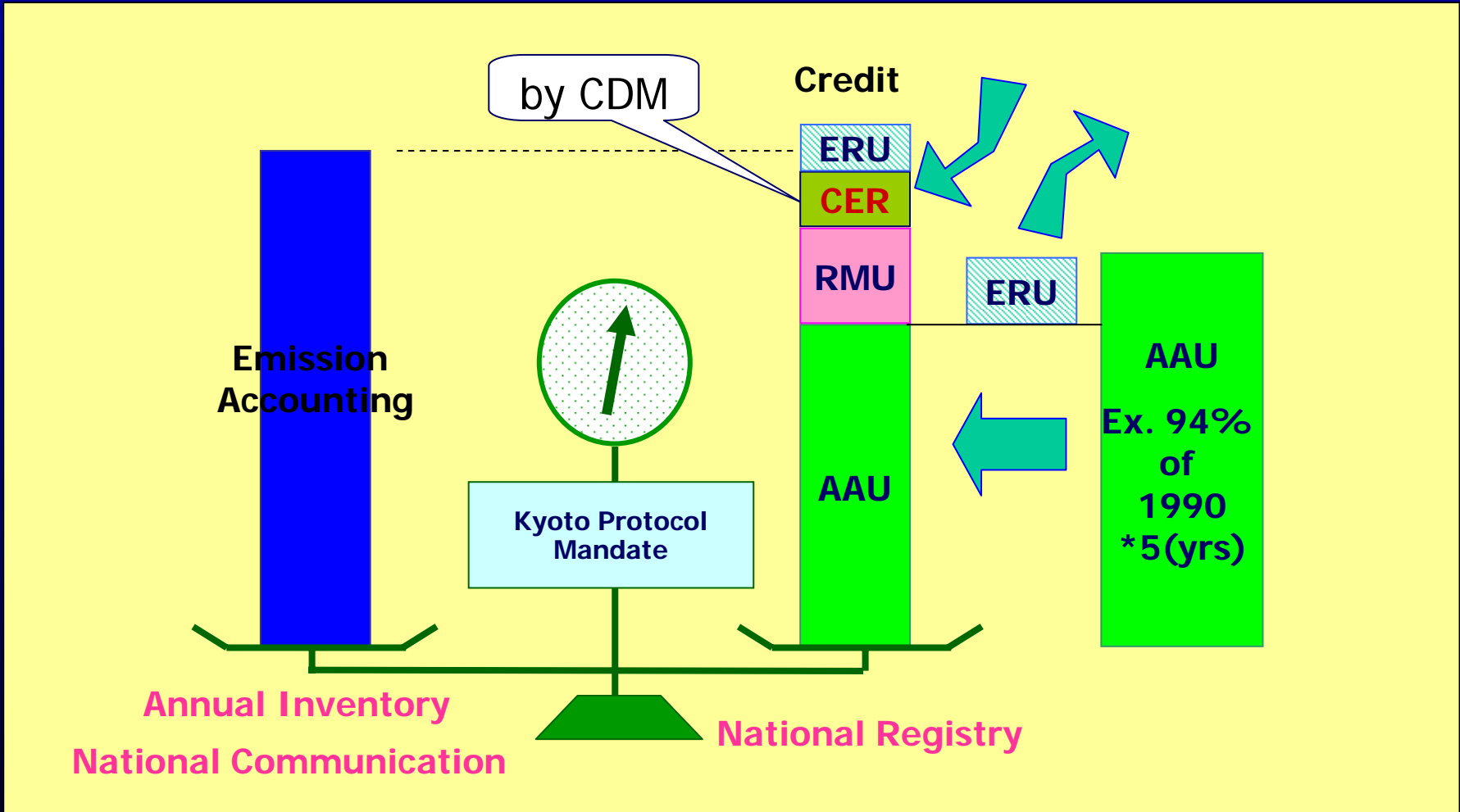
Contents

- Basis for Accounting
- Emission estimation
- Accounting
 - Emission reduction or Removal ?
 - Project boundary
 - Baseline and additionality
 - Monitoring and physical leakage
- Conclusion

Basis for Accounting



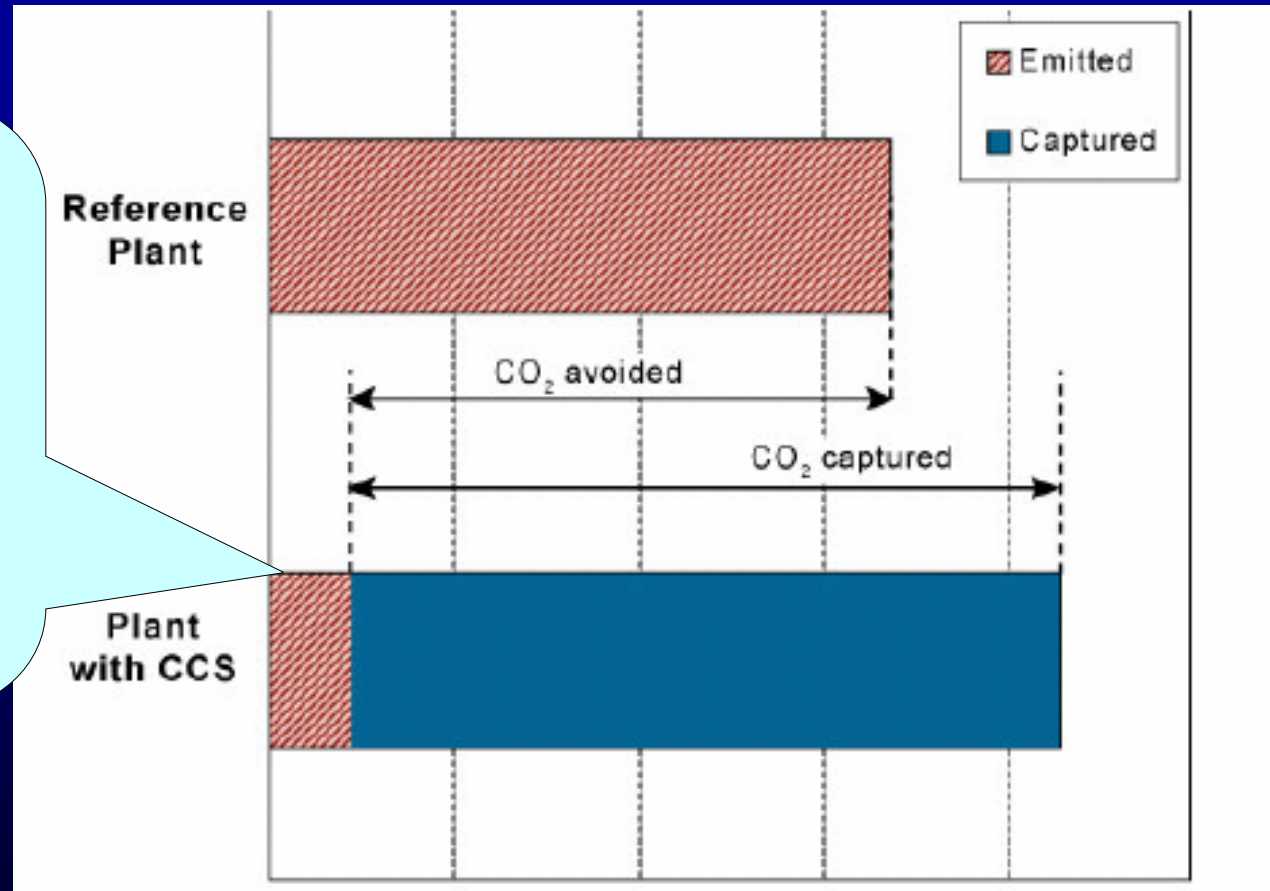
National GHG Inventories and Kyoto Protocol



Net emission reduction

defined by IPCC Special Report Carbon Dioxide Capture and Storage:

- Not captured CO₂
- Energy penalty (capture, transport and storage)
- Fugitive emission (capture, transport and storage)



Net reduction (CO₂ avoided) = CO₂ emission from reference plant
- CO₂ emission from plant with CCS

Emission Estimation

Draft 2006 IPCC Guideline for GHG inventories:

Volume 2 Chapter 5 Carbon Dioxide Transport Injection and Geological Storage provides methodology to estimate **fugitive emissions**.




Category Code and Name		Definition	Tier
1 C 1	Transport of CO ₂	Fugitive emissions from the systems used to transport captured CO ₂ from the source to the injection site. These emissions may comprise losses due to fugitive equipment leaks, venting and releases due to pipeline ruptures or other accidental releases	
1 C 1 a	Pipelines	Fugitive emissions from the pipeline system used to transport CO ₂ to the injection site.	1
1 C 1 b	Ships	Fugitive emissions from the ships used to transport CO ₂ to the injection site.	3
1 C 1 c	Other (please specify)	Fugitive emissions from other systems used to transport CO ₂ to the injection site and temporary storage .	
1 C 2	Injection and Storage	Fugitive emissions from activities and equipment at the injection site and those from the end containment once the CO ₂ is placed in storage.	
1 C 2 a	Injection	Fugitive emissions from activities and equipment at the injection site.	3
1 C 2 b	Storage	Fugitive emissions from the end equipment once the CO₂ is placed in storage.	3
1 C 3	Other	Any other emissions from CCS not reported elsewhere.	

Emission Estimation

Draft 2006 IPCC Guideline for GHG inventories:

Methodology to estimate fugitive emission from storage sites is elaborated

Estimating, Verifying & Reporting Emissions from CO2 Storage Sites

Site Characterization	Confirm that geology of storage site has been evaluated and that local and regional hydrogeology and leakage pathways (Table 5.1) have been identified. 
Assessment of Risk of Leakage	Confirm that the potential for leakage has been evaluated through a combination of site characterization and realistic models that predict movement of CO2 over time and locations where emissions might occur. 
Monitoring	Ensure that an adequate monitoring plan is in place. The monitoring plan should identify potential leakage pathways, measure leakage and/or validate update models as appropriate. 
Reporting	Report CO2 injected and emissions from storage site

- However, no time horizon for monitoring would be provided probably because national inventories are created on annual basis.

Emission Estimation

Draft 2006 IPCC Guideline for GHG inventories:

For QA/QC for whole CCS system, making overview table is required.

Category1	Data Source	CO2 (Gg)
Total amount captured for storage (A)	Summed from all relevant categories	
Total amount of import for storage (B)	Data from pipeline companies, or statistical agencies	
Total amount of export for storage (C)	Data from pipeline companies, or statistical agencies	
Total amount of CO2 injected at storage sites (D)	Data from storage sites provided by operators, as described in Chapter 5	
Total amount of leakage during transport (E1) category 1 C 1	Summed from IPCC reporting category 1 C 1	
Total amount of leakage during injection (E2) category 1 C 2 a	Summed from IPCC reporting category 1 C 2 a	
Total amount of leakage from storage sites (E3) category 1 C 2 b	Summed from IPCC reporting category 1 C 2 b	
Total leakage (E4 = E1 + E2 + E3))	E1 + E2 + E3	
Capture + Imports (F = A + B)	A + B	
Injection + Leakage + Exports (G = D + E4 + C)	D + E4 + C	
Discrepancy (F – G)	F - G	

Accounting

Key issues

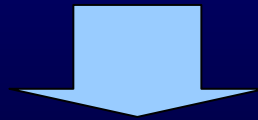
- Emission reduction or Removal?
- Project boundary
 - relevant to Leakage (UNFCCC term)
- Baseline and additionality
- Monitoring and physical leakage
 - relevant to Permanence

Accounting

Credit calculation

[Decision 3/CMP.1 Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol]:

- (...), CERs resulting from a CDM project activity during a specified time period shall be calculated, applying the registered methodology, by subtracting the actual anthropogenic emissions by sources from baseline emissions and adjusting for leakage.



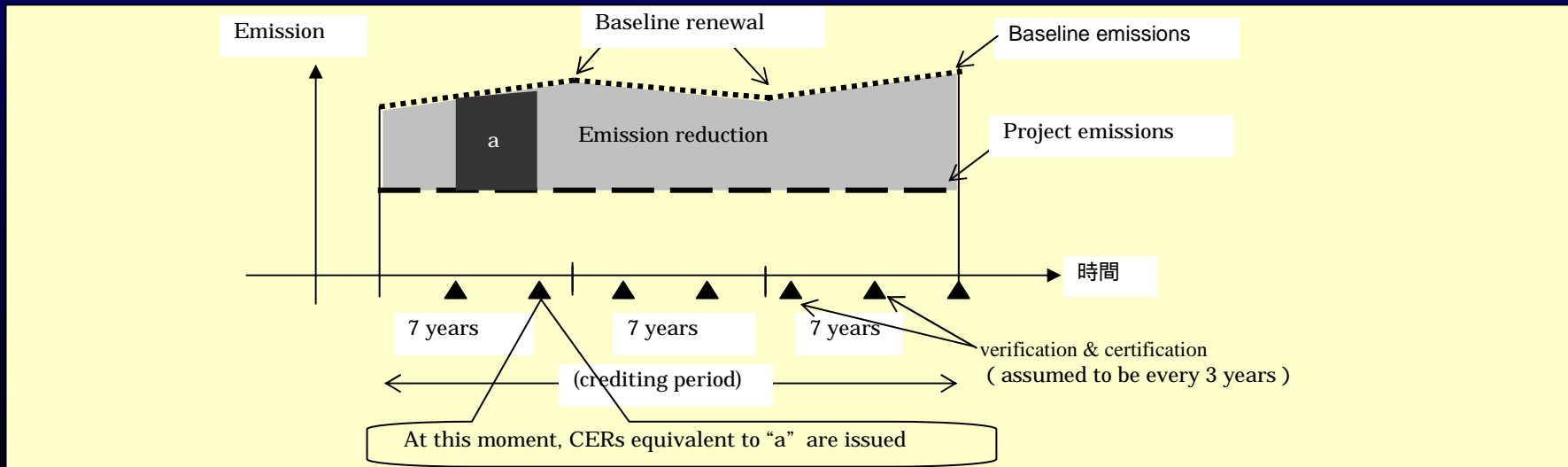
$$\text{CERs} = \text{Baseline emissions} - \text{Actual emission by source} \pm \text{Leakage}$$

Accounting

Crediting period

[Decision 3/CMP.1 Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol]:

- A maximum of seven years which may be renewed at most two times, provided that, for each renewal, a designated operational entity determines and informs the Executive Board that the original project baseline is still valid or has been updated taking account of new data where applicable; or
- A maximum of 10 years with no option of renewal.

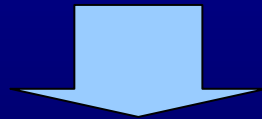


Accounting

Q: Is CCS activity Emission reduction or Removal?

» Current Draft of 2006 IPCC Guideline would indicate
“Yes.”

- If CCS is considered as emission reduction,



- Modalities & Procedure of CDM (Marrakesh Accord, Decision 3/CMP.1) would be applicable.

- **However, the Modalities & Procedure of CDM is not fully relevant to CCS activities.**
- **There is no clear accounting rules under UNFCCC (COP decision or CDM methodology panel).**

Accounting

Project boundary

[Decision 3/CMP.1 Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol]:

- The **project boundary** shall encompass all anthropogenic emissions by sources of greenhouse gases under the control of the project participants (...).
- **Leakage** is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary,

Accounting

Project boundary

Geographical or jurisdictional boundary

- Cross-border transfer of captured CO₂.
- Storage in international territory.
- International legal issues

Economic boundary

- Leakage

- **However, most issues on project boundary or leakage are not CCS specific.**
- **Common methodology for CDM would be developed.**

Accounting

Baseline and additionality

- IPCC Guideline does not provide methodology to define baseline.
- Marrakesh Accord provide three baseline rules (Decision 3/CMP.1):

- (a) Existing actual or historical emissions, as applicable; or
- (b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment; or
- (c) The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.



- **However, the reality is not so simple to apply these rules for CCS.**
- **Development of more methodology for CCS is encouraged (Decision 7/CMP.1)**

Accounting

Baseline and additionality

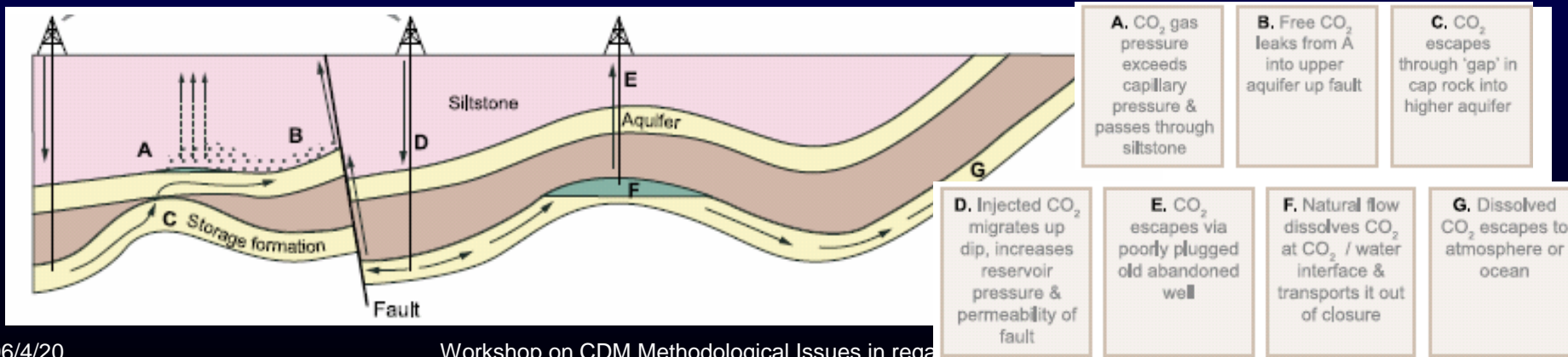
- What would happen in absence of CCS?
 - In principle, the most economically attractive scenario would be reasonable as baseline in satisfying other conditions such as environmental regulation.
- Replacement or new installation of power generation.
 - What is the most economically attractive scenario?
- Retrofitting of existing power generation.
 - Existing actual emission - (project emission + energy penalty emission)
 - How to account energy penalty of CCS ?
 - Averaged emission of a similar facility
 - Averaged emission of grid connected generation facilities
- EOR
 - If economically feasible without carbon price, no CRU.
 - Need to demonstrate financial additionality.
 - Leakage from increased oil production could be an issue.

Accounting

Monitoring and physical leakage

- IPCC Guideline provides methodology to estimate fugitive emission (physical leakage) from storage site:
 - Monitoring and modelling
 - Tier 3 method.

- How to treat potential physical leakage would be a controversial issue in project-based accounting, which
 - need transferability of credit
 - would decide who assume liability for the leakage



Accounting

Monitoring and physical leakage:

Leakage during project operation

- Leakage could happen as real phenomena.
- If physical leakage is detected by monitoring technology, it can be reflected to calculation of crediting.
- Probably, no leakage would happen except for accidental incidences.

Long term leakage

- Leakage is realized as risk.
- Methodology to account potential leakage (risk) has not developed.
- Risk perception of public could matter.
- How long is long enough for monitoring (permanence issue)?
 - Agreeable time horizon for monitoring and accounting is needed.

Accounting

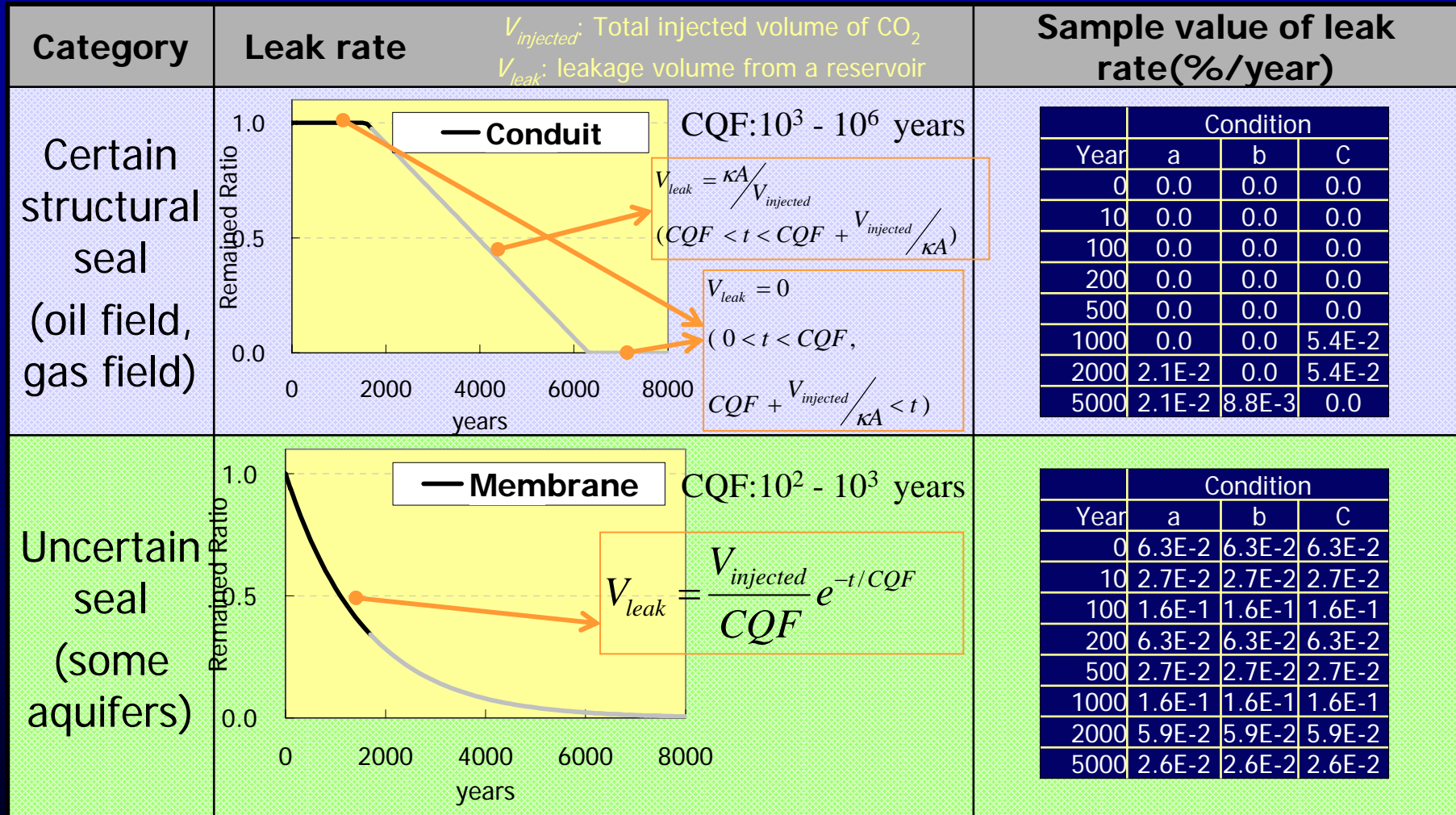
Monitoring and physical leakage: Possible methodology to account long-term leakage

Option	Treatment of liability for non-permanency	Transferability	Disadvantage
Full crediting with one time insurance payment	Ignore long-term leakage risk. Governments assume for liability.	High	Not conservative for accounting emission reduction. Acceptability of Climate community?
Discount	Future leakage is reflected to discount	High	Difficult to find appropriate discount rate(time frame is needed)
Compensation for leakage	Leakage is compensated at certain interval. A part of amount is permanent.	Possible	Period for verification is needed(a few centuries) Low liability

- Standardization of methodology to account long-term leakage in a conservative manner would be necessary.
- Rigorous site selection procedure would be crucial to make cost-effective monitoring plan.

Ex. Estimation methodology for long term leakage

Level-1 method (Geological)



a: 1000m deep $k=2.01E-9m/sec$ (CQF=1580years)

b: 2000m deep $k=8.41 E-10m/sec$ (CQF=3770years)

c: 500m deep $k=5.09 E-9m/sec$ (CQF=622years)

A(Area of CCS)=1km²

The remained ratio curves are drawn in black during the timeframe related to mitigation effect.

Conclusion

- Emission estimation methodology regarding CCS activities are being developed by IPCC and will be available soon.
- However, the methodology would not provide time horizon for monitoring and accounting, which would significantly influence feasibility for CCS projects.
- More methodologies for baseline setting and additionality demonstration are to be developed with broad applicability.
- Methodology of monitoring and accounting for long-term leakage would be the most difficult but crucial for project based CCS. Standardization of the methodology would be necessary.
- Rigorous site selection procedure would be crucial to make cost-effective monitoring plan.

Thank you