

One Planet

GREEN and J-MRV

August 26, 2011

ERM Japan
Sustainability Management Team
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1. GREEN and J-MRV

J-MRV is introduced in JBIC's WEB site:

<http://www.jbic.go.jp/en/about/environment/j-mrv/index.html>



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Today's presentation

1. GREEN and J-MRV
2. J-MRV Guidelines
3. J-MRV Methodologies
4. Example of Methodologies
5. Conclusion

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Japan's commitment for Climate Change

Hatoyama Initiative
~2012 :USD 15 billion
2013~ :?



Developing Countries

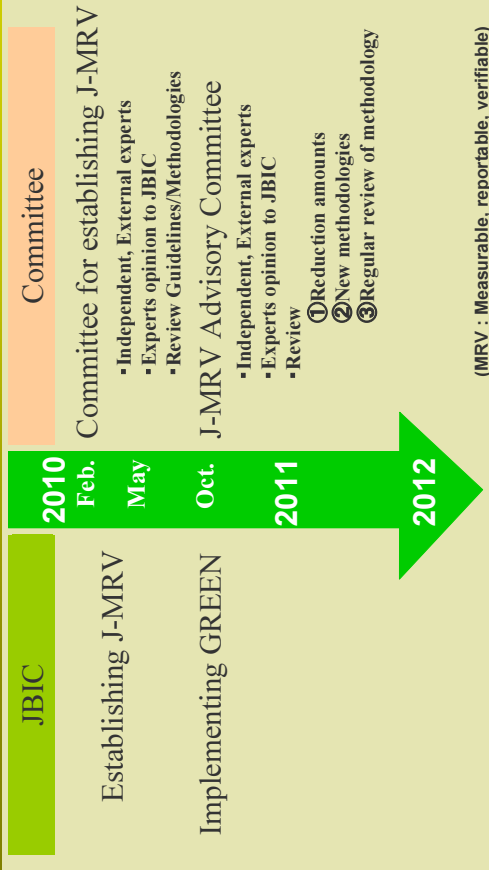
- measurement for mitigation
- Countries with climate change impacts

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Establishment of J-MRV



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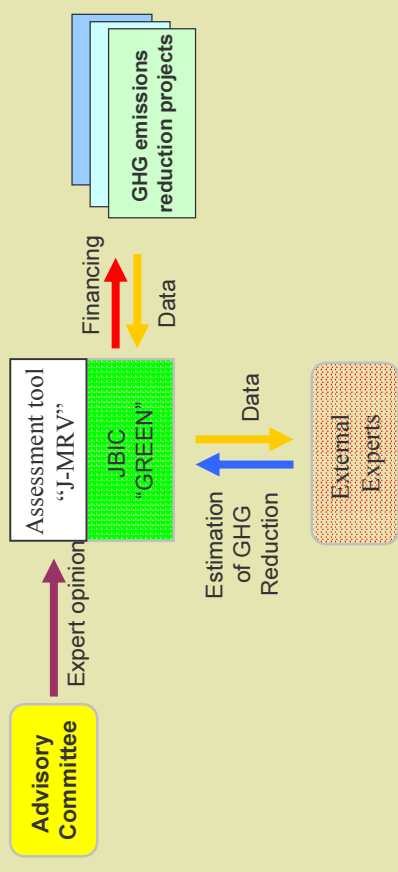


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5

New Financial program (GREEN) and -MRV

(Global action for Reconciling Economic growth and Environment conservation)



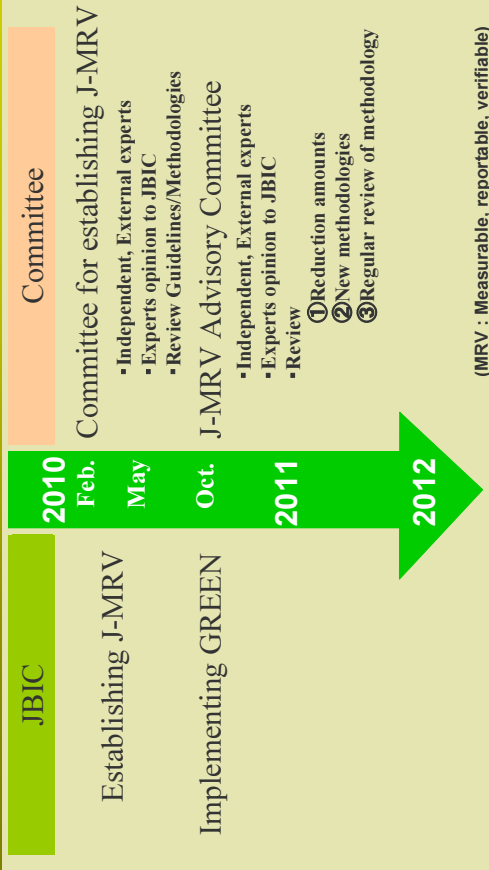
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Process of GREEN



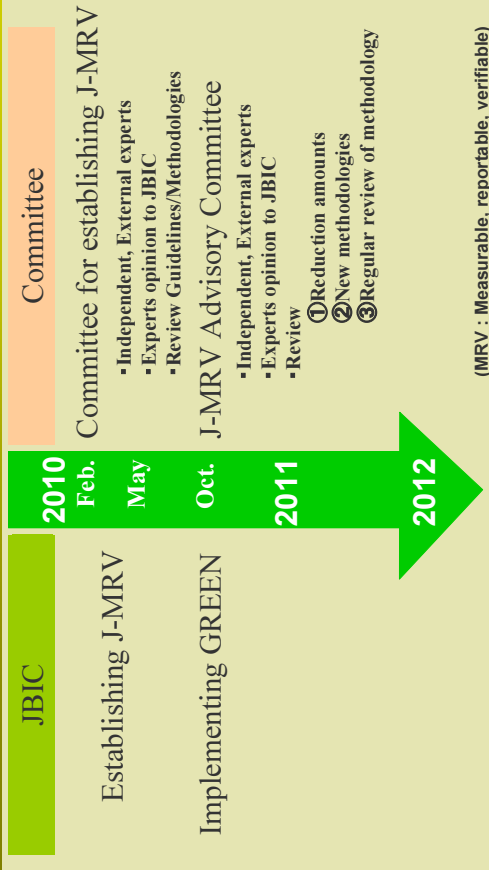
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Process of GREEN



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J-MRV Advisory Committee

- Ryuji Matsuhashi** :The University of Tokyo (Chairman)
- Tsuyoshi Nakao** :ERM Japan Ltd.
- Tomohiko Ike** :E&E Solutions Inc.
- Hiroki Kudo** :The Institute of Energy Economics, Japan
- Kuniyuki Nishimura** :Mitsubishi Research Institute, Inc.
- Kazuhito Yamada** : Pacific Consultants Co., Ltd.

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The Role of J-MRV Advisory Committee

- Independent from JBIC
- Experts on energy or methodology on CDM, ISO and others.
- Facilitate the quantification of GHG emission reductions
- Provide third party and professional opinion to JBIC

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9

2. J-MRV Guidelines



<http://www.jbic.go.jp/en/about/environment/j-mrv/index.html>

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J-MRV Guideline

1. Principle :
 - Simple
 - Practical
 - Internationally acceptable
2. Contents
 - A guiding principle of methodologies and its procedures.
 - Annex
 - Methodologies attached
 - New methodologies will be successively added.
 - Reference data ; carbon emission factor etc

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11

Structure of J-MRV Guideline

0. Preface
 1. Purpose of J-MRV
 - (1) Aims of J-MRV
 - (2) Principle and procedure of MRV
 - (3) Eligibility
 - (4) Advisory Committee
 2. Principle of J-MRV
 - (1) Principle
 - (2) Boundary of MRV
 - (3) Baseline emission
 - (4) Reduction amount
 - (5) Minor effects
 - (6) Leakage
 - (7) Minor impact
 - (8) Small installations
 3. Procedure
 - (1) Methodology setting
 - (2) Planned reduction amount
 - (3) Measurement and Monitoring at and after the project completion
 - (4) Verification
 4. Disclosure
- Annex
- Methodology
 - Good practice of Measurement
 - FAQ
 - Reference data ; carbon emission factor etc

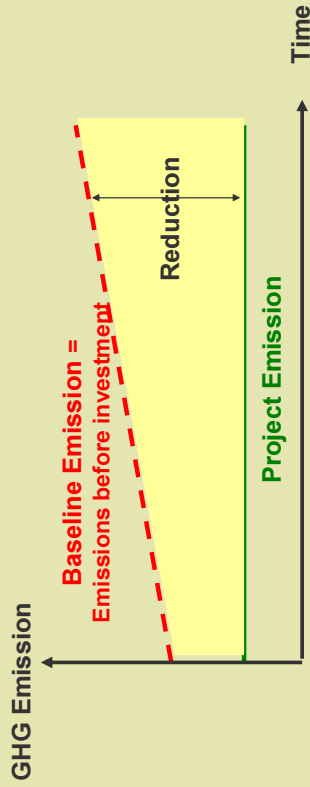
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12

Baseline Emission and Reduction amounts



Taking account of :

- investment climate such as economy, energy, technology, regulation.
 - availability and reliability of data
- Sampling and theoretical value may be applicable

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13

3. J-MRV Methodologies



<http://www.jbic.go.jp/en/about/environment/jj-mrv/index.html>



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Framework of Methodology

- Applicability
- Boundary
- Baseline emissions
 - Principles and assumptions
 - Baseline emissions
- Leakage
- Project emissions
- Emission reductions
- Monitoring

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Boundary

- Boundary of emission
 - ⇒ project financed by JBIC's GREEN
- Boundary of project
 - ⇒ defined depending on projects and the form of JBIC's participation

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16

Leakage and minor impact

Leakage

- To be considered at each methodology

Small installations

- Sampling or theoretical value is possible
- 5% deduction from the reduction amount, in principle

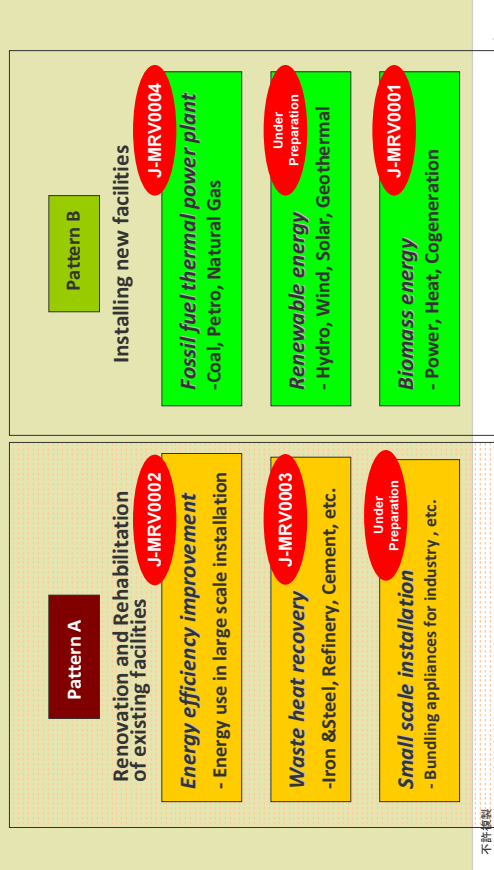
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17

Typical CO2 emission reduction projects



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18

J-MRV0001: Electric power generation and/or thermal energy supply from biomass residue

Project:

- Electricity and/or heat generation by using Only **biomass residue**:
By-products, waste from agriculture / forestry / other agro-industries

Baseline Scenario before investment:

- ① Purchase of power from the **grid** with which the project plant is connected
- ② Generation of power with **fossil fuels** at the project site (**captive power plant**)

Monitoring:

- Electricity, heat generated in the project activity;
- Electricity, fossil fuel consumption of the project activity.

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19

J-MRV0002: Project which improves energy efficiency of equipment

Project:

- Energy conservation technologies by replacing, modifying or retrofitting existing facilities, switching fuel or improving operation;

Baseline Scenario before investment

- ① **In case of existing facility**: replacement, modification or retrofit project.
Continuation of the operation of the existing plants, facilities and equipment.
- ② **In case of new installation (green-field project)**
Operation of the plants, facilities and equipment which apply **conventional technologies**.

Monitoring:

- Electricity, fossil fuel consumption of base year
- Electricity, fossil fuel consumption of the project activity.
- HFC, PFC emissions of refrigerator or air-conditioning.

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20

J-MRV0003: Waste heat recovery projects

Project:

- improvement of existing facilities which recover and utilize waste heat.

Baseline Scenario before investment

① In case that an in-house power generation facility:

Higher emission factor of that of the in-house power generation facility before investment and that of the electric grid shall be used as the baseline emission factor, if not **logically contradictory**.

② In case that an in-house power generation facility is NOT installed:
The emission factor of the grid from which electricity is supplied.

Monitoring:

- Electricity generated in the project activity
- Electricity consumption of the project activity,
- Fossil fuel consumption of the project activity.

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21



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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

Project:

- fossil fuel fired power plant

Baseline Scenario before investment

● New plant;

- GHG emissions by electricity generation in the project country
- GHG emissions by electricity generation through **same fuel** in the project country if there is **some constraint or minimum requirement** such as regulation

● Existing plant;

- **Continuation of the operation** of the power plant

Monitoring:

- Total power generation at sending-out terminal
- Total fuel consumption

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Monitoring:

- Electricity generated in the project activity
- Electricity consumption of the project activity,
- Fossil fuel consumption of the project activity.

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4. Example of Methodologies



<http://www.jbic.go.jp/en/about/environment/j-mrv/index.html>

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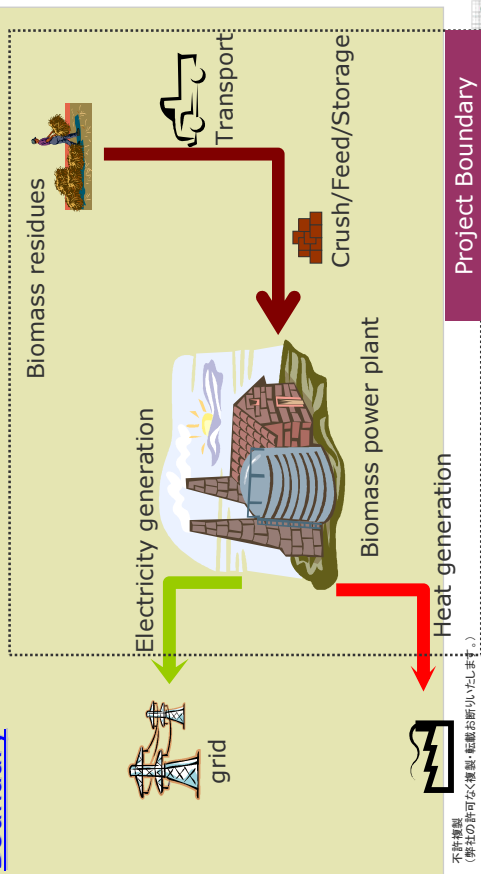
24



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J-MRV0001: Electric power generation and/or thermal energy supply from biomass residue

Boundary



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J-MRV0001: Electric power generation and/or thermal energy supply from biomass residue

Project emissions:

- ① On-site imported electricity consumption attributable to the project activity

$$PE_{e,y} = EC_y \times EF_e$$

EC_y : On-site electricity consumption (MW/ y)

- ② Fossil fuel consumption attributable to the project activity

$$PE_{FF} = FC_y \times NCV \times EF_{FF,y}$$

FC_y : Fossil fuel consumption (t or kl/ y)

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J-MRV0001: Electric power generation and/or thermal energy supply from biomass residue

Baseline Scenario before investment:

- ① Displacement of electricity : Net quantity of electric power generated in the project activity

$$BE_{e,y} = EG_y \times EF_e$$

EG_y : Electric power generation (MW/ y)

- ② Displacement of heat : heat generated in the project activity

$$BE_{h,y} = Q_y \times EF_h / \varepsilon$$

Q_y : Heat generation (GJ/ y)

ε : Energy efficiency of boiler (can be 100% from conservative viewpoint)

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J-MRV0001: Electric power generation and/or thermal energy supply from biomass residue

CO2 reduction

$$\begin{aligned} ER_y &= BE_y - PE_y \\ &= (BE_{e,y} + BE_{h,y}) + (PE_{e,y} + PE_{FF,y}) \end{aligned}$$

Leakage

No leakage is envisaged.

Small emission sources

5% deduction from the reduction amount.

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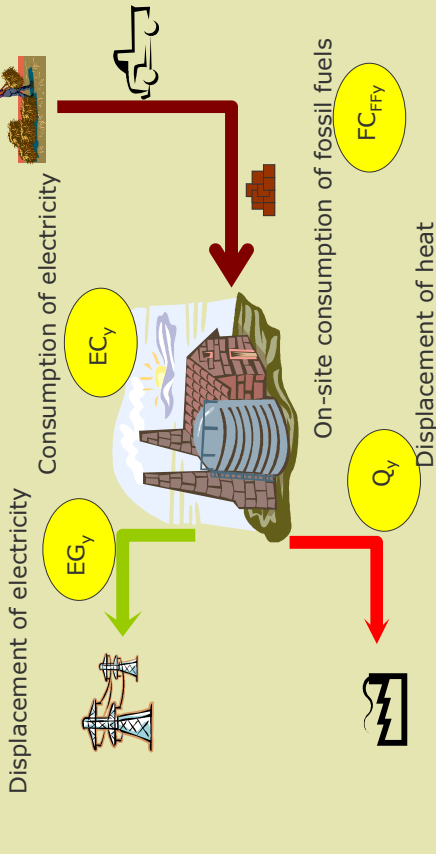
28

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J-MRV0001: Electric power generation and/or thermal energy supply from biomass residue

Monitoring:



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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

Principles of this methodology

- J-MRV evaluate;
- (in principle) Promoting emission reductions **in the project country**
 - Improvement of emissions **under constraint**
 - Improvement from **minimum requirement** such as regulation

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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

Applicability

- **New or existing** fossil fuel fired power plant introducing low-carbon technology
- Power plant **supplies electricity to grid and is not a cogeneration.**
- Power plant **uses the same type of fossil fuel as prior to the retrofit.**

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31

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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

Baseline emissions

$$BE_y = EG_y \times EF_{CO_2, EL, Y}$$

EG_y : Electric power generation (MW/ y)

Which number is applied for EF ?

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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

EF_{CO2, EL, Y}

I, new plant

- a) Average of **all power plants in the host country** (in principle)
 ↓ Constraints such as fuel supply
- b) Average of **same fuel type as the project in the host country**
- c) **Minimum requirements** such as regulations/benchmarks or de facto international standards

II, existing plant

⇒ **Continuation of the operation of the power plant**

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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

Project emissions

Actual CO2emission from power plants

$$PE_y = FC_{pj,y} \times NCV_{l,y} \times COEF_{l,y}$$

FC_{pi,y} : Fossil fuel consumption (t or kl/y)

CO2 reduction

$$ER_y = BE_y - PE_y$$

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J-MRV0004: Fossil fuel fired power generation projects introducing low-carbon technology

Monitoring

EG_y : Total power generation at sending-out terminal per year (MWh)

FC_{PJ,y}: Total fuel consumption per year (t or kl or m3)

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5. Conclusion

<http://www.jbic.go.jp/en/about/environment/j-nirv/index.html>

As experience of a member of Advisory committee

To develop MRV;

1. Decide principle of MRV at first
2. Learning by Doing
3. Invite experienced experts of CDM and other GHG projects.
4. Refer to CDM, ISO14064 and other scheme but not seized.

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37



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Thank you!
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Contents

1. **Background and Overview**
2. General Rules
3. Rules in detail: Monitoring, Reporting and Verification (MRV)
4. Comparison with EU ETS

Japan's Voluntary Emissions Trading Scheme (JVETS) and its MRV

August 26, 2011

What is J-VETS?

- ◆ Ministry of the Environment, Japan (MOEJ) has started JVETS to accumulate knowledge and experience about emissions trading in Japan and to support CO₂ emissions reduction activities by Japanese business operators.
- ◆ The scheme aims to support voluntary CO₂ reduction activities by business operators and to ensure their target achievement in a cost-effective way using (1) a subsidy to facilities which contribute CO₂ emissions reduction, (2) participants' commitments to reduce CO₂ emissions below their base year emissions and (3) emissions trading.
- ◆ Merits for scheme participants
 - Subsidy to facilities which contribute CO₂ emissions reduction
 - Opportunity to take third-party verifications of their CO₂ emissions
 - Sales revenues from their surplus emission allowances
 - Acquisition of know-how on domestic emissions trading
 - Acquisition of know-how on the established CO₂ emissions calculation system
 - Reduction of energy costs for JVETS participants

2

Key features

1. First carbon pricing and emissions trading in Japan
2. Development of infrastructure for emissions trading
3. Introduction of third-party emissions verification
4. Started from 2005. Started Phase 7 this year.
 - Phase 1: Apr. 05 - Aug. 07, Phase 2 : Apr. 06 - Aug. 08,
 - Phase 3: Apr. 07 - Aug. 09, Phase 4 : Apr. 08 - Aug. 10,
 - Phase 5: Apr. 09 - Aug. 11, Phase 6 : Apr. 10 - Nov. 12,
 - Phase 7: Apr. 11 - Nov. 13
5. Site based
 - cf. EUETS: installation based, CDM: project based
6. Combined with subsidy
7. CO₂ only (including process, waste)
8. Emission target = Baseline emission - Commitment
 - Baseline emission: average of past 3 years
 - Commitment: Voluntarily commitment (in exchange for subsidy)

3

Participants and project types

Project type	Major participants
Fuel switch to city gas/LPG	Japan Pepsi, Rengo, Hitachi Construction Machinery, etc.
Fuel switch to LNG	Rengo, Hitachi Cable, Sumitomo Rubber Industries, etc.
Electricity heat pumps	Panasonic Electricity Works, Japan Victor, Suntory, etc.
CHPs	Nissan Shatai, Toyo Glass, Asahi Rousai Hospital, etc.
High-efficiency boilers	Teijin DuPont Films, Kikkoman, Gojo Paper, etc.
High-efficiency lamps	INAX, Seiyu, Aeon Retail, etc.
Biomass boilers/power plants	Teijin Techno Products, Sekisui Chemical, Daiken Corporation, etc.
Waste heat recovery	Sumikin and Nippon Steel Stainless Steel Pipes, Shinko Industrial Co., etc.
Electric furnaces	JFE PF, Japan Metal, Yodoshi Corporation, etc.
Others	Isuzu Motors, Yanmar, Otsuka Chemical Co., etc.

4

Overview of Results

- ◆ 1st -4rd phase : All participants met their target, of which some participants acquired sufficient allowances by trading.
- ◆ 5th & 6th phase are in practice. 7th phase adopted participants in last May.

Phase	1 st	2 nd	3 rd	4 th	5 th	6 th
Commitment period	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011
Participants with target	31	61	61	81	69	55
Participants for trading	7	12	24	—	—	—
Total Base Year Emissions (kt-CO ₂)	1,289	1,123	1,661	3,369	639	516
Achieved reduction (kt-CO ₂)	377 (29%)	280 (25%)	383 (23%)	950 (28%)	—	—
Committed reduction (kt-CO ₂)	273 (21%)	217 (19%)	136 (8%)	335 (10%)	100 (16%)	83
Number of total transactions	24	51	23	24	—	—
Total amount of traded JPA (kt-CO ₂)	82	55	34	58	—	—
Average JPA prices (JPY/ t-CO ₂)	¥1,200	¥1,250	¥800	¥750	—	—

*5th and 6th phase are under verification process.

5

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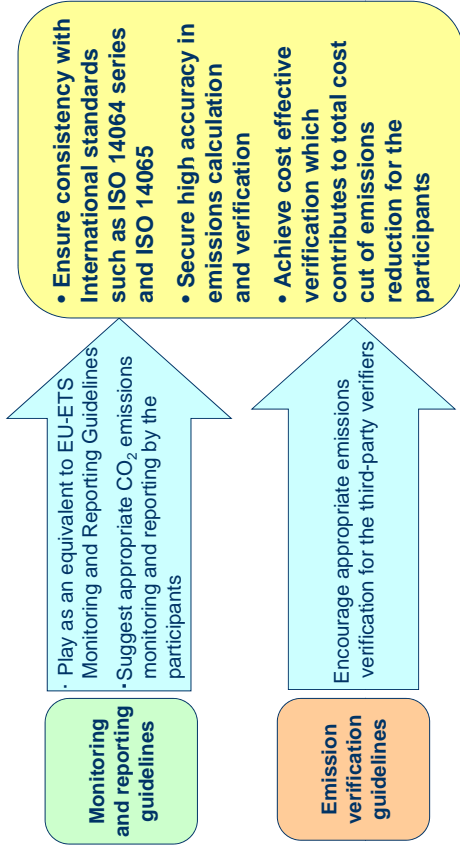
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Rules and guidelines

- ◆ Monitoring and reporting guideline
 - Published Feb. 16, 2007, revised Mar. 7, 2011 (Ver. 5.0)
 - Defined specific accounting and reporting methodologies
- ◆ Verification guideline
 - Published Mar. 31, 2007, revised Sep. 13, 2010 (Ver. 4.0)
 - Defined specific verification methodologies
- ◆ Rules/guidelines revised when necessary - learning by doing
 - ◆ Refer to existing laws/regulations to reduce the burden of participants
 - Boundary setting, uncertainty of instruments, etc.

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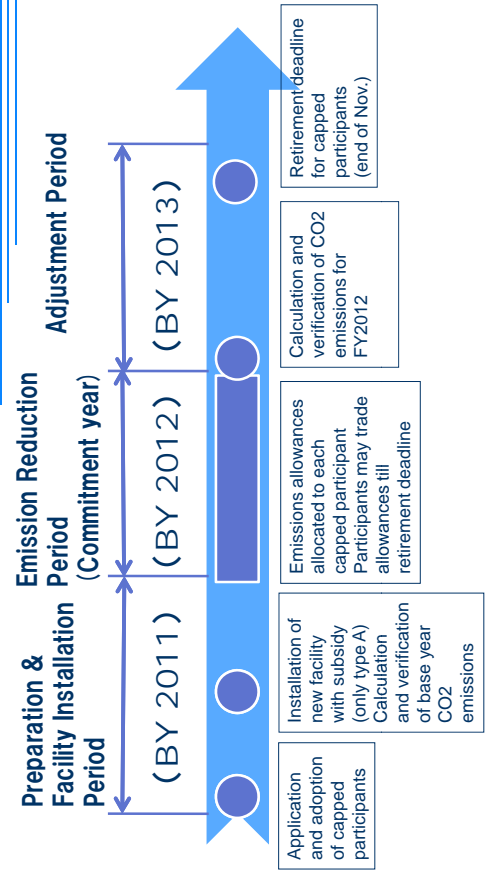
2 Key guidelines



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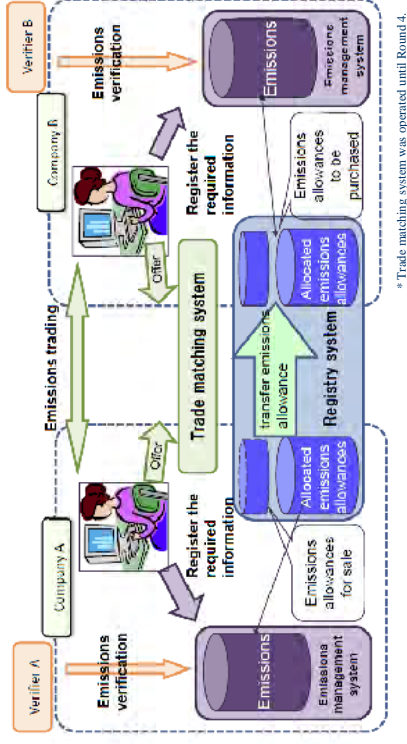
Time frame (for Phase 7)



10

Operation Infrastructure

- One of the big contributions of JVEETS is that it has established basic infrastructure (the emission monitoring, reporting and verification guidelines, registry system, and emissions management system etc.) which is required for smooth operation.



9

Contents

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11

Target Activities for MRV

Type	Activity
CO ₂ emissions resulting from fuel consumption	Use of fossil fuels (including vehicular emissions on the premises)
CO ₂ emissions resulting from the use of electricity and heat	Use of electric power and heat supplied from beyond the site boundaries
CO ₂ emissions resulting from the incineration and use of wastes	Calculated CO ₂ emissions from the incineration of wastes, use of wastes for production, and use of waste fuels
CO ₂ emissions resulting from industrial processes	Production of cement and lime, use of limestone and dolomite, production of ammonia and other chemical products, and use of liquefied carbon dioxide

*Electricity users account for CO₂ emissions from electricity and heat.

12

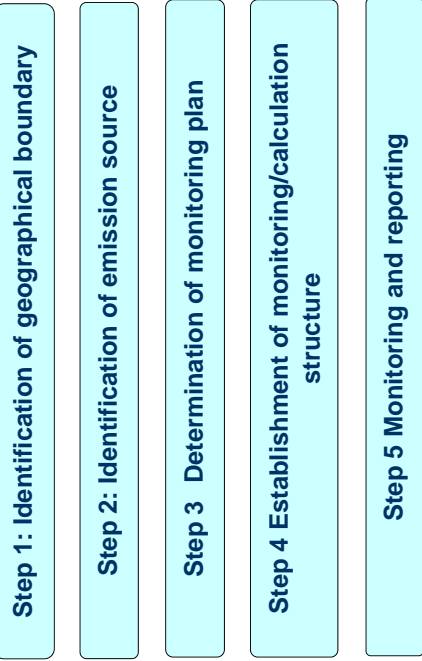
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Activities Excluded from MRV

- ♦ Emissions by contracted parties
 - Emissions produced by the incineration of wastes entrusted to waste disposers
 - Emissions produced by the cargo carriers used to transport products and materials are excluded.
- ♦ Emissions by consumers
 - Emissions produced by the use of products that are manufactured by the operators
- ♦ Utilization of CO₂ not released into the atmosphere
 - If the CO₂ released by the target activities is recycled as a raw material to outside parties, the portion of CO₂ supplied in this manner can be excluded from the operator's emission.
 - Ex. CO₂ used to carbonate drinks
- ♦ CO₂ emissions from vehicles used outside the factory or business facility

13

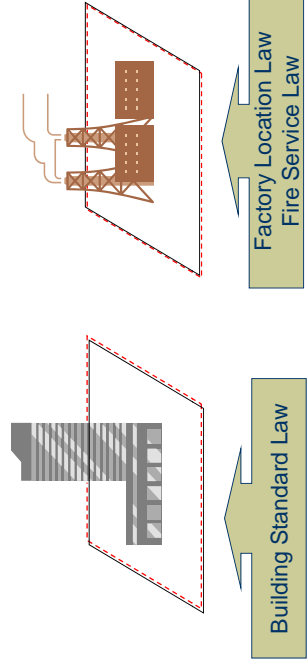
Emission monitoring and reporting flow



14

Step 1: Identification of geographical boundary

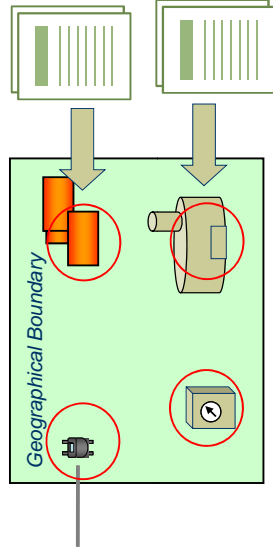
- ♦ The boundary of a factory or business facility site shall be confirmed by official documents such as the notifications and reports submitted to the competent administrative agencies in accordance with the Factory Location Law, Fire Service Law, Building Standards Law, etc.



15

Step 2: Identification of emission sources

- ◆ Emission sources are identified from relevant documents or materials such as:
 - Documents submitted to the local government under the energy law (Fire Service Law, High Pressure Gas Safety Law and etc)
 - Documents prepared for ISO such as Environmental Management System (ISO14001) and Quality Management System (ISO9001) etc.



16

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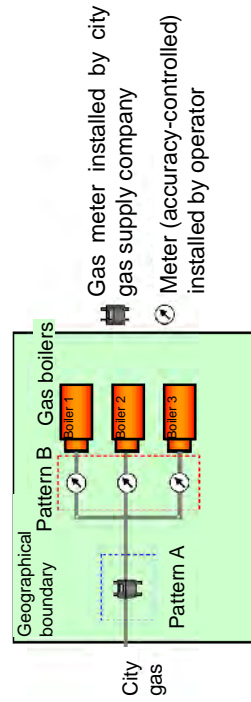
Step 3 Determination of monitoring plan

- ◆ The monitoring point is where the amount of activity is measured. The ideal location to accurately determine the amount of activity must be selected.
- ◆ The monitoring point is identical to the location of the measuring instrument. The monitoring pattern is the method used to measure the amount of activity. Monitoring patterns can be generally categorized as below.
 - Pattern A: Purchase-based method (data used: purchase slips, etc.)
 - Pattern B: Method based on actual measurements (data used: measurements)
 - Other method: Monitoring using a method other than Pattern A or Pattern B is not permitted. The operator must consult with the Competent Authority in advance using the approved format.

17

Step 3 Determination of monitoring plan

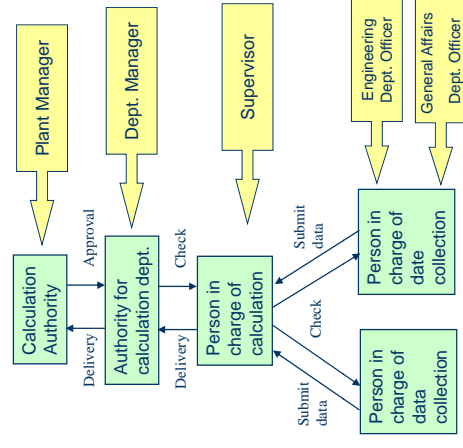
- ◆ Pattern A: Monitor the amount of city gas supplied by the three boilers collectively using the gas meter installed by the city gas supply company
- ◆ Pattern B: Monitoring using a meter installed by the operator



18

Step 4 Establishment of monitoring/calculation structure

- ◆ Operators are required to establish the appropriate monitoring and calculation structure for emissions calculation.
 - Appointment of the responsible person.
 - Establishment of a reliable mechanism to check the collected data.
 - Establishment of proper procedures - what should be done, who should do it, and when it should be done.



19

Calculation of GHG Emissions

- ◆ Operators must calculate their greenhouse gas emissions, based on the data monitored using the required methods.
- ◆ CO2 emissions must be calculated using one of the following equations:
 - Emissions from combustion of fuels

$$\text{CO2 emissions} = \text{Amount of activity} \times \text{heat value} \times \text{emission factor}$$
 - Emissions from other sources

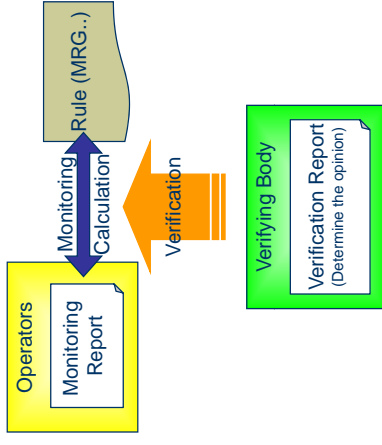
$$\text{CO2 emissions} = \text{Amount of activity} \times \text{emission factor}$$

20

A4-170

Verification Process

- ◆ In order to ensure the reliability of calculation results, a third party verification body that is independent from the operator verifies those calculations.



- ◆ Operators are responsible for calculating their emissions and preparing their Emission Reports in accordance with this guideline.
- ◆ Verifying bodies are responsible for verifying the information contained in the Emission Report and for expressing comments.

21

Contents

1. Background and Overview
2. General Rules
3. Rules in detail: Monitoring, Reporting and Verification (MRV)
4. **Comparison with EU ETS**

22

Boundary - site-based and installation-based -

Adopted scheme	Site-based (including one or more emission sources)	Installation-based
JVETS	JVETS	EU-ETS
Merits	<ul style="list-style-type: none"> • Compatible with the existing law (Energy Conservation Law) and therefore the data already available under this law can be utilized. • Actual emission reductions can be achieved. 	<ul style="list-style-type: none"> • Easier to MRV emissions
Demerits	<ul style="list-style-type: none"> • Need to monitor and verify emissions from several emission sources 	<ul style="list-style-type: none"> • There may be a case that the total emission of the site increases despite of the reduction achieved by the installation
Note	<ul style="list-style-type: none"> • A group of two or more sites can participate as a single participant 	

Emissions from electricity usage - indirect and direct emissions -

	Indirect emission	Direct emission
Adopted scheme	JVETS	EU-ETS
Merits	<ul style="list-style-type: none"> Promotion of energy saving at final consumption stage 	<ul style="list-style-type: none"> Promotion of power companies to switch to low carbon energy Higher coverage rate
Demerits	<ul style="list-style-type: none"> Lower coverage rate 	<ul style="list-style-type: none"> Weak incentive for final electricity consumers to reduce their demand (if carbon cost is transferred to final consumers, it may provide incentives due to negative price elasticity of electricity demand)
Note	<ul style="list-style-type: none"> Setting mandatory targets of carbon intensity on power companies partially improve the coverage 	

MRV in the context of the negotiation

Aug.25, 2011

IGES, Hayama, Japan

Jusen ASUKA

asuka@cneas.tohoku.ac.jp

1

Contents

1. Drama in Bali (COP13)
2. MRV negotiation after Bali
3. Issues to be negotiated and compromised

**COP 13 was close to
breaking down due to
the battle over the MRV
of the commitments and
action**

Developed countries did not like the unconditional “measurable, reportable and verifiable support for developing countries actions”

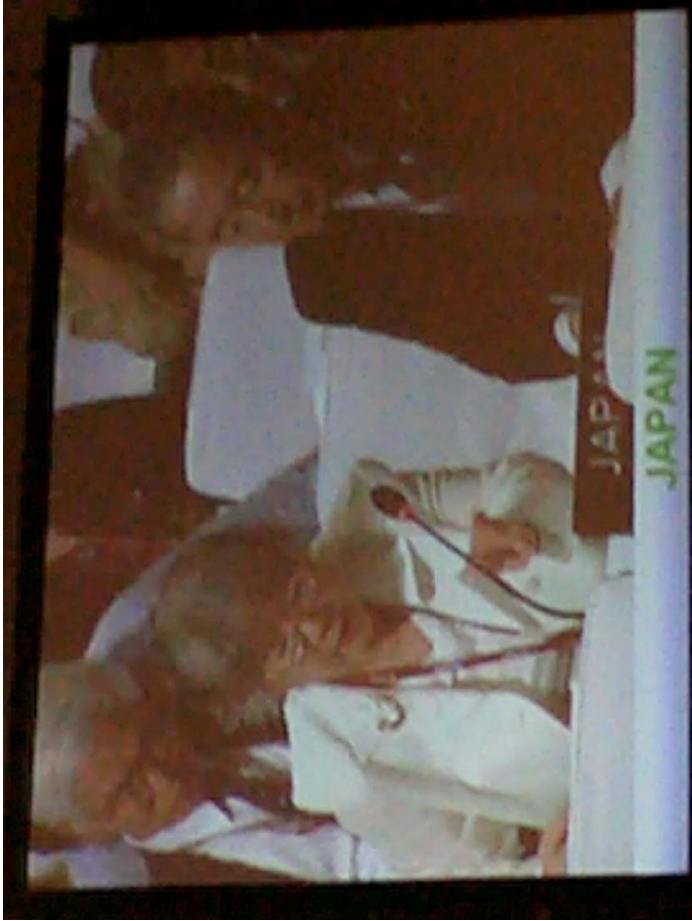
“Get out of the way”

Intervention by a delegate from Papua New Guinea



BREAK DOWN of the meeting makes only the US happy!

“Support” is very crucial for developing countries!





The most sticking issue at Bali

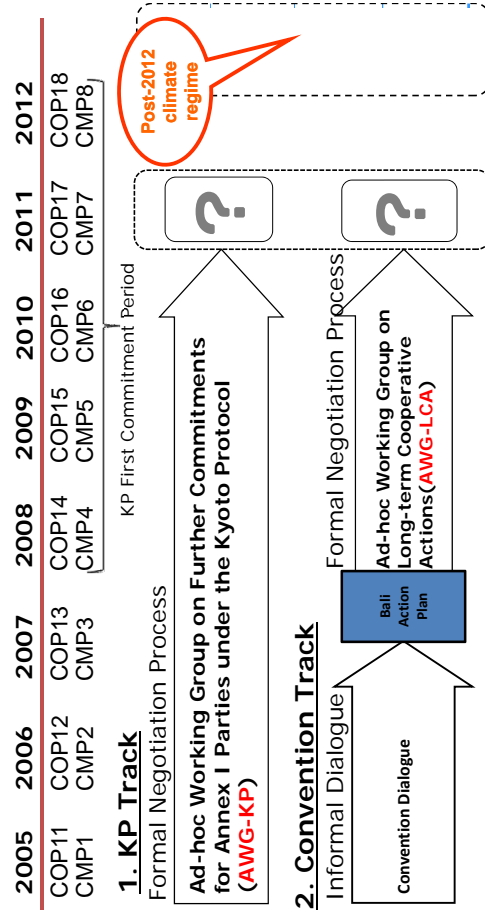
measurable, reportable and verifiable nationally appropriate mitigation actions by developing countries in the context of sustainable development, supported and enabled by technology, financing and capacity building.

➡ “Proposal by the President” (FCCC/CP/2007/L.7)

nationally appropriate mitigation actions by developing countries in the context of sustainable development, supported and enabled by technology, financing and capacity building, *in a measurable, reportable and verifiable manner.*

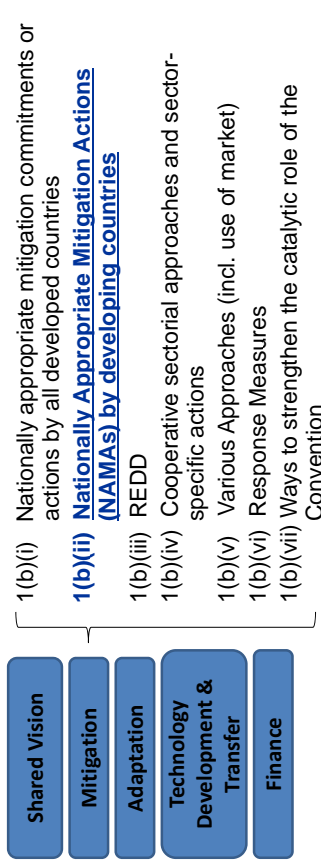
Advance unedited version Decision -/CP.13 Bali Action Plan **igES** 10

Progress of the negotiation



Bali Action Plan (COP13)

Closer Look at Mitigation Block for Post-2012 Climate Regime



“1(b)(ii): *Nationally appropriate mitigation actions by developing Parties in the context of sustainable development, supported and enabled by technology, finance and capacity building, in a measurable, reportable and verifiable manner*” (BAP)

→ **First time to refer to mitigation actions by developing countries**

→ **MRV provision included, but diverse interpretations emerged**

Source: Fukuda (2011)

IGES 13

Copenhagen Agreement (COP15)

- **Elaboration of MRV Provisions**
- Domestically supported mitigation actions**
 - subject to domestic MRV
 - results reported through NATCOM in every 2 years, and are subject to ICA
- (International Consultation and Analysis).**
- Internationally supported mitigation actions**
 - to be recorded in a registry along with support provided
 - subject to international MRV

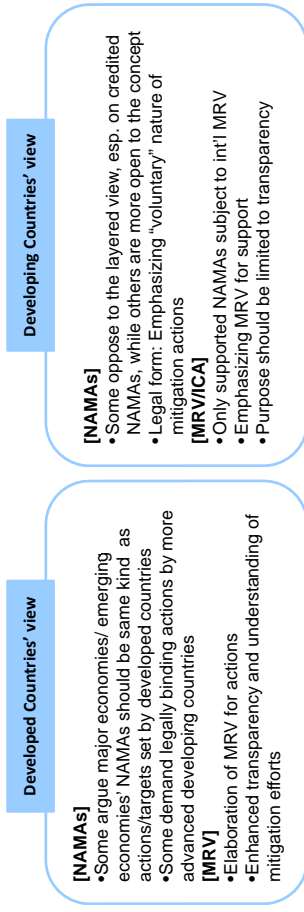
Source: Fukuda (2011)

IGES 15

Interpretations of NAMAs and MRV

Types of NAMAs: “Layered” view

Domestically funded (unilateral) NAMAs	Mitigation actions implemented unilaterally by a country from its own resources
Internationally supported NAMAs	Mitigation actions enabled and supported by technology, finance and capacity building (international support)
Credited NAMAs	Mitigation actions supported through the carbon market



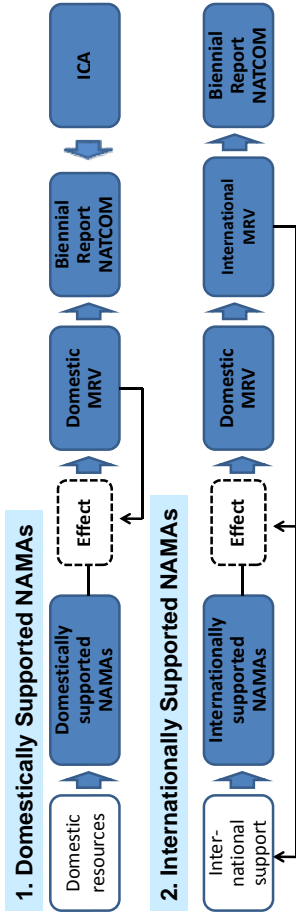
Source: Fukuda (2011)

IGES 14

Cancun Agreement (COP16)

Closer Look at Mitigation under the AWG-LCA Track

- **Anchoring pledges** through the INF.1 documents submitted both by Annex I Parties and non-Annex I Parties
- More clarity over MRV and ICA processes on NAMAs
- More clarity over functions of registry (matching and recognition functions)
- Agreed to develop work programme for further modalities and guidelines on MRV/ICA



Source: Fukuda (2011)

IGES 16

Cancun Agreement (COP16)

In addition to ICA, IAR (International Assessment and Review for Developed countries' commitments and actions) was defined.

3. Issues to be negotiated and compromised

In short...

MRV should be:

- **Transparent**
- **Consistent**
- **Comparable**
- **Complete**
- **Accurate**

More specific...

- Content of the report (NATCOM and biennial report)
- How in detail? How frequent? From when?
- Who assess (verify) and how?
- Facilitative or punitive?
- Domestic or international?
- Low carbon development plan (contents?)
- Common format for the MRV of Support (How to define financial additionality?)
- **How much is the support from developed countries for making these MRV?**

Conclusion

- MRV is to some extent technical issue and there are many elephants in the room such as KP2 and target.
- Developed countries use MRV to push developing countries more
- Several countries want to establish “pledge & review” world only with MRV.

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Conclusion (cont'd)

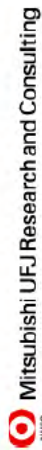
- Having said that, MRV is an very essential issue and better than no discussion at all.
- MRV can have a bargaining power for the negotiation.

References

- Asuka, Jusen (2010) Emergence of MRV and the Intentions of Different Countries [Measurable, Reportable and Verifiable \(MRV\): Trends and Developments in Climate Change Negotiations](#) in Trends and Developments in Climate Change Negotiations, p.13-17, IGES Report.
- Fukuda, Koji (2011) “Climate Change Negotiations: From Bali Action Plan to Supported NAMAs”, presentation at the World bank e-learning course, Module 4/Section 1/Class 2: April 2011.
- Fukuda, Koji and Tamura, Kentaro (2011) “AN ANALYSIS OF NON-ANNEX I PARTIES NAMAs: Challenges for Designing International Support and Implementing an Effective MRV Framework” IGES Climate Change working paper. No. 2011-01

iges ²³

The situation of REDD plus



Introduction: Messages from FAO and IPCC

- The total area of forests on the earth is about 4 billion ha, covering around 30% of the earth's land area. The FAO reported that the annual decrease in land covered by forest in about 13 million ha (2000-2005 average), which is equivalent to about one-third the total land area of Japan.

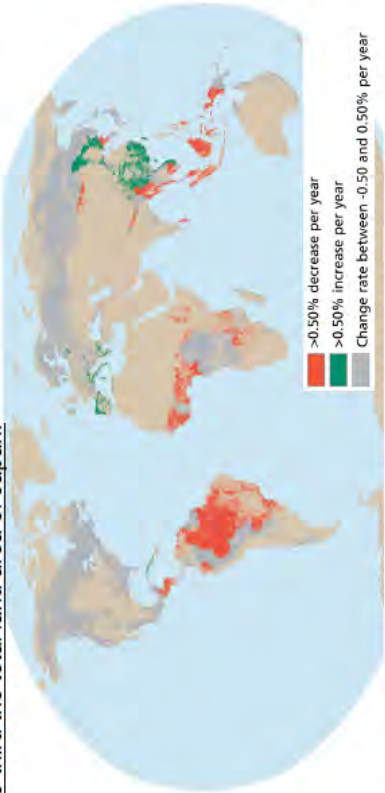


Figure: Changes in the world's forest area (2000-2005) (Source: FAO FRA2005)

Introduction: Messages from FAO and IPCC

- In share of the types of GHG emissions by sector, over half of that was GHG attributable to the combustion of fossil fuels, but the second largest share was GHG from deforestation, decay and peat. By sector, forestry (which includes deforestation) account for 17.4% of total emission.

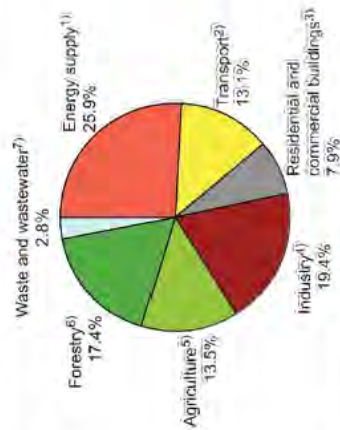
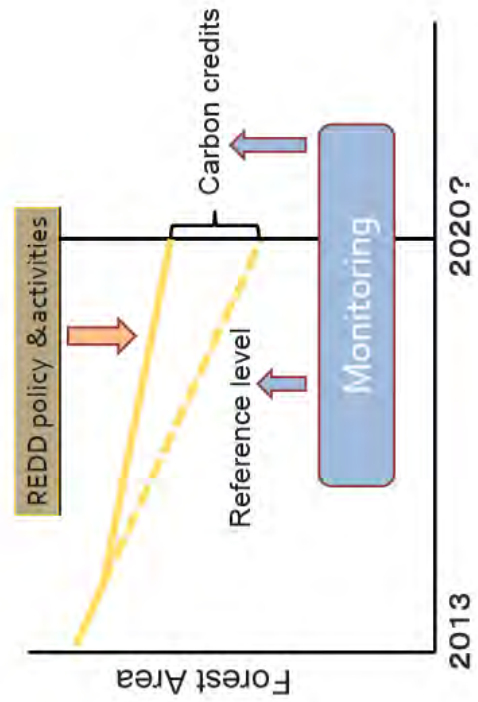


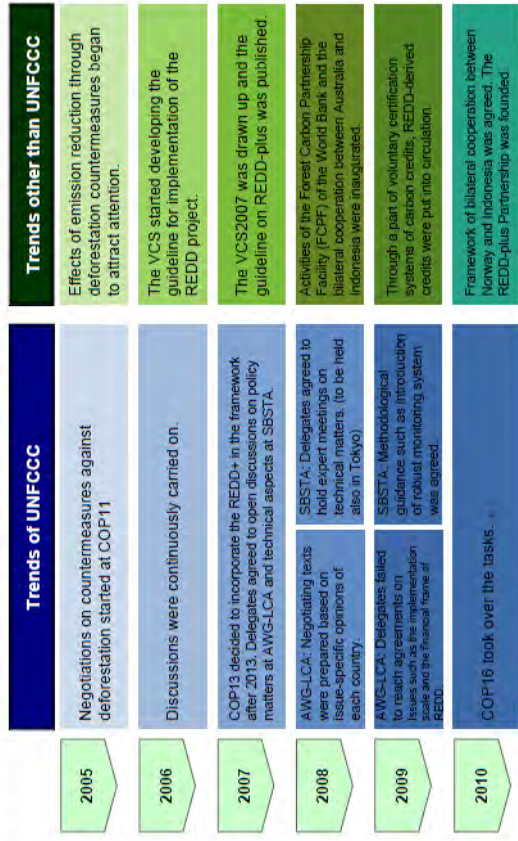
Figure: GHG emissions by sector in 2004 (Source: IPCC AR4)

Concept of REDD plus



International Affairs regarding REDD plus

Approaches of REDD+ by UNFCCC and Others (Flow Chart)



5

Discussions on REDD-plus at the UNFCCC

- Under the UNFCCC, to start implementation of REDD+, the "Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA)" mainly discusses policy matters, and the "Subsidiary Body for Scientific and Technological Advice (SBSTA)" mainly discusses technological aspects.
- Discussions on policy matters at the AWG-LCA
 - Discussions have been continued particularly on policy matters as part of mitigation measures within the next framework after 2013, since the Bali Action Plan (1/CP.13), adapted as a COP13 Decision held in the end of 2007, described "conservation, sustainable management of forests and enhancement of forest carbon stocks" as part of the scope of the REDD-plus, in addition to "reduction of emission from deforestation and forest degradation."
 - Discussions were aggressively carried spending much time in the COP 15 of 2009, though they didn't reach agreement in terms of how to set up targeted boundaries, how the MRV works, and how to set up reference levels, partly due to the relation with the Nationally Appropriate Mitigation Actions (NAMAs) by Developing Country Parties (NAMAs).

6

Discussions on REDD-plus at the UNFCCC

- Situations regarding technical aspects at the SBSTA
 - Considerations regarding methodologies are being carried in accordance with the working plan (2/CP.13) prepared at the COP13. Agreement was reached on methodological guidance to build up robust forest monitoring systems and to follow the IPCC guideline in calculations at the COP 15 in the end of 2009.
 - However, negotiations in 2010 are in a temporary lull and the preparation of concrete methodological guidance is not progressed.

7

What was Agreed at Cancun (COP16)

- The main outcome to emerge from the climate discussions is a series of COP decisions that have collectively been called the 'Cancun Agreements'.
- The Decision that is relevant to REDD-Plus is contained:
 - Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention (AWG-LCA) that includes, among other things, a section on paragraph 1 b iii) of the Bali Action Plan on 'Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries'.
 - Agreements about REDD-Plus is the culmination of three years of negotiation on REDD-Plus and is not substantively different from the draft decision in Cancun. At just under two pages long and containing only 12 paragraphs of text and a short preamble.
 - Agreements about REDD-Plus does not provide a concrete framework for how REDD-Plus should work but instead offers a set of clear guidelines and a work plan for the coming year.

8

Cancun Agreement -Scope of REDD plus-

- The choice of scope will have an impact on the scale, relative cost and mitigation potential of a REDD-Plus mechanism. It will also play an important role in the countries that might benefit under REDD-Plus. The scope of the REDD-Plus decision in Cancun is broad, and includes all of the elements that were originally agreed in Bali (COP13) and later reconfirmed in Poznan (COP14). The REDD-Plus decision states that developing country Parties can contribute to mitigation actions in the forest sector by undertaking the following activities:
 - Reducing emissions from deforestation;
 - Reducing emissions from forest degradation;
 - Conservation of forest carbon stocks;
 - Sustainable management of forest;
 - Enhancement of forest carbon stocks;

9

Cancun Agreement -Drivers of Deforestation

- The REDD-Plus decision makes reference to the drivers of deforestation but falls short in placing adequate and fair guidelines on how to address these drivers.
- The decision requests developing countries to address the drivers of deforestation and forest degradation, but fails to address the role that developed countries play in driving tropical deforestation.
- Whilst SBSTA has been requested to develop a programme of work to look into the drivers of deforestation, this appears to be limited currently to an assessment of the methodological aspects in estimating emissions and removals resulting from land use, land use change and forestry (LULUCF) activities.

10

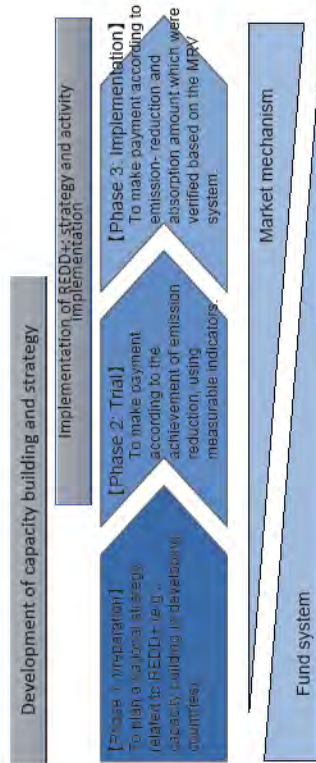
Cancun Agreement -Three Elements for REDD plus Readiness

- Developing country parties wishing to engage in REDD-Plus are encouraged to develop the following elements:
 - **A national strategy or plan:** The decision provides no additional guidelines on how the plan should be developed but it is likely to be either in the context of the ongoing readiness processes (i.e. UN-REDD and FCPF).
 - **A national reference level:** As with other areas of the REDD-Plus text the details around how reference levels are established will need to be elaborated over the coming year. The issue of sub-national reference levels has been resolved (albeit maybe only temporarily) by making provision for both national and sub-national approaches; although to address concerns over leakage, sub-national reference levels are only advised as an interim measure.
 - In UNFCCC-speak the reference level can also be based on either emissions or forest area (reference level) although it will remain to be resolved from a methodological perspective how these two approaches can be reconciled.
 - **A forest monitoring system:** The forest monitoring system should provide information on the progress of the activities within the scope of REDD-Plus. The monitoring system should also provide information on how the safeguards.

11

Cancun Agreement - Phased Approach

- The REDD-Plus decision refers to a phased approach as follows:
 - Phase 1: Development of national plan and capacity building
 - Phase 2: Implementation of national plan, policies and measures and further capacity building, technology development and transfer, and results based demonstration activities
 - Phase 3: Results-based actions with full measurement reporting and verification



12

Cancun Agreement - Safeguards

- The safeguards referred to in Annex I of the decision provide guidelines on how REDD-Plus should be implemented and have hardly changed at all from the draft text that was put forward in Copenhagen (COP15).
- The safeguards refer to the UN Declaration on the Rights of Indigenous Peoples as well as to social and environmental safeguards, but it is unclear how these provisions will be effectively operationalized.
- The safeguards also fail to address the issue of biodiversity loss and the role of the Convention on Biological Diversity (CBD), which is alarming given the wealth of experience that exists within the CBD.

13

Cancun Agreement - Programme of work under AWG-LCA

- Aside from the need to provide adequate and predictable sources of finance, there was little guidance in the REDD-Plus decision on where the money might come from.
- The Parties have requested that the AWG-LCA explore financing options for Phase 3 activities (i.e. results-based emissions reductions - see above) and to report on progress at COP 17 in Durban.
- It is unclear what this report will look like but it will hopefully build on the platform provided by publications.

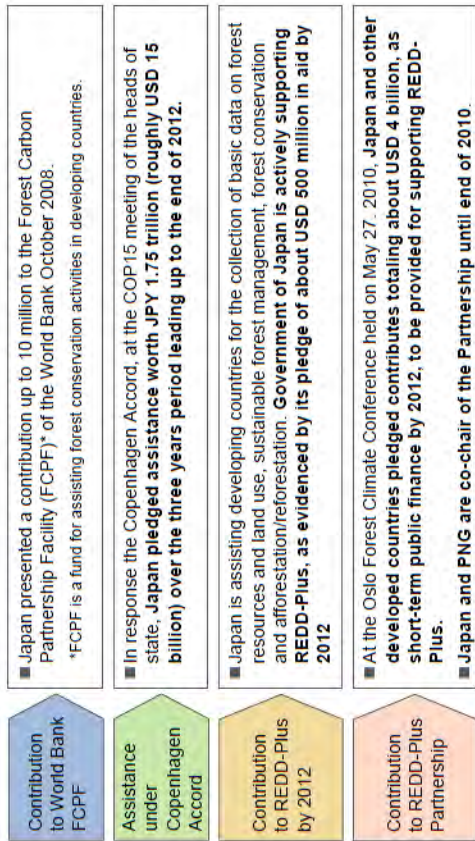
14

Cancun Agreement - Programme of Work Under SBSTA

- The Subsidiary Body for Scientific and Technological Advice (SBSTA) has also been tasked with a programme of work to move forward on methodological issues following on from the AWG-LCA decision on REDD contained in Annex II to the decision. Annex II is broken down into 3 sections.
 - **Identify LULUCF activities in developing countries:** Particularly those linked to the drivers of deforestation to assess the mitigation potential across these activities. This will be particularly important in identifying which activities offer the most potential to reduce emissions in developing countries. SBSTA is requested to report back to COP 18 in December, 2012.
 - **Develop modalities for reference levels and forest monitoring systems:** Reference levels are perhaps the most important element in defining the environmental effectiveness of a REDD-Plus mechanism. The process of creating modalities will no doubt be closely followed by civil society organizations. SBSTA will report back by COP 17 in Durban in December, 2011.
 - **Develop modalities for MRV:** Whilst the text is confusing, the final task for SBSTA is to develop modalities for measuring, reporting and verifying emissions reductions resulting from REDD-Plus activities for consideration by the Conference of the Parties at its seventeenth session;

15

Japan's Contribution for REDD-Plus



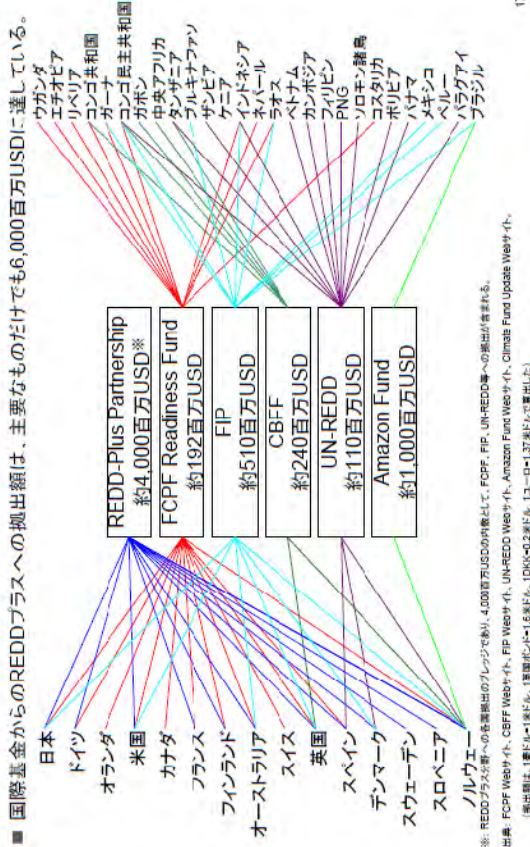
16

Markets in the World



18

UNFCCC以外(国際基金)でのREDDプラスへの取組状況-2



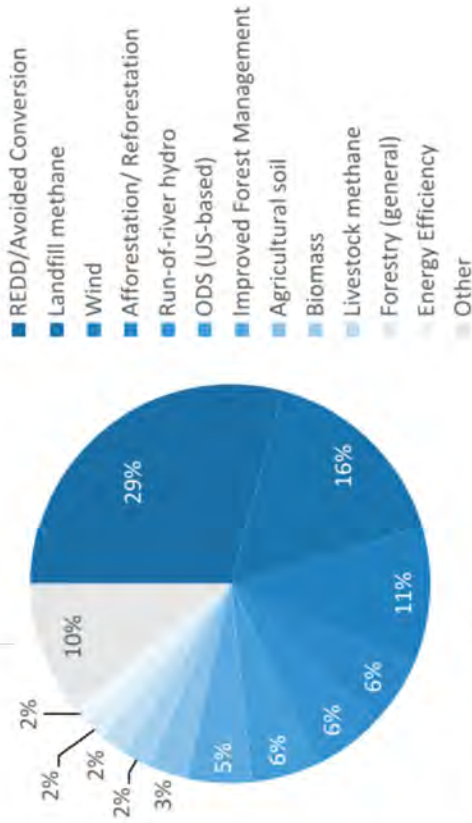
17

Present status of private-sector based approaches

- [REDD+-derived credits in the voluntary market]
- REDD projects led by private sectors are ongoing prior to international negotiations under the UNFCCC. About three million tons of CO2 is in circulation as the VER.
 - [Private-sector-based approaches toward REDD+ implementation]
 - Guidelines and methodology for the Verified Carbon Standard (VCS) are being developed.
 - Major REDD+ approaches funded by public organizations are as follows:
 - Advanced approaches among them will be shown from the next page, including FCPF among the funds founded by public organizations, as well as CCBS and VCS as case-studies for development of voluntary guidelines and methodologies.

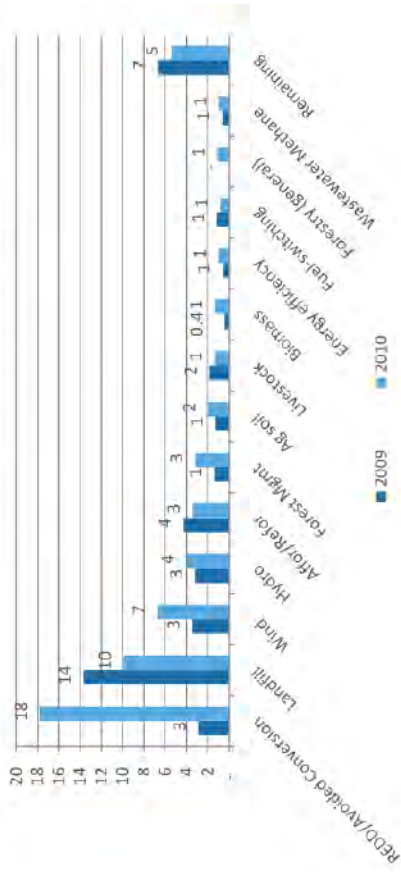
19

Transaction Volume by Project Type, OTC 2010



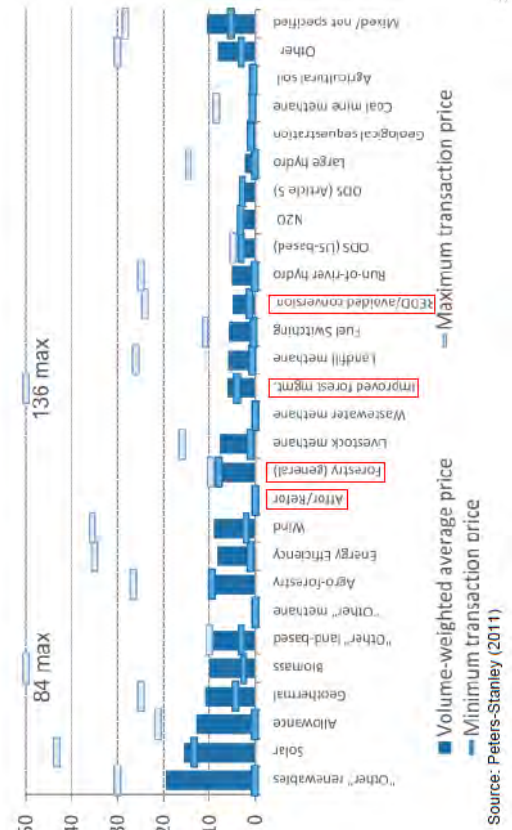
Source: Peters-Stanley (2011)

Transaction Volume by Project Type, 2009 vs. 2010



Source: Peters-Stanley (2011)

Average Credit Price and Price Range by Project Type, OTC 2010



Source: Peters-Stanley (2011)

Main Certification Systems in Voluntary Market

Standard	Description	Co-Benefits Required	Geographic Scope	Total Projects Registered	Total VERS Verified (MTCO2e)
American Carbon Registry Standard	Certification program for offsets, and an emissions reporting registry	No	International	25	31.3
CarbonFix Standard	Certification program for forestry offset projects	Yes	International	4	0.7
CCB Standard	Validation & verification standard for land-based carbon offset projects	Yes	International	32	VERS not issued
J-VER	Verification and certification scheme for offset projects	No	Japan	75	0.03
Verified Carbon Standard	Certification for offset project & carbon credits	No	International	555 registered	49.4

Source: Peters-Stanley (2011)

Outline of Forest Carbon Partnership Facility (FCPF)

Backgrounds and objectives of the establishment

【Objectives】

- FCPF has the following two major objectives.
 - To provide capacity building in order to implement REDD+* in developing countries situated in tropical and subtropical areas.
 - To continuously give incentives to future programs through "Performance-based incentive payments" in multiple countries.
- "While the term REDD-plus is used, its definition only includes measures against deforestation and forest degradation, i.e., "to reduce emissions from deforestation and forest degradation."

Source: FCPF Website

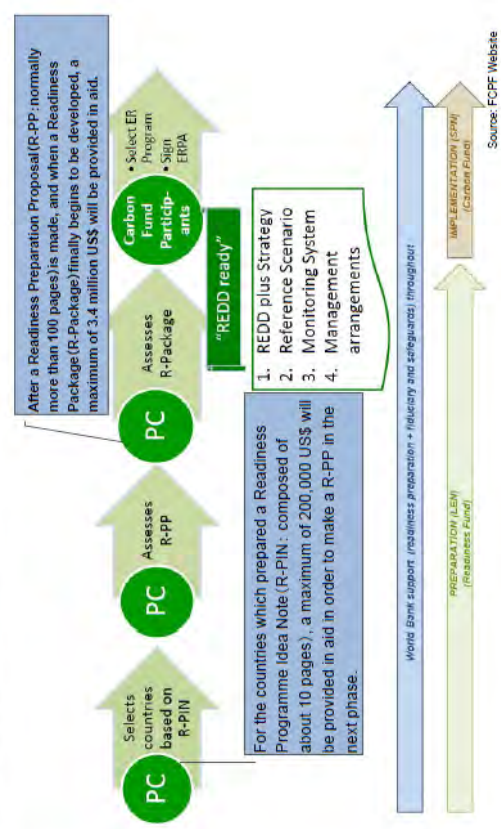
Backgrounds and objectives of the establishment

【Backgrounds】

- Importance of forest conservation has always been recognized, in that the progress of deforestation and forest degradation has a strong impact on various issues such as climate change, poverty, loss of biodiversity, and loss of water resources. However, tropical forests have been decreased and degraded in spite of international assistance for forest conservation in the past several decades.
- In line with this, it was thought that without urgent measures, most part of existing tropical forests would be lost during this century, and recognized that to implement countermeasures, strong international partnership as well as novel and sustainable funding mechanism might be necessary. In addition, considerations on REDD+, which were commenced at the COP11 held in the end of 2005, raised international awareness about REDD.
- With this background, COP13 in 2007 announced the establishment of FCPF, which started activities in June 2008.

Source: FCPF Website

Phases toward REDD+ implementation



Backgrounds and objectives of the establishment of VCS

- Verified Carbon Standard (VCS) are the validation and verification standards for voluntary programs by companies, organizations, and individuals. The VCS are designed to provide a certain standards to the voluntary carbon market and give credibility to the traded VER.
- The methodology of the VCS is robust, novel, and internationally standardized. It has a real, additional, measurable, permanent and independently verified system (no double counting).
- The credits to be issued (Verified Carbon Unit: VCU) are expected to promote additional emission-reduction activities through voluntary trading (market) mechanism.
- After the VCS were established in 2005, the standards were revised. The latest version "VCS 2007" was published in November, 2007, and was run mainly by The Climate Group, International Emissions Trading Association (IETA), the World Economic Forum, and The World Business Council for Sustainable Development. The Department of International Development (UK) and the International Organization for Standardization (ISO) also support the VCS.

Source: VCS Website

29

The Outline of REDD Projects in the Verified Carbon Standard (VCS)

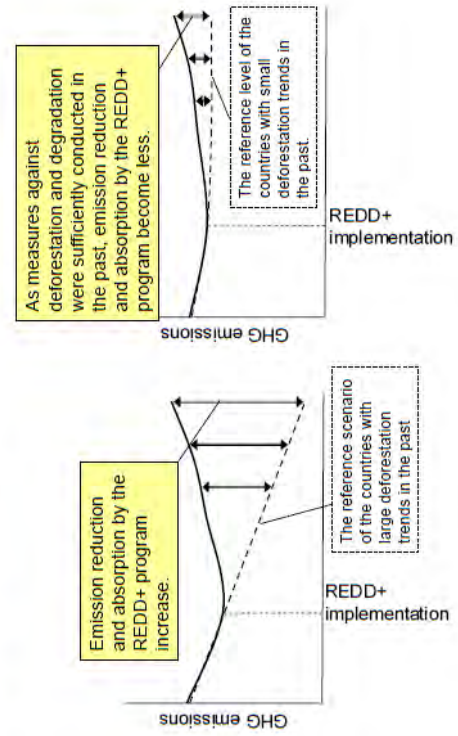
Application requirements for the REDD+ Approach 1

- The VCS Approach 1 related to REDD, "Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests" specifies the following application requirements (the followings are exception of major requirements).
 - To satisfy the application requirements when it targets tropical forests focusing on those without drainage treatment or peat swamp forests in South East Asia (e.g., northern forests are out of the target).
 - The definition of forests shall be based on that of the project-hosting country. And the application requirements are fulfilled when the peat has more than 65% of carbon rate and 50cm depth or more.
 - It assumes only the conversion of peat swamp forests. For example, the activity in which only above-ground biomass (trees) is harvested and carried out does not fulfill the application requirements.
 - The conversion restriction of peat swamp forests is applied only to the activities implemented by governments and tree-planting companies, while it is not applied to those only by local communities.
 - Dead woods and litter will fulfill application requirements as far as they decrease due to the project implementation.
 - Unless the plan to convert the project-targeting land is intended for REDD+-derived credits, it fulfills the application requirements.

Source: VCS Website

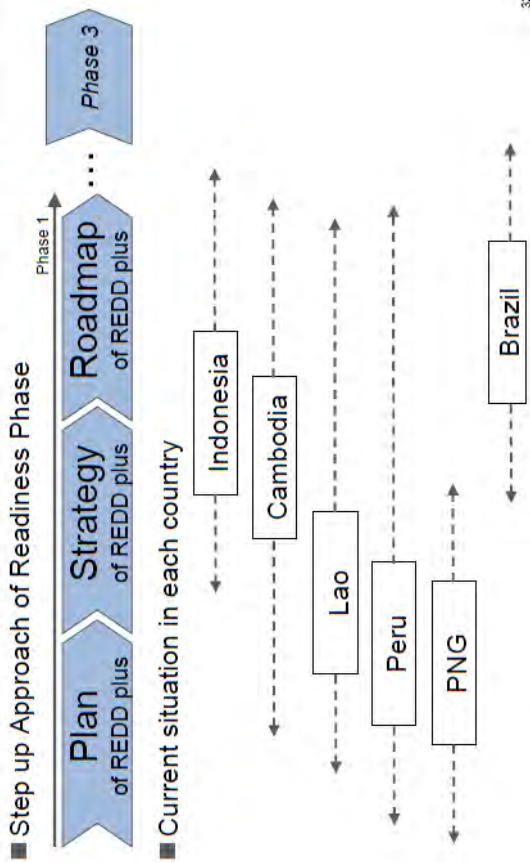
30

Concept of reference level



31

Common Trend and Current Situation in Each Country



Aug.30.2011

Roles of Forests for Mitigation of Climate Change and Forest Carbon Monitoring

Dr. Mitsuo Matsumoto

Principal Research Coordinator
Director of REDD Research and Development Center
in Forest and Forest Products Research Institute (FFPRI)

Lead Author of IPCC 4th Assessment Report, Working Group 3,
IPCC 2006 AFOLU Guidelines and IPCC LULUCF Good Practice

1

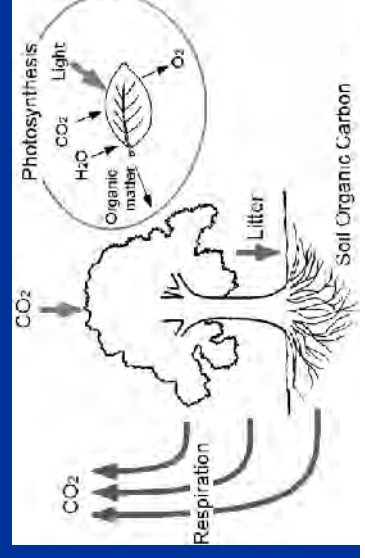
Program

1. Roles of forests and wood products for mitigation
2. REDD+
3. Evaluation methods of CO₂ flux by forests
4. Japan's methods for Kyoto Reporting

2

Forests and CO₂

- Vegetation removes CO₂ and emits O₂ by photosynthesis.
- Annual plants emit CO₂ back to atmosphere in a year.
- Trees stock carbon for a long term.
- Forests have a role to reduce CO₂ in atmosphere and to reduce global warming.

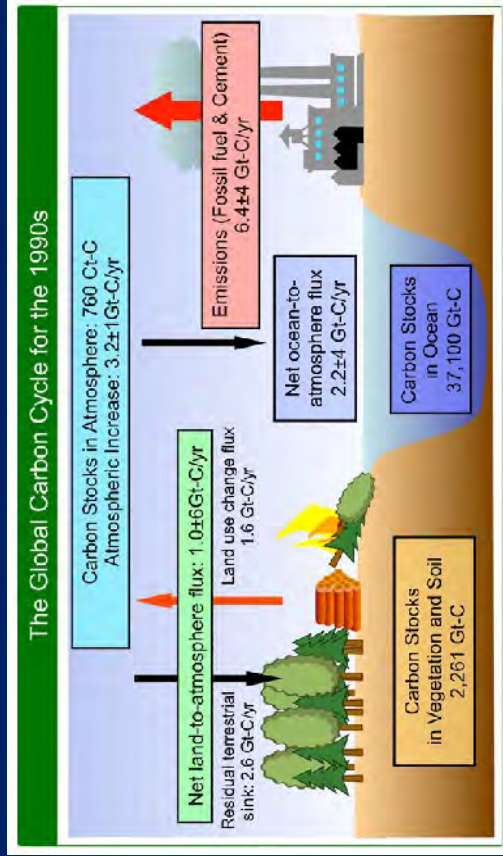


3

Roles of forests and forest products for mitigation of climate change

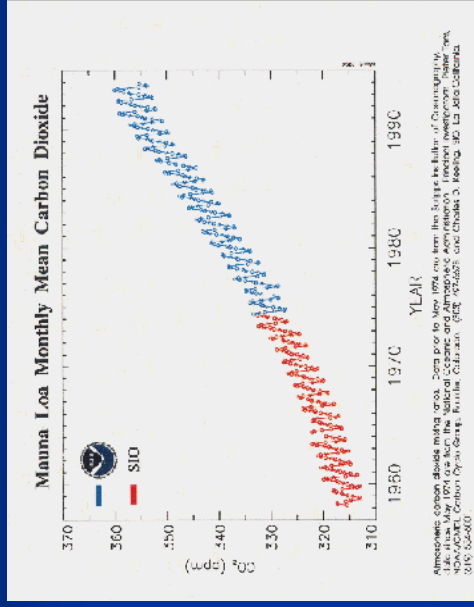
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Carbon cycle in 1990s



5

CO₂ increase at Mauna Loa



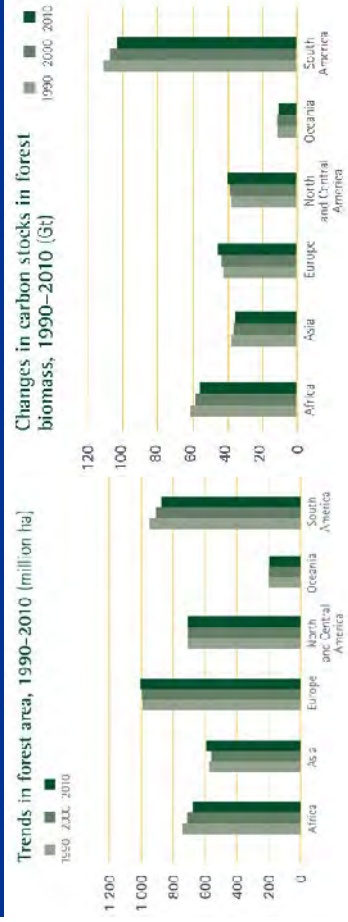
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CO₂ Emission from Forests

- Forests have a role to reduce CO₂ in atmosphere.
- But 1/5 of carbon increase in atmosphere was from forests actually.
- Deforestation makes large emissions from forests
 - Deforestation : Land use change from forests to other land uses

7

Changes of forest area and carbon stocks FAO(2010) FRA2010



8

Deforestation and Regeneration

- Deforestation
 - Forest -> Harvested -> Other land-use
 - Harvesting makes a carbon emission.
 - The land will not sink carbon at all.
- Regeneration
 - Forest -> Harvested -> Forest
 - Harvesting makes a temporal carbon emission.
 - Forests remove CO₂ while they re-grow.
 - There is no CO₂ release in a long term
- Reduction of deforestation is the most important to keep carbon sink.

9

Forest managements for mitigation of global warming

1. Avoiding deforestation
2. Avoiding degradation
3. Keeping forests sound
4. Promoting regeneration after harvesting forests
 1. Natural regeneration
 2. Planting
5. Increasing forest stocks
6. Increasing forest lands
 1. Afforestation
 2. Reforestation

1, 6: Land use management
2-5: Forest management

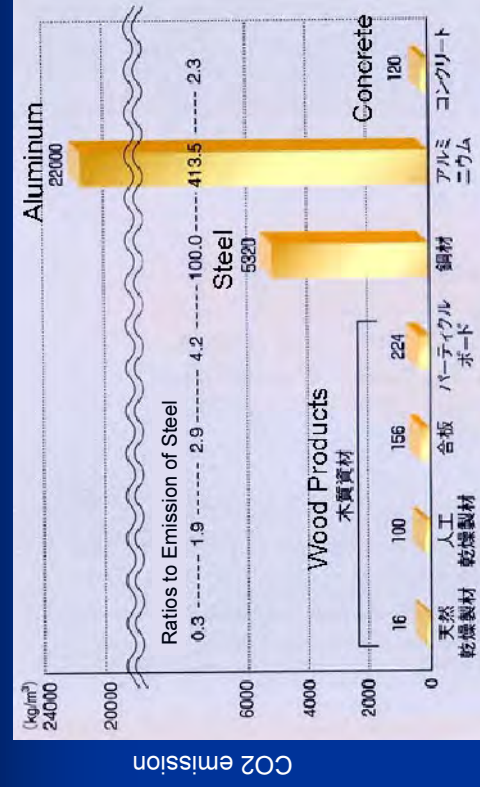
10

Roles of wood products for mitigation of climate change

1. Increasing carbon stocks in wood products
2. Material substitution
 - “Low-energy” wood products substitute “high-energy” other materials
 - Saving energy and fossil fuel
3. Fossil fuel substitution
 - Forest biomass energy substitutes fossil fuel energy
 - Saving fossil fuel

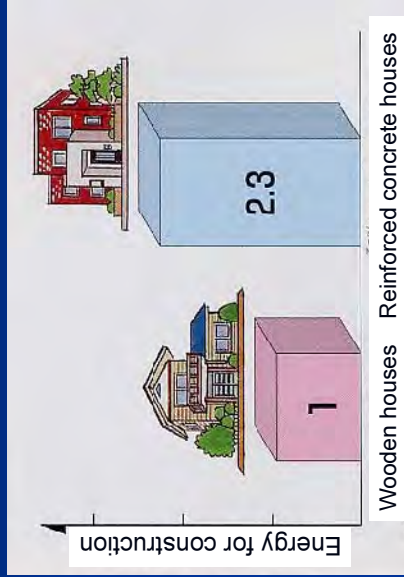
11

Energy for producing materials

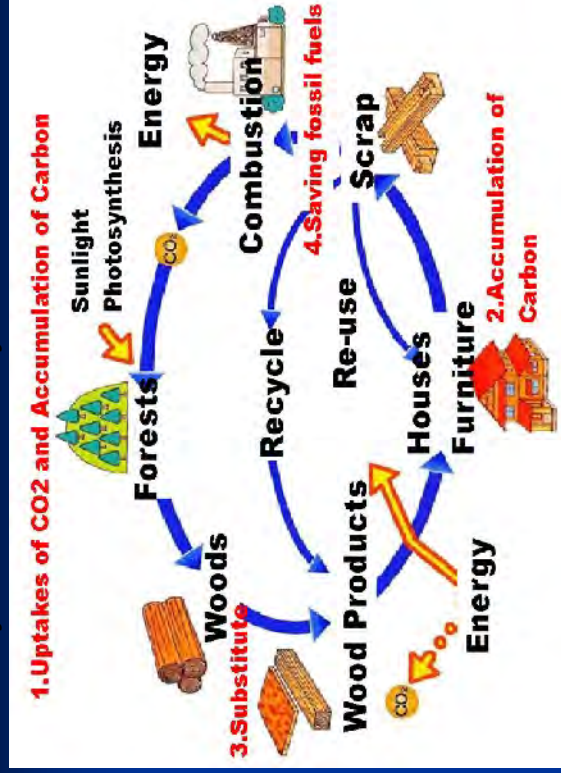


12

Saving energy by wooden houses



Carbon Cycles of Forestry and Wood Products



Mitigation Options in Forest Sector in IPCC AR4 WG3 report

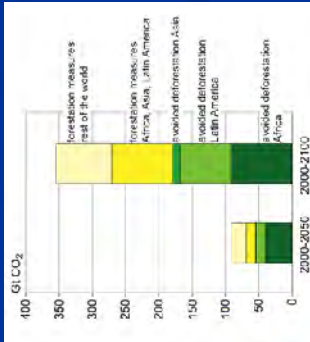
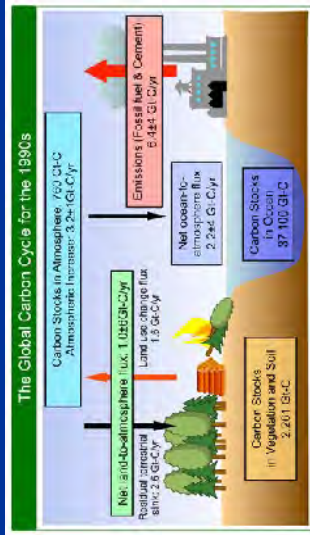
- Mitigation options in forest sector contribute to both enhancement of sink and reduction of source

Mitigation Activities	Type of Impact	Timing of Impact	Timing of Cost	Timing of net benefits (sink minus source)
1A Increase forest area (e.g. new forest)	↑	→	→	Delayed
1B Maintain forest area (e.g. prevent deforestation, JJC)	→	→	→	Delayed
2A Increase site-level C density (e.g. intensive management, fertilize)	↑	→	→	Up-front
2B Maintain site-level C density (e.g. avoid degradation)	→	→	→	Delayed
3A Increase landscape-scale C stocks (e.g. SFM, agroforestry, etc.)	↑	→	→	Delayed
3B Maintain landscape-scale C stocks (e.g. suppress disturbances)	→	→	→	Delayed
4A Increase off-site C in products (but must also meet 1B, 2B and 3B)	↑	→	→	Delayed
4B Increase bioenergy and substitution (but must also meet 1B, 2B and 3B)	↓	→	→	Delayed

New topics in the forest sector: REDD+

Deforestation and Forest Degradation

- About 80% of anthropogenic CO₂ emissions during the 1990s resulted from fossil fuel burning, with about 20% from land use change
- About 65% of the total mitigation potential is located in the tropics and about 50% of the total could be achieved by reducing emissions from deforestation and forest degradation.
- However, the Kyoto protocol has no role to stop DD in developing countries



Changes of Forest Area in 2005 – 2010 FAO(2010) FRA2010

- The total net change in forest area in the period 2000–2010 is estimated at -5.2 M ha/yr, an area slightly bigger than the size of Costa Rica
- Deforestation was almost occurred in developing countries
- Various situations of forests in developing countries
 - Large deforestation: Brazil, Indonesia, Tropical Africa
 - Stable forest area: Thailand
 - Increasing forest area: China, Vietnam, India

Net change in forest area by country, 2005–2010 (ha/year)



18

Countries in deforestation FAO(2010) FRA2010

Country	Annual change 1990–2000		Annual change 2000–2010	
	1 000 ha/yr	%	1 000 ha/yr	%
Brazil	-2 890	-0.51	-2 642	-0.49
Indonesia	-1 914	-1.75	-562	-0.37
Sudan	-589	-0.80	-498	-0.51
Myanmar	-435	-1.17	-410	-3.67
Nigeria	-410	-2.68	-403	-1.13
United Republic of Tanzania	-403	-1.02	-327	-1.88
Mexico	-354	-0.52	-311	-0.20
Zimbabwe	-327	-1.58	-310	-0.93
Democratic Republic of the Congo	-311	-0.20	-290	-0.49
Argentina	-293	-0.88	-288	-0.60
Total	-7 926	-0.71	-6 040	-0.53

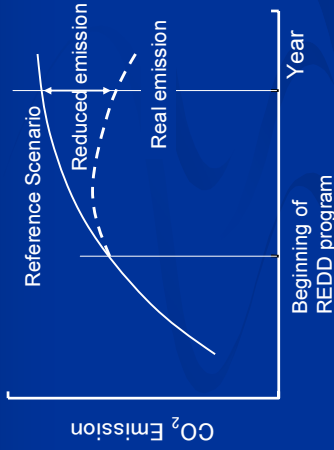
19

Deforestation in Indonesia



REDD: The first proposal

- Proposal from PNG and Costa Rica in COP11, 2005
- Positive incentives
 - Market mechanism
 - Credits of emission reductions by reducing deforestation
 - Credits to countries, not projects
 - Reference scenarios are significant



21

REDD and REDD+ Reducing Emission from Deforestation and Forest Degradation in Developing countries

- COP13 in 2007
 - REDD was listed in Bali Roadmap as an important option for mitigation of climate change
- COP14 in 2008
 - REDD became REDD+
 - REDD: Reducing emission from deforestation and forest degradation
 - +: Conservation, Sustainable forest management, carbon stock enhancement
- COP15, Copenhagen accords decision
 - 6. We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries.

22

What was Agreed at Cancun (COP16) ?

- The main outcome to emerge from the climate discussions is a series of COP decisions that have collectively been called the 'Cancun Agreements'.
- Agreements about REDD-Plus does not provide a concrete framework for how REDD-Plus should work but instead offers a set of clear guidelines and a work plan for the coming year.

23

Cancun Agreement -Scope of REDD-

- The REDD-Plus decision states that developing country Parties can contribute to mitigation actions in the forest sector by undertaking the following activities:
 - Reducing emissions from deforestation;
 - Reducing emissions from forest degradation;
 - Conservation of forest carbon stocks;
 - Sustainable management of forest;
 - Enhancement of forest carbon stocks;

24

Cancun Agreement -Drivers of Deforestation

- The REDD-Plus decision makes reference to the drivers of deforestation but falls short in placing adequate and fair guidelines on how to address these drivers.
- The decision requests developing countries to address the drivers of deforestation and forest degradation, but fails to address the role that developed countries play in driving tropical deforestation.

25

Cancun Agreement -Three key Elements for REDD-Plus Readiness

- Developing country parties wishing to engage in REDD-Plus are encouraged to develop the following elements:
- A national strategy or plan
- A national reference level
- A forest monitoring system

26

Cancun Agreement - Phased Approach

- Phase 1: Development of national plan, policies and measures and capacity building
- Phase 2: Implementation of national plan, policies and measures and further capacity building, technology development and transfer, and results based demonstration activities
- Phase 3: Results-based actions with full measurement reporting and verification

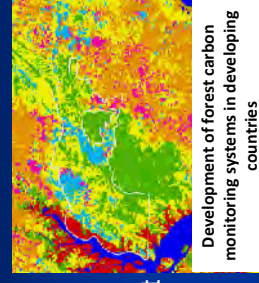


Figure: Concept of Phased Approach
Source: UN-REDD Web site

27

REDD Research & Development Center in FFPRI

- REDD R & D Center was founded within the Forestry and Forest Products Research Institute (FFPRI) in July 2010.
- Through international and domestic cooperation it will provide a technical hub for REDD+ activities in Japan, including technical development and giving support to private sector activities within the REDD+ framework.
- Activities
 - to develop technologies for forest carbon monitoring systems and international frameworks for REDD+
 - to train experts for REDD+ program
 - to provide opportunities for reinforcing collaboration between government, industry and academia.



Visit WEB! <http://www.ffi.jp/redd-rtc/en/index.html>

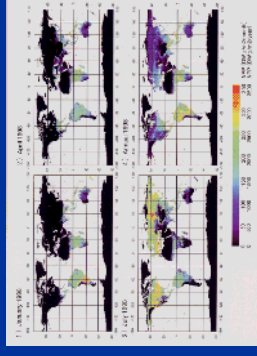
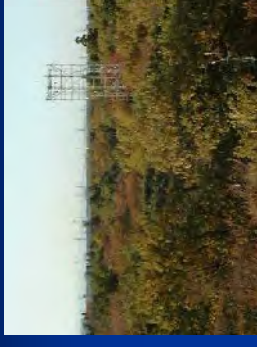
28

Evaluation methods of CO₂ flux by forests

29

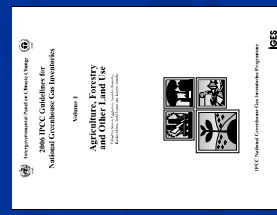
Evaluation of carbon flux by forests

- Various approaches
 - Meteorological approaches
 - Remote sensing approaches
 - Ecological approaches
 - Forest inventory approaches



IPCC approach to evaluate carbon flux by forests

- IPCC Guidelines for National Greenhouse Gas Inventories (1996)
 - For all countries
- IPCC Good Practice Guidance for Land use, Land-use change and Forestry (2004)
 - For all countries
 - For Annex I parties
 - Reports under the the Kyoto protocol have to follow this IPCC GPG
- IPCC Guidelines for Agriculture, Forestry and Other Land uses (2006)



31

Annual CO₂ and carbon flux by forests

- Annual CO₂ flux
= Annual Carbon flux • 44/12
- Annual Carbon flux
= Annual biomass change • Carbon fraction

Carbon fraction = 0.50 (t c/t dm) for all species

Positive = Removal, Uptake
Negative = Emission, Release

32

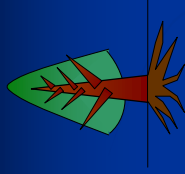
Average annual biomass change

Default method or Gain-Loss method

- $\Delta G = A \cdot G_{\text{TOTAL}} - L_{\text{TOTAL}}$
- ΔG = Average annual biomass change (t dm/yr)
- A = Area of forest land (hectares)
- G_{TOTAL} = Average annual growth in biomass (t dm/yr•ha)
- L_{TOTAL} = Total biomass loss (t dm/yr)
- dm : dry matter
- yr: year

33

Average annual growth in biomass



- $G_{\text{TOTAL}} = G_W \cdot (1 + R)$
- $G_W = G_V \cdot D \cdot \text{BEF}$
- G_{TOTAL} = Average annual growth in biomass (t/ha•yr)
- G_W = Average annual growth in aboveground biomass (t/ha•yr)
- G_V = Average annual growth in volume (m³/ha•yr)
- D = Wood density (t dm/m³)
- BEF = Biomass expansion factor
- R = Root-shoot ratio

34

Average annual biomass change

Stock change method or Stock-Difference Method

- Annual biomass stock change
 $\Delta G = (B_t - B_{t-\Delta t}) / \Delta t$
- ΔG = Average annual biomass change (t dm/yr)
- B_t = Biomass stock in an inventory year (t dm)
- $B_{t-\Delta t}$ = Biomass stock in a previous inventory year (t dm)
- Δt = Inventory cycle (yr)

35

Tiers

- Tier-1
 - To use default data
- Tier-2
 - To use country-specific data combined with country applicable default data
- Tier-3
 - To use detailed country-specific data

36

Examples of default data for annual increment in IPCC Good Practice Guidance, 2004

Age Class	Tropical and Sub-Tropical Forests					
	Wet R > 2000	Moist with Short Dry Season 2000-R > 1000	Moist with Long Dry Season 2000-R > 1000	Dry R > 1000	Montane Moist R > 1000	Montane Dry R > 1000
Africa						
≤20 years	10.0	5.3	7.4 (2.3-11.5)	1.7 (0.8-2.5)	5.0	7.0 (1.0-11.0)
>20 years	3.1 (2.1-3.8)	1.3	1.8 (0.6-3.0)	0.9 (0.2-1.6)	1.0	1.5 (0.5-4.5)
Asia & Oceania Continental						
≤20 years	11.0	9.0	6.0	5.0	5.0	1.0
>20 years	7.7 (1.3-11.0)	2.0	1.5	1.7 (1.0-2.2)	1.0	0.5
Insular						
≤20 years	13.0	11.0	7.0	2.0	12.0	3.0
>20 years	3.4	3.0	2.0	1.0	3.0	1.0
America						
≤20 years	10.0	7.0	4.0	4.0	5.0	1.8
>20 years	1.9 (1.2-2.6)	2.0	1.0	1.0	1.1 (1.0-2.0)	0.4

Note: R = annual rainfall in mm/yr

37

Examples of default data for annual increment in IPCC Good Practice Guidance, 2004

Age Class	Temperate Forests		Broadleaf
	Mixed Broadleaf- Coniferous	Coniferous	
≤20 years	1.0	1.5	4.0 (0.5-8.0)
>20 years	1.5	2.5	4.0 (0.5-7.5)
Eurasia			
≤20 years	1.1 (0.7-1.5)	0.8 (0.5-1.0)	0.4 (0.2-0.5)
>20 years	1.1 (0.7-1.5)	1.5 (0.5-2.5)	0.4 (0.2-0.5)
America			
≤20 years	1.1 (0.7-1.5)	0.8 (0.5-1.0)	1.5 (1.0-2.0)
>20 years	1.1 (0.7-1.5)	1.5 (0.5-2.5)	1.3 (1.0-1.5)

38

Wood density, BEF and R

- Wood density
 - Weight per m³
 - Default value in 1996 guidelines
 - 0.45 t dm/m³ for conifers, 0.65 t dm/m³ for deciduous
- Biomass Expansion Factors
 - To convert stem weight to aboveground biomass weight.
 - BEF = (Stems+Branches+Leaves)/Stems
- Root-Shoot ratios
 - To convert aboveground biomass weight to whole tree weight including roots
 - R = Aboveground/Roots

39

Examples of default data for Root-Shoot ratio in IPCC Good Practice Guidance, 2004

Vegetation type	Aboveground biomass (t/ha)	Mean	SD	Lower range	Upper range	Reference
Secondary tropical/sub-tropical forest	≤125	0.42	0.22	0.14	0.83	5, 7, 11, 23, 28, 31, 48, 71
Primary tropical/sub-tropical moist forest	NS	0.21	0.05	0.23	0.33	33, 37, 61, 67, 69
Tropical/sub-tropical dry forest	NS	0.27	0.01	0.27	0.28	65
Conifer forest/plantation	≤50	0.46	0.71	0.71	1.05	7, 8, 41, 44, 56, 61, 15
Conifer forest/plantation	50-150	0.32	0.08	0.21	0.50	6, 56, 51, 53, 58, 61
Conifer forest/plantation	>150	0.23	0.09	0.12	0.49	1, 6, 70, 40, 51, 63, 67, 77, 79
Oak forest	>70	0.35	0.25	0.20	1.15	15, 90, 64, 67
Eucalypt plantation	>50	0.45	0.15	0.29	0.81	6, 31, 59
Eucalypt plantation	50-150	0.35	0.25	0.15	0.81	4, 9, 55, 60, 76
Eucalypt forest/plantation	>150	0.30	0.08	0.10	0.33	4, 9, 10, 66
Other broadleaf forest	<75	0.43	0.74	0.12	1.93	10, 43, 46, 67
Other broadleaf forest	75-150	0.36	0.10	0.13	0.52	30, 36, 45, 46, 63, 77, 78, 81
Other broadleaf forest	>150	0.24	0.05	0.17	0.50	2, 23, 30, 37, 67, 78, 81
Temperate broadleaf forest	NS	1.95	1.97	1.97	11.51	50, 56, 70, 77
Temperate sub-tropical/montane grassland	NS	1.36	1.02	0.39	1.11	27, 31, 32, 37
Semi-arid savanna	NS	2.80	1.33	1.43	4.92	17, 13, 34
Woodland/savanna	NS	0.48	0.19	0.26	1.01	10, 13, 21, 27, 30, 45, 73, 74
Savanna	NS	2.83	2.04	0.34	6.49	11, 29, 31, 38, 41, 42, 47, 67
Total world	NS	1.04	0.21	0.74	1.23	24, 39, 66, 80

NS = Not specified

40

Examples of default data for Wood density in IPCC Good Practice Guidance, 2004

Species or genus	Basic wood density Mg/V _{wood}
Abies	0.40
Acer	0.52
Alnus	0.45
Betula	0.51
Carpinus betulus	0.63
Castanea sativa	0.48
Fagus sylvatica	0.58
Fraxinus	0.57
Juglans	0.53
Larix decidua	0.46
Larix koraiensis	0.49
Picea abies	0.40
Picea sibirica	0.40
Pinus pinaster	0.44
Pinus strobus	0.32

Pinus sylvestris	0.42
Populus	0.35
Prunus	0.49
Pseudotsuga menziesii	0.45
Quercus	0.38
Salix	0.45
Thuja plicata	0.31
Ulmus	0.43
Tsuga	0.42

41

Examples of default data for BEF in IPCC Good Practice Guidance, 2004

Climatic zone	Forest type	Minimum dbh (cm)	BEF2 (overbark) to be used in connection to growing stock biomass data (Equation 3.2.3)	BEF1 (overbark) to be used in connection to increment data (Equation 3.2.5)
Boreal	Conifers	0-8.0	1.35 (1.15-3.8)	1.15 (1-1.3)
	Broadleaf	0-8.0	1.3 (1.15-4.2)	1.1 (1-1.3)
Temperate	Conifers: Spruce-fir Pines	0-12.5	1.3 (1.15-4.2)	1.15 (1-1.3)
	Broadleaf	0-12.5	1.3 (1.15-3.4)	1.05 (1-1.2)
Tropical	Pines	10.0	1.4 (1.15-3.2)	1.2 (1.1-1.3)
	Broadleaf	10.0	1.3 (1.2-4.0)	1.2 (1.1-1.3)
			3.4 (2.0-9.0)	1.5 (1.3-1.7)

42

IPCC EFDB Emission Factors Database

- EFDB is meant to be a recognized library, where users can find emission factors and other parameters such as BEF, Root/Shoot ratios and Wood density
- IPCC EFDB <http://www.ipcc-nggip.iges.or.jp/EFDB/main.php>

43

Annual biomass loss

- $L_{TOTAL} = L_H + L_F + L_D$
 - L_{TOTAL} = Total biomass loss (t dm/yr)
 - L_H = Biomass loss due to harvest (t dm /yr)
 - L_F = Biomass loss due to (non commercial) fuelwood gathering (t dm/yr)
 - L_D = Biomass loss due to disturbances (t dm/yr)

44

Biomass loss due to harvest

- $L_H = HW \times BEF \times D$
- L_H = Biomass loss due to harvest (t dm /yr)
- HW = Commercial harvested wood (m³)
- BEF = Biomass Expansion Factors
- D = Wood density (t dm/m³)

45

Average annual loss due to disturbance

- $L_D = A_D \times W$
- L_D = Biomass loss due to disturbances (t dm / yr)
- A_D = Forest areas affected by disturbances (ha /yr)
- W = Average biomass stock of forest areas (t dm/ha)

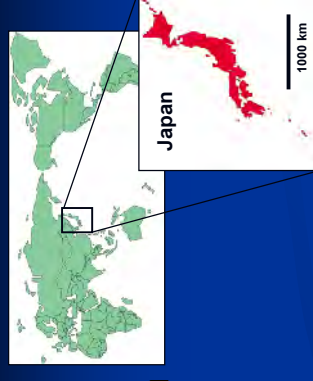
46

Japan's forest carbon accounting system for Kyoto reporting

47

Japan's Forest

- Total land is 37 M ha and islands are distributed over about 3,000km from South-West to North-East.
- Four climatic zones:
 - Sub-tropic, Warm temperate, Cool temperate, Boreal
- Large amount of precipitation (1,700 mm/year)
- Large proportion of land is occupied by steep mountains with forest cover.
- 67% of total land is forest
- 40% of forest is planted forest and 60% is semi-natural forest
- 69% of forest is private and 31% is national



Kyoto Target for Japan

- Kyoto target
 - -6% from the level in the base year
- Target of forest sinks
 - -3.8% (13 M t-C/yr = Japan's Cap in MA)
- Present situation of emission in Japan
 - +8.7% in 2007 without forest removals
 - +1.9% in 2008
 - Kyoto target will be achieved in 2008 with Forest removals & JI, CDM, Credits by emission trading

49

Requirements for Forest Removals under the Kyoto Protocol

- Definition and choice
 - Definition of "Forest"
 - Election of Article 3.4 activities
 - Definition of Forest management
 - Choice of reporting method
- Data and methods for accounting
 - Transparent data source and methods
 - Uncertainty assessment, Verification and QA/QC
- Accounting methods
 - Carbon in 5 pools
 - Above ground biomass, Below ground biomass, Dead wood, Litters and Soil organic matter
 - Article 3.3 ARD
 - Article 3.4 FM lands
- Accounting and reporting systems

50

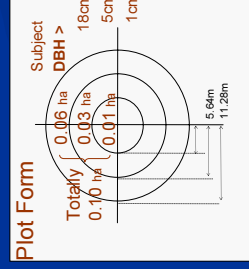
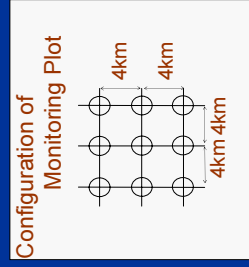
Japan's Forest Inventory System based on Forest registers and Forest maps

- Forest registers
 - Enumeration
 - Attribute information : Area, Species, Age, DBH, Volume etc.
 - Every sub-compartment of all private and national forests
 - Total 41 M records
 - Updating every 5 years
 - Linkage with boundaries in forest planning maps
- Forest maps
 - 1/5000 scale maps
 - Boundaries of forest compartments and sub-compartments
 - 100% of the boundaries of forest components have been digitized for GIS.
 - Around 80% of the boundaries of sub-compartments have been digitized for GIS

51

Forest Resources Monitoring Survey

- Started from 1999
- About 15,700 permanent plots on 4km x 4km grid points over the whole of national territory
- Each plot is surveyed every 5 years. 3,200 plots are surveyed annually.
- Each monitoring plot: triple circle of 0.1 ha



52

Definitions and Choices for Kyoto Reporting

- Definition of forests
 - Minimum value for forest area: 0.3ha
 - Minimum value for tree crown cover: 30%
 - Minimum value for tree height: 5m
 - Minimum value for forest width: 20m
- Election of Article 3.4 activities
 - Forest Management
 - Revegetation
- Choice of reporting method
 - Reporting method 1
 - 47 prefectures

53

Data and Method for Carbon Flux Estimation

- Base data
 - Forest registers
 - Forest planning maps
- Estimation methods
 - Stock Change Method
 - Carbon flux
 - = $(C \text{ stocks at } t_2 - C \text{ stocks at } t_1) / (t_2 - t_1)$
 - Carbon stocks
 - = $\text{Volume} \times \text{Density} \times \text{BEF} \times (1 + R/S \text{ ratio}) \times \text{Carbon fraction}$

54

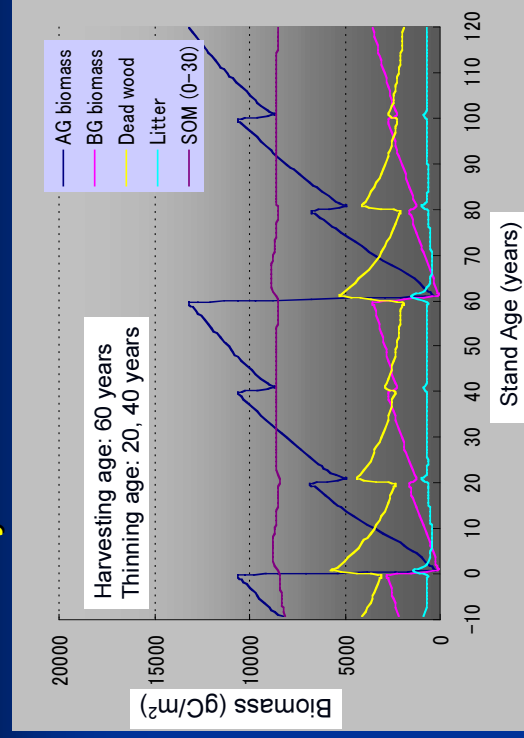
Parameters for Japanese trees

BEF, Root/Shoot ratio, Density and Carbon fraction

	BEF		R	D	Carbon Fraction	Note
	≤ 20	> 20				
Japanese cedar	1.57	1.23	0.25	0.314		
Fir/alder/cypress	1.55	1.24	0.26	0.407		
Sugi/cypress	1.53	1.24	0.76	0.787		
Japanese red pine	1.63	1.25	0.27	0.416		
Japanese black pine	1.30	1.36	0.34	0.464		
Fir/alder/birch	2.43	1.38	0.18	0.429		
Japanese larch	1.50	1.15	0.29	0.404		
Mitsunori	1.40	1.40	0.40	0.473		
Sakhalin fir	1.88	1.38	0.21	0.319		
Japanese hemlock	1.40	1.40	0.40	0.464	0.5	
Yew/spruce	1.92	1.46	0.22	0.348		
Sakhalin spruce	2.15	1.67	0.21	0.364		
Japanese umbrella pine	1.36	1.25	0.18	0.455		
Japanese yew	1.56	1.25	0.18	0.454		
Crab apple	1.51	1.15	0.18	0.451		
Japanese camellia trees	1.01	1.41	0.17	0.320		
Other conifer trees:	2.55	1.22	0.34	0.532		Fukuroku, Tsuboku, Tsubaki, Kurume, Shirane, Nagaoka, Toyama, Yamashiro, Niigata, Gifu, Shizuoka
	1.30	1.36	0.34	0.464		Obanawa
	1.40	1.40	0.40	0.423		Other deciduous

55

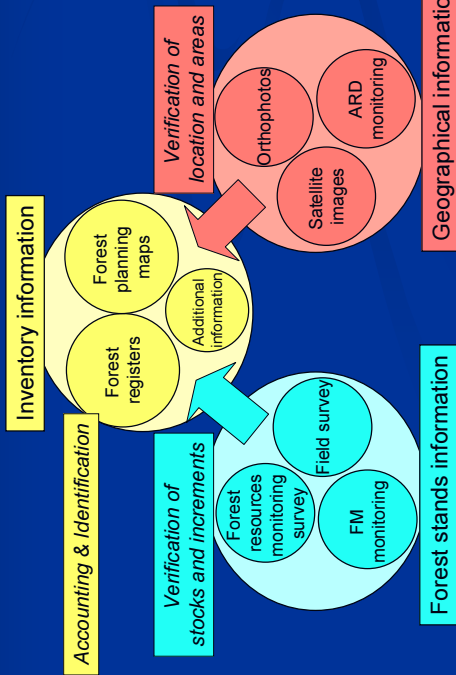
Carbon Stock Changes in 5 pools by CENTURY model



56

Design of Accounting and Reporting System

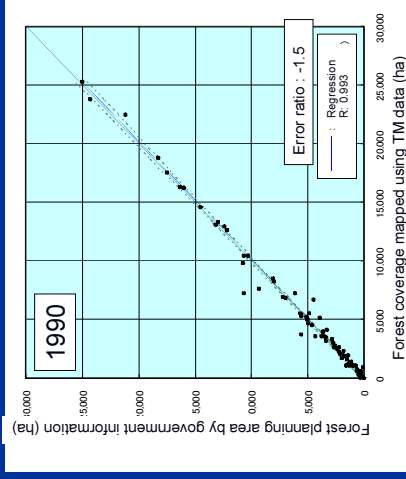
- Accounting is based on forest registers and forest planning maps mainly
- It is verified with independent stands and geographical information



57

Verification of forest area - RS mapping and forest registers -

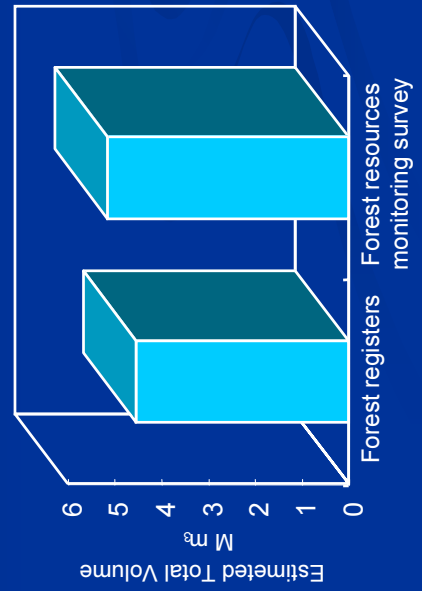
- Comparison of forest area by TM and forest registers in municipalities.
- Error ratios were less than 5%



58

Verification of Forest Volume

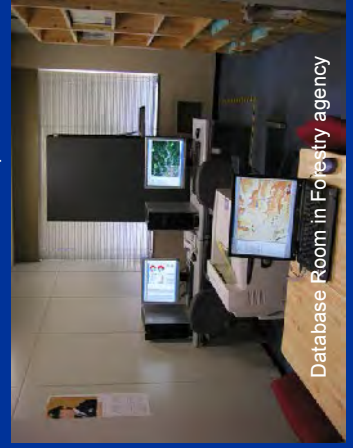
- Estimated forest volume by Forest resources monitoring survey was 13.8% larger than one by forest registers.



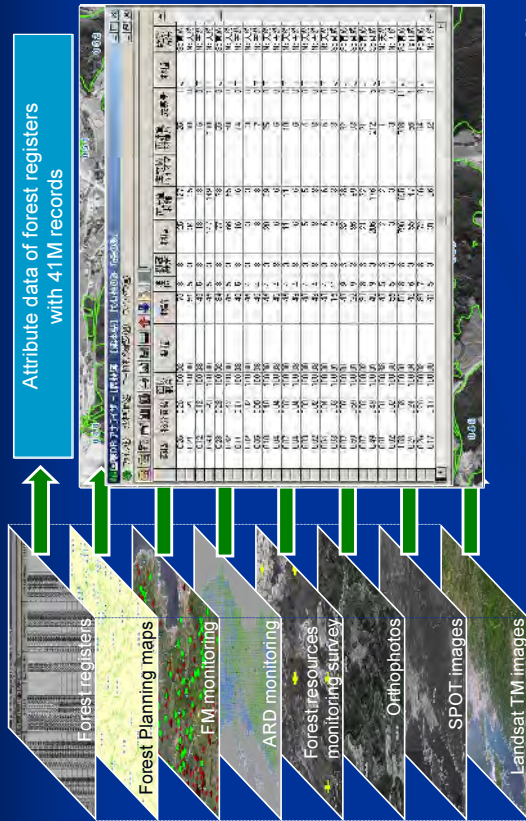
59

National Forest Resources Database - NFRDB -

- Two servers
 - Main system in Forestry agency
 - Ordinary use
 - Sub system in FFPRI
 - Backup system
 - Research and development



Main Data on The NFRDB



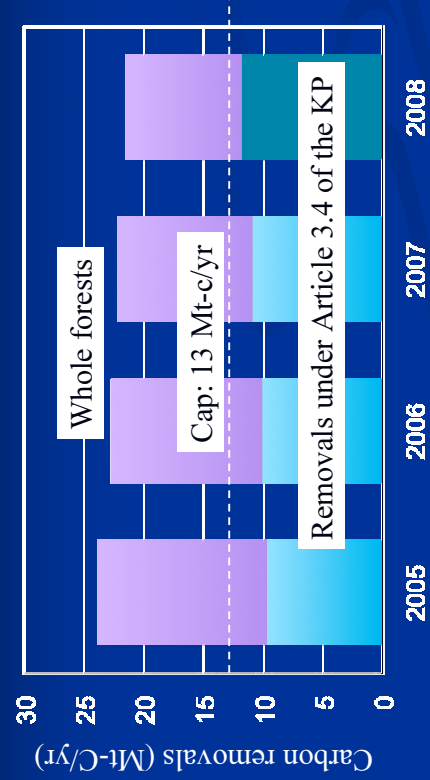
61

Carbon Removals under UNFCCC and KP in the 2008 report

	Mt-C					
	Above ground biomass	Below ground biomass	Dead wood	Litters	Soil organic matters	Total
Whole forests	20.87	0.15				21.80
Forests under the KP	9.19	2.31	▲ 0.14	0.09	0.37	11.83
Art.3.4 AR	0.06	0.02	0.02	0.01	0.00	0.11
Art. 3.3 D	▲ 0.35	▲ 0.09	▲ 0.12	▲ 0.05	▲ 0.06	▲ 0.66
Art. 3.4 FM	9.48	2.39	▲ 0.04	0.13	0.43	12.38

62

Carbon Removals under UNFCCC and KP



63

References

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■ All documents can be downloaded at <http://www.ipcc.ch/>

64

Thank you for your attention