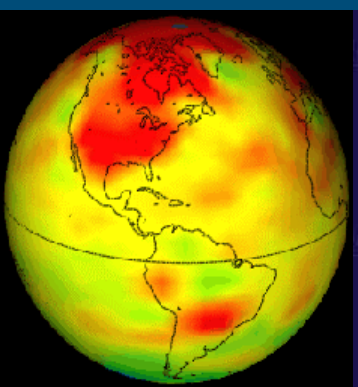
Measures to Comply with the Kyoto Protocol in Agricultural Sector

Dr. Chang-Gil Kim

KREI Korea Rural Economic Institute

Contents

I Introduction







Research Backgrounds and Objective

■ Backgrounds

► Mandatory emission reduction under Kyoto Protocol (KP)

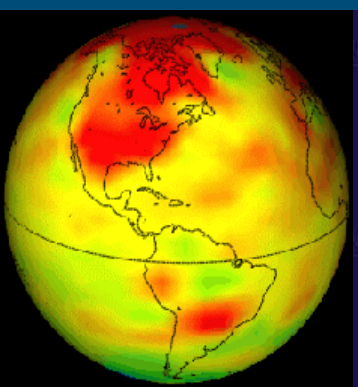
- Significant Impact on national economy and agricultural sector including production and consumption activities
- Positive or negative aspect of reducing GHGs in Ag-sector

⇨ Depending on how to comply with the KP, it might work either as a threat or as an opportunity for the Ag-sector

▣ Study Objective

► Analyze impacts on the Ag-sector and propose systematic measures for the Ag-sector to comply with the KP

Ⅱ Contents of the Kyoto Protocol and Post-2012 Discussions







Major Contents of the Kyoto Protocol

UN Framework Convention on Climate Change (UNFCCC)

- stabilizing GHGs concentrations in the atmosphere
  - "common and differentiated responsibility' principles and cost-efficient implementing measures to prevent climate change

Kyoto Protocol

- legally binding international agreement by which the COP3 commit each developed country to a target to reduce GHGs emission level
  - preamble, 28 articles and 2 annexes
  - definitions of major terms, measures for GHG reduction, reduction commitment for Annex I countries, GHG calculation method, preparation and submission of national communication

Kyoto Protocol

- clarification of GHG source and sinks in agriculture

  - source: enteric fermentation, manure management, rice cultivation, agricultural soils, prescribed burning of savannas, field burning of agricultural residues
  - sink: land use, land-use change and forestry activities (LULUCF)
  - reservoirs : storing carbon in soils

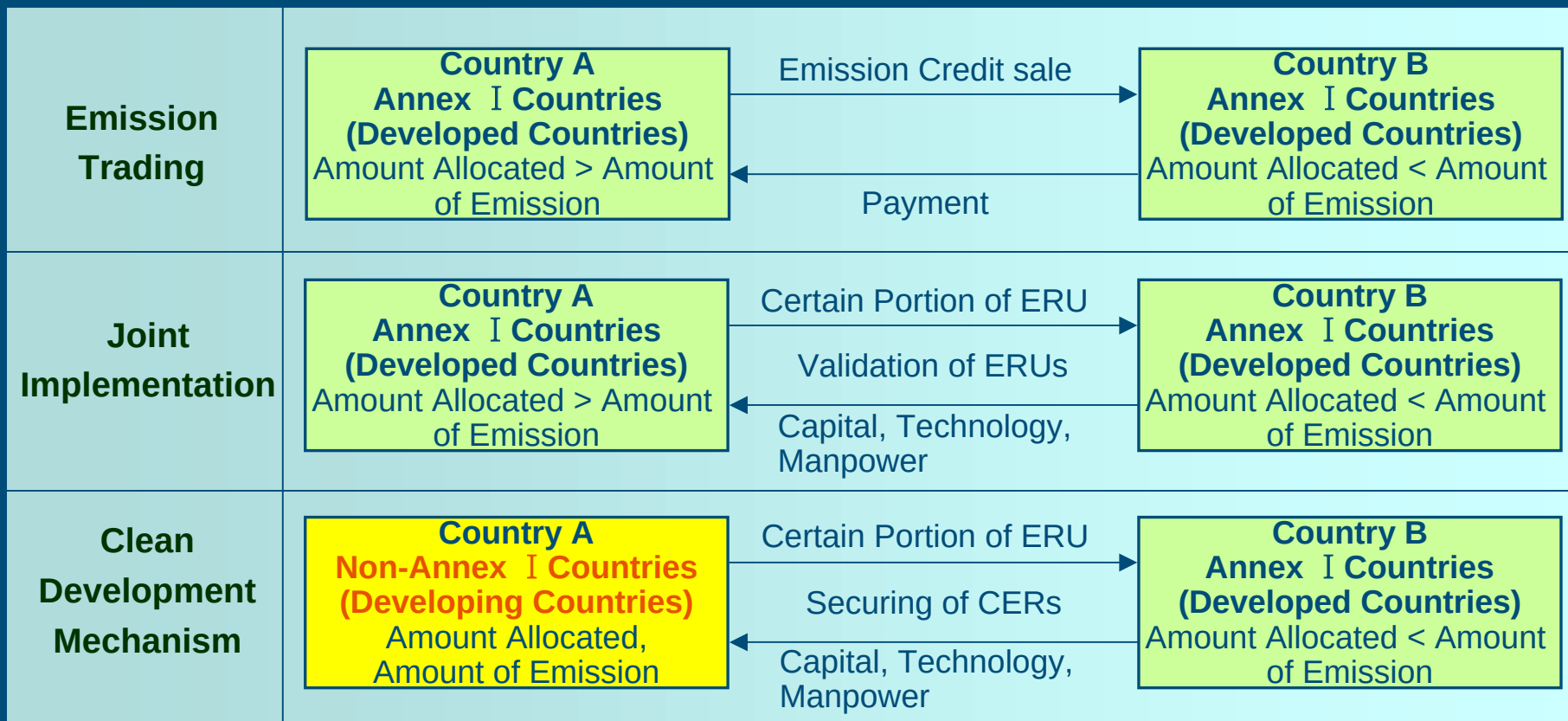
- policies and measures for GHG reduction
  - enhancement of energy efficiency
  - taxation and subsidies
  - environmentally sound clean technologies
  - research and development
  - international cooperation

Mechanism of KP Implementation

Kyoto Mechanism

▶achieving at the minimum cost GHGs reduction targets with Emission Trading, Joint Implementation, and Clean Development Mechanism

<Operating System of the Kyoto Mechanism>



Trend / Prospect of Discussion on Post -2012 Mechanism

Discussions on post-2012 mechanism

▶ UN process

- continued discussion in the COP (Conference of Parties)
- COP 13 - Bali Plan of Action (Bali Roadmap) in December 2007 calling for all countries reduce GHG emission starting in 2013
- COP 15 - conference in Copenhagen 2009 (Copenhagen Protocol) last time on government level before the climate agreement need to be renewed

▶ Major countries' process centering on the USA

- 17 top GHG emitters' meeting at Washington in 2007
- technologies promotion through R&D, financial mechanism, land use, energy efficiency adaptation
- standpoint of new US administration to be launched in January 2009

Ⅲ Instruments for GHGs Control in Ag-Sector

Means of GHGs Reduction

- **Economic Instruments using market mechanism**
  - Tax system – carbon tax and GHG tax
  - Emission trading system – setting credit and permitting trade
  - Subsidy – financial incentive
- **Regulation – emission standards**
  - emission cap, chemical fertilizers spreading standard, manure and liquid fertilizer spraying standard, breeding density regulation
- **Voluntary Agreement**
  - Good farming practice, voluntary resource-recycling village
- **R&D, Information provision and Public awareness enhancement**

Key Measures of GHGs Control under the KP

■ Emission Trading System

▶ Suggested by the Kyoto Protocol (Article#17)

- scheme for assigning GHG quota to each country and credit trading in order to reduce the reduction cost and to facilitate the emission reduction
- types of credits : Assigned Amount Unit (AAU), Emission Reduction Unit (ERU), Removal Unit (RU), Certified Emission Reduction (CER)

▶ Domestic Emission Trading System

- giving credits to those under agricultural sector who achieve emission reduction so as to substantially compensate for them.
- environmental credit trading system in the USA ag-sector

Key Measures of GHGs Control under the KP

■ Clean Development Mechanism (CDM)

▶ Validation and Verification of CDM Project

- Document Review, On-site Evaluation, and Verification of Corrective Measures

▶ Current Registration of CDM Project (November, 2007)

- 844 CDM projects (India: 289, China 131, Brazil 113, Korea 19)
- About 30% projects related to ag-sector
  - 79 projects: CH_4 reduction from livestock manure treatment (Biogas plant using livestock manure)
  - 149 projects : energy projects using biomass (power generation using rice husks)

Key Measures of GHGs Control under the KP

■ Utilization of GHG Reduction Technologies

▶ Clean technology for reducing CH_4 and N_2O

- Crop cultivation technologies (fertilization control and water management), livestock feeding techniques

▶ Organic agricultural and livestock practices

▶ Soil Organic Carbon (SOC) Sequestration techniques

- soil management, mulched crop cultivation, conservation tillage, no-tillage farming, integrate nutrients management

▶ Bio-energy utilization

- bio-gas from livestock manure and food wastes
- bio-diesel from rapes and oilseed crops
- ethanol from corn, sugar cane, potato and sweet potato starch

GHG Reduction Technologies in the Agricultural Sector

Fields	Reduction Technologies
Reduction of CH4 and N2O	Expand organic techniques. and environment-friendly farming
	Reduce of fossil fuel through the improved farming methods
Formation of pasture on lands in fallow	Afforest lands in fallow and form pastures.
	Cultivate mulched crops on lands in fallow.
Soil organic carbon sequestration	Perform conservation tillage and crop rotation.
	Substitute chemical fertilizers with organic substances
	Improve soil mulch and irrigation methods
Improvement of rumen fermentation	Improve energy content of feeds and digestion efficiency.
	Improve breeds of cattle and feed good-quality roughage.
	Apply ruminant additive (feed additive and microbiological agent).
Improvement of livestock manure treatment facilities	Expand facilities for aerobic treatment of slurry and install covers.
	Capture methane and turn it into resource
Utilization of biomass and reduction of fossil fuel use	Substitute fossil fuels by cultivating bio-energy crops
	Expand bio-gas and biomass technologies.
	Power generation using rice husks

IV Impacts of Reduction Measures on Ag-Sector and Their Potential

Economic Impacts of Emission Reduction Scenario

■ Economic Impacts of Emission Trading System

▶ Setting up the scenarios under the reduction commitment level after 2013 based on 5% below 2000 emission levels

- used dynamic CGE (computable general equilibrium) model

<Emission Reduction Scenarios to Comply with the KP>

Scenario	Contents
Scenario 1	Each industry implements its emission reduction target individually (Reduction cost per ton in each industry)
Scenario 2	All industries meet their reduction targets through ETS
Scenario 3	Non-agricultural sectors (manufacturing, service, and fossil fuel sectors) are allowed for emission trading, while the agricultural sector implements the reduction commitment individually

Analysis of Potentials of Emission Reduction Measures

Analytical Results

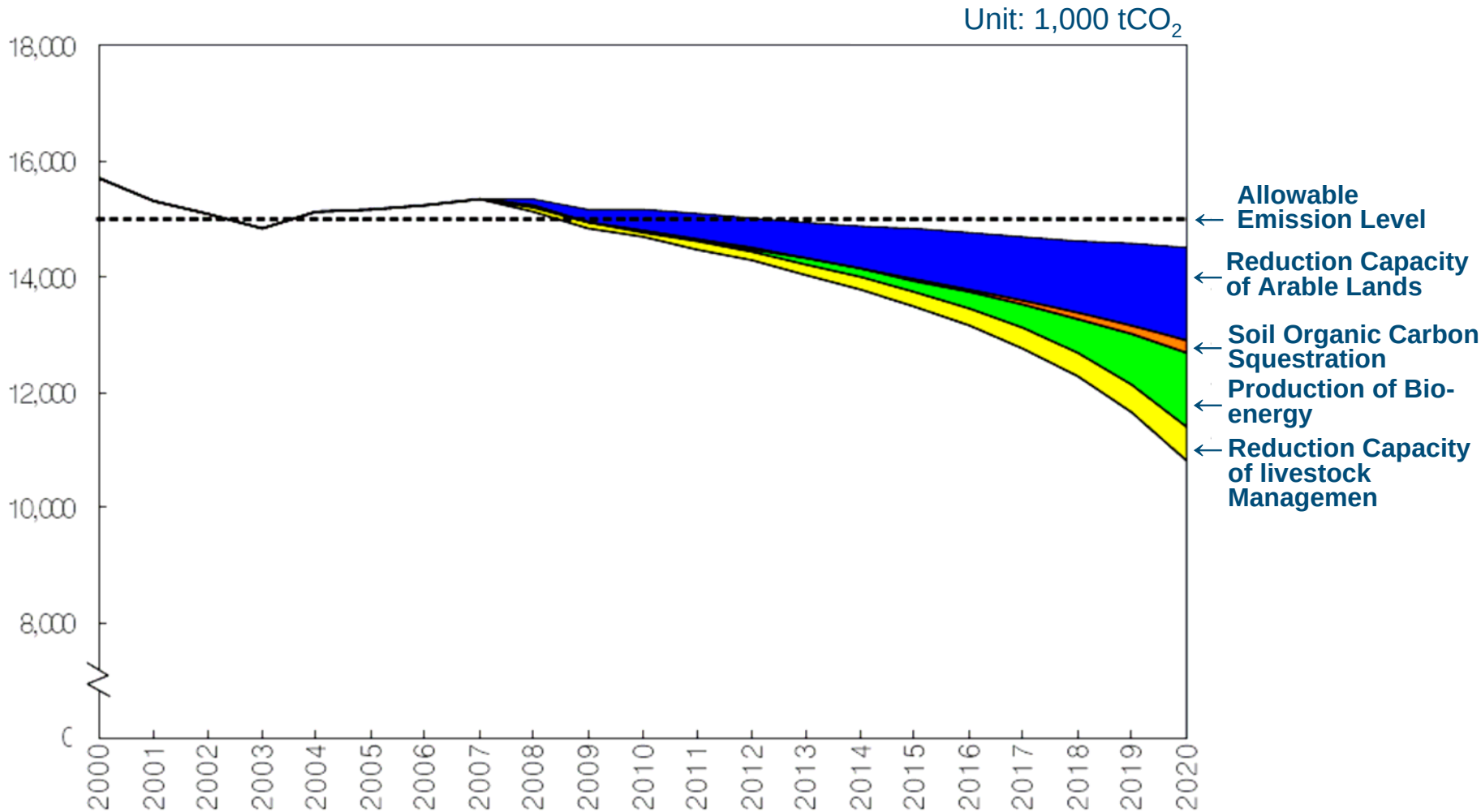
- when the agricultural sector participated in emission trading system as a means of greenhouse gas reduction, it would contribute to the national economy as well as increasing the profits of the agricultural sector

Analysis of Potentials of Emission Reduction Measures

■ Potentials of GHGs Reduction Measures in Ag-Sector

- ▶ Methane Reduction Potential of Direct Sowing of Rice on Dry Fields
- ▶ Emission Reduction Potential of Soil Organic Carbon in Arable Lands
- ▶ Fossil Fuel Reduction Potential through Cultivation of Energy Crop
- ▶ Emission Reduction Potential of Rumen Fermentation Improvement and Manure Treatment Facilities in Livestock Sector

Total Emission and Reduction Emission Potentials



V Strategy for GHGs Reduction Commitment in Ag-Sector

Approach to Formulating Practical Strategies

■ Basic Directions for Establishing Eco-friendly Low Carbon Farming System

- ▶ Optimal policy mix through policy integration and coordination
- ▶ Actively Coping with inter- and intra-national negotiation with relation to GHGs emission reduction
- ▶ Carbon sinks and reduction potential to be estimated on a basis of scientific analyses
- ▶ Feasible adaptation programs should be developed and carried out in the fields in order to cope with climate change

<Measures to cope with Kyoto Protocol in Korea>

Establishment of Eco-friendly Low Carbon Production System

GHG emission reduction

- Extension of GHG emissions reduction technology.
- GHG emissions reduction incentive
- Promotion of sound organic farming
- Setting up a foundation of utilizing Kyoto Mechanism.

Carbon sinks

- Extension of carbon sequestration techniques.
- Encourage farmers to grow bio-energy crops
- Commercialize bio-gas plant from livestock manure.
- Identify carbon sinks and sequestration in farmlands.

Adaptation to climate changes

- Establishment of ecological monitoring system.
- Setting up climate information system
- Development of adaptation in climate changes and R&D

Set up global warming and adaptive system to climate changes

- Establishment of national GHG emissions inventory, developing domestic emissions factor
- Identification of GHG emissions / sinks mechanism and establishing carbon balance model
- Estimation crop production quantity, predicting agricultural flora, and setting up adaptive system (early warning system in agricultural sector)

<Roadmap for Activating Measures>

	Initial stage (2008 - 2012)	Interim stage (2013 - 2018)	Final stage (2019 - 2030)
GHG Emissions Reduction	Provide subsidy &supports Energy saving campaigns Develop and spread GHG emissions reduction Increase bio-energy crops Execute emission trading system/ CDM pilot project	Set up GHG emissions DB. Establish bio-energy production system Establish emission trading system	Supplement GHG emission reduction programs. Set up low carbon farming system. Establish GHG reduction BMP
GHG Sinks	Clarify organic carbon's role in soils Estimate accumulated organic carbon and set up a system of using it	Apply incentives and programs for carbon sinks. Make pubic the methods of using sink sources.	Utilize GHG sinks. Set up maximized carbon sink farming system
Adaptation to Climate Change	Establish the model for productivity forecast and flora evaluation. Set up eco agricultural monitoring system. Map out adaptive croplands and crop distribution. Develop adaptive species to climate changes.	Prepare and distribute anti-global warming manuals. Set up weather info & early warning system. Set up adaptation to climate changes & training system	Distribute adaptation manuals Set up adaptation system Set up crop transformation evaluation system

Measures to Comply with the GHG Reduction Commitment

CDM Pilot Project in the Ag-Sector

▶ Initiation of CDM projects in the domestic agricultural sector

- executive program should be established to validate greenhouse gas reduction potentials of livestock manure treatment facilities, bio-mass generation and bio-fuel utilization.
- For validation, greenhouse gas emission from each project unit should be calculated and applicable conditions of baselines and monitoring methodologies currently in use for CDM projects should be reviewed in depth.

▶ For step-by-step implementation of CDM pilot projects in the domestic agricultural sector

- clear understanding of how to calculate the amount of greenhouse gas emissions from each source in the agricultural sector should precede.
- proper emission calculation methods should be devised in consideration of regional characteristics
- then, accumulated knowledge of and experiences in technologies to reduce greenhouse gases from their sources should be provided.

Bio-gas plant for livestock manure treatment

Measures to Comply with the GHG Reduction Commitment

Utilization of Emission Trading System in Ag-Sector

- Under ETS, every country assigns emission units to firms and sectors in it to meet the reduction target assigned to it, and the firms that do not meet the assigned reduction targets are induced to certified emission reductions from the firms of other countries.

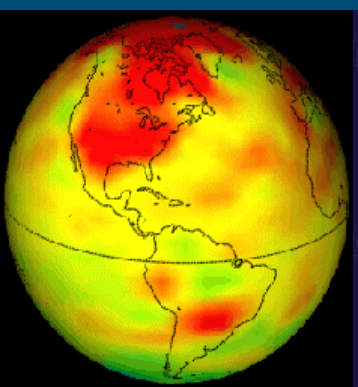
- Illustrated example of environmental credit trading system in the USA

  - The environmental credit system allows firms under regulation to meet their reduction targets through emission reduction service credits trading.

  - Though the agriculture does not come under most of environmental regulations, farmers could participate in the credit trading program by producing emission reduction credits and selling them to the firms under regulation.

  - When the cost of producing emission reduction credits is lower than the price of the credits, the farmers could make profits, so that they would actively participate in the ETS.

V Concluding Remarks







Summary and Concluding Remarks

Summary of the Paper

Policies for establishing measures to comply with the KP in as-sector

- Establishing low-carbon sustainable agricultural system through policy mix, positively and actively coping with the domestic and international negotiations, scientifically analyzing the amounts of greenhouse gas emission and capture, and adapting to global warming
- Implementation strategy for the agricultural sector to be approached in 3 stages with 2030 as the target year such as foundation establishment stage (2008~2012), take-off stage (2013~2018) and settlement stage (2019~2030).
- A stage-by-stage road map presented to establish an environment-friendly low-carbon agricultural production system through program implementation in each sector of greenhouse gas reduction, capture and adaptation.

Measures to Comply with the GHG Reduction Commitment

Recommendation for the Forum

▶ Significance of CDM as one of co-operative mechanisms

- CDM project is the only one, which has potential to assist developing countries in achieving sustainable development by promoting environmentally friendly investment from industrialized country government and business.

- For catalyzing green investment priorities in developing countries, the CDM offers an opportunity to make progress simultaneously on climate, development, and local environmental issue.

- For developing counties that might otherwise be preoccupied with immediate economic and social needs, the prospect of such benefits should provide a strong incentive to participating in the CDM.

Measures to Comply with the GHG Reduction Commitment

▶ Concluding Remarks for Initiating Platform on CDM Project

- The developing countries like Asian-Pacific countries can benefit from this mechanism as the CDM not only can attract capital for projects that assist a more prosperous but less greenhouse gas-intensive economy but also provide a tool for technology transfer, if investment is channeled into projects that replace technologies which lead to high emissions.

- Thus, given the potential of CDM in the Asian-Pacific countries, concerted research and policy efforts are required to transform this potential into actual CDM projects in the agricultural sector.

Thanks for your attention!!