APO Members' Need and Readiness for Climate-Smart Agriculture Technologies

NARO
National Agriculture and Food Research Organization

The Asian Productivity Organization (APO) is an intergovernmental organization that promotes productivity as a key enabler for socioeconomic development and organizational and enterprise growth. It promotes productivity improvement tools, techniques, and methodologies; supports the National Productivity Organizations of its members; conducts research on productivity trends; and disseminates productivity information, analyses, and data. The APO was established in 1961 and comprises 21 members.

APO Members

Bangladesh, Cambodia, Republic of China, Fiji, Hong Kong, India, Indonesia, Islamic Republic of Iran, Japan, Republic of Korea, Lao PDR, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, Turkiye, and Vietnam.

APO MEMBERS' NEED AND READINESS FOR CLIMATE-SMART AGRICULTURE TECHNOLOGIES

SEPTEMBER 2024 | ASIAN PRODUCTIVITY ORGANIZATION

APO Members' Need and Readiness for Climate-Smart Agriculture Technologies

This report is an output of the need and readiness survey, supported by the Asian Productivity Organization (APO) and conducted by the Center of Excellence (COE) on Climate-smart Agriculture (CSA) with the participation of 8 national resource persons from 8 APO member economies: Bangladesh, India, Indonesia, Pakistan, the Philippines, the ROC, the ROK, and Thailand. The views expressed in this report are those of the resource persons affiliated with the COE on CSA and 8 national resource persons as an expert and do not necessarily reflect the views of each member economy.

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FOREWORD

In the face of escalating climate challenges, the agricultural sector stands at a critical juncture. The dual pressures of mitigating greenhouse gas (GHG) emissions and adapting to the adverse impacts of climate change necessitate innovative, sustainable approaches. The concept of climate-smart agriculture (CSA), introduced by the UN Food and Agriculture Organization (FAO) in 2010, embodies a comprehensive strategy to address these challenges by enhancing productivity, fostering resilience, and reducing emissions.

This publication, *APO Members' Need and Readiness for Climate-smart Agriculture Technologies*, is a testament to the efforts of the APO through the Center of Excellence (COE) on CSA to foster sustainable, innovative agricultural practices. Since its inception in April 2023, the COE has diligently pursued its mission to develop and disseminate cutting-edge CSA technologies and transform agricultural sectors throughout APO member economies. The publication encapsulates the findings of a need and readiness survey conducted in the eight APO member economies Bangladesh, the Republic of China, India, Indonesia, the Republic of Korea (ROK), Pakistan, the Philippines, and Thailand. The survey, conducted from September to December 2023, aimed to identify priority CSA technologies and assess the readiness of those economies to implement them.

The report is structured into four comprehensive chapters. The first chapter provides a background to the necessity for CSA and the role of the APO and COE on CSA. The second chapter outlines the objectives, targets, methods, and items of the need and readiness survey. Detailed results of the three surveys conducted are presented in the third chapter. Finally, the fourth chapter focuses on the pilot project planned for 2024, highlighting target CSA technology and member economies, along with the planned activities.

The insights from this publication are pivotal for guiding future CSA initiatives and ensuring that the selected technologies align with the specific needs and capacities of APO member economies. By fostering knowledge exchanges and capacity building, this report paves the way for a more resilient, sustainable agricultural sector in the Asia-Pacific region. The three follow-up projects resulting from the publication will collectively strengthen regional resilience to climate change and foster sustainable agricultural development throughout the Asia-Pacific. Through these initiatives, COE on CSA researchers will share and integrate cutting-edge agricultural technologies, with Thailand as the pilot project site for the introduction and replication of CSA technologies in 2024 and 2025 to ensure tailored implementation of soil carbon sequestration and carbon credit methodologies.

As we tackle the challenges of climate change and work toward better agricultural practices, the findings in this report will be invaluable. I extend my sincere thanks to all who contributed to this endeavor, from the participating members to the dedicated team at the COE on CSA. Together, we are taking meaningful steps toward a sustainable future for agriculture in the Asia-Pacific.

Dr. Indra Pradana Singawinata
Secretary-General
Asian Productivity Organization
Tokyo

INTRODUCTION

As part of the efforts to reduce greenhouse gas (GHG) emissions and enhance productivity in the agricultural sector in the Asia–Pacific region, the APO designated the National Agriculture and Food Research Organization (NARO) of Japan as its new center of excellence (COE) on Climate-smart Agriculture (CSA) on 10 March 2023. The COE on CSA, implemented by the NARO, started its activities from April 2023. The COE is expected to transfer the CSA technologies it has developed and provide the related knowledge for reducing GHG emission and productivity improvement in the agricultural sector across APO member economies.

The COE on CSA had planned to transfer the CSA technologies it has developed through annual pilot projects in member economies starting from 2024. To transfer the technologies, there was a need to understand which of the developed technologies were needed on priority and what was the readiness for implementing those technologies in APO member economies. For this purpose, the COE on CSA conducted three surveys from September 2023 to December 2023 in eight APO member economies that responded to the request for participation. These were: Bangladesh, India, Indonesia, the Republic of China (ROC), the Republic of Korea (ROK), Pakistan, the Philippines, and Thailand. The findings of the surveys were used as the reference for selecting the target CSA technologies and target member economies for a pilot project in 2024.

This report is divided into four chapters: Background; Outline of Need and Readiness Survey; Survey Results; and Pilot Project in 2024. In the first chapter, the background of the survey is overviewed. In the second chapter, objectives, targets, method, items, and the timeline of the survey are described. The third chapter presents the results of the three surveys. The fourth chapter focuses the target CSA technologies and the target member economies for a pilot project in 2024, along with the planned activities.

BACKGROUND

The Need for CSA

Agriculture is highly vulnerable to climate change, as it depends on weather and climatic conditions. Increases in temperatures, changes in precipitation patterns as well as frequent and/or severe extreme weather events may negatively affect agricultural productivity, eventually leading to food insecurity. Adaptation to climate change in agriculture is essential for mitigating the adverse impacts of climate change. At the same time, agriculture is also a major contributor to climate change due to its significant GHG emissions. According to the Food and Agriculture Organization (FAO), agriculture emitted 7,400,000 giga grams of carbon dioxide equivalent (GgCO2eq.) of GHG in 2020, accounting for 14% of total anthropogenic GHG emissions [1]. Mitigation of GHG emissions in agriculture is crucial to achieve the goal of limiting the rise in global average temperature to 1.5°C and reducing the rate of climate change.

In response to this dual challenge, the FAO launched the concept of CSA in 2010. CSA is a set of practices and technologies that pursue the objectives of increasing productivity, adapting to climate change, and reducing GHG emissions. There is a need to move toward CSA to promote sustainable agriculture and food security.

The APO-COE on CSA

The APO [2] started the COE program in 2009 with the aim of enhancing productivity in all sectors, including agriculture, in its member economies. The APO-COE program designates an institution in a member economy, having world-class competency and best practices in a specific area and contributing to productivity as a COE. The APO-COE program promotes the adoption of best practices of one member economy by other member economies while adapting them to suit local contexts.

As part of its efforts to enhance productivity and reduce GHG emissions in the agricultural sector in member economies, the APO announced the designation of the NARO of Japan as the COE on CSA on 10 March 2023. This COE on CSA started its activities in April 2023 and received a plate in the 65th session of the APO Governing Body Meeting (GBM) in Ulaanbaatar, Mongolia, on 25 May 2023. The COE aimed to promote and implement CSA-related activities, such as pilot projects, conferences, workshops, and on-site training, to contribute to the improvement of productivity and the reduction of GHG emissions in the agricultural sector in member economies.

The Need and Readiness Survey

The COE on CSA had planned to implement annual pilot projects in member economies from 2024 to transfer the following CSA technologies that the NARO has developed:

- water management technologies that can reduce methane emissions from paddy fields (e.g., prolong mid-season drainage);
- soil carbon sequestration technologies (e.g., biochar production and application);

- soil carbon sequestration visualization tool;
- carbon credit methodologies (e.g., methodology for calculating and reporting methane emission reductions from rice cultivation by water management practice; methodology for calculating and reporting carbon stock in agricultural soils by biochar application); and
- agro-meteorological grid square data system.

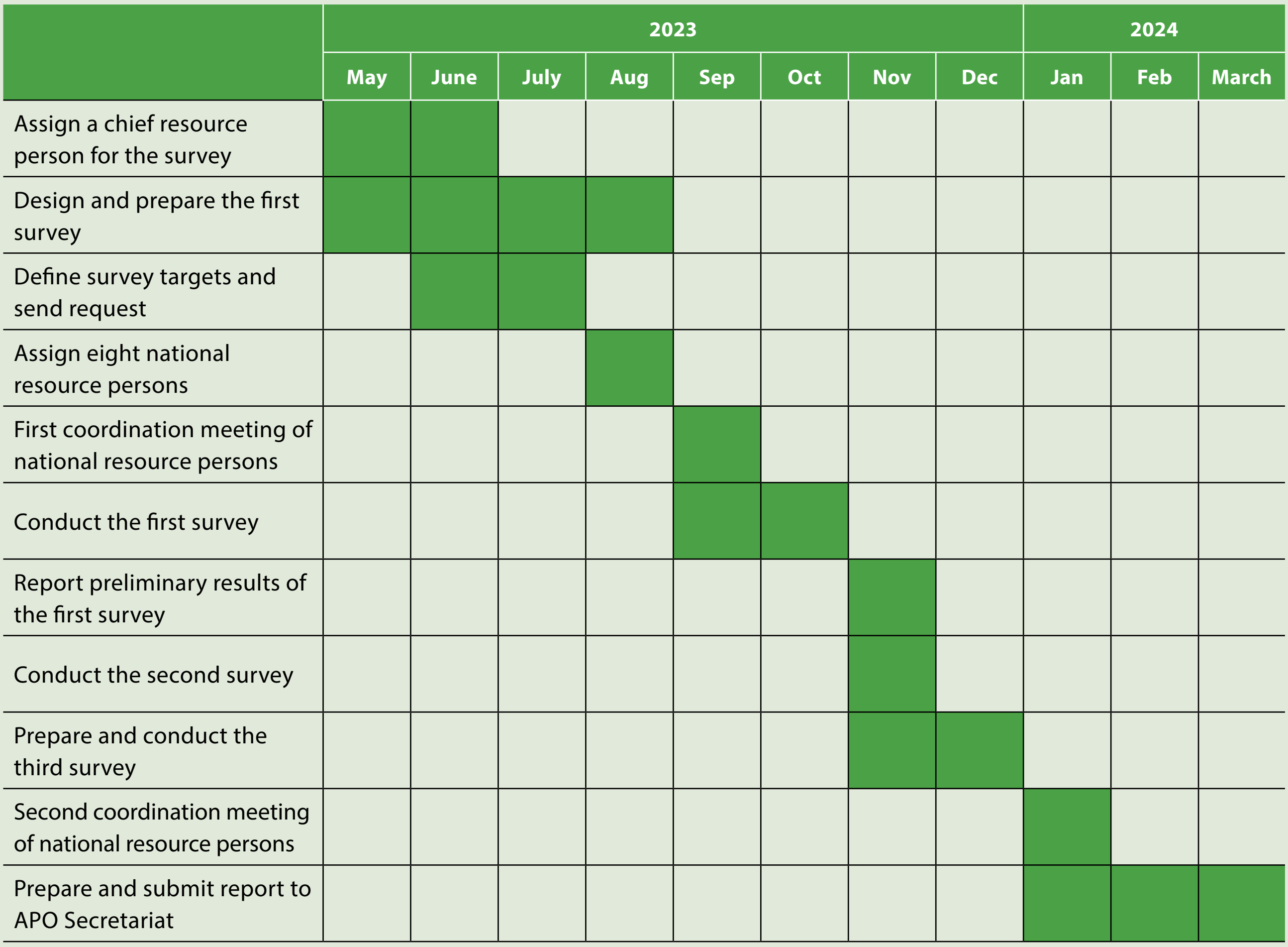
Selecting target CSA technologies and member economies was crucial for implementing a pilot project from 2024. To do this, the COE on CSA conducted a survey in member economies to find out which CSA technologies were needed on priority and how ready the member economies were to implement those technologies. The survey was necessary to ensure an objective and appropriate selection of the target CSA technology and the target member economy for a pilot project in 2024.

Timeline of Major Activities

The timeline of the major activities of the survey is shown in Figure 1.

FIGURE 1

TIMELINE OF THE MAJOR SURVEY ACTIVITIES.



Assignment of Chief Resource Person

- The COE on CSA, in the period from May 2023 to June 2023, nominated a chief resource person to oversee the entire survey.

- The APO Secretariat issued the Letter of Assignment to the nominated chief resource person.

Preparation for the First Survey

- The chief resource person and other resource persons affiliated with the COE on CSA prepared the questionnaire for the first survey.

- The chief resource person and other resource persons affiliated with the COE on CSA identified the target member economies for the survey and sent requests to potential national resource persons in 11 member economies for their participation in the survey via the APO Secretariat and the NPO in each member economy.

- After the national resource persons had been nominated from eight member economies, the APO Secretariat issued the Letter of Assignment to all national resource persons.

- These activities were carried out from May 2023 to August 2023.

First Coordination Meeting of National Resource Persons and First Survey:

- The first coordination meeting of national resource persons was held on 8 September 2023 by the chief resource person, involving other resource persons affiliated with the COE on CSA and the APO Secretariat, to explain and discuss methods and items for the first survey.

- The chief resource person and other resource persons affiliated with the COE modified the questionnaire based on the discussion in the first coordination meeting and sent the final questionnaire back to the eight national resource persons.

- The first survey was conducted from 12 September 2023 to 20 October 2023.

International Conference on Climate-smart Agriculture and Second Survey

- To share knowledge and experiences on CSA technologies, to present the preliminary results of the first survey, and to gather additional information from 8 member economies, the COE on CSA hosted the International Conference on CSA during 8–10 November 2023 in Tsukuba, Japan (see Tables 1, 2, and 3).

- On 8 November 2023, several CSA technologies were introduced by the researchers from the NARO and the Japan International Research Center for Agricultural Sciences (JIRCAS). The chief resource person also presented the preliminary results of the first survey to the eight national resource persons.

- On 9 November 2023, a workshop on "Information Services related to Climate Change and Soil Carbon Sequestration Visualization Tool" was held, and presentations on the current situation regarding climate change mitigation and adaptation were made by the eight national resource persons.

- On 10 November 2023, the introduction of the NARO's Agriculture Research Hall and Genebank, lectures on paddy water management, and a demonstration of methane measurement using the closed chamber method were made.

Third Survey

- The chief resource person and other resource persons affiliated with the COE on CSA prepared and conducted the third survey from 21 November 2023 to 5 December 2023.

Second Coordination Meeting of National Resource Persons and Report Preparation

- The second coordination meeting of national resource persons was held on 9 January 2024 by the chief resource person and other resource persons affiliated with the COE, to report the results of the third survey, the target CSA technology, and the target APO member economy for a pilot project in 2024.

- The chief resource person and other resource persons affiliated with the COE prepared the report and submitted it to the APO Secretariat in March 2024.

TABLE 1

SCHEDULE OF THE FIRST DAY OF THE INTERNATIONAL CONFERENCE ON CLIMATE-SMART AGRICULTURE.

International Conference on CSA
8–10 November 2023 (Hybrid)

Time	Agenda	Speaker
Day 1: Wednesday, 8 November 2023 Tsukuba International Congress Center (Conference Room 406, Tsukuba, Japan)		
12:30–13:00	Onsite and online registration	
13:00–13:15	Opening remarks: National Agriculture and Food Research Organization (NARO)	Dr. Kyuma Kazuo, President, NARO
	The APO	Dr. Indra Pradana Singawinata, Secretary–General, APO
13:15–13:45	Keynote speech: Global situations on GHG emissions and Center of Excellence on Climate-smart Agriculture	Dr. Morita Satoshi, Director, NARO Development Strategy Center (NDSC)
13:45–13:55	**Break**	
13:55–14:00	Introduction of the APO Centers of Excellence Program	Gozde Bosnali, Program Officer, In-country Programs Division, APO
14:00–15:00	Conference Session: Climate-smart Technologies	
	Topic 1 Survey on the Current Status of Crediting GHG Reductions and Absorption in the Agricultural Sector	Dr. Kuwahata Kenya, Senior Principal Scientist, NDSC
	Topic 2 Application of Prolonged Mid-season Drainage (MD) to Paddy Fields	Dr. Sudo Shigeto, Leader, NARO Institute for Agro-Environmental Sciences (NIAES)
	Topic 3 Application of Alternate Wetting and Drying (AWD) to Paddy Fields	Dr. Minamikawa Kazunori, Senior Researcher, Japan International Research Center for Agricultural Sciences (JIRCAS)
	Topic 4 Application of Biochar	Dr. Kishimoto Ayaka, Principal Scientist, NIAES

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International Conference on CSA 8–10 November 2023 (Hybrid)		
Time	**Agenda**	**Speaker**
15:00–15:15	**Break**	
15:15–16:15	Conference Session: Climate-smart Technologies (continued)	
	Topic 5 Development and Application of a Soil Carbon Sequestration Visualization Tool	Dr. Fumoto Tamon, Principal Scientist, NIAES
	Topic 6 Development and Application of the 1-km Mesh Agricultural Weather Data System	Ms. Sasaki Kaori, Principal Scientist, NIAES
	Topic 7 Predicting Rice Grain Yield Using Normalized Difference Vegetation Index from UAV	Dr. Nakano Hiroshi, Senior Principal Scientist, NARO Central Region, Agricultural Research Center (NARO CARC)
	Topic 8 GHG Emission Reduction Technology for Livestock Waste Treatment Processes	Dr. Fukumoto Yasuyuki, Leader, NARO Institute of Livestock and Grassland Science (NILGS)
16:15–16:35	Preliminary Results of the Need and Readiness Assessment Survey on CSA	Dr. Hasegawa Toshihiro, Executive Scientist, NIAES
16:35–16:50	Knowledge Sharing from the International Workshop on Developing Low-carbon Farming for Smallholders in the Asia-Pacific Region in the ROC	Dr. Lurhathaiopath Puangkaew, Senior Scientist, Central Region Agricultural Research Center (CARC), former NARO Development Strategy Center (NDSC)

TABLE 2

SCHEDULE OF THE SECOND DAY OF THE INTERNATIONAL CONFERENCE ON CLIMATE-SMART AGRICULTURE.

Time	Agenda	Speaker
Day 2: Thursday, 9 November 2023 **NIAES Conference Room,** **Tsukuba, Japan**		
9:45–10:00	Registration	
10:00–10:20	Workshop: Demonstration and Application of the Information Services related to Climate Change **Topic 1** Demonstration of the Development and Application of the 1-km Mesh Agricultural Weather Data System	Dr. Ohno Hiroyuki and Sasaki Kaori, Principal Scientists, NIAES
10:20–10:40	**Topic 2** Application of Climate information to the Yield Forecasting in the Asian Context	Dr. Iizumi Toshichika, Principal Scientist, NIAES

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Time	Agenda	Speaker
10:40–11:00	**Topic 3** Demonstration of the Development and Application of a Soil Carbon Sequestration Visualization Tool	Dr. Fumoto Tamon, Principal Scientist, NIAES
11:00–11:15	**Break**	
11:15–12:00	Discussion on the Use of Climate Services and Soil Carbon Visualization Tools	
12:00-13:30	**Lunch break**	
13:30–14:30	Presentations by National Resource Persons on the Current Situation Regarding Climate Change Mitigation and Adaptation	Dr. S.M. Mofijul Islam, Senior Scientific Officer, Soil Science Division, Bangladesh Rice Research Institute (BRRI), Bangladesh Dr. Sri Mulyani, Manager, Division of Environment Science, Agriculture Extension Center Ministry of Agriculture, Indonesia Dr. Niveta Jain (online) Principal Scientist, Division of Environment Science, Indian Agricultural Research Institute (ICAR), India Dr. Ghani Akbar, Principal Scientific Officer Climate, Energy and Water Research Institute (CEWRI), National Agricultural Research Centre (NARC), Pakistan Agricultural Research Council (PARC), Pakistan
14:30–14:45	**Break**	
14:45–15:45	Presentations by National Resource Persons on the Current Situation Regarding Climate Change Mitigation and Adaptation (continued)	Dr. Eduardo Jimmy P. Quilang, Chief Science, Research Specialist, Department of Agriculture, Philippine Rice Research Institute, the Philippines Dr. Szu-Meng Wu, Professor/Director, Department of Life Science Chinese Culture University, the ROC Dr. Gilwon Kim, Academic research professor, Department of Applied Life Science, Gyeongsang National University, the ROK Dr. Theerawut Chutinanthakun, Director, Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand
15:45–16:30	Discussion on the needs and barriers	

TABLE 3

SCHEDULE OF THE THIRD DAY OF THE INTERNATIONAL CONFERENCE ON CLIMATE-SMART AGRICULTURE.

Time	Agenda	Speaker
Day 3: Friday, 10 November 2023 NARO's Tsukuba Agriculture Research Hall, NARO's Genebank, and JIRCAS Tsukuba, Japan		
9:45–11:15	Visiting NARO's Tsukuba Agriculture Research Hall: Introduction of Agriculture Research Hall Lectures on paddy water management	Tsukamoto Ai, Senior staff, NARO Public Relations Department; Dr. Nakaya Tetsuo, Deputy Leader, NARO Institute for Rural Engineering (NIRE) Dr. Minagawa Hiroki, Principal Scientist, NIRE
11:30–12:00	Visiting Genebank	Staff of Genebank
12:00–13:00	**Lunch break**	
13:15–14:30	Visiting JIRCAS: Lecture on the overview of the activities in JIRCAS Visiting Alternate Wet and Dry (AWD) field with Closed Chamber for Methane Measurement	Dr. Hayashi Keiichi, Program Director, JIRCAS Dr. Uno Kenichi, Senior Researcher, JIRCAS
End of program		

OUTLINE OF THE NEED AND READINESS SURVEY

Survey Objectives

The objectives of the survey were to find out and assess the need and readiness of APO member economies in order to select the CSA technology and the member economy for a pilot project in 2024.

Survey Targets

Survey targets were identified based on the following criteria:

- the size of cultivation area of relevant crops such as rice and sugarcane;
- the number of relevant livestock such as poultry; and
- the amount of GHG emissions from agriculture.

Among the 20 APO member economies (excluding Japan), 11 member economies (Bangladesh, India, Indonesia, Malaysia, Pakistan, Philippines, ROC, ROK, Sri Lanka, Thailand, and Vietnam) have comparatively large rice cultivation areas, number of poultries, and amount of GHG emissions from agriculture. The COE on CSA sent a request to the national productivity organizations (NPOs) of these 11 member economies for their participation in the survey via the APO Secretariat. Among these member economies, eight NPOs (Bangladesh, India, Indonesia, Pakistan, Philippines, ROC, ROK, and Thailand) responded to the request. They nominated one national resource person each, who were later approved by the APO. The COE on CSA conducted three surveys with these eight national resource persons (see Table 1 for the details).

TABLE 1

SIZE OF MAJOR AGRICULTURAL INDUSTRIES AND GHG EMISSIONS IN THE EIGHT TARGET MEMBER ECONOMIES.

	Rice		Sugarcane		Poultry		GHG emissions from agriculture	
	Year	Area (1,000 ha)	Year	Area (1,000 ha)	Year	Number (1,000 wing)	Year	Amount (GgCo2eq.)
Bangladesh	2012	11,528	2012	109	2012	288,570	2019	61,865
India	2016	43,190	2016	3,990	2012	851,810	2016	407,821
Indonesia	2017	8,188	2021	449	2017	3,538,739	2019	105,301
Pakistan	2017	2,901	2017	1,342	2006	73,648	2018	191,930
The Philippines	2021	4,805	2021	420	2012	189,332	2020	66,159
The ROC	2005	225	2019	9	2022	111,882	2021	3,231

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	Rice		Sugarcane		Poultry		GHG emissions from agriculture	
	Year	Area (1,000 ha)	Year	Area (1,000 ha)	Year	Number (1,000 wing)	Year	Amount (GgCo2eq.)
The ROK	2022	776	–	–	2023	177,855	2020	21,100
Thailand	2018	11,022	2021	1,764	2021	518,642	2019	56,766
Percentage of total APO member economies, excluding Japan		**84%**		**94%**		**82%**		**76%**

Source: Agricultural statistics and other reports from each member economy. GHG emissions from agriculture do not include those from land use change.

Survey Method and Items

The COE on CSA conducted three surveys in the eight target member economies with the participation of the eight national resource persons from September 2023 to December 2023. The method and items of each survey were as detailed below.

First Survey

The first survey was conducted from 12 September 2023 to 20 October 2023. In the survey, the eight national resource persons from eight target member economies were requested to fill out the questionnaire using Google Forms (see Figure 2). The purpose of the surveys was to get information on GHG emissions from agricultural soils, government policies, or support measures for climate change mitigation in agriculture, including the participation in carbon credit mechanisms, need and readiness for implementing CSA technologies developed by the NARO, and key stakeholders in the CSA across the eight member economies. The questionnaire comprised 42 items across eight sections, with four types of questions (open-ended questions; single answer, multiple choices; multiple answers, multiple choices; and scale questions), as follows:

Section 1: Member Economy (1 item)

Q1. Select your member economy from the list (single answer, multiple choices).

Section 2: GHG Emissions from Agriculture in Member Economies (three items)

Purpose: To get information on GHG emissions from agriculture, methane emissions from paddy soils, and nitrous oxide emissions from managed soils, in the eight member economies.

Q2. National estimate of GHG emissions from agricultural sector (open-ended question).

Q3. National estimate of methane emissions from paddy soils (open-ended question).

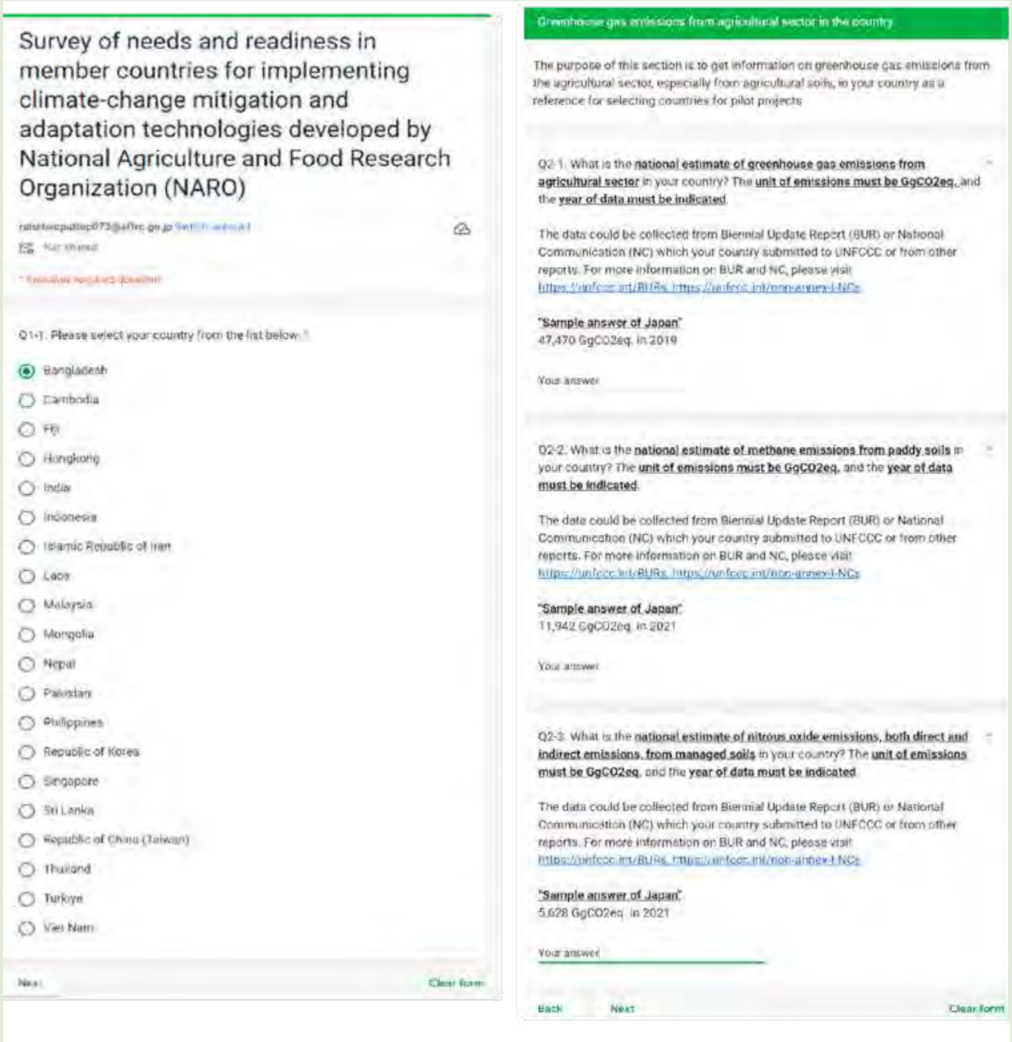
Q4. National estimate of nitrous oxide emissions, both direct and indirect emissions, from managed soils (open-ended question).

Section 3: Government Policies or Support Measures for Climate Change Mitigation in Agriculture in Member Economies (11 items)

Purpose: To get information on government policies or support measures for reducing GHG emissions from agriculture in the eight member economies.

FIGURE 1

THE FIRST SURVEY USING GOOGLE FORMS.


Survey of needs and readiness in member countries for implementing climate-change mitigation and adaptation technologies developed by National Agriculture and Food Research Organization (NARO)

Q1-1. Please select your country from the list below. *

- Bangladesh
- Cambodia
- Fiji
- Hongkong
- India
- Indonesia
- Islamic Republic of Iran
- Laos
- Malaysia
- Mongolia
- Nepal
- Pakistan
- Philippines
- Republic of Korea
- Singapore
- Sri Lanka
- Republic of China (Taiwan)
- Thailand
- Turkiye
- Viet Nam

Next Clear form

Greenhouse gas emissions from agricultural sector in the country

The purpose of this section is to get information on greenhouse gas emissions from the agricultural sector, especially from agricultural soils, in your country as a reference for selecting countries for pilot projects

Q2-1. What is the **national estimate of greenhouse gas emissions from agricultural sector** in your country? The **unit of emissions must be GgCO2eq.** and the **year of data must be indicated**.

The data could be collected from Biennial Update Report (BUR) or National Communication (NC) which your country submitted to UNFCCC or from other reports. For more information on BUR and NC, please visit https://unfccc.int/BURs https://unfccc.int/non-annex-I-NCs

"Sample answer of Japan"
47,470 GgCO2eq. in 2019

Your answer

Q2-2. What is the **national estimate of methane emissions from paddy soils** in your country? The **unit of emissions must be GgCO2eq.** and the **year of data must be indicated**.

The data could be collected from Biennial Update Report (BUR) or National Communication (NC) which your country submitted to UNFCCC or from other reports. For more information on BUR and NC, please visit https://unfccc.int/BURs https://unfccc.int/non-annex-I-NCs

"Sample answer of Japan"
11,942 GgCO2eq. in 2021

Your answer

Q2-3. What is the **national estimate of nitrous oxide emissions, both direct and indirect emissions, from managed soils** in your country? The **unit of emissions must be GgCO2eq.** and the **year of data must be indicated**.

The data could be collected from Biennial Update Report (BUR) or National Communication (NC) which your country submitted to UNFCCC or from other reports. For more information on BUR and NC, please visit https://unfccc.int/BURs https://unfccc.int/non-annex-I-NCs

"Sample answer of Japan"
5,628 GgCO2eq. in 2021

Your answer

Back Next Clear form

Q5. Government policies, actions, or plans for methane emission reductions from paddy soils (open-ended question).

Q6. Government policies, actions, or plans for carbon sequestration in agricultural soils (open-ended question).

Q7. Availability of national carbon credit trading mechanisms and voluntary emission reduction programs (open-ended question).

Q8. Types of agricultural projects registered in the national carbon credit trading mechanisms and voluntary emission reduction programs (multiple answers, multiple choices).

Q9. Types of agricultural projects registered in the Clean Development Mechanism (CDM) (multiple answers, multiple choices).

Q10. Types of agricultural projects registered in the Verified Carbon Standard (VCS) (multiple answers, multiple choices).

Q11. Types of agricultural projects registered in the Gold Standard (GS) (multiple answers, multiple choices).

Q12. Participation in the Puro Earth (single answer, multiple choices).

Q13. Participation in Joint Crediting Mechanism (JCM) and/or Climate Protection and Carbon Offset (Klik) (single answer, multiple choices).

Q14. Availability of Monitoring, Reporting and Verification (MRV) of GHG emissions (single answer, multiple choices).

Q15. Availability of GHG validation and verification bodies (single answer, multiple choices).

Section 4: Methodology for Calculating and Reporting Methane Emission Reductions from Rice Cultivation (six items)

Purpose: To understand the need and readiness of the eight member economies for implementing the methodology for calculating and reporting methane emission reductions from rice cultivation with water management.

Q16. Importance of the methane emission reductions from paddy soils (scale question).

Q17. Importance of the methodology for calculating and reporting methane emission reductions from rice cultivation by water management practice (scale question).

Q18. Availability of an estimate of the potential methane emission reductions from paddy soils (single answer, multiple choices).

Q19. Types of technologies practiced or promoted to reduce methane emissions from paddy soils (multiple answers, multiple choices).

Q20. Availability of shared or approved methodologies for calculating and reporting methane emission reductions from paddy soils (open-ended question).

Q21. Potential area of paddy fields that can implement water management practices for reducing methane emissions from paddy soils (open-ended question).

Section 5: Methodology for Calculating and Reporting Carbon Stock in Agricultural Soils (six items)

Purpose: To understand the need and readiness of the eight member economies for implementing methodology for calculating and reporting carbon stock in agricultural soils with biochar application.

Q22. Importance of the conservation or sequestration of carbon in agricultural soils (scale question).

Q23. Importance of the methodology for calculating and reporting carbon stock in agricultural soils by biochar application (scale question).

Q24. Potential of biochar as a soil amendment for carbon sequestration in agricultural soils (open-ended question).

Q25. Potential organic materials from the agricultural sector that can be used to produce biochar for carbon sequestration in agricultural soils (multiple answers, multiple choices).

Q26. Estimated quantity of the potential organic materials mentioned above (open-ended question).

Q27. Competing uses and estimated utilization rate of the potential organic materials mentioned above (open-ended question).

Section 6: Soil Carbon Sequestration Visualization Tool (six items)

Purpose: To understand the need and readiness of the eight member economies for implementing the Soil Carbon Sequestration Visualization Tool.

Q28. Importance of Soil Carbon Sequestration Visualization Tool (scale question).

Q29. Availability of soil map (single answer, multiple choices).

Q30. Available data from soil map (multiple answers, multiple choices).

Q31. Availability of activity data related to organic matter (such as crop residue and compost) inputs (single answer, multiple choices).

Q32. Availability of long-term continuous experiment data of organic matter inputs (single answer, multiple choices).

Q33. Availability of long-term soil carbon observation data (single answer, multiple choices).

Section 7: Agro-meteorological Grid Square Data System (five items)

Purpose: To understand the need and readiness of the eight member economies for implementing the Agro-meteorological Grid Square Data System.

Q34. Importance of grid-based Agro-meteorological Data System (scale question).

Q35. Government policies or plans to support Agro-meteorological Data System (open-ended question).

Q36. Availability of grid-based Agro-meteorological Data System (open-ended question).

Q37. Number of weather stations (open-ended question).

Q38. Available weather elements from the weather stations (open-ended question).

Section 8: Key Stakeholders in CSA and Their Efforts (four items)

Purpose: To know the key stakeholders in CSA in eight member economies for possible collaboration.

Q39. Key government agencies in CSA and their efforts for climate change adaptation and mitigation in agriculture (open-ended question).

Q40. Key private enterprises in CSA and their efforts for climate change adaptation and mitigation in agriculture (open-ended question).

Q41. Key universities or research institutes in CSA and their efforts for climate change adaptation and mitigation in agriculture (open-ended question).

Q42. Key international organizations in CSA and their efforts for climate change adaptation and mitigation in agriculture (open-ended question).

Second Survey

At the International Conference on Climate-smart Agriculture held by the APO, in collaboration with the NARO, from 8 to 10 November 2023, eight national resource persons from eight member economies were requested to make 10-minute presentations on the current situation of climate-change adaptation and mitigation as well as the major barriers and potential enablers to enhance the climate action in agriculture in their respective member economies. The COE on CSA was able to get additional information from the national resource persons. So, this presentation can be regarded as a second survey.

Third Survey

The third survey was conducted via e-mail from 21 November 2023 to 5 December 2023. In this survey, the national resource persons from eight member economies were requested to fill out the "Priority Sheet" with priority CSA technologies and specific topic, possible collaboration with the COE on CSA, and challenges to be addressed or overcome, for pilot projects. All national resource persons were also asked to provide information on related projects underway (see Figure 2).

FIGURE 2

THE SECONDARY SURVEY USING PRIORITY SHEET.

Priorities on Climate-smart Agriculture Technologies for pilot projects

Please fill out the form below to specify your preference.

Member economy ( )

Your priority	CSA technology	Specific topic for possible collaboration with the COE on CSA	Challenges to be addressed or overcome	Related projects currently underway or planned if any
1				
2				
3				
4				
5				

SURVEY RESULTS

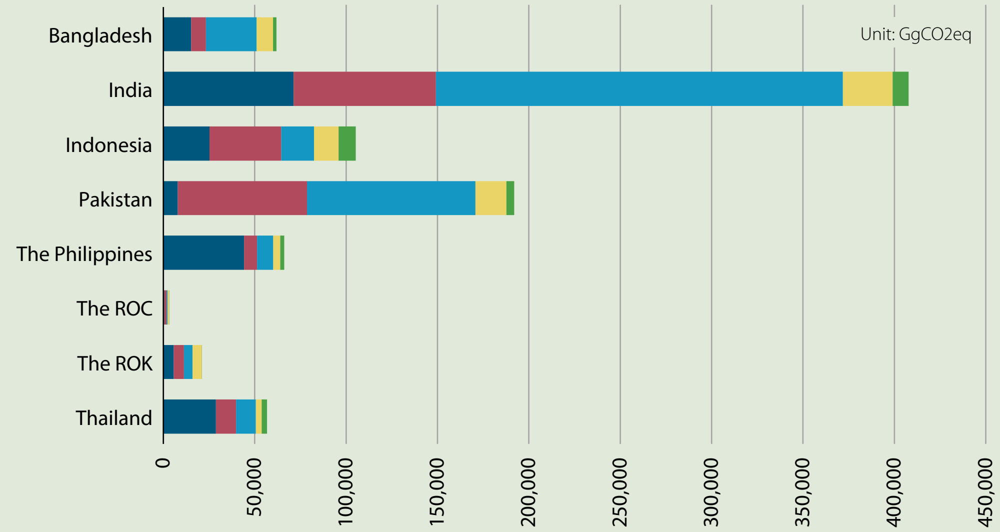
Results of First and Second Surveys

GHG Emissions from Agriculture in Eight Member Economies

Figure 1 shows the recent estimates of total GHG emissions from agriculture, including a breakdown by source, in the eight target member economies. GHG emissions due to land use change are not included in the figure.

FIGURE 1

GHG EMISSIONS FROM AGRICULTURE IN EIGHT MEMBER ECONOMIES.



	Thailand	The ROK	The ROC	The Philippines	Pakistan	Indonesia	India	Bangladesh
Rice cultivation	28,715	5,700	537	44,206	7,830	25,235	71,322	15,239
Fertilizer application	11,110	5,600	1,175	7,112	70,730	39,326	77,781	8,098
Enteric fermentation	10,766	4,700	593	8,782	92,170	17,898	222,655	27,765
Manure management	3,248	5,000	898	3,906	16,950	13,422	27,227	8,893
Other activities	2,927	100	28	2,154	4,250	9,420	8,836	1,870

Source: Based on results of the first and second surveys.
Note: Data of Bangladesh and the ROC represent estimates for 2021; data of the Philippines and the ROK represent estimates for 2020; data of Indonesia and Thailand represent estimates for 2019; data of Pakistan represent estimates for 2018; and data of India represent estimates for 2016.

Bangladesh

Among the eight member economies, Bangladesh is the fifth-largest producer of GHG emissions from agriculture. In 2019, GHG emission from agriculture in Bangladesh was estimated to be 61,865 GgCO2eq. The largest source of GHG emissions from agriculture in Bangladesh was enteric fermentation (accounting for 45%); followed by rice cultivation (25%); manure management

(14%); application of N-based fertilizers to agricultural soils (13%); and other activities such as urea application (3%).

The ROC

Among the eight member economies, the ROC is the smallest producer of GHG emissions from agriculture. In 2021, GHG emission from agriculture in the ROC was 3,231 GgCO2eq. The largest source of GHG emissions from agriculture was application of N-based fertilizers to agricultural soils (accounting for 36%); followed by manure management (28%); enteric fermentation (18%); rice cultivation (17%); and other activities (1%).

India

Among the eight member economies, India is the largest producer of GHG emissions from agriculture. In 2016, the estimated GHG emission from agriculture in India was 407,821 GgCO2eq. The largest source of GHG emissions from agriculture was enteric fermentation (55%); followed by application of N-based fertilizers to agricultural soils (19%); rice cultivation (17%); manure management (7%); and other activities such as field burning of agriculture residues (3%).

Indonesia

Indonesia is the third-largest producer of GHG emissions from agriculture among the eight member economies. In 2019, the estimated GHG emission from agriculture in Indonesia was 105,301 GgCO2eq. The largest source of GHG emissions from agriculture was application of N-based fertilizers (accounting for 37%); followed by rice cultivation (24%); enteric fermentation (17%); manure management (13%); and other activities such as urea and lime application (9%).

Pakistan

Pakistan is the second-largest producer of GHG emissions from agriculture among the eight member economies. In 2018, Pakistan's agriculture emitted 191,930 GgCO2eq. of GHG into the atmosphere. The largest source of GHG emissions from agriculture was enteric fermentation (accounting for 48%); followed by application of N-based fertilizers to agricultural soils (37%); manure management (9%); rice cultivation (4%); and other activities (2%).

The Philippines

The Philippines is the fourth-largest producer of GHG emissions from agriculture among the eight member economies. In 2020, Philippine agriculture emitted 66,159 GgCO2eq. of GHG into the atmosphere. The largest source of GHG emissions from agriculture was rice cultivation (accounting for 67%); followed by enteric fermentation (13%); application of N-based fertilizers to agricultural soils (11%); manure management (6%); and other activities (3%).

The ROK

The ROK is the seventh-largest producer of GHG emissions from agriculture among the eight member economies. In 2020, GHG emission from agriculture in the ROK was estimated to be 21,100 GgCO2eq. The largest source of GHG emissions from agriculture was rice cultivation (accounting for 27%); followed by application of N-based fertilizers to agricultural soils (26.5%); manure management (24%); enteric fermentation (22%); and other activities (0.5%).

Thailand

Thailand is the sixth-largest producer of GHG emissions from agriculture among the eight member economies. In 2019, Thai agriculture emitted 56,766 GgCO2eq. of GHG into the atmosphere. The largest source of GHG emissions from agriculture was rice cultivation (accounting for 51%); followed by application of N-based fertilizers to agricultural soils (20%); enteric fermentation (19%); manure management (6%); and other activities (5%) such as field burning of agriculture residues and application of urea and lime.

Government Policies for Methane Emission Reductions in Eight Member Economies

The summary of government policies or support measures for methane emission reduction in the eight member economies is as follows:

Bangladesh

The government aims to reduce methane emissions from paddy soils by 17% by 2030 by promoting alternate wetting and drying (AWD), developing climate-smart rice varieties, implementing balanced fertilization, and distributing urea deep placement technology.

The ROC

The ROC's Department of Agriculture aims to achieve net-zero agricultural emissions by 2040 through four main axes of reduction, increase of sinks, circulation, and green trend. There are three low-carbon production models for methane emission reductions: (1) reduce the amount of chemical fertilizers and use them accurately; (2) promote organic and friendly agriculture; and (3) adjust paddy field irrigation mode.

India

Methane emissions from Indian rice paddies have been almost stable for the last two decades. However, due to high water requirements of paddy crops, the Government of India has initiated a crop diversification program under the National Mission for Sustainable Agriculture (NMSA) to reduce water requirements and promote alternate crop cultivation. As part of the National Food Security Mission (NFSM), the System of Rice Intensification (SRI) and 'direct seeded rice' are being implemented to increase productivity and reduce methane emissions from paddy soils.

Indonesia

Indonesia's Nationally Determined Contribution (NDC) aims to reduce GHG emissions by 29% unconditionally and 41% conditionally by 2030. Mitigation actions in the NDC for the agricultural sector include the use of low-emission crops, implementation of water-efficient concepts in water management, use of organic fertilizers, manure management for biogas, and feed supplements for the cattle. For ongoing actions, there is a program called Strategic Irrigation Modernization and Urgent Rehabilitation Project (SIMURP) by the Ministry of Agriculture, using CSA technologies such as AWD/intermittent and Jajar Legowo (Spacing-Plant) rice cultivation systems to reduce methane emissions from paddy soils.

Pakistan

There are several policies in Pakistan, such as National Climate Change Policy 2012 (updated in 2021); Pakistan Climate Change Act 2017; Sindh Agriculture Policy 2018; and National Food Security Policy 2018, that recommended the reduction of GHG emissions from agriculture. Pakistan is also currently implementing some projects as part of the national public sector development program to introduce machinery, tillage, irrigation, and field management practices for enhancing the productivity of rice. These may also reduce methane emissions from paddy fields and control rice straw burning at field.

The Philippines

The country's comprehensive efforts to mitigate methane emissions from paddy soil are geared for improving access to climate finance, promoting technology development and transfer, and strengthening capacity-building initiatives embedded in different programs of the Department of Agriculture (DA).

The ROK

The government is implementing a soil improvement project using silicate fertilizer to reduce methane emissions and is developing various emission factors to accurately measure methane emissions from paddy soils. The government is also promoting organic-friendly farming, low-till farming, organic fertilizer application, use of highly stable organic-matter fertilizers and soil microorganisms, circulation of surplus agricultural materials, and establishment of effective carbon pricing and trading systems.

Thailand

There is a project called "Thai rice: Strengthening Climate-smart Rice Farming (Thai Rice GCF)" under the Rice Department, supported by Green Climate Fund (GCF) and Gesellschaft für Internationale Zusammenarbeit (GIZ). This project aims to promote low-emission and climate-resilient rice farming, supporting 250,000 farmers across 21 provinces from 2023 to 2028. The CSA technologies included in this project are laser-land leveling; AWD; site-specific nutrient management; straw/stubble management; integrated pest management (IPM); climate-smart rice varieties, direct seeded rice; crop diversification, including perennial plants and trees; intercropping; and agromet advisory support. The Ministry of Agriculture and Cooperatives (MOAC) of Thailand announced the "Agricultural Action Plan for climate change 2023–2027" to implement various countermeasures to cope with the effects of climate change including the introduction of CSA.

Government Policies for Carbon Sequestration in Eight Member Economies

A summary of government policies or support measures for carbon sequestration in the eight member economies is as follows:

Bangladesh

Bangladesh has a low level of soil organic carbon with an average of 1% nationwide. Bangladesh has conducted long-term experiments of balanced fertilization, organic amendment, and conservation agriculture study to investigate the increase in soil organic carbon. An increased soil organic carbon content of 10–15% over baseline soil has been observed in long-term experiments with balanced fertilization and organic amendment. The conservation agriculture study has revealed 5–10% increase in soil organic carbon over the initial soil.

The ROC

The Ministry of Agriculture and the Ministry of Science and Technology collaborate on the "Carbon Negative Technology Working Circle" to reduce carbon dioxide emissions through carbon negative technologies such as increasing natural carbon sinks. The technical group headed by the Ministry of Agriculture evaluates the carbon sinks that can be contributed by natural environments such as forests, soils, and oceans.

India

Indian soils are low in soil organic carbon in the topsoil layer (20cm) and require carbon sequestration rate of 23–28 per mille, compared with the global requirement of 4 per mille. Long-term experiments have shown that balanced fertilization and application of organic residues can increase soil organic carbon content by 10–20%. Effective utilization of organic resources, enhanced composting and farmyard manure (FYM) management, along with conservation agriculture or resource conservation technologies, can enhance soil organic carbon in Indian soils.

Indonesia

The agricultural sector is just drafting the regulation of a result-based payment (RBP) for economic carbon implementation. For ongoing action, in the SIMURP Program, technologies that support carbon reduction in the agricultural sector, such as reducing the use of chemical fertilizers and adding more organic fertilizers (balanced fertilization), have been employed.

Pakistan

The Climate Change Policy in Pakistan recommends carbon sequestration in agriculture, agroforestry, mangroves, sea grasses, and tidal marshes. Initiatives such as Ten Billion Tree Tsunami; Miyawaki Forest; REDD+ Indus Delta (2019–30 delta blue carbon phase I); and restoring mangrove forest are underway. However, there is a lack of resources, awareness, and national/international support for stimulating carbon sequestration projects.

The Philippines

The Organic Agriculture (OA) Act, enacted by the Republic Act 10068, promotes organic farming in the Philippines. It aims to improve farm productivity, reduce natural resource depletion, and enhance health benefits for farmers and consumers. The Act further provides for: labelling requirements; retailing of organic produce; research, development, and extension (RDE); creation of organic agriculture RDE networks; incentives; penalties; etc.

The ROK

The projects include biochar support project, carbon direct payment system, conversion of rice fields into upland areas, and methane emission reductions feed for cattle.

Thailand

Thailand’s National Climate Change Policy Committee, chaired by the Deputy Prime Minister, is focusing on the following topics: fertilizer usage according to the soil analysis value; study on effects of soil, fertilizer, and water management in maize, sugarcane, cassava, soybean, and mung bean production systems on soil quality changes and GHG emissions; and study of effects of cover crops on beneficial soil microorganisms to increase crop production potential.

Government Policies to Support Agro-meteorological Data Systems in Eight Member Economies

A summary of government policies or plans to support agro-meteorological data systems in the eight member economies is as follows:

Bangladesh

The Government of Bangladesh is trying to formulate agro-meteorological policies that support the agro-meteorological data system.

The ROC

With the support of the Ministry of Science and Technology Program and the National High-Speed Network and Computing Center, the windy webpage (https://pm25.colife.org.tw), which currently has the highest resolution of 1 km in the ROC, was constructed. The system was developed and maintained by professors of National Chung Hsing University and National Central University. It provides air pollution forecasts for the next four days and simulation results of wind fields and rainfall fields with a resolution of 1 km across the region.

India

India Meteorological Department (IMD) records the agro-meteorological data in the country through 200 Agro Automatic Weather Station (AWS) installed across the country. The data is used for providing agro advisories by the Indian Council of Agricultural Research (ICAR), along with the IMD. Recently, a Weather Information Network and Data System (WINDS) portal has been launched by the Ministry of Agriculture and Farmers Welfare to augment the weather data collection system in the country in terms of adequacy of network, data collection, standardization, hosting and dissemination through coordinated efforts of the IMD and different states.

Indonesia

In Indonesia, there is a web-based Integrated Cropping Calendar Information System called "SI KATAM Terpadu" that provides planting time guidelines, and fertilizer and variety recommendations for rice, maize, and soybean crops.

Pakistan

The government is keen to pursue a grid-based agro-meteorological system in Pakistan. The government tried to develop the agroecological and crop zoning system for decision-making. A web-based data management system called "Pakistan subnational food systems dashboard" is currently being developed in collaboration with the FAO. However, the majority of these initiatives are in preliminary stages and are undergoing improvements and refinements.

The Philippines

The Philippine Atmospheric, Geophysical and Astronomical Service (PAGASA), a government agency responsible for weather forecasting and monitoring, has ongoing programs to improve meteorological and climate data collection, dissemination, and capacity-building for various sectors, including agriculture. Moreover, different government agencies also have various plans, programs, and policies that support and complement the agro-meteorological data system in the country. For example, the DA-Philippine Rice Research Institute has institutionalized the Philippine Rice Information System (PRISM) that harnesses satellite technology and agro-meteorological data to deliver timely information to rice farmers. Furthermore, the Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines (SARAI) project under the Department of Science and Technology (DOST) aims to modernize and enhance the agricultural sector in the country through the application of advanced technologies, including remote sensing, information technology, and data analytics.

The ROK

Research and development to support agro-meteorological data system are being continued by the Rural Development Administration.

Thailand

Thai Meteorological Department is providing daily, weekly, fortnight, quarter, and seasonal agromet forecast data such as average relative humidity, average rainfall, average soil temperature, sun time, and wind run. It is also developing policies to support an agro-meteorological data system in the country.

Carbon Credit Trading and Emission Reduction Program for the Agricultural Sector

The availability of a national carbon credit trading mechanism; a voluntary emission reduction program for the agricultural sector; and types of agricultural projects registered in the mechanism and the program in the eight member economies (see Figure 2), can be summarized as follows:

Bangladesh, Pakistan, and the Philippines

There is no national carbon credit trading mechanism or voluntary emission reduction program for the agricultural sector in Bangladesh, Pakistan, and the Philippines. However, the Government of Pakistan is keen to develop such mechanisms in the near future, though skills, resources, and awareness are the impediments. The Government of the Philippines is engaged in discussions with the Government of Japan to establish a joint crediting mechanism (JCM) for projects related to reduction or removal of methane emissions from rice cultivation. The projects will fall under Article 6.2 of the Paris Agreement and will be located in Luzon, within two different national irrigation systems managed by the National Irrigation Administration (NIA) in the Philippines.

India and Indonesia

India and Indonesia are in the process of drafting regulations for a national carbon credit trading mechanism or a voluntary emission reduction program.

The Government of India published Gazette notifications in 2023 on the Green Credit Program, which is a market-based voluntary scheme proposed to be notified under Environment (Protection) Act, 1986. A green credit will be a unit of an incentive provided for a specified activity, delivering a positive impact on the environment. An activity generating green credits under the Green Credit Program may also get carbon credits from the same activity in the carbon market. Draft Green Credit Program Implementation Rules 2023 have been published in the Gazette for public comments. Eight sectors, including agriculture, are proposed to be included in the scheme.

In Indonesia, there is a regulation for carbon trading, such as Presidential Regulation Number 98 of 2021 (Peraturan President NEK, Nilai Emisi Karbon) concerning the economic value of carbon, but it is not specific to the agricultural sector. For the agricultural sector, Indonesia is drafting a regulation to support the aforementioned presidential regulation.

The ROC, the ROK, and Thailand

There is a national carbon credit trading mechanism or voluntary emission reduction program in the ROC, the ROK, and Thailand.

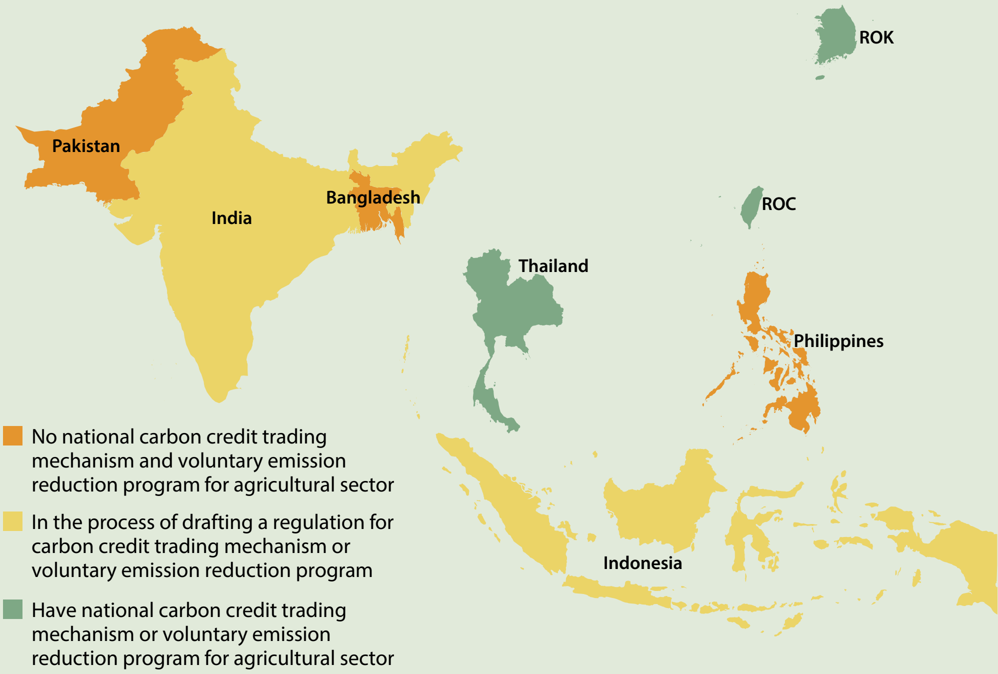
The ROC established a carbon trading platform, “The ROC Carbon Solution Exchange: TCX” in August 2023, focusing on “voluntary reduction” to conduct domestic carbon rights trading, international carbon rights trading, and carbon consulting services.

The ROK has a national carbon credit trading mechanism for the agricultural sector. There are some major types of agricultural projects that were registered in the mechanism: water management in rice cultivation; addition of biochar to agricultural land; good fertilization practice; utilization of animal waste or agricultural residues for electricity generation; and others. The other projects include unused heat energy (heated wastewater); circulating water film cultivation; LED lighting replacement; high-efficiency thermal insulation material (multi-layer thermal insulation curtain); geothermal heat pump; renewable energy (solar power, solar power, hydroelectric power, wind power); use of by-product fertilizer; cover cropping; conservation tillage; and land use change (rice paddy to upland).

Thailand has a voluntary emission reduction program called "T-VER," covering the agricultural sector. There were two major types of agricultural projects registered in the program: good fertilization practice in agricultural land; and carbon sequestration and GHG emission reductions.

FIGURE 2

CARBON CREDIT TRADING MECHANISM AND EMISSION REDUCTION PROGRAM, WITH TYPES OF REGISTERED AGRICULTURAL PROJECTS.



Types of agricultural projects registered in the national carbon credit trading mechanism and voluntary emission reduction program

The ROK:
1. Water management in rice cultivation
2. Addition of biochar to agricultural land
3. Good fertilization practice
4. Utilization of animal waste or agricultural residues for electricity generation
5. Others: Unused heat energy (heated wastewater); circulating water film cultivation LED lighting replacement; high-efficiency thermal insulation material (multi-layer thermal insulation curtain); geothermal heat pump; renewable energy (solar power, solar power, hydroelectric power, and wind power); use of by-product fertilizers; cover cropping; conservation tillage; land use change (rice paddy to upland).

Thailand:
1. Good fertilization practice in agricultural land
2. Carbon sequestration and reducing emissions

Source: Based on the results of the first and second survey.

Participation in Clean Development Mechanism

The Clean Development Mechanism (CDM) is an international offset mechanism under the Kyoto Protocol that allows crediting of emission reductions from GHG abatement projects in developing countries. Since the ROC is not party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, it could not become formally eligible to participate in the CDM.

Among the rest of the seven member economies that are participating in the CDM, only Bangladesh has not registered any of the agricultural projects in the CDM (see Figure 3). Common and distinctive features of agricultural projects registered in the CDM in the other six member economies are as follows:

Common features

India, Indonesia, Pakistan, the Philippines, the ROK, and Thailand have registered several projects related to treatment and utilization of animal waste or agricultural residues for electricity generation in the CDM.

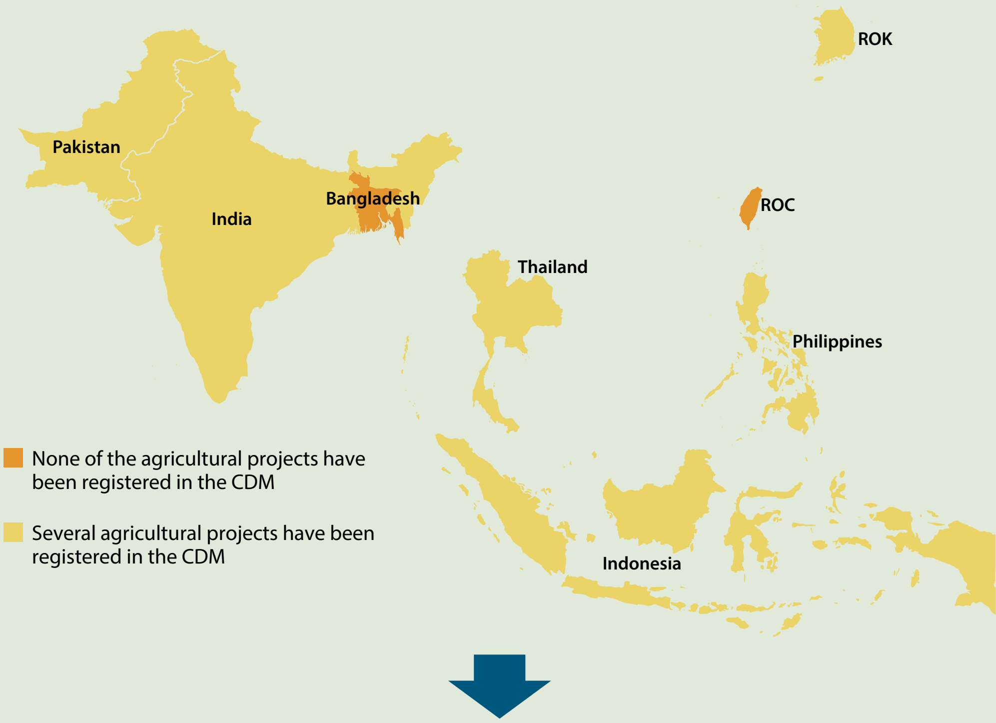
Distinctive Features

(1) India is the only member economy that has registered a project related to water management in rice cultivation.

(2) Only Indonesia and Pakistan have registered a project related to good fertilization practices.

FIGURE 3

REGISTRATION AND TYPE OF AGRICULTURAL PROJECTS IN THE CDM IN EIGHT MEMBER ECONOMIES.



Types of agricultural projects registered in the CDM

Common features between six member economies that have registered agricultural projects in the CDM:
All six member economies have registered several projects related to the treatment of animal waste and the utilization of animal waste or agricultural residues for electricity generation.

Distinctive features between six member economies that have registered agricultural projects in the CDM:
1. India is the only member economy that has registered a project related to water management in rice cultivation.
2. Only Indonesia and Pakistan have registered projects related to good fertilization practice.

Source: Based on the results of the first and second surveys.

Participation in Verified Carbon Standard

Verified Carbon Standard (VCS) is the world's most widely used GHG crediting program. All eight member economies are participating in the VCS. However, only India and Thailand have registered agricultural projects in the VCS (see Figure 4). Types of agricultural projects registered in the VCS in India and Thailand are as follows:

India

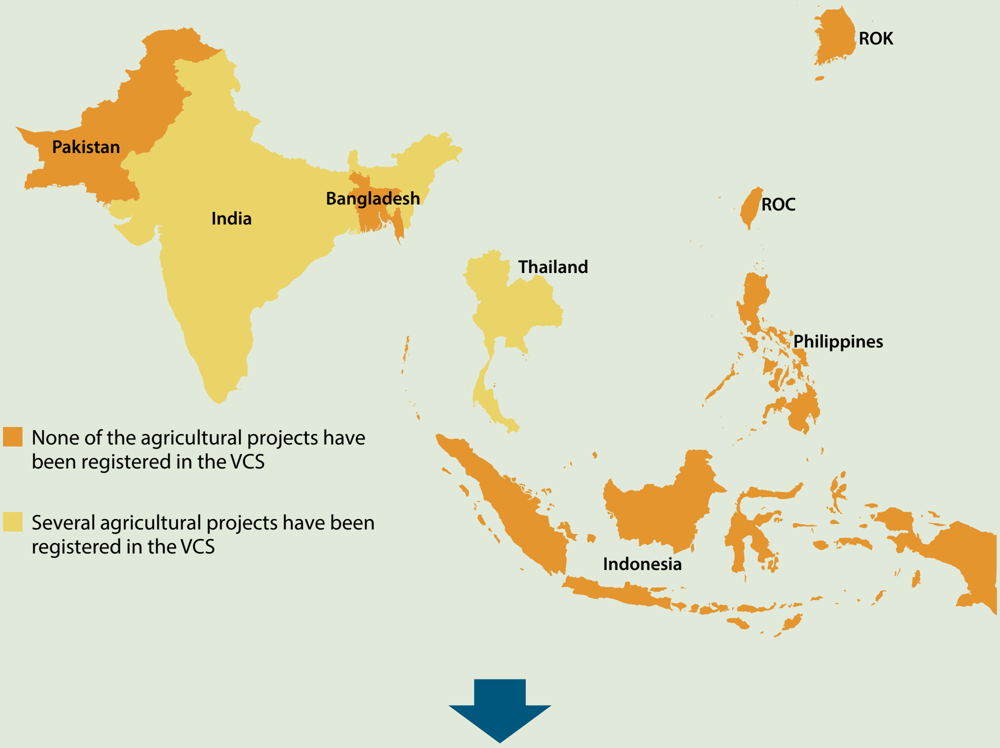
1. Addition of biochar to agricultural land;
2. Utilization of animal waste or agricultural residues for electricity generation; and
3. Water management in rice cultivation.

Thailand

1. Utilization of animal waste or agricultural residues for electricity generation.

FIGURE 4

REGISTRATION AND TYPE OF AGRICULTURAL PROJECTS IN THE VCS BY EIGHT MEMBER ECONOMIES.



Types of agricultural projects registered in the VCS

India:
1. Addition of biochar to agricultural land
2. Utilization of animal waste or agricultural residues for electricity generation
3. Water management in rice cultivation

Thailand:
1. Utilization of animal waste or agricultural residues for electricity generation

Source: Based on the results of the first and second surveys.

Participation in Gold Standard

Gold Standard (GS) is an international voluntary carbon offset program focusing on progressing the UN's Sustainable Development Goals (SDGs) and ensuring that projects benefit their neighboring communities. Seven member economies, i.e., except for the ROK, are participating in the GS. India, the ROC, and Thailand have registered several agricultural projects, while Pakistan has registered one agricultural project in the GS (see Figure 5). Common and distinctive features of agricultural projects registered in the GS by these four member economies are as follows:

Common features

Most of the member economies have registered project related to water management in rice cultivation, treatment of animal waste, and utilization of animal waste or agricultural residues for electricity generation.

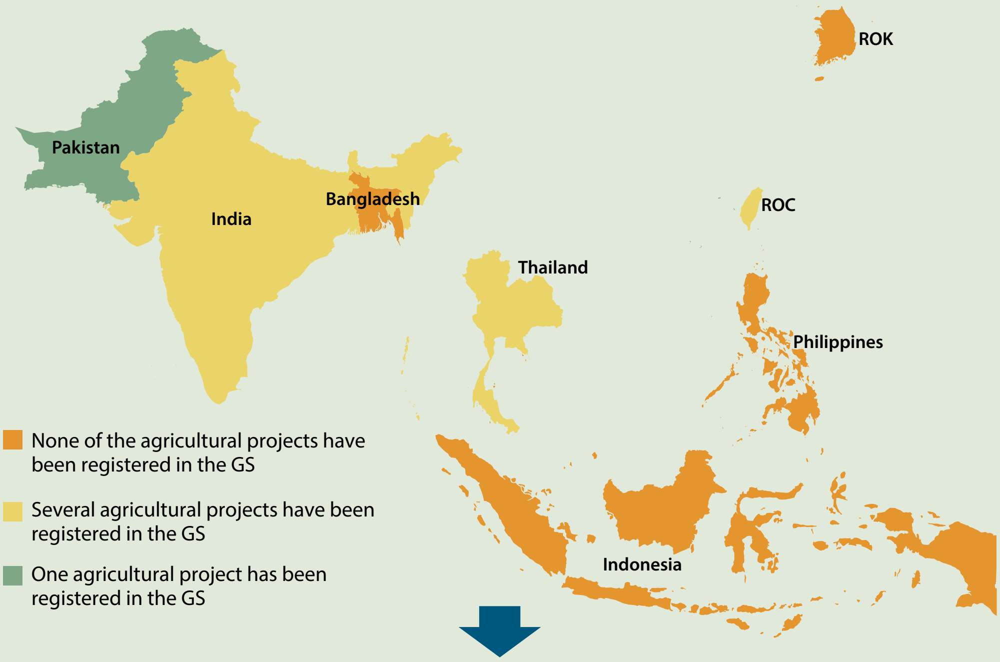
Distinctive features

1. India is the only member economy that has registered a project related to water management in rice cultivation.

2. Only the ROC has registered a project related to soil carbon sequestration.

FIGURE 5

REGISTRATION AND TYPE OF AGRICULTURAL PROJECTS IN THE GS BY EIGHT MEMBER ECONOMIES.



Types of agricultural projects registered in the GS

Common features between four member economies that have registered agricultural projects in the GS: Most of the member economies have registered projects related to water management in rice cultivation, the treatment of animal waste, and the utilization of animal waste or agricultural residues for electricity generation.

Distinctive features between four member economies that have registered agricultural projects in the GS: Only the ROC has registered project related to soil carbon sequestration.

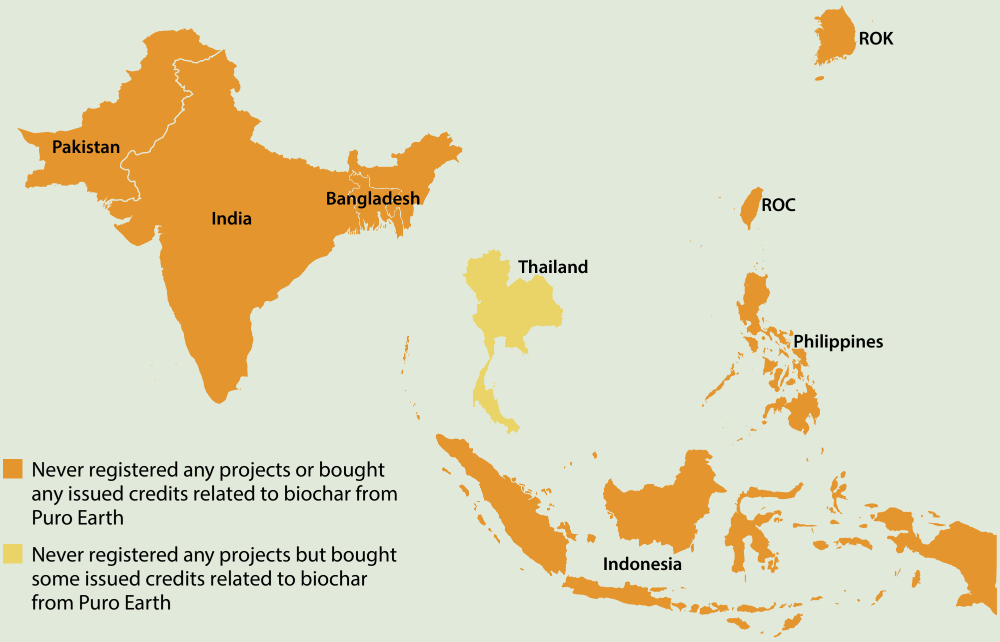
Source: Based on the results of the first and second surveys.

Participation in Puro Earth

Puro Earth is the world's leading crediting platform for engineered carbon removal. Among the eight member economies, only Thailand is participating in Puro Earth. Thailand has never registered any projects in it but has bought some issued credits of biochar from Puro Earth (see Figure 6).

FIGURE 6

PARTICIPATION OF MEMBER ECONOMIES IN PURO EARTH.



Source: Based on the results of the first and second surveys.

Participation in JCM and Climate Protection and Carbon Offset

As noted earlier, JCM is a Japan-initiated bilateral mechanism for reducing GHG emissions while transferring Japan's technologies to partner countries in exchange for transferring carbon credits to Japan. Climate Protection and Carbon Offset (Klik) is a bilateral mechanism for supporting climate-friendly technologies and innovations in Switzerland and abroad. Participation of the eight member economies in the JCM of Japan and/or Klik of Switzerland, shown in Figure 7, can be summarized as follows:

India, Pakistan, and the ROC

India, Pakistan, and the ROC are not participating in any bilateral offset crediting mechanisms.

Bangladesh, Indonesia, the Philippines, and the ROK

Bangladesh, Indonesia, the Philippines, and the ROK are participating only in the JCM of Japan.

Thailand

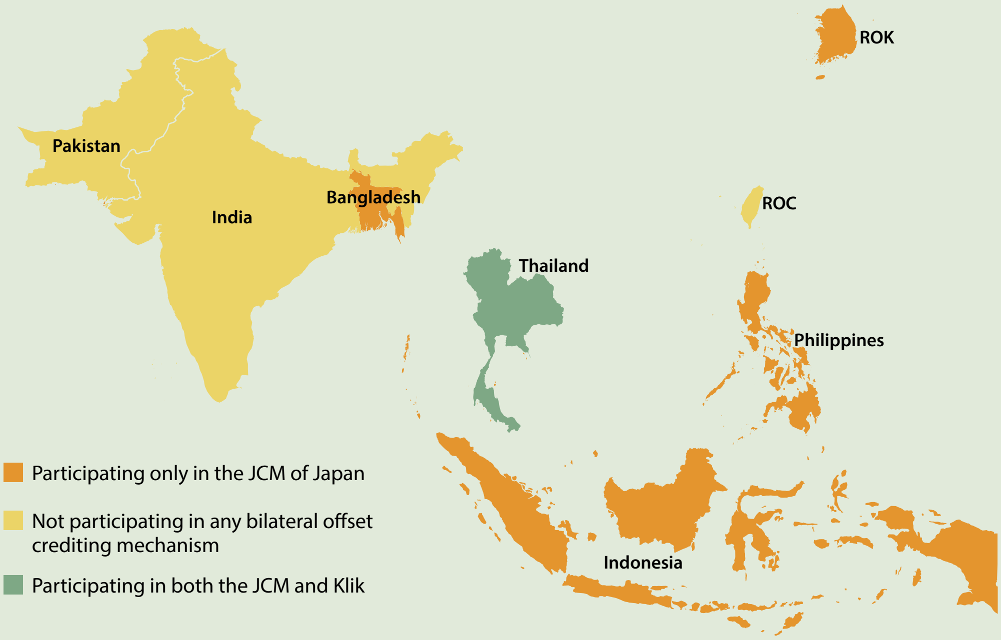
Thailand is the only member economy that is participating in both the JCM and the Klik.

Availability of MRV and GHG Validation and Verification Body

Monitoring, Reporting, and Verification (MRV) is a system for monitoring the amount of GHG emissions reduced by a specific mitigation activity and reporting the findings to an accredited

FIGURE 7

PARTICIPATION OF EIGHT MEMBER ECONOMIES IN THE JCM AND THE KLIK.



Source: Based on the results of the first and second surveys.

validation and verification body (VVB). The VVB then verifies the report so that the results can be certified, and carbon credits can be issued. The GHG VVB is a qualified and independent third party and operates according to the ISO 14065:2020 general principles and requirements for bodies validating and verifying environmental information. The availability of the MRV system and the GHG VVB in the eight member economies (see Figure 8), can be summarized as follows:

Bangladesh and the Philippines

Although there is the MRV system, there is no GHG VVB in both Bangladesh and the Philippines.

The Philippines collaborates with international organizations and receives support for capacity-building in MRV. Organizations such as the United Nations Development Program (UNDP) and the Global Environment Facility (GEF) frequently aid countries such as the Philippines in developing MRV capabilities. Furthermore, the UNFCCC has approved the standardized baseline for methane emissions from rice cultivation in the Philippines (ASB0008) for the CDM Methodology "AMS-III. AU.v4.0," which pertains to methane emission reductions through adjusted water management in rice cultivation. In addition, the Philippines, through the DA-Philippine Rice Research Institute, has contributed to the "Handbook of Monitoring, Reporting, and Verification (MRV) for a GHG Mitigation Project with Water Management in Irrigated Rice Paddies," published in February 2018 by the Institute for Agro-Environmental Sciences, NARO, Japan. The Philippines does not yet have a dedicated national GHG VVB. The GHG validation and verification processes are typically carried out following internationally accepted and approved standards and protocols. The Philippines will adhere to internationally approved guidelines issued by the UNFCCC when implementing projects for emission reductions and removals. One such example is the "Guidelines on the Use of the Closed Chamber Method for GHG Measurement from Rice Cultivation," for which the country has also made contributions as an author through the DA-Philippine Rice Research Institute.

India and Pakistan

Although there is no MRV system, there is GHG VVB in India and Pakistan.

India has an institutional arrangement of GHG inventory preparation under the leadership of Ministry of Environment Forest and Climate Change (MoEFCC).

Pakistan does not currently have institutional arrangements for GHG inventory preparation or a broader climate MRV. However, Pakistan has conducted ad hoc project-based inventory work, which has helped build some institutional capacity for ongoing and continuously improving MRV outputs. The Ministry of Climate Change through the Global Change Impact Study Center in Islamabad has developed a transparency web platform with the support of GIZ Germany and CITEFA France for MRV and ETF strengthening to manage climate change and GHG. Also, the project under the National Forest Monitoring System (NFMS) has developed an MRV system for REDD+ in Pakistan to support continuous monitoring of forest and land/use change. The Ministry of Climate Change (MoCC) has been working toward developing standards to make the climate change monitoring process efficient and effective.

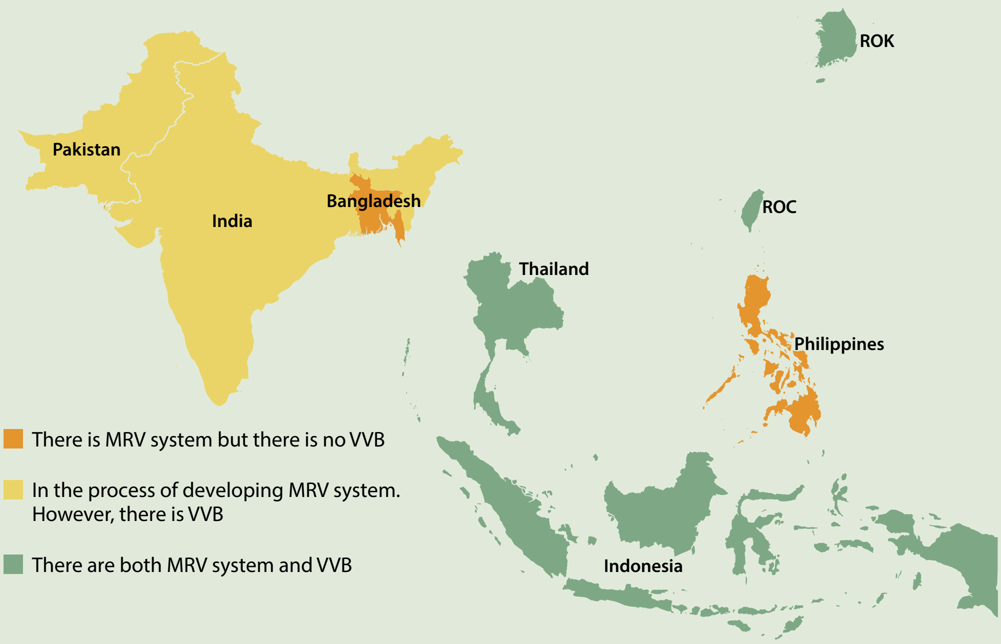
Indonesia, the ROC, the ROK, and Thailand

Both the MRV system and the GHG VVB are there in Indonesia, the ROC, the ROK, and Thailand.

In Indonesia, there are systems such as the Indonesian National Carbon Accounting System (INCAS), designed as a tier 3 type GHG accounting system to support Indonesia's MRV requirements for the land-based sectors. The INCAS is also designed for GHG reporting for the

FIGURE 8

AVAILABILITY OF THE MRV SYSTEM AND THE VVB IN EIGHT MEMBER ECONOMIES.



Source: Based on the results of the first and second surveys.

Agriculture, Forestry, and Other Land Use (AFOLU) sectors, as well as for tracking progress in achieving national emission reduction targets. The INCAS was developed by the Ministry of Environment and Forestry, with support and inputs from other national institutions, such as the National Aeronautics and Space Agency (LAPAN), and the Ministry of Agriculture. Indonesia also has the GHG VVB, which is certified by the National Accreditation Committee (KAN). One of the accreditation services provided by the KAN is the accreditation scheme for the *Lembaga Validasi dan/atau Verifikasi Sektor Informasi Lingkungan Lingkup Gas Rumah Kaca (LVV GRK)* or Validation and/or Verification Institution for Environmental Information Sector in the Scope of GHG. The ROC's GHG emissions inventory registration is an organizational inventory. Its complete mechanism is based on the inventory report standard structure of the ISO14064-1 international standard and the US Greenhouse Gas Reporting Program (GHGRP) to establish its consistent inventory procedures, technical regulations, and management methods. Controlled objects should go to the inventory and registration area of the National GHG Registration Platform in accordance with the law. The Environmental Protection Agency is entrusted to promote members of the International Accreditation Forum (IAF), International Multilateral Mutual Recognition Agreement (MLA), to declare that legal entities meet specific standards or requirements based on GHG verification and verification, such as ISO14065, ISO14066, ISO14064-3, and other international standards. Inspection agencies certified by the ROC apply to the Environmental Protection Agency and obtain a domestic inspection execution license in accordance with the regulations and requirements of the ROC's inspection agency management to ensure that the implementation work and management mechanisms of the certification agency and the inspection agency comply with international requirements.

Calculating and Reporting Methane Emission Reductions from Rice Cultivation by Water Management

The COE on CSA, implemented by the NARO, has been involved in the development of a methodology for calculating and reporting the reduction of methane emissions from paddy soils by mid-season drainage, which is one of the water management practices. The methodology, "AG-005 extension of mid-season drainage period in rice cultivation," developed by the COE on CSA and the Ministry of Agriculture, Forestry, and Fisheries of Japan was registered as one of the agricultural methodologies in the J-Credit Scheme, a scheme set up in 2013 by the government of Japan to certify the amount of GHG emission reductions and removals in the country, in March 2023. This methodology is essential not only for calculating and reporting the reduction of methane emissions from paddy soils by water management practice in a project but also for generating tradable carbon credits.

According to the results of the first and second surveys, all eight member economies gave the highest score to the importance of methodology for calculating and reporting the reduction of methane emissions from paddy soils by water management practice (see Figure 9). On why the methodology was so important, Bangladesh stated that the GHG measurement from rice fields was not robust and they were not very experienced with such methods. As a result, it was crucial for Bangladesh to establish a baseline for methane emission data; develop mitigation strategies; monitor ongoing research activities, data analysis, and reporting; and communicate effectively.

Various types of technologies were practiced or promoted in India, Indonesia, Pakistan, the Philippines, the ROC, and the ROK to reduce methane emissions from paddy soils, while only water management was practiced or promoted in Bangladesh and Thailand (see Table 1).

FIGURE 9

IMPORTANCE OF METHODOLOGY FOR CALCULATING AND REPORTING THE REDUCTION OF METHANE EMISSIONS.

Source: Based on the results of the first and second surveys.

TABLE 1

TYPES AND TECHNOLOGIES PRACTICED TO REDUCE METHANE EMISSIONS FROM PADDY SOILS.

	Water management	Soil/organic matter management	Other agronomic management	Others
Bangladesh	○			
India	○ AWD		○ System of rice intensification/direct sowing rice	○ Crop diversification
Indonesia	○ AWD/Intermittent	○ Organic and balanced fertilizers	○ Low methane rice varieties	
Pakistan	○ Drip irrigation, AWD, raised bed	○	○ Minimizing tillage and direct seeding of rice	○ Land use change
The Philippines	○	○	○	○ Direct Seeding, Aerobic rice
The ROC	○	○ Well-decomposed compost, improved method of manure and straw application	○ Fertilizers containing sulphate and superphosphate	○ Land use change
The ROK	○	○	○	○ Land use change
Thailand	○			

Source: Based on the results of the first and second surveys.
Note: ○ indicates that the technology is practiced or promoted in the economy.

Only four member economies, namely, Indonesia, the Philippines, the ROK, and Thailand, have a shared or approved methodology for calculating and reporting the reduction of methane emissions from paddy soils (see Figure 10).

Indonesia

MSAP-002 is used for reducing methane emissions from rice fields.

The Philippines

ASB0008-2020 is used in the context of methane emissions from rice cultivation.

The ROK

Water management during paddy cultivation is practiced.

FIGURE 10

AVAILABILITY OF SHARED OR APPROVED METHODOLOGY FOR CALCULATING AND REPORTING THE REDUCTION IN METHANE EMISSIONS.

Shared or approved methodology for calculating and reporting the reduction of methane emissions from paddy soils

Indonesia:
MSAP-002: Reducing methane emissions from rice fields

The Philippines:
ASB0008-2020: Methane emissions from rice cultivation in the Philippines

The ROK:
Water management during paddy cultivation

Thailand:
T-VER-P-TOOL-01-13: Calculation for methane emission reduction by adjusted water management practice in rice cultivation

Source: Based on the results of the first and second surveys.

Thailand

T-VER-P-TOOL-01-13 is applied for calculation of methane emission reduction by adjusted water management practice in rice cultivation.

Methodology for Calculating and Reporting Carbon Stock in Agricultural Soils by Biochar Application

The COE on CSA has been involved in developing methodologies for calculating and reporting soil carbon stock resulting from biochar addition to mineral soil in cropland/grassland. The methodology "AG-004 Biochar addition to mineral soil in cropland/grassland" developed by the COE on CSA was registered in September 2020 under the J-credit Scheme. This methodology is essential not only to calculate and report carbon stock in agricultural soils resulting from biochar addition of a project but also to generate tradable carbon credits.

Except for the ROC and the ROK, six member economies, namely, Bangladesh, India, Indonesia, Pakistan, the Philippines, and Thailand, gave the highest score to the importance of methodology for calculating and reporting carbon stock in agricultural soils by biochar application (see Figure 11). Bangladesh and Indonesia stated that the methodology was very important because carbon was the main driver for determining the soil's potentiality and its output. It also indicated how much carbon was sequestrated in soils. Regular updates and monitoring are crucial to tracking changes in carbon stocks over time and to evaluate the effectiveness of soil management practices in achieving carbon sequestration goals. It is very important to measure and calculate carbon stock in agriculture soils to know how sufficient the carbon level is in agricultural soils.

FIGURE 11

IMPORTANCE OF THE METHODOLOGY FOR CALCULATING AND REPORTING CARBON STOCK IN AGRICULTURAL SOILS.

Source: Based on the results of the first and second surveys.

Table 2 shows the outlook of biochar as a soil amendment for soil carbon sequestration, major potential organic materials for biochar production, and competing uses of major potential organic materials in the eight member economies. All member economies, except for Bangladesh, considered biochar as an important soil amendment for soil carbon sequestration. In all the member economies, rice husks, rice straw, sugarcane bagasse, and livestock manure were the major potential organic materials for biochar production due to their large quantities. However, competing uses of these materials are expected. For example, rice husks are used for various purposes such as animal feeding, bedding, fuel, and brick making. Rice straw is used for bioenergy, biofuel, mushroom production, and animal feeding, and is sometimes burned on the farm. Sugarcane bagasse is widely used as boiler fuel and animal fodder, as well as for producing bioethanol.

TABLE 2

OUTLOOK OF BIOCHAR FOR SOIL CARBON SEQUESTRATION, MATERIALS NEEDED, AND CHALLENGES.

	Outlook for biochar as a soil amendment for soil carbon sequestration	Note for outlook	Major potential organic materials for biochar production	Competing uses of major potential organic materials
Bangladesh	Rare	Very rare to produce biochar in Bangladesh	• Rice husks	70% of rice husks have been utilized for feed, bedding, and fuel
India	Yes	Need to understand long-term effects of biochar; energy is required to produce biochar	• Rice straw • Sugarcane bagasse	Rice straw is burned on farm, and some areas use it as animal fodder. Bagasse is used for fuel in boilers to produce steam and generate electricity
Indonesia	Yes	Indonesia needs to re-use agricultural waste to improve and meet soil carbon needs	• Rice husks	Animal husbandry, brick making, and fuel
Pakistan	Yes	Some field trials of biochar application are ongoing	• Rice straw • Sugarcane bagasse	Animal fodder, domestic burning, and organic fertilizers
The Philippines	Yes		• Rice straw • Rice husks • Coconut husk	Rice straw is used for bioenergy, biofuel, mushroom production, and animal feeds. Rice husks are used for biochar material, fuel, and bedding. Coconut husk is used for cocofiber, fuel, particle board, and ropes.

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	Outlook for biochar as a soil amendment for soil carbon sequestration	Note for outlook	Major potential organic materials for biochar production	Competing uses of major potential organic materials
The ROC	Yes	There has been a draft proposal for biochar quality specifications and safety management regulations since 2000, but not much progress has been made yet	• Biomass waste, crop residue, and livestock manure	Rice husks are used for livestock bedding, fuel, etc.
The ROK	Yes	There are ongoing projects on biochar application	• Rice straw • Poultry manure	Rice straw is used for feeding, bedding, and incorporation. Poultry manures have been used as compost and soil amendment
Thailand	Yes	Limited information is available for carbon sequestration	• Rice husks • Sugarcane bagasse	40% of rice husks are utilized as feed fertilizer, bedding, and fuel. Bagasse is used as boiler fuel in sugar factories as well as for producing bioethanol

Source: Based on the results of the first and second surveys.

Need and Readiness for Implementing Soil Carbon Sequestration Visualization Tool

The COE on CSA has developed a web-based soil carbon sequestration visualization tool that can simply visualize the effects of organic material inputs on soil carbon sequestration and GHG emissions in Japan. By simply selecting a location on a map and choosing a crop and organic material management practice from a menu, changes in soil carbon content will be calculated for the next 20 years and a total evaluation of GHG emissions (methane, nitrous oxide, and carbon dioxide) will be displayed. This tool can be used to support policy evaluation of the government. The Ministry of Agriculture, Forestry and Fisheries of Japan uses this tool to calculate soil carbon stock and GHG emissions to evaluate the effects of activities eligible for the Direct Payment for Environmentally Friendly Agriculture in which farmers are given direct payment subsidies in exchange of their efforts to shift from conventional to environmentally friendly farming, for global warming prevention.

As shown in Figure 12, most of the member economies have evaluated the importance of soil carbon sequestration visualization tools with high scores. Bangladesh noted that the tool was very important because it might be easy to use and give a complete picture of carbon sequestration in agriculture. In addition, farmers could claim carbon credit for reduced emissions.

FIGURE 12

IMPORTANCE OF SOIL CARBON SEQUESTRATION VISUALIZATION TOOL IN EIGHT MEMBER ECONOMIES.

Source: Based on the results of the first and second surveys.

Table 3 shows the availability of soil map, available data from soil map, availability of long-term experiment data of organic matter inputs, and availability of long-term soil carbon observation data, in the eight member economies. To develop and apply the Soil Carbon Sequestration Visualization Tool, the following data are needed: soil map with data of clay content, carbon content or organic matter content, and bulk density; long-term experiment data of organic matter inputs; and long-term soil carbon observation data. Table 3 shows that all eight member economies have most of data needed for developing the Soil Carbon Sequestration Visualization Tool.

TABLE 3

POTENTIAL DATASETS FOR THE SOIL CARBON SEQUESTRATION VISUALIZATION TOOL.

	Availability of soil map	Available data from soil map	Availability of long-term experiment data on organic matter inputs	Availability of long-term soil carbon observation data
Bangladesh	○	Carbon content, organic matter content, pH, NPK, EC, ESP, OC, soil type/texture	○	○
India	○	Clay content, carbon content, bulk density, pH, NPK, EC, ESP, OC, soil type/texture	○	○
Indonesia	○	Clay content	○	○

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	Availability of soil map	Available data from soil map	Availability of long-term experiment data on organic matter inputs	Availability of long-term soil carbon observation data
Pakistan	○ Not entire country	pH, NPK, EC, ESP, OC, soil type/texture	○ Only short-term	○ Only short-term
The Philippines	○	Clay content, carbon content, organic matter content, Bulk density	○	○
The ROC	○	Clay content, carbon content, organic matter content, bulk density	○ Only short-term	○
The ROK	○	Clay content, carbon content, organic matter content, bulk density, pH, OM, available P, K, Ca, and Mg, available SiO2, bulk density, OC, soil texture	○	○
Thailand	○	Carbon content, organic matter content, pH, NPK, EC, ESP, OC, soil type/texture	○	○

Source: Based on the results of the first and second surveys.
Notes: (1) ○ indicates that data is available.
(2) pH stands for potential of hydrogen; NPK stands for nitrogen, phosphorus, and potassium; EC stands for soil's electrical conductivity; ESP stands for exchangeable sodium percentage; and OC stands for organic carbon.

Need and Readiness for Implementing Agro-meteorological Grid Square Data System

The COE on CSA has also developed a meteorological data system that provides daily meteorological data and covers entire Japan in a 1-km grid. The dataset comprises 13 different meteorological elements, including daily mean air temperature, daily accumulated global solar radiation, daily mean humidity, and snow water equivalent. This dataset can be combined with crop development prediction models and other existing techniques and knowledge regarding crop responses to meteorological stress to formulate novel crop management technologies.

As shown in Figure 13, all eight member economies have evaluated the importance of the grid-based agro-meteorological data system with the highest score. Bangladesh said that the grid-based agro-meteorological data system was very important because it made it simple to collect, analyze, and communicate meteorological and climate data at a fine-grained, regional level to assist farmers and policymakers in making informed decisions. By providing accurate and timely data on temperature, rainfall, humidity, and other meteorological parameters, the system helped farmers plan their crop cycles, irrigation schedules, and pest control measures. It also aided in disaster preparedness, enabling authorities to anticipate and respond to weather-related threats, such as floods or droughts. Ultimately, the system contributed to increased agricultural productivity, food security, and sustainable rural development.

FIGURE 13

IMPORTANCE OF GRID-BASED AGRO-METEOROLOGICAL DATA SYSTEM IN EIGHT MEMBER ECONOMIES.

Source: Based on the results of the first and second surveys.

Table 4 shows the availability of grid-based agro-meteorological data system in the eight member economies. Some member economies already have the system in place, while some are currently developing the system. To develop a grid-based agro-meteorological data system and combine the data with crop development prediction models and other existing techniques to formulate novel crop management technologies, data that are commonly used for crop management, such as air temperature, precipitation, relative humidity, wind speed, and solar radiation, are required. As shown in Table 5, most of the member economies have most of the important data needed for developing a grid-based agro-meteorological data system.

TABLE 4

AVAILABILITY OF GRID-BASED AGRO-METEOROLOGICAL DATA SYSTEM IN EIGHT MEMBER ECONOMIES.

	Availability of grid-based agro-meteorological data system
Bangladesh	The installation of grid-based meteorological data system is ongoing.
India	The gridded data (0.25 x 0.25) for rainfall and surface air temperature (1x1) data is available with Indian Meteorological Department, Pune, India for the entire country.
Indonesia	Grid-based agro-meteorological data is provided by the Agricultural Instruments Standardization Agency (BSIP), the Ministry of Agriculture.
Pakistan	There is a satellite-based crop monitoring system in Pakistan that uses remote sensing and GIS to forecast and estimate crop statistics of major crops.
The Philippines	There are projects using satellites for deriving grid-based agromet data. Free satellite images like Sentinel 1 and 2 with resolutions of 100m and 10m, respectively, are used.

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	Availability of grid-based agro-meteorological data system
The ROC	A total of 176 agricultural meteorological stations are currently maintained by the Central Meteorological Administration. It also performs data analysis and compilation of data from various agricultural meteorological stations, releases weekly agricultural meteorological forecasts, and compiles data.
The ROK	It is currently under development and has not yet been released.
Thailand	Thai Meteorological Department (TMD)'s Numerical Weather Prediction System provides short-range forecast with grids $2km^2$ and $6km^2$, medium-range forecast with grids $18km^2$, and long-range forecast with grids $27km^2$. Geo-Informatics and Space Technology Agency (GISTDA) is also implementing "Weather Data and Daily Agricultural Image Collection System" with 24-station Field Server.

Source: Based on the results of the first and second surveys.

TABLE 5

WEATHER DATA, INCLUDING TIMESTEP AND PERIOD, AVAILABLE FROM WEATHER STATIONS IN EIGHT MEMBER ECONOMIES.

		Bangladesh	India	Indonesia	Pakistan	The Philippines	The ROC	The ROK	Thailand
Mean air temperature	Availability	○		○	○	○	○	○	
	Timestep	Daily		Daily	Daily, Monthly	Daily	Daily, weekly, monthly	Hourly	
	Periods	1981–		1980–	1960–	1985–	1998~	1960s–	
Minimum air temperature	Availability	○	○	○	○	○	○	○	○
	Timestep	Daily	Daily	Daily	Daily, monthly	Daily	Daily, weekly, monthly	Hourly	Daily, monthly
	Periods	1981–	1970–	1980–	1960–	1985–	1998~	1960s–	
Maximum air temperature	Availability	○	○	○	○	○	○	○	○
	Timestep	Daily	Daily	Daily	Daily, monthly	Daily	Daily, weekly, monthly	Hourly	Daily, monthly
	Periods	1981–	1970–	1980–	1960–	1985–	1998~	1960s–	
Relative humidity	Availability	○	○	○	○	○	○	○	○
	Timestep		Daily	Hourly	Daily, Monthly	Hourly	Daily, weekly, monthly	Hourly	Hourly, daily, monthly
	Periods	1981–	1970–	1980–	1990–	1985–	1998~	1960s–	
Wind speed	Availability	○	○	○	○	○	○	○	○
	Timestep		Daily	Hourly	Daily	Hourly	Daily, weekly, monthly	Hourly	Hourly, monthly
	Periods	1981–	1970–	1980–	1990–	1985–	1998~	1960s–	

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		Bangladesh	India	Indonesia	Pakistan	The Philippines	The ROC	The ROK	Thailand
Solar radiation	Availability			○	○		○	○	○
	Timestep			Daily	Daily		Daily, weekly, monthly	Hourly	Hourly, daily, monthly
	Periods			1980–	1990–		1998~	1960s–	
Precipitation	Availability	○	○	○	○	○	○	○	○
	Timestep		Daily	Daily	Daily	Daily	Daily, weekly, monthly	Hourly	3 Hour, daily, monthly
	Periods	1981–	1970–	1980–	1960–	1985–	1998~	1960s–	

Source: Based on the results of the first and second surveys.
Note: ○ indicates that data is available.

Key Stakeholders in CSA and Their Efforts

In the survey, eight national resource persons from the eight member economies were asked to identify key stakeholders in CSA, as well as their efforts, across the following four categories: government agency; private enterprise, university or research institute, and others such as international organizations; non-governmental organization (NGO); and non-profit organization (NPO). The results regarding key stakeholders in CSA and their efforts in climate change mitigation and adaptation in agriculture are shown in Tables 6–9.

TABLE 6

KEY GOVERNMENT AGENCIES IN CSA AND THEIR EFFORTS IN EIGHT MEMBER ECONOMIES.

Member economy	Key government agency in CSA
Bangladesh	**Name:** The Ministry of Agriculture **Effort:** Develop action plans for climate change, develop climate change mitigation and adaption technologies, and provide support to conduct research in the mitigation of GHG emissions in the agricultural sector.
The ROC	**Name:** The Ministry of Agriculture of the ROC **Effort:** Develop action plans for climate change and support the development of climate-change mitigation and adaptation technologies.
	Name: Department of Climate Change, the Ministry of Environment of the ROC **Effort:** Provide climate-change response policies, manage GHG emissions/ reductions, and strengthen climate change adaptation resilience.
	Name: National Science and Technology Council of the ROC **Effort:** Develop action plans and projects for climate change and support the development of climate-change mitigation and adaptation technologies
India	**Name:** Ministry of Agriculture and Farmers Welfare, Government of India **Effort:** Develop policies and action plan for climate-resilient agriculture in India, support the technologies for adaptation to climate change with various policies such as the National Mission on Sustainable Agriculture, National Food Security Mission, PM Krishi Sinchai Yojna, etc.

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Member economy	Key government agency in CSA
Indonesia	**Name:** Agency of Agriculture Extension and Human Resource Development (AAEHRD), The Ministry of Agriculture **Effort:** Develop action plans for climate change and support the development of climate-change mitigation and adaptation technologies through CSA SIMURP.
	Name: The CSA SIMURP Program **Effort:** Implement the CSA technology as the Province Project Implementation Unit (PPIU).
Pakistan	**Name:** The Ministry of National Food Security and Research (MNFS&R) of Pakistan **Effort:** Develop action plans for promoting climate-smart agriculture practices for climate-change mitigation and adaptation in the agricultural sector of Pakistan.
	Name: The Ministry of Climate Change and Environmental Coordination (MoCCEC) **Effort:** Mainstream climate change in the economically and socially vulnerable sectors of the economy and steer Pakistan toward climate-resilient development. It is also a key stakeholder in developing policy recommendations and promoting carbon credit trading mechanisms in the country. The provincial ministries on Climate Change Forestry, Environment and Wildlife are its key subnational partners.
	Name: The Ministry of Planning Development and Special Initiatives (PD&SI), Economic Affairs Division (EAD) **Effort:** Manage Pakistan's socioeconomic development in a strategic and sustainable manner and be responsible for resource allocation, coordination, and planning.
The Philippines	**Name:** Department of Agriculture (DA) **Effort:** Develop comprehensive initiatives to address climate change in the agricultural sector and implement measures to enhance the resilience of farmers to climate-related challenges, including the development of climate-smart technologies. Additionally, the department has been actively engaged in capacity-building and awareness campaigns to empower farmers with the knowledge and tools for climate adaptation. The multifaceted approach aims to both mitigate emissions and help the agricultural sector adapt to the changing climate. The department also provides some funds to implement a few exploratory research on GHG measurement from animals and rice paddies. Furthermore, The Philippine Rice Research Institute (PhilRice), an attached agency to the DA is the premier research body that has conducted research on GHG emissions from rice paddies, along with the IRRI (1994–2000) and the NARO-MAFF, Japan (2013–2017). The institute is the only government agency that has trained, experienced, and competent staff to implement GHG measurement projects in the country as defined by the UNFCCC. Moreover, the Climate Resilient Agriculture Office (CRAO) of DA that cuts across policy instruments and agencies of the department implements seven programs that include Mainstreaming Climate Change Adaptation and Mitigation Initiative in Agriculture, Climate Change Information System, Philippine Adaptation and Mitigation in Agriculture Knowledge Toolbox, Climate-smart Agriculture Infrastructure, Financing and Risk Transfer Instruments on Climate Change, Climate-smart Agriculture and Fisheries Regulations, and Climate-smart Agriculture Extension System.

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Member economy	Key government agency in CSA
The Philippines	**Name:** Department of Science and Technology (DOST) **Effort:** The DOST supports research and development initiatives related to climate science, weather forecasting, and development of climate-resilient technologies for agriculture.
	Name: Climate Change Commission (CCC) **Efforts:** The CCC is the government agency responsible for coordinating on climate-change policies and programs. It works on developing strategies and action plans to reduce GHG emissions across all sectors, including agriculture. Universities in the Philippines also conduct research and development works to address the problems brought about by climate change.
The ROK	**Name:** Rural Development Administration Climate Change Assessment Division **Effort:** It measures GHG emissions and develops various emission factors to reduce GHG emissions.
	Name: Korea Agricultural Technology Promotion Agency **Effort:** A voluntary GHG reduction project is implemented, and incentives are provided.
Thailand	**Name:** The Ministry of Agriculture and Cooperatives (MOAC) of Thailand **Effort:** The Committee on Agricultural and Cooperative Development Policy and Planning of the MOAC has developed Agricultural Action Plan for climate change 2023–27, including the following five strategies: (1) raise the level of climate adaptation of farmers and relevant businesses in the supply chain of agriculture; (2) participate in reducing GHG emissions throughout the agricultural supply chain to lessen long-term effects of climate change; (3) develop databases and raise awareness on the impact of climate change and adaptation and participation to decrease GHG emissions; (4) develop human capacity in the agricultural sector and extend collaboration with stakeholders to cope with climate change; and (5) drive and act on climate change operation.
	Name: Department of Climate Change and Environment, Ministry of Natural Resources and Environment

TABLE 7

KEY PRIVATE ENTERPRISES IN CSA AND THEIR EFFORTS IN EIGHT MEMBER ECONOMIES.

Member economy	Key private enterprise in CSA
Bangladesh	Not indicated
The ROC	**Name:** CH Biotech **Effort:** Research and develop efficient, precise, low-carbon plant growth regulators and fertilizer products that meet the needs of modern agricultural production.
	Name: Smartagri Integration Service Co., Ltd. **Effort:** Integrate information and communication technology applications to develop smart agricultural production management solution technologies and information systems.
	Name: Agneeds **Effort:** With ecological agriculture as its core technology, it provides agricultural technical consulting and supplies its own brand materials.

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Member economy	Key private enterprise in CSA
India	**Name:** Grow Indigo (Agriculture Technology Start up) established in 2018 by Mahyco Grow and Indigo Ag. **Effort:** Help farmers in adopting carbon farming through regenerative practices like cover crops and no-till to improve soil health for smallholder farmers in India.
Indonesia	Not indicated
Pakistan	**Name:** The South Asian Conservation Agriculture Network (SACAN) **Effort:** Provide consultancy services in climate smart agriculture resource conservation technologies (CSARCTs) to enhance agriculture productivity.
	Name: Sustainable Agriculture, Water, and Intelligent Ecosystem (SAWIE) **Effort:** Combine geospatial data with the power of machine learning and IoT to provide smart and sustainable solutions to farmers.
	Name: Rabail Sprinkler and Drip Irrigation Technologies **Effort:** Provide consultancy services in establishing, promoting, and capacity building on the sprinkler, drip, and solar-powered pumping systems
The Philippines	**Name:** Ostrom Climate Solutions Inc., Vancouver Canada **Effort:** Provide members of Irrigators Associations in the Upper Pampanga River Integrated Irrigation Systems with capacity building and support for the adoption of alternate-wetting and drying (AWD) technology through farmer field schools, and eventually generate carbon credits from which incentives for participating farmers is derived
	Name: Green Carbon Inc. **Effort:** Ongoing proposals for carbon credits, implementation of AWD to reduce GHG in the Philippines
	Name: Creattura Company Ltd., Tokyo, Japan **Effort:** Establish a pilot project (The Climate Resilient Rice Farming in Pangasinan, Philippines) of 1,000 hectares in the Dipalo River Irrigation System with main irrigation source from the San Roque Dam. The focused technology is AWD. Creattura aims to implement and support initiatives that aim to reduce GHG emissions.
	Name: Sagri **Effort:** A Japanese agri-tech company, with expertise in satellite data analysis on farmland, introduced its technologies to leverage carbon credit to convert GHG reduction into cash.
	Name: Waste X **Effort:** Support agricultural producers in the Philippines to utilize biomass waste while generating additional income and reduce carbon emissions.
The ROK	Not indicated
Thailand	**Name:** Thailand GHG Management Organization (public organization) or the TGO **Effort:** The mechanism is implemented under the methodology of GHG mitigation, including Thailand Voluntary Emission Reduction Program (T-VER), Low Emission Support Scheme (LESS), and Clean Development Mechanism (CDM).
	Name: Wave BCG, Varuna, etc.

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Member economy	Key private enterprise in CSA
Thailand	**Effort:** Try to implement the project to reduce GHG under the T-VER or other international mechanisms. Those companies are comprehensive businesses on carbon credit.
	Name: Thai feed mill association, Mitr Phol Sugar Company, Siam Quality Starch Company, etc. **Effort:** The private sectors/companies related to plant production have some policies to support farmers to produce economic crops under CSA.

TABLE 8

KEY UNIVERSITIES OR RESEARCH INSTITUTES IN CSA AND THEIR EFFORTS IN EIGHT MEMBER ECONOMIES.

Member economy	Key university or research institute in CSA
Bangladesh	**Name:** Bangladesh Rice Research Institute (BRRI) **Effort:** Develop climate-smart technologies in rice cultivation to reduce the negative impact of climate change.
The ROC	**Name:** National Chung Hsing University **Effort:** It established the Smart Sustainable New Agriculture Research and Development Center. The main projects promoted include developing time-saving and labor-saving machinery and equipment to solve the problem of human resource shortage; build a big-data database and analysis platform to collect important information; build a common information platform that meets the needs and development of agricultural production and food industry to increase the speed of information transmission; and promote food and agriculture education and combine science and technology with education to improve overall agricultural production efficiency. In addition, demonstration sites and talent cultivation centers integrating industry, academia, and R&D units have also been established to cultivate talents related to smart agriculture.
	Name: National Chiayi University **Effort:** National Chiayi University established the Smart Food and Agriculture Teaching and Research Center in 2021. It mainly promotes the development and application guidance of smart agricultural technology, including drone education and training, AI, IoT, and big data collection, analysis, and application.
	Name: National Ilan University **Efforts:** (1) Build mobile smart agriculture based on artificial intelligence. (2) Use probiotics to protect the health of poultry and livestock and convert high-value agricultural waste. (3) Provide guidance, promotion, and improvement of agricultural technology in Yilan and Hualien areas. (4) Cultivate current and future agricultural talents.

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Member economy	Key university or research institute in CSA
India	**Name:** Indian Agricultural Research Institute, (IARI) New Delhi, also known as Pusa institute **Effort:** The institute is working since 1993 toward the development of emission inventories of GHG from agricultural soils, development of emission factors for N2O from managed agricultural soils and CH4 from rice paddies. The institute is also working on assessing the CH4 mitigation potential of different water management options in rice and various agri management options for mitigation of nitrous oxide emission from cropped soils. The institute is also working toward the development of climate-change mitigation and adaption technologies for agriculture and breeding of different stress-tolerant varieties of crops.
	Name: Central Research Institute for Dryland Agriculture, Hyderabad (CRIDA) **Effort:** Develop climate-change adaption technologies for rainfed agriculture in the country.
Indonesia	**Name:** Indonesian Agricultural Environmental Standardization Institute (IAESI), Pati, Central Java, Indonesia **Effort:** Study climate-change mitigation and adaption technologies for agriculture.
Pakistan	**Name:** The Climate, Energy and Water Research Institute (CEWRI) of the National Agricultural Research Centre (NARC) in Pakistan Agricultural Research Council (PARC) under the MNFS&R **Effort:** It is actively involved in developing climate-smart agricultural techniques related to land, water, and energy management in agriculture and their promotion through capacity building and coordination with line departments. Other research institutes of the National Agricultural Research Centre (NARC) under PARC are developing crop varieties resistant to droughts, diseases, pests, and multiple agro-silvo-pastoral management practices.
	Name: The University of Agriculture Faisalabad (UAF); the University of Agriculture Peshawar (UAP); and the National University of Science and Technology (NUST) Islamabad **Effort:** Actively involved in academic and field research in developing climate-smart agricultural practices for Pakistan.
	Name: Global Climate Change Impact Study Centre (GCISC) under the (MoCC) of Pakistan **Effort:** The GCISC is mandated for national-level R&D effort, capacity building, policy analysis, information dissemination, and assistance to national planners and policymakers on issues related to past and projected future climatic changes in the country; their likely impacts on the key socioeconomic sectors of the country such as water, food, agriculture, energy, forestry, health, and ecology; and appropriate adaptation and mitigation measures.

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Member economy	Key university or research institute in CSA
The Philippines	**Name:** DA-Philippine Rice Research Institute (PhilRice) **Effort:** PhilRice conducts research and development activities focused on rice production, including the development of climate-smart rice varieties and sustainable farming practices that reduce emissions and enhance climate resilience. PhilRice has partnered with IRRI (1994–2000) and NARO-MAFF, Japan (2014–17) on several projects related to mitigating GHGs and adaptation to climate change.
	Name: DOST- Philippine Council for Agriculture and Natural Resources Research and Development **Effort:** Support R&D agenda related to Agriculture 4.0 that is smart, green, and S&T-based. One of its priority projects is geared toward climate change adaptation and mitigation, and disaster risk reduction in the agriculture and forestry sectors.
	Name: University of the Philippines Los Banos (UPLB), Central Luzon State University **Effort:** UPLB is one of the country's premier agricultural universities and has various research units and departments dedicated to agricultural and environmental sciences. It also conducts research on climate-resilient crop varieties, sustainable farming practices, and environmental conservation. The Central Luzon State University conducts research on climate change and has established the Institute of Climate Change and Environmental Management (ICCEM). It has included relevant subjects in its curriculum and also offers MS degree in environmental science.
The ROK	**Name:** Gyeongsang National University. **Effort:** To reduce GHG emissions, various GHG emission factors have been developed, and various reduction technologies are currently being developed.
Thailand	**Name:** Horticulture Research Institute (HRI); Field and Renewable Energy Crops Research Institute (FCRI); and Agricultural Engineering Research Institute under the MOAC. National Science and Technology Development Agency (NSTDA) **Effort:** Develop climate-change mitigation and adaption technologies for agriculture.
	Name: Universities related to agriculture, such as Kasetsart University, Konkean University, Chiangmai University, and Price of Songkha University.

TABLE 9

KEY INTERNATIONAL ORGANIZATIONS OR NGOs, NPOs IN CSA AND THEIR EFFORTS IN EIGHT MEMBER ECONOMIES.

Member economy	Key international organization or NGOs, NPOs in CSA
Bangladesh	**Name:** Food and Agriculture Organization (FAO) **Effort:** Climate-change mitigation, adaptation, and agri-food systems transformation
The ROC	**Name:** The APO Green Center of Excellence **Effort:** Since 2014, it has promoted and planned green farming teams to carry out technical service exchanges in six member countries (Vietnam, Indonesia, Philippines, Lao PDR, India, and Thailand), mainly focusing on topics such as resource recycling, green energy, green factories, and ecological agriculture.
	Name: The ROC Green Productivity Foundation **Effort:** Assist the government to promote various environmental protection and energy-saving policies, actively guide industries to improve environmental economic efficiency, and promote enterprises to move toward sustainable development and operations.
	Name: The ROC Ecological Agriculture Development Association **Effort:** (1) Verify green ecological agricultural products and agricultural product processing and assist farmers in putting their products on the blockchain to make them traceable and non-modifiable. (2) Convene relevant plant science experts and scholars to establish a carbon sequestration expert committee.
India	**Name:** International Maize and Wheat Improvement Center (CIMMYT), Borlaug Institute for South Asia (BISA) **Effort:** Scale appropriate farm mechanization solutions, especially for smallholder farmers, and precision water and nutrient management practices. Develop climate-smart villages to scale up adaptation practices and technologies, cross-cutting agricultural research for social and gender inclusiveness across south Asia.
	Name: International Rice Research Institute (IRRI) **Effort:** Conduct research on mitigation of future climate crises by developing new cultivation practices and technologies that minimize GHG emissions, enhance input-use efficiency, and predict and respond to future climate threats. Work in partnership with policy makers and national research and extension systems (NARES) to deliver consolidated research and education support services that will improve the efficiency, sustainability, and equity of the region's rice-based agrifood sector and help deliver the Sustainable Development Goals (SDGs). IRRI and India have been successfully collaborating for more than five decades. India has been actively involved in IRRI's priority setting, strategic planning, scientific advising, and implementation of research across south Asia.

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Member economy	Key international organization or NGOs, NPOs in CSA
India	**Name:** International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) **Effort:** ICRISAT the CGIAR institute headquartered in India has developed a pool of climate-smart technologies. A few such approaches for building climate-smart villages include: watershed management approach (improving rural livelihoods by rehabilitating natural ecosystems); futuristic multi-model approach (customizing adaptation packages to enhance climate resilience); digital technologies approach (integrating climate information and eco- conservation technologies); met-advisory and farm-systems approach (building resilience agro-ecosystems by using climate information); and the climate- and crop-modelling approach (cropping advisories based on seasonal forecasts).
Indonesia	Not indicated
Pakistan	**Name:** CIMYT, ACIAR, FAO, and ICARDA **Effort:** Contribute to promoting CSA practices and securing funding for promoting climate-smart agriculture in Pakistan
	Name: JICA, SWISS Interoperation-Helvitas, and ICIMOD **Effort:** Support in arranging funding and skill development related to climate-change mitigation and adaptation and a few more projects are in the pipeline.
	Name: GIZ Germany and CITEFA France **Effort:** Contribute to research and development projects related to GHG emission reduction and promote climate-smart agricultural practices in Pakistan.
The Philippines	**Name:** International Rice Research Institute (IRRI) **Effort:** IRRI has been at the forefront of developing and promoting climate-resilient rice varieties to withstand various climate-related challenges, including drought, flood, and temperature extremes while improving yield stability and food security. It also conducts research to reduce CH_4 emissions from rice fields and is a pioneering organization in the research and development of AWD, which is a widely known water-saving technique in Asia.
	Name: Green Climate Fund (GCF) **Effort:** The GCF is an international fund designed to aid developing nations in addressing the impacts of climate change. It assists these countries in mitigating their GHG emissions and adapt to climate-change effects.
	Name: Asian Development Bank (ADB) **Effort:** The ADB funds projects related to climate-smart agriculture in the Philippines, aiming to enhance the resilience of agricultural systems, reduce emissions, and increase the efficiency of resource use. It provides policy-based loans for the Climate Change Action Program in support of the Government of the Philippines for the implementation of its national climate policies, including its Nationally Determined Contribution that is projected to have a peak emission by 2030, and reduction in GHG emissions by 75% from business as usual, with a just transition to an inclusive, low-carbon, and climate- and disaster-resilient economy.

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Member economy	Key international organization or NGOs, NPOs in CSA
The ROK	Not indicated
Thailand	**Name:** GIZ
	Name: FAO
	Name: The World Bank

Summary of First and Second Survey Results

Results of the first and second surveys can be summarized as follows:

- In most of the member economies, methane emissions from paddy soils and nitrous oxide emissions from managed land account for a significant proportion of GHG emissions from the agricultural sector.
- All the eight member economies participating in the surveys already have various policies and scientific bases that support climate-change mitigation and adaptation in agriculture. Many of the policies target multiple benefits, including higher crop production with reduced GHG emissions and inputs (water and nutrients).
- There are only three member economies, the ROC, the ROK, and Thailand, that already have national carbon credit trading mechanisms or voluntary emission reduction programs for the agricultural sector.
- All the eight member economies are participating in various international carbon credit trading mechanisms. Specifically, Thailand is participating in all international carbon credit trading mechanisms (CDM, VCS, GS, Puro Earth, JCM, and Klik) listed in the survey.
- There are four member economies, namely, Indonesia, the ROC, the ROK, and Thailand, that have both MRV and VVB.
- All the eight member economies have given high scores to the importance of all CSA technologies developed by the COE on CSA.
- All the eight member economies have most of the important data needed for implementing all CSA technologies developed by the COE on CSA. Some member economies already have similar or advanced systems for climate information services.

Results of the Third Survey

The third survey was conducted via e-mail from 21 November 2023 to 5 December 2023. In the survey, eight national resource persons from eight member economies were requested to fill out the "Priority Sheet" with priority CSA technologies and specific topics; possible collaborations with the COE on CSA; and challenges to be addressed or overcome for the pilot projects. India and the ROK have listed one priority CSA technology and topic each; Indonesia has listed two priority

CSA technologies and topics; Bangladesh, the ROC, and Thailand have listed four priority CSA technologies and topics each; and the Philippines and Pakistan have listed six and seven priority CSA technologies and topics, respectively. The top 2 priority CSA technologies, topics, and challenges to be addressed or overcome, and possible collaborations with the COE on CSA in the eight member economies, are listed in Tables 10–17.

TABLE 10

BANGLADESH'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaboration with the COE on CSA
(1) Qualification of soil carbon stock, carbon credit, and GHG emissions	**Challenges:** (1) Lack of carbon sequestration visualization tool (2) Lack of technical and financial support (3) Lack of proper methodology for calculating carbon credit **Possible measures:** (1) Availability of carbon sequestration visualization tool (2) Ensuring technical and financial support (3) Training	Determination of soil carbon sequestration, GHG emissions, and carbon credit through carbon sequestration visualization tool with soil and water management.
(2) Mitigation of GHG emissions from rice fields	**Challenges:** (1) Fixed seasonal contract between the pump owner and the farmer (2) Lack of technical and financial support (3) Lack of farmers awareness **Possible measures:** (1) Ensuring technical and financial support (2) Training for farmers and extension workers (3) Ensuring farmer incentives (4) Government intervention (5) Field demonstration	Mitigation of methane and nitrous oxide emissions from rice fields through mid-season drainage.

TABLE 11

THE ROC'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Quantification of soil carbon sequestration.	**Challenges:** (1) Lack of carbon sequestration visualization tool (2) Lack of technical and financial support (3) Lack of proper methodology for calculating carbon credit **Possible measures:** (1) Availability of carbon sequestration visualization tools (2) Ensuring technical and financial support (3) Government support	Determination of soil carbon sequestration, GHG emissions, and carbon credit through carbon sequestration visualization tools

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Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(2) Soil carbon sequestration	**Challenges:** Lack of technical and financial support **Possible measures:** (1) Ensuring technical and financial support (2) Training for farmers' motivation (3) Government support	(1) Increase soil carbon sequestration and improve soil fertility through biochar or other nutrient solution amendment. (2) Increase the amount of carbon captured by plants and increase crop yields through nutrient solution amendment.

TABLE 12

INDIA'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Soil carbon sequestration visualization and carbon credit methodology	Carbon sequestration potential of long-term crop residue incorporation or organic farming/regenerative farming in tropical environments like India and the methodology to be used for carbon credits to farmers	A tool to quantify the effects of soil and water management on soil carbon and GHG emissions such as carbon dioxide, methane and nitrous oxide emissions. Methodologies to utilize these effects for carbon crediting.
(2) N/A	N/A	N/A

TABLE 13

INDONESIA'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATION WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Methane emission reductions by water management	(1) Irrigation water management is managed by different departments, so the synergy is needed between water managers and water users (farmers) for irrigation channels at the tertiary level (2) Farmers have difficulty in getting sufficient water distribution for paddy fields at the tertiary and quaternary levels because many of water channels are damaged (3) Farmers have different perceptions to accept/apply a new method or application (4) Farmer awareness on CSA application-related AWD technologies could increase the productivity and reduce methane emissions	(1) Water management systems can be applied by water stakeholders (water managers and water users) at the tertiary level. (2) Water management technology alternatives can be adopted and applied by farmers to support methane emission reductions in paddy fields (3) Disseminate and apply the AWD technology effectively and massively for paddy fields.

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Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(2) Soil carbon sequestration	(1) It is relatively difficult to implement biochar to paddy fields (a big capacity of biochar is needed in paddy fields and geographies) (2) Farmers have different perceptions to accept/apply a new method/application (3) Farmers' awareness on CSA application-related biochar technology could increase the productivity and reduce methane emission	(1) The biochar technology application can be adopted and applied by farmers easily. (2) Carbon measurement mechanism-related carbon credits from biochar can be applied in paddy fields.

TABLE 14

PAKISTAN'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Methane emission reductions in paddy fields through water management	Operationalization of available gas chromatography equipment, training on data collection and testing, and accessories provisioning and resources for field execution	Piloting of mid-season drainage for identifying methane emission reduction potential compared with conventional prolonged standing water on farmers' fields and subsequent carbon credit projects
(2) Soil carbon sequestration	Biochar production technology availability, trained manpower, field execution of research, and development activities on biochar production	Piloting of biochar production technology for rice straws and husks in rice-growing areas and subsequent project development for carbon credit earning

TABLE 15

THE PHILIPPINES' TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Methane emission reductions in paddy fields through water management	(1) Methane emissions monitoring, reporting, and validation (MRV) (2) Lack of gas chromatograph for gas analysis (3) Availability and access to satellite data	Introduction of mid-season drainage (MSD) with extension as alternative to AWD (more complicated to implement than MSD). It may facilitate faster adoption of MSD. Capacity building to address the limited competent experts on MSD, AWD. Methodologies to quantify the effects of soil and water management for carbon crediting. Additional training for gas analysis and measurements. Linking/partnership with JAXA for the access of satellite data.

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Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(2) Climate information service	(1) More frequent forecasts and higher resolution (2) Access to satellite data	Capacity building on the use of Grid-square Data Systems of Agromet Traits. Adoption of the system for Philippine condition and use for forecasts, specifically rice yield for improvement of PAGASA forecast and PRiSM yield forecasts.

TABLE 16

THE ROK'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Soil carbon sequestration visualization and carbon credit methodology	Create a GHG emissions calculation platform that can be easily used by all citizens.	Learn from the COE on CSA about the operating principles of GHG emissions calculation website currently used by the COE and create a GHG emissions calculation platform that can be used in the ROK.
(2) N/A	N/A	N/A

TABLE 17

THAILAND'S TOP 2 PRIORITY CSA TECHNOLOGIES, CHALLENGES, AND POSSIBLE COLLABORATIONS WITH THE COE.

Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(1) Soil carbon sequestration visualization and carbon credit methodology	Develop the guidelines in economic crops production to get carbon credit for T-VER. Develop guidelines to support GHG emission reductions in the agricultural sector to be recognized both at national and international levels. Develop standard methodology for baselining for GHG emission reductions in the agricultural sector for major economic crops. Develop operational guidelines for obtaining carbon credit certification for crops in farming communities and the private sector. Scale up carbon credits schemes in the agricultural sector at both national and regional levels.	Transfer or develop a tool to quantify the effects of soil and water management on soil carbon and GHG emissions/specific carbon credit methodology in agriculture for Thailand or T-VER. Develop a tool to quantify the effects of soil and water management on soil carbon and GHG emissions at national and regional levels.

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Top 2 priority CSA technologies and topics	Challenges to be addressed or overcome	Possible collaborations with the COE on CSA
(2) Soil carbon sequestration	Develop a practical biochar production mechanism to decrease global warming and reduce burning from agriculture waste (rice, maize, sugarcane, etc.).	Biochar production and application to utilize (unutilized) organic materials and transform them, and obtain carbon credit.

Summary of the Third Survey Results

Results of the third survey can be summarized as follows:

- Five out of eight member economies (Bangladesh, India, ROC, ROK, and Thailand) have noted “Soil Carbon Sequestration Visualization and Carbon Credit Methodology” as their top priority.

- A possible pilot project regarding “Soil Carbon Sequestration Visualization and Carbon Credit Methodology” includes developing a soil carbon sequestration visualization tool to quantify the effects of biochar application and water management as well as developing and utilizing related methodologies to quantify the effects of biochar application and water management for carbon crediting.

- On the other hand, Pakistan, Indonesia, and the Philippines have stated “methane emission reductions in paddy fields through water management” as their top priority.

- A possible pilot project on “methane emission reductions in paddy fields through water management” includes implementing mid-season drainage (MSD) or prolonged MSD to support methane emission reductions from paddy soils as well as developing and utilizing related methodologies to quantify the effects of water management for carbon crediting.

PILOT PROJECT IN 2024

Target CSA Technology and Target Member Economy for a Pilot Project in 2024

One of the main activities of the COE on CSA in 2024 is to implement a pilot project in the APO member economy that has the greatest readiness for implementing CSA technologies developed by the COE on CSA. The survey conducted by the COE on CSA in eight member economies revealed that “Soil Carbon Sequestration Visualization and Carbon Credit Methodology” received the highest priority, as indicated by five member economies (Bangladesh, India, ROC, ROK, and Thailand). Therefore, the COE has decided to select “Soil Carbon Sequestration Visualization and Carbon Credit Methodology” as the target CSA technology for a pilot project in 2024.

In the survey, five member economies (Bangladesh, India, ROC, ROK, and Thailand) mentioned that a possible pilot project on “Soil Carbon Sequestration Visualization and Carbon Credit Methodology” includes developing soil carbon sequestration visualization tools to quantify the effects of biochar application and water management as well as to develop and utilize related methodologies to quantify the effects of biochar application and water management for carbon crediting. The COE has decided to select Thailand as the target member economy for a pilot project in 2024 based on the following reasons:

- Thailand has most of the important data needed for implementing and developing “Soil Carbon Sequestration Visualization and Carbon Credit Methodology.” Soil map data and meteorological data are particularly extensive.

- Thailand already has a national carbon credit system called T-VER, which is similar to J-Credit, a national carbon credit system of Japan. It would be possible for the COE on CSA to transfer carbon credit methodologies of J-credit, such as the methodology regarding biochar addition, to T-VER.

- The Thai government is making efforts to promote the application of biochar.

- The Thai government has a solid policy, the “Agricultural Action Plan for climate change 2023–27,” for tackling climate change challenges in the agricultural sector.

Goal of the Pilot Project in 2024 in Thailand and Planned Activities of the COE on CSA

The goal of the pilot project in 2024 is to build capacities of national resource persons and stakeholders in Thailand to enable the development of a Soil Carbon Sequestration Visualization Tool and the methodologies for carbon crediting.

The planned activities of the COE on CSA for the pilot project in 2024 in Thailand are shown in Figure 1. In April 2024, resource persons affiliated with the COE on CSA and working on “Soil Carbon Sequestration Visualization and Carbon Credit Methodology” will visit national resource

FIGURE 1

GOAL OF A PILOT PROJECT IN 2024 IN THAILAND AND PLANNED ACTIVITIES OF THE COE ON CSA.

The COE on CSA visited Thailand (April 2024)

- Detailed discussion with pilot national resource persons and stakeholders in Thailand
- Field visit

Workshop on methodology for carbon crediting (in Japan or Thailand)

- Workshop and information sharing on the development of methodology for carbon crediting

Note: National resource persons from other member economies besides Thailand are welcome to participate.

Workshop on Soil Carbon Sequestration Visualization Tool (in Japan or Thailand)

- Training for developing a soil carbon sequestration visualization tool
- Field visit

Note: National resource persons from other member economies besides Thailand are welcome to participate.

Online follow-up (Until February 2025)

Note: Revisit Thailand if necessary

Capacity building on the development of Soil Carbon Sequestration Visualization Tool and methodologies for carbon crediting in Thailand (March 2025).

persons and stakeholders in Thailand for detailed discussions, in-depth interviews, and field visits, to develop project details. To build capacities of national resource persons and stakeholders, two workshops are being planned. One workshop will be on the Soil Carbon Sequestration Visualization Tool, while the other workshop will be on methodologies for carbon crediting. In both the workshops, national resource persons from other member economies besides Thailand are welcome to participate. Online preparatory and follow-up are also planned. If necessary, resource persons affiliated with the COE on CSA will revisit national resource persons in Thailand.

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APPENDIX

Presentation slides of 8 national resource persons from 8 member economies for International Conference on Climate-smart Agriculture on 9 November 2023


Current Situation Regarding Climate Change
Mitigation and Adaptation in Bangladesh
Dr. S.M. Mofijul Islam, Senior Scientific Officer
Soil Science Division
Bangladesh Rice Research Institute (BRRI)
IRRI
USAID
FROM THE AMERICAN PEOPLE
IFDC
KGF


Introduction
❖ Food security
❖ Rice and GHG emissions and absorption
❖ GHG effect and Global Warming
❖ Likely impact in agriculture
❖ Carbon credit
Electricity and heat prod, 24%
Industry 21%
Transport 14%
Buildings 6.0%
FOLU 11%
Other energy 11%
Agriculture 14%

NDC 2021 and BUR-1

Nationally Determined Contribution (NDC) 2021

Bangladesh contribute 169.05 MT CO_2 eq GHG globally

- **Energy sector (93.09 MT CO_2 eq) is the largest contributor to total GHG emissions**
- **Agriculture and livestock contribute 46.24 MT CO_2 eq GHG (27% of total emission)**
- **Under the BAU scenario, total GHG emission would increase from 169.05 MT to 409.4 MT CO_2 eq by 2030.**
- **It is expected to reduce CH_4 emissions by 17% in 2030 than BAU scenarios.**

Biennial Update Report-1 (BUR-1)

- **GHG emissions from agriculture (61,865 Gg CO_2eq in 2019)**
- **CH4 emissions from rice soils (15,239 Gg CO_2eq in 2019)**
- **N2O emission from both direct and indirect emissions (8098 Gg CO_2eq in 2019)**

Survey activities

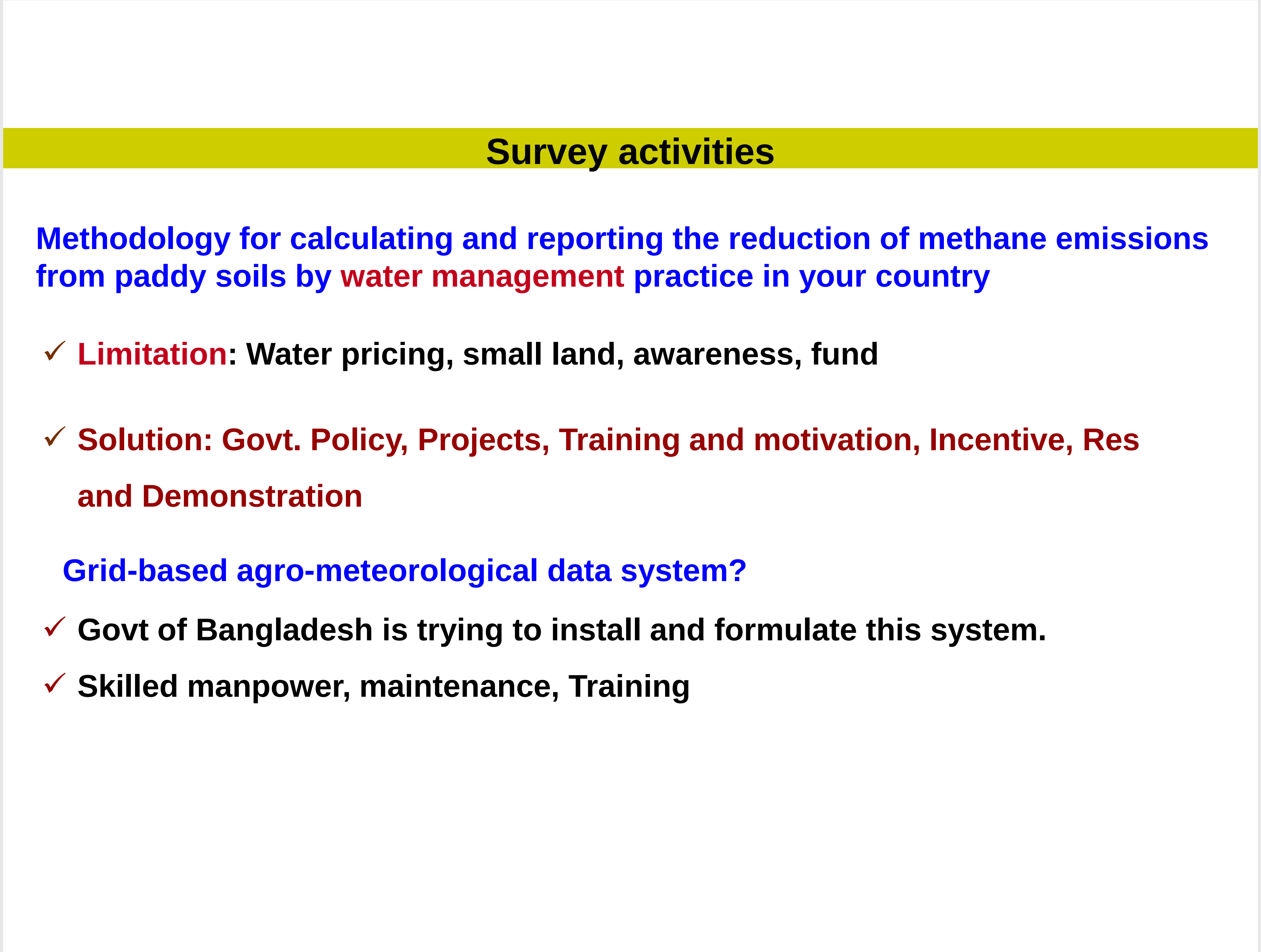
Government polices to reduce CH_4 emissions-

- ✓ **Dissemination of AWD**
- ✓ **Balanced fertilization/Fertilizer deep placement**
- ✓ **Integrated nutrient management**
- ✓ **Develop and disseminate climate-smart rice varieties**
- ✓ **Implement precision and conservation agriculture**

Carbon sequestration and carbon credit mechanism?

Carbon sequestration or C sequestration visualization tool?

- ✓ **Limitation: high costs, low yield, organic amendment, biochar.**
- ✓ **Solution: Projects, Training, Incentive, and Demonstration**


Survey activities
Methodology for calculating and reporting the reduction of methane emissions from paddy soils by water management practice in your country
✓ Limitation: Water pricing, small land, awareness, fund
✓ Solution: Govt. Policy, Projects, Training and motivation, Incentive, Res and Demonstration
Grid-based agro-meteorological data system?
✓ Govt of Bangladesh is trying to install and formulate this system.
✓ Skilled manpower, maintenance, Training


Why fertilizer deep placement?
❖ It increases NUE
❖ It saves N fertilizer use
❖ It increases rice yield
❖ It minimizes negative environ. consequences
Challenges
❖ Lack of UDP applicator
❖ High labor cost
❖ Suffer back pain
❖ Knowledge gap
❖ Topography
Normal Guti 0.9 g
Mega Guti 1.8 g
Mega Guti 2.7 g

Why alternate wetting and drying irrigation?

- It improves WUE (saves 4-5 numbers of irrigation)
- It saves 25-30% fuel cost
- It does not decrease rice yield
- It increases FUE
- It improves rice root morphology, physiology
- It enhances soil urease activity
- It increase O_2 conc.
- It increases NO^-_3 content in rhizosphere soil
- It reduces grain As and Pb concentration
- It is carbon-friendly technology

Farmers' perception about AWD

- Yield increase about 15 to 20%
- It saves 4-5 number of irrigation
- It is cost effective

Suggestions offered by the farmers

- Water pricing/fixed seaso
- Knowledge gap/Training
- Media coverage
- Incentive
- Government intervention

CH_4 and N_2O gas measurement

- **Closed gas chamber technique**
- **Gas sampling was done once a week at 15 min interval (0,15 and 30 min)**
- **Gas concentration was measured using GC Analyzer equipped with FID and ECD**
- **Emission rates were determined from the slope of the linear regression curve of CH_4 or N_2O concentration against the chamber closing time.**

Research Findings

The effects of fertilizer × water regimes on rice yield, total nitrogen uptake (TNU) and recovery efficiency of N (RE_N) in the Boro (dry) season.

Year	Fertilizer management	Grain yield (t ha^{-1})		TNU (kg ha^{-1})		RE_N (%)	
		Mean of 2 water regimes		Mean of 2 water regimes		Mean of 2 water regimes	
Fertilizer and water regimes interaction							
Mean	Control-N0	2.79c		34.70d		-	
	UDP-N78	5.88a		99.07a		82.5a	
	PU-N78	4.86b		75.41c		52.2c	
	IPNS-N78	5.60a		88.84b		69.4b	
Effects of water regimes		AWD	CF	AWD	CF	AWD	CF
Mean	Mean	4.75A	4.82A	72.81B	76.20A	66.3A	69.8A
ANOVA (p values)							
Water regimes (W)		0.1382		0.0200		0.3051	
Fertilizer (F)		0.0000		0.0000		0.0000	
Year (Y)		0.5891		0.1172		0.0824	
W × F		0.9788		0.6786		0.6993	
W × Y		0.0442		0.0132		0.6459	
F × Y		0.7086		0.0819		0.2760	
W × F × Y		0.9100		0.9760		0.9652	

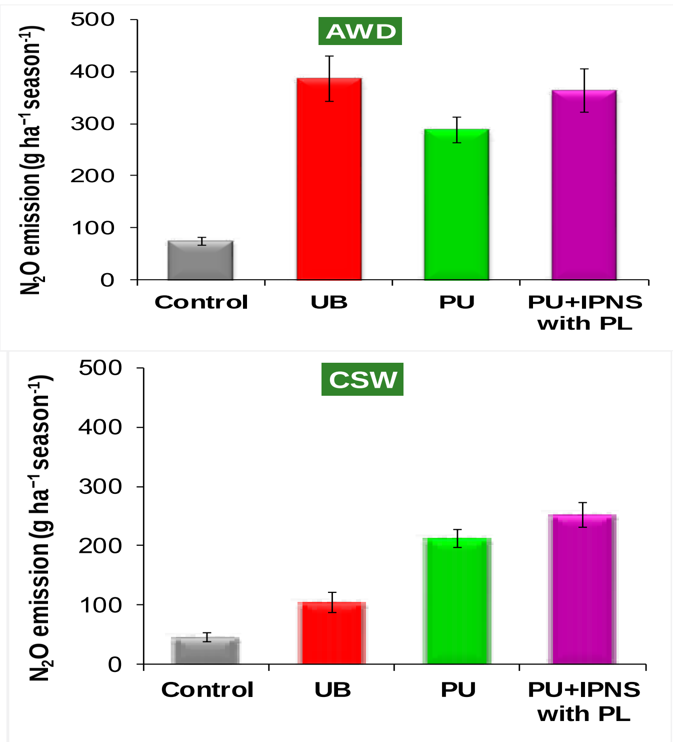

Agricultural Water Management

Research paper

Different nitrogen rates and methods of application for dry season rice cultivation with alternate wetting and drying irrigation: Fate of nitrogen and grain yield

IF: 6.61

Nitrous oxide (N_2O) emission



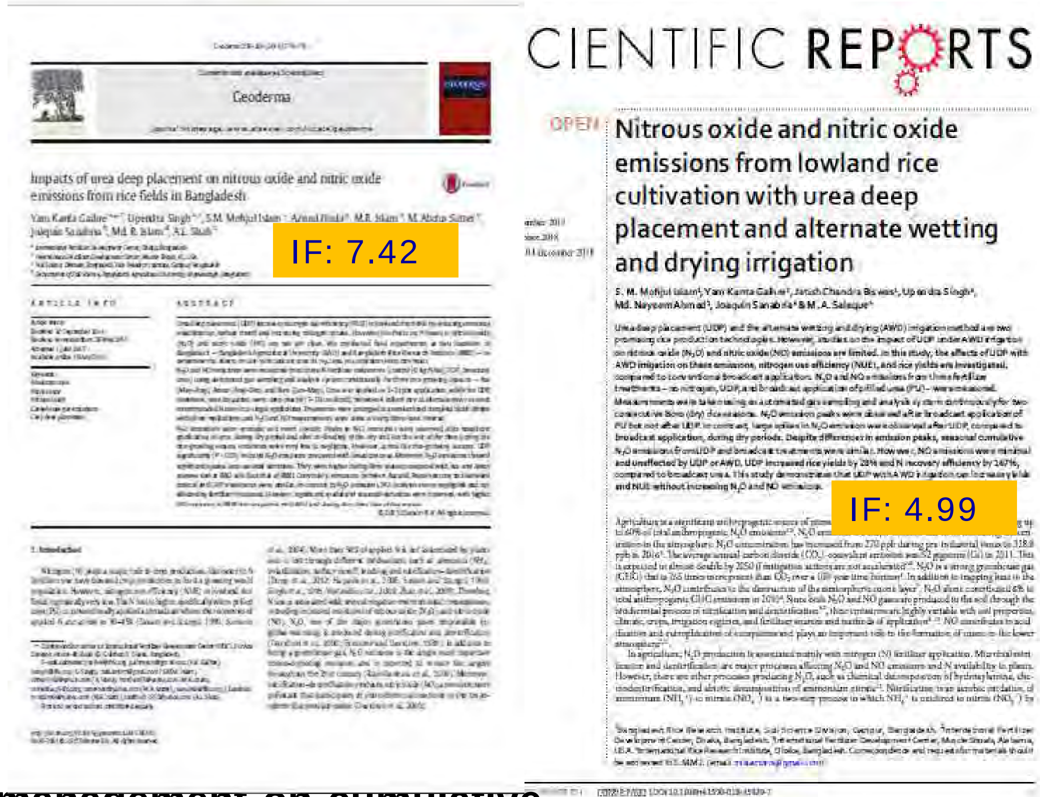
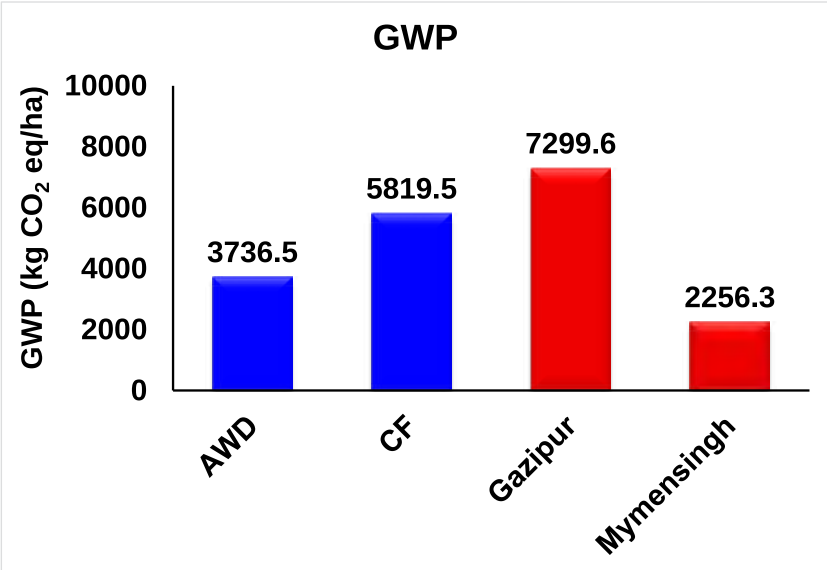
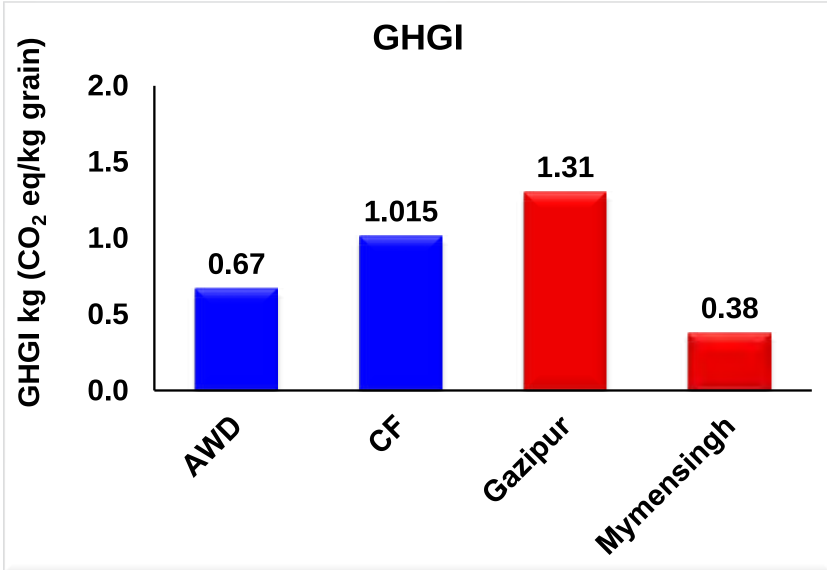


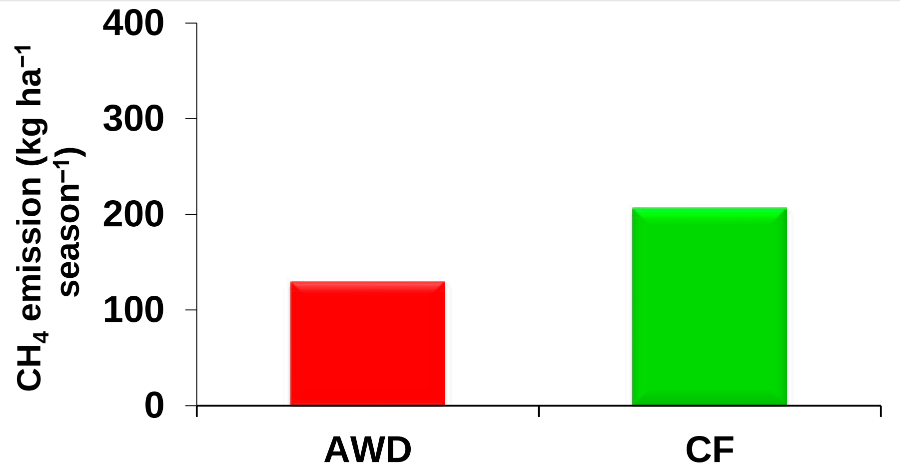
Fig. Effects of water and fertilizer management on cumulative N_2O emission during Boro season at BRRI farm, Gazipur.

Global warming potential and Greenhouse gas intensity





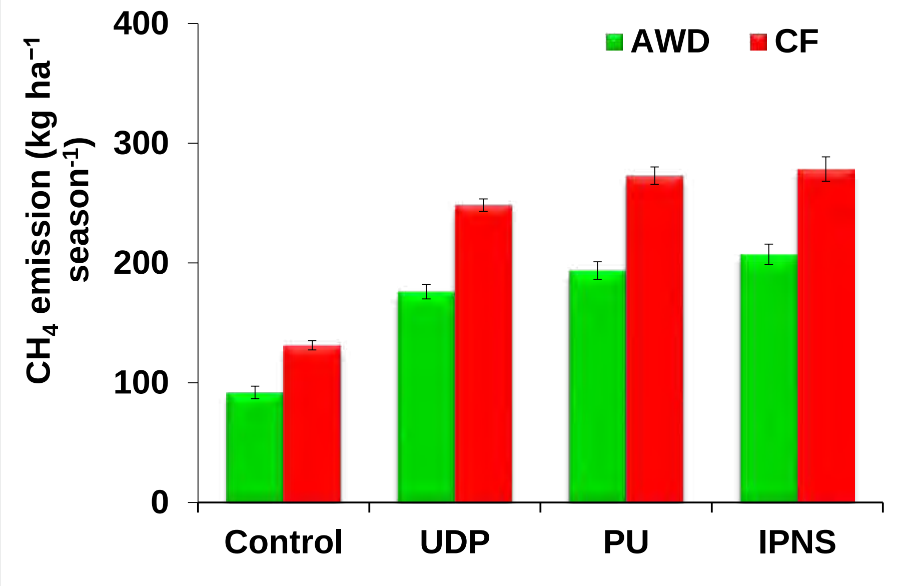
Irrigation regimes on CH_4 emissions



Mitigation potential of AWD for 4.8 M ha	
Area (%)	GWP (MT CO_2 eq/ Boro)
100%	9
75%	7
50%	4
25%	2

AWD reduces CH_4 emissions 37% compared to CF during Boro (dry) season

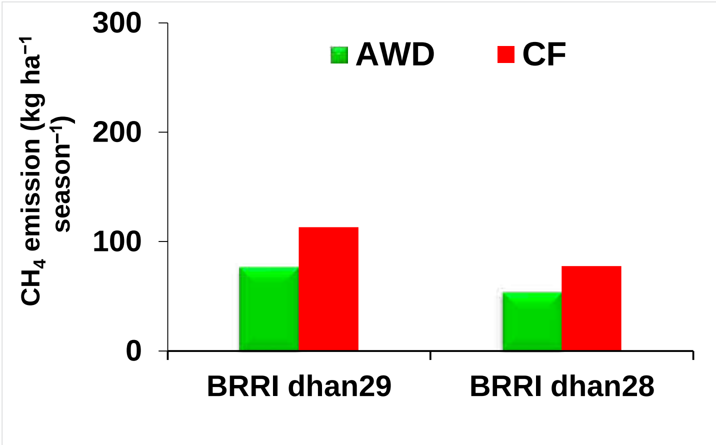
UDP on CH_4 emissions



Mitigation potential of UDP for 11.6M ha	
Area (%)	GWP (M ton CO_2 eq)
100%	8
75%	6
50%	4
25%	2

UDP significantly reduced cumulative CH_4 emissions by 9% and 15 under AWD irrigation, and 9% and 11% under CF condition compar to PU and IPNS treatments, respectively

Rice cultivars and CA on CH_4 emissions



Mitigation potential of SRV for 11.6M ha	Area (%) 11.6 M ha	100%	75%	50%	25%
	GWP (Million ton CO_2 eq)	5	4	2	1

In Boro, BRRI dhan28 reduced by 32% compared to BRRI dhan29 under CF conditions.

In Aman, BRRI dhan75 reduced by 22% and 16% compared to BR11 and BRRI dhan49 under AWD, respectively.

Effects of AWD and UDP on carbon credit

Treat	GWP, CO_2eq (kg/ha)	Carbon credit (ton CO_2 eq reduction/ha) due to AWD	Carbon credit (US$)	Rice cultivated area in Boro (million ha)	Total claimable amount (million US$)
AWD	4188	1.89	68	4.8	305
CF	6080	-	-	-	-
UDP	5825	0.74	27	4.8	120
PU	6567	-	-	-	-

The US government has endorsed a ‘central’ estimate cost of $36 per ton of reduction of CO_2e from rice fields

Conclusions

Nitrogen Management

- UDP significantly increased rice yield compared to PU, additionally it could save N by 25-30% without any yield penalty.
- UDP showed higher N_2O fluxes than PU in AWD conditions, while UDP greatly reduced N_2O fluxes over PU in CSW practice.
- UDP significantly reduced CH_4 emission than PU in both irrigation regimes

Water Management

- AWD practice showed comparable rice yield with CF irrigation in safe AWD principle.
- Across the N mgt. AWD irrigation reduced ca. 37% GWP over CF condition.

Conclusions (Contd.....)

Carbon credit

- AWD irrigation might be a good option for claiming carbon credit from the global carbon market in Boro season.

Treatment	Claimable amount (million USD) due to AWD and UDP			
	100% area	75% area	50% area	25% area
AWD	305	229	152	76
UDP	120	90	60	30

However, these observations should be checked at farmer's field of different AEZ in BD.

Future Research

- Modified N fertilizers like neem coated urea for increasing nutrient use efficiency and mitigation of GHG emissions from rice fields
- Quantify methane emission under varied soil conditions both in Boro and T. Aman crops throughout the country
- Screening of high-yielding rice varieties with low emitted methane emissions
- Use of household biomass ash and biochar to mitigate methane emission from rice field
- Precision agriculture, conservation agriculture or direct-seeded rice or nano-fertilizer
- Suppression of methanogenic bacteria

Citation, total IF and paper review

Dr. S.M. Mofijul Islam

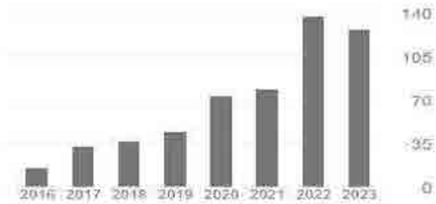
Bangladesh Rice Research Institute
Verified email at brri.gov.bd
Greenhouse Gas Emissions   Soil Fertility and Plant Nutri...   Nutrient Management
Water Management   Agronomy

FOLLOWING

TITLE	CITED BY	YEAR
Impacts of urea deep placement on nitrous oxide and nitric oxide emissions from rice fields in Bangladesh YK Gaihre, U Singh, SMM Islam, A Huda, MR Islam, MA Satter, J Sanabria, ... Geoderma 259, 370-379	121	2015
Different nitrogen rates and methods of application for dry season rice cultivation with alternate wetting and drying irrigation: Fate of nitrogen and grain yield SMM Islam, YK Gaihre, JC Biswas, MS Jahan, U Singh, SK Adhikary, ... Agricultural Water Management 196, 144-153	66	2018

Cited by   VIEW ALL

	All	Since 2018
Citations	605	502
h-index	11	10
i10-index	14	11



SN	Journal name	Publisher	IF_2022
1	Geoderma	Elsevier	7.422
2	Agricultural water management	Elsevier	6.611
3	Nutrient cycling in agroecosystems	Springer	3.866
4	Nutrient cycling in agroecosystems	Springer	3.866
5	Science of the total environment	Elsevier	10.75
6	Scientific reports	Nature Portfolio	4.996
7	Journal of environmental management	Elsevier	8.910
8	Sustainability	MDPI	3.889
9	Sustainability	MDPI	3.889
10	Soil Systems	MDPI	3.50
	Sum		57.69

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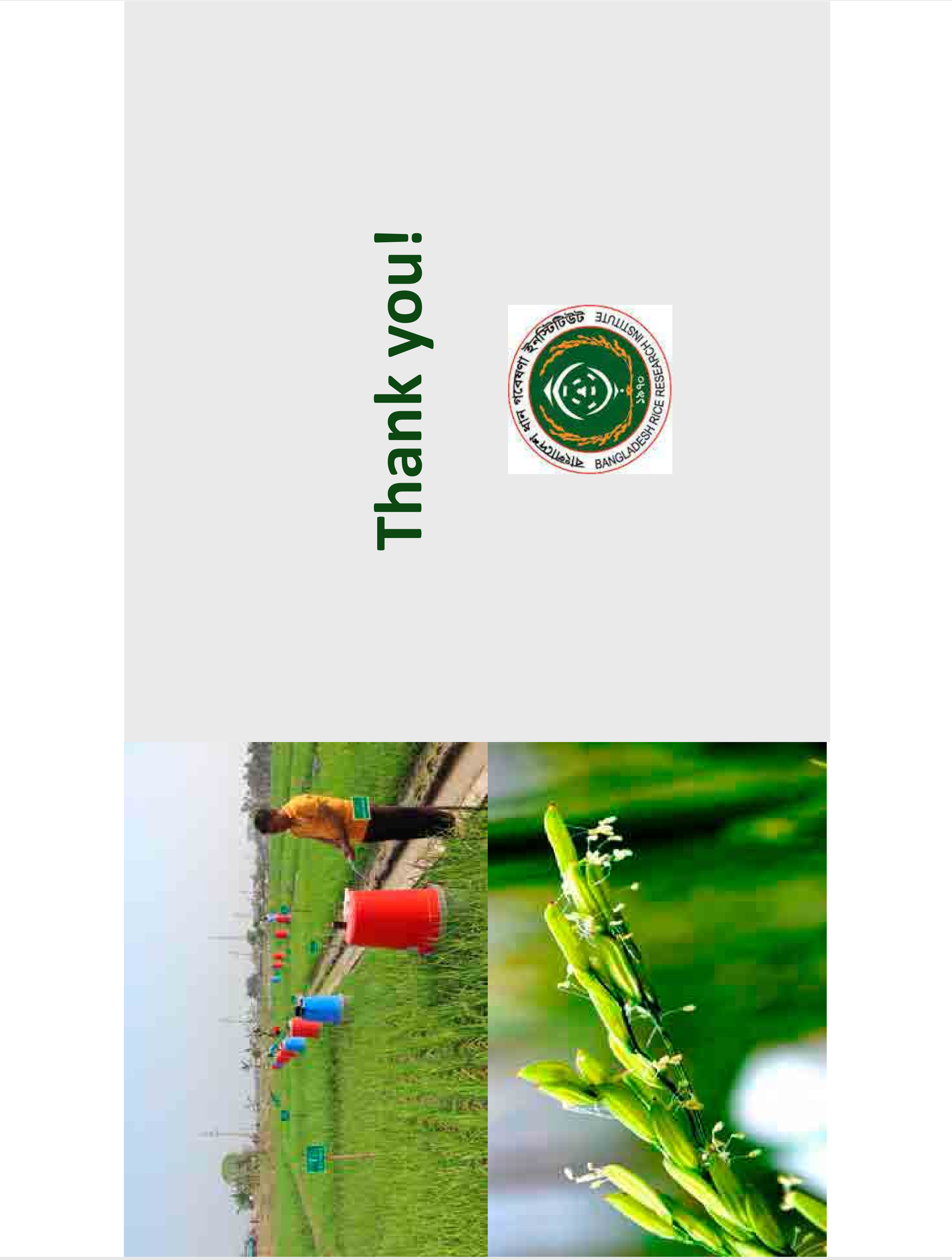
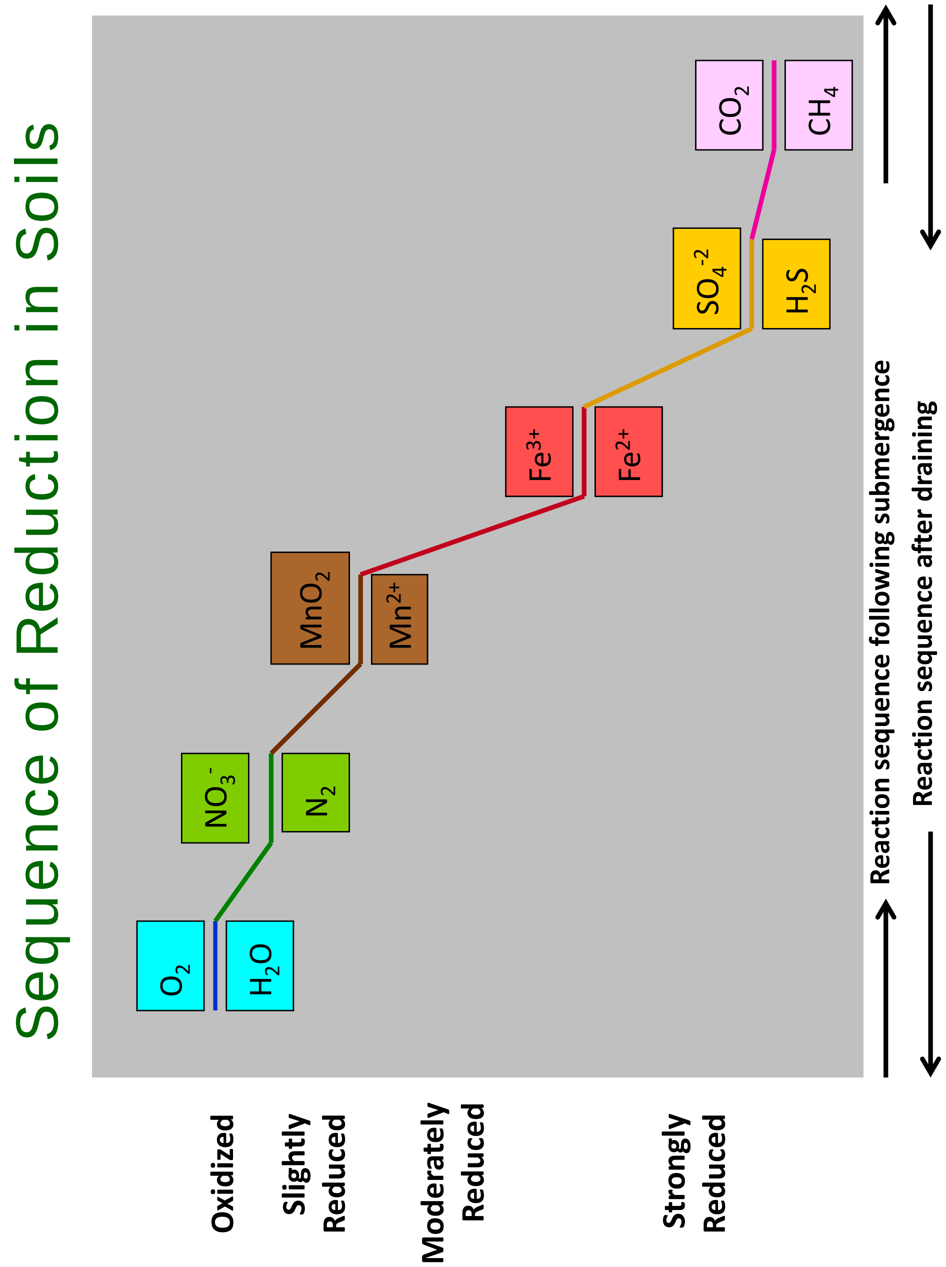
Verified peer reviews: 106

National and International Awards

Acknowledgement


Thank you!
BANGLADESH RICE RESEARCH INSTITUTE


Sequence of Reduction in Soils
O2
H2O
NO3 -
N2
MnO2
Mn2+
Fe3+
Fe2+
SO4 -2
H2S
CO2
CH4
Reaction sequence following submergence
Reaction sequence after draining
Oxidized
Slightly Reduced
Moderately Reduced
Strongly Reduced


Need and Readiness Assessment Survey for Implementing Climate change Mitigation and Adaptation Technologies in Agriculture
Semon Wu
1

Contents:

- Introduction myself and Taiwan Ecological Farming Development Association
- Phased Goal and Actions Toward Net-Zero Transition of Taiwan
- Smart Agriculture Program of Taiwan

2

- Committee of Experts of Taiwan Ecological Farming Development Association, 01/2023-till now

- Professor and Director of Department of Life Science, 08/2017-till now

-Responsible for overseeing and managing the academic and administrative affairs of the Department of Life Science at Chinese Culture University.

- Consultant of License Biotechnology Co., Ltd., 10/2019-till now

3

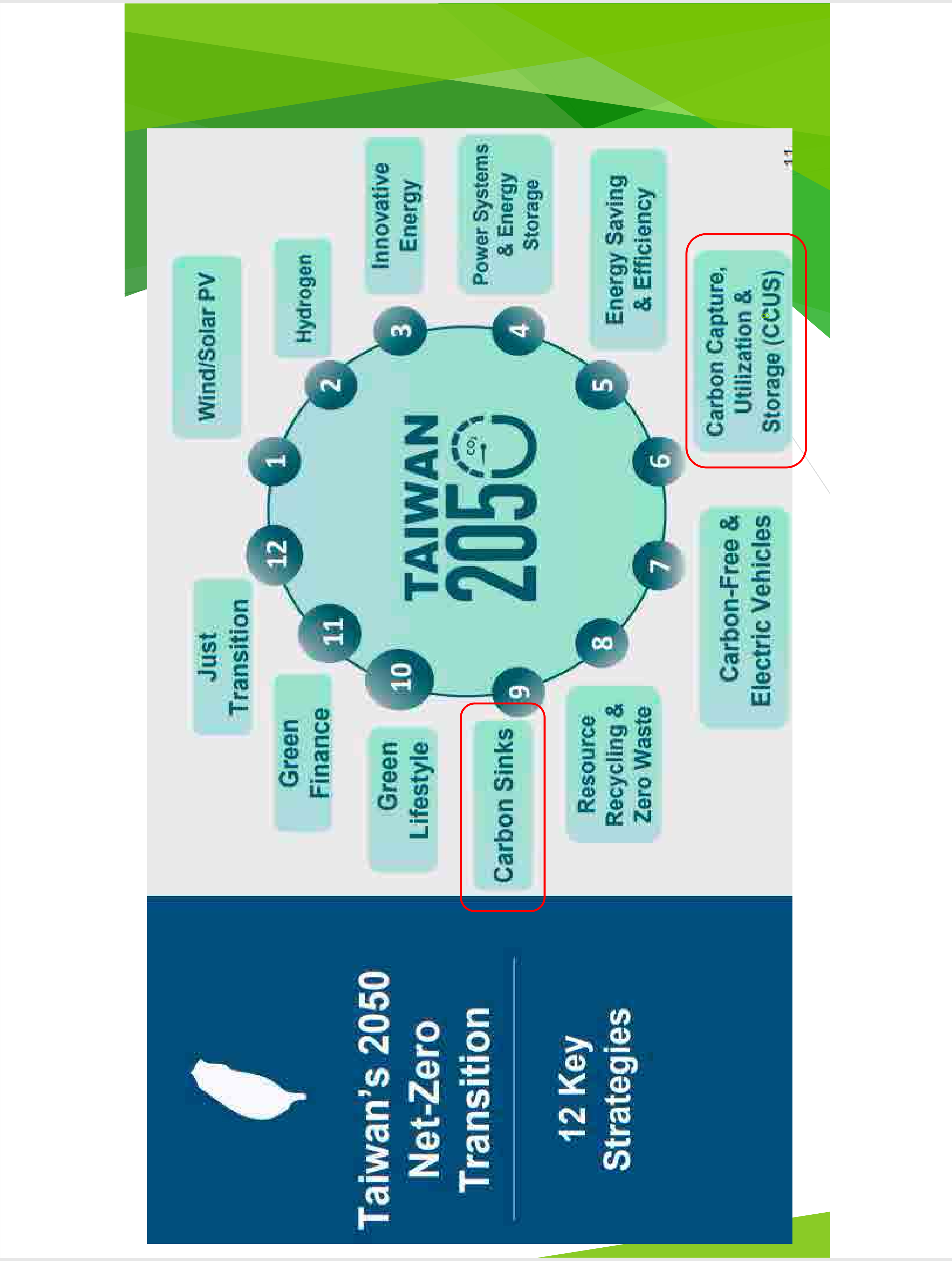

Taiwan Ecological Farming Development Association
A nonprofit organization
Scholars and experts from public and private organization
Provide various carbon sink measurement methods to the government
Verification of green ecological agricultural products and agricultural product processing
Provide comprehensive plant nutrition cultivation and consultation (increase carbon capture and carbon sink)
Encourage farmers to adopt ecological farming
4

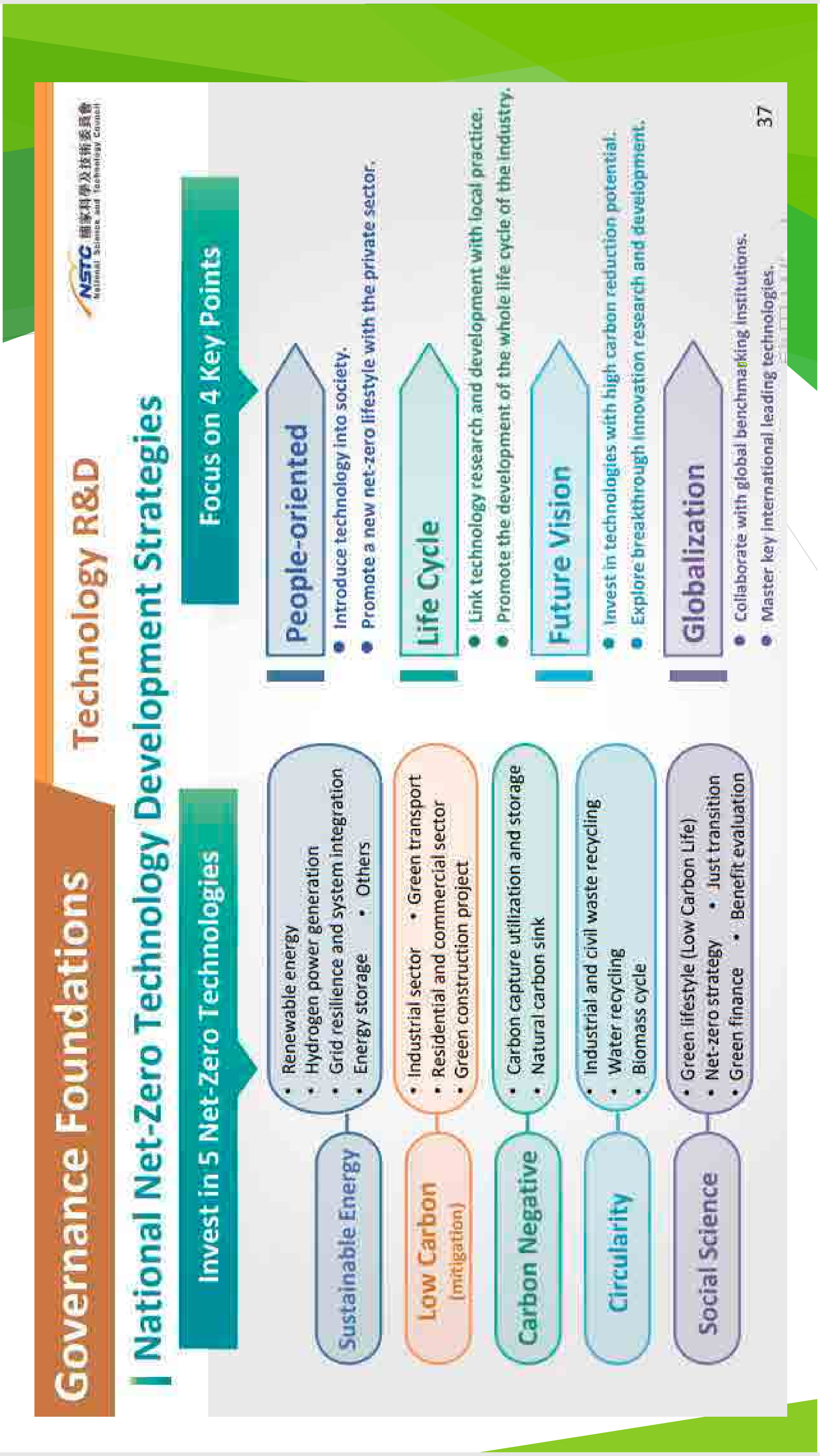
Phased Goal and Actions Toward Net-Zero Transition of Taiwan

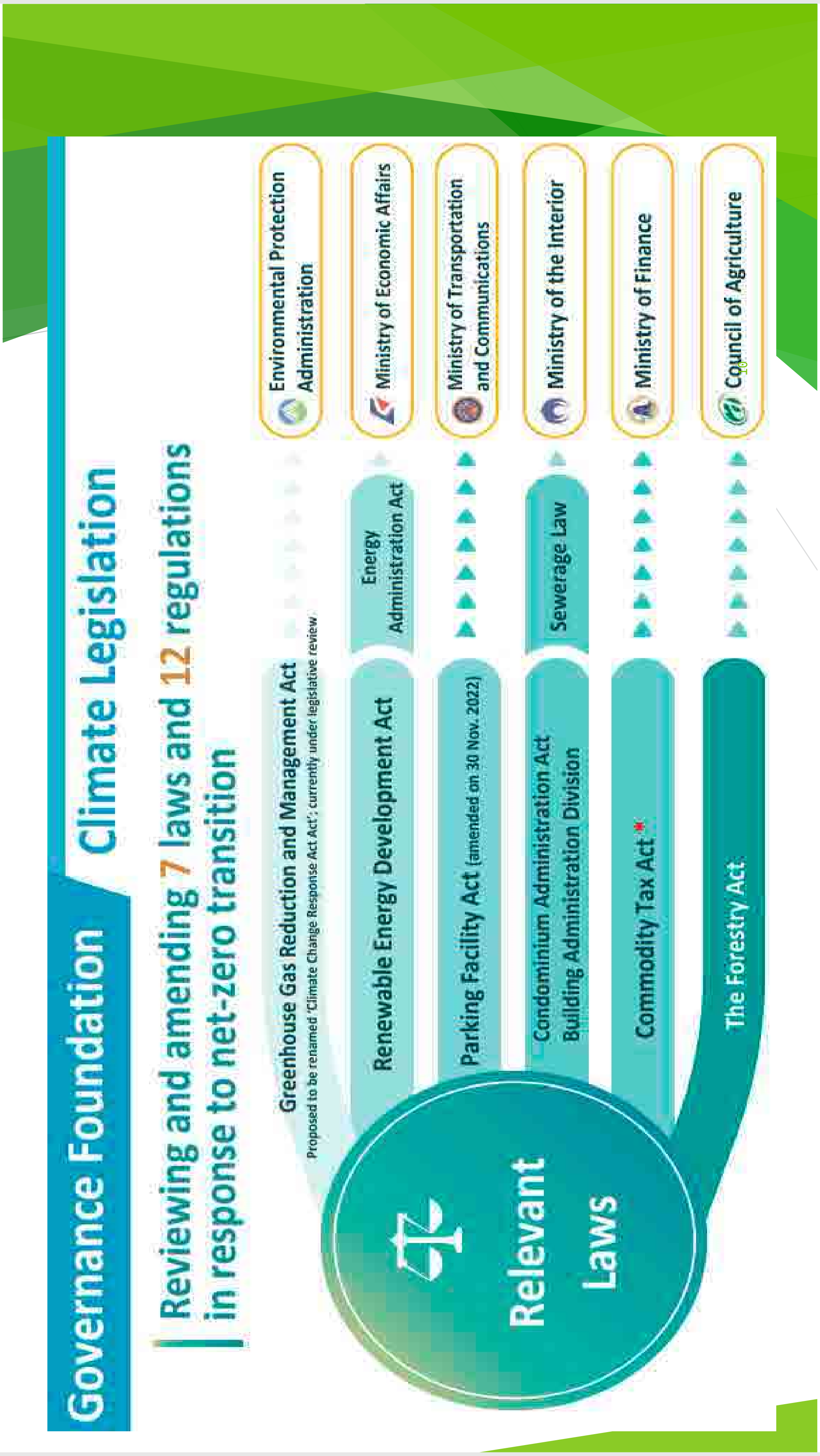
5

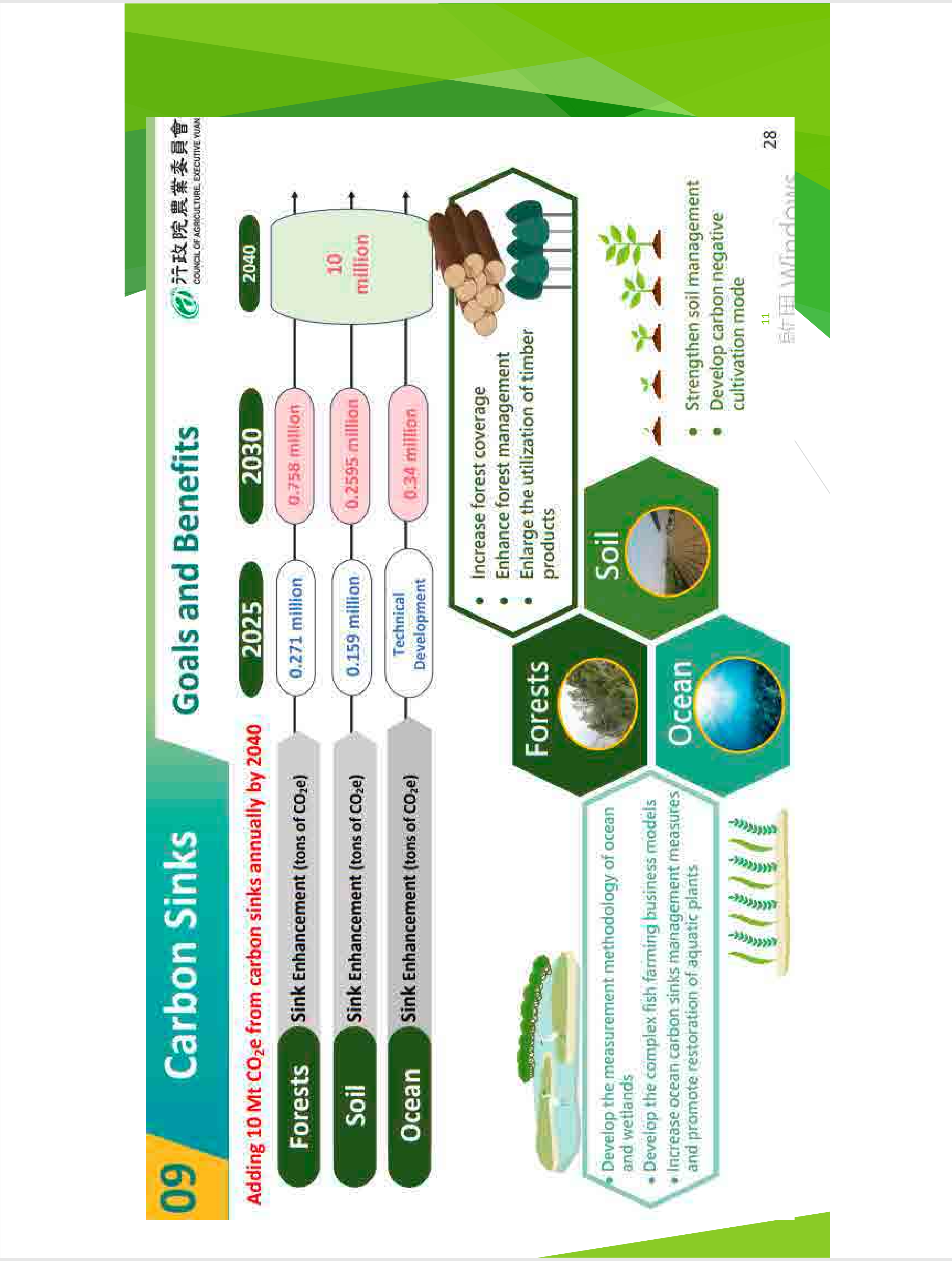

2050 Net-Zero Pathway Promotion Process
TAIWAN 2050 Milestones
Apr. 22 2021
Aug. 30 2021
March 30 2022
DEC. 2022
Declaration
President Tsai
Taiwan's 2050 Net-Zero Transition Target
Legislation
Premier Su
Amendments to the GHG Reduction and Management Act (revised as the Climate Change Response Act) including 2050 Net-Zero Emissions Target
Planning
Promulgation
Taiwan's Pathway to Net-Zero Emissions in 2050
Implementation
Official Release
Taiwan's 2050 Net-Zero Transition 12 Key Strategies


Taiwan's 2050 Net-Zero Transition
4 Tansition + 2 foundations
Strategies for Transition
Energy transition
Wind power, solar PV, system integration & energy storage, new energies (hydrogen, deep geothermal, ocean)
Industrial transition
High-tech, traditional manufacturing, construction, transportation, electrification, food, agriculture and forestry, resource recycling
Lifestyle transition
Green transportation, electrified environment, residential and commercial lifestyle (behavior change)
Social transition
Just transition, public participation (social dialogue)
Foundations in Governance
Technology R&D
Net-zero technology
Negative-emission technology
Climate Legislation
Regulations and policy
Carbon pricing and green finance


Taiwan's 2050 Net-Zero Transition
12 Key Strategies
TAIWAN 2050
1
2
3
4
5
6
7
8
9
10
11
12
Wind/Solar PV
Hydrogen
Innovative Energy
Power Systems & Energy Storage
Energy Saving & Efficiency
Carbon Capture, Utilization & Storage (CCUS)
Carbon-Free & Electric Vehicles
Resource Recycling & Zero Waste
Carbon Sinks
Green Lifestyle
Green Finance
Just Transition


Governance Foundations
Technology R&D
NSTC 國家科學及技術委員會 National Science and Technology Council
National Net-Zero Technology Development Strategies
Invest in 5 Net-Zero Technologies
Sustainable Energy
Renewable energy
Hydrogen power generation
Grid resilience and system integration
Energy storage
Others
Low Carbon (mitigation)
Industrial sector
Green transport
Residential and commercial sector
Green construction project
Carbon Negative
Carbon capture utilization and storage
Natural carbon sink
Circularity
Industrial and civil waste recycling
Water recycling
Biomass cycle
Social Science
Green lifestyle (Low Carbon Life)
Net-zero strategy
Just transition
Green finance
Benefit evaluation
Focus on 4 Key Points
People-oriented
Introduce technology into society.
Promote a new net-zero lifestyle with the private sector.
Life Cycle
Link technology research and development with local practice.
Promote the development of the whole life cycle of the industry.
Future Vision
Invest in technologies with high carbon reduction potential.
Explore breakthrough innovation research and development.
Globalization
Collaborate with global benchmarking institutions.
Master key international leading technologies.
37


Governance Foundation
Climate Legislation
Reviewing and amending 7 laws and 12 regulations in response to net-zero transition
Relevant Laws
Greenhouse Gas Reduction and Management Act
Proposed to be renamed 'Climate Change Response Act Act'; currently under legislative review
Renewable Energy Development Act
Energy Administration Act
Parking Facility Act (amended on 30 Nov. 2022)
Condominium Administration Act
Building Administration Division
Sewerage Law
Commodity Tax Act *
The Forestry Act
Environmental Protection Administration
Ministry of Economic Affairs
Ministry of Transportation and Communications
Ministry of the Interior
Ministry of Finance
Council of Agriculture


09 Carbon Sinks
Goals and Benefits
行政院農業委員會
COUNCIL OF AGRICULTURE, EXECUTIVE YUAN
Adding 10 Mt CO2e from carbon sinks annually by 2040
2025
2030
2040
Forests
Sink Enhancement (tons of CO2e)
0.271 million
0.758 million
Soil
Sink Enhancement (tons of CO2e)
0.159 million
0.2595 million
Ocean
Sink Enhancement (tons of CO2e)
Technical Development
0.34 million
10 million
Increase forest coverage
Enhance forest management
Enlarge the utilization of timber products
Forests
Soil
Ocean
Strengthen soil management
Develop carbon negative cultivation mode
Develop the measurement methodology of ocean and wetlands
Develop the complex fish farming business models
Increase ocean carbon sinks management measures and promote restoration of aquatic plants
28


09
Carbon Sinks
Strategies
行政院農業委員會
COUNCIL OF AGRICULTURE, EXECUTIVE YUAN
Technological research and development
For setting the foundation of carbon sinks, continue scientific and technological research and development on the three major paths of carbon sinks - soil, forests and ocean - before 2050.
Complete the inventory report of national greenhouse gas emissions
Develop innovative technology to increase carbon sinks
Promote the management of conservation
Methodology and incentive mechanism for establishing carbon rights conversion
Goal in 2024
Carbon sinks to increase by 10 Mt CO_2e
Develop carbon sinks and establish a benefit-sharing mechanism
Protect the rights of residents and all people as wetland, ocean and forest resources are protected.
Increase carbon sink benefits with multiple models:
Set up sharing mechanisms by introducing multi-sources, such as incentives and rewards, carbon rights mechanism, and agricultural ESG.
12

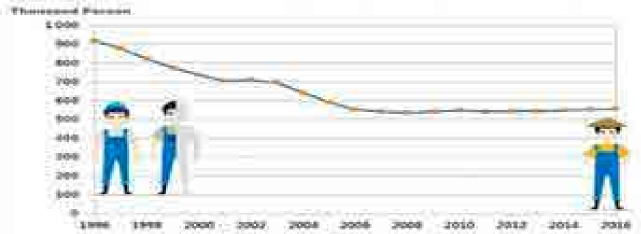
13

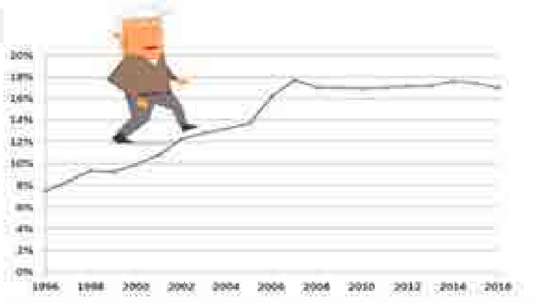
Smart Agriculture Program of Taiwan

Agricultural challenges

severe weather

Agricultural manpower

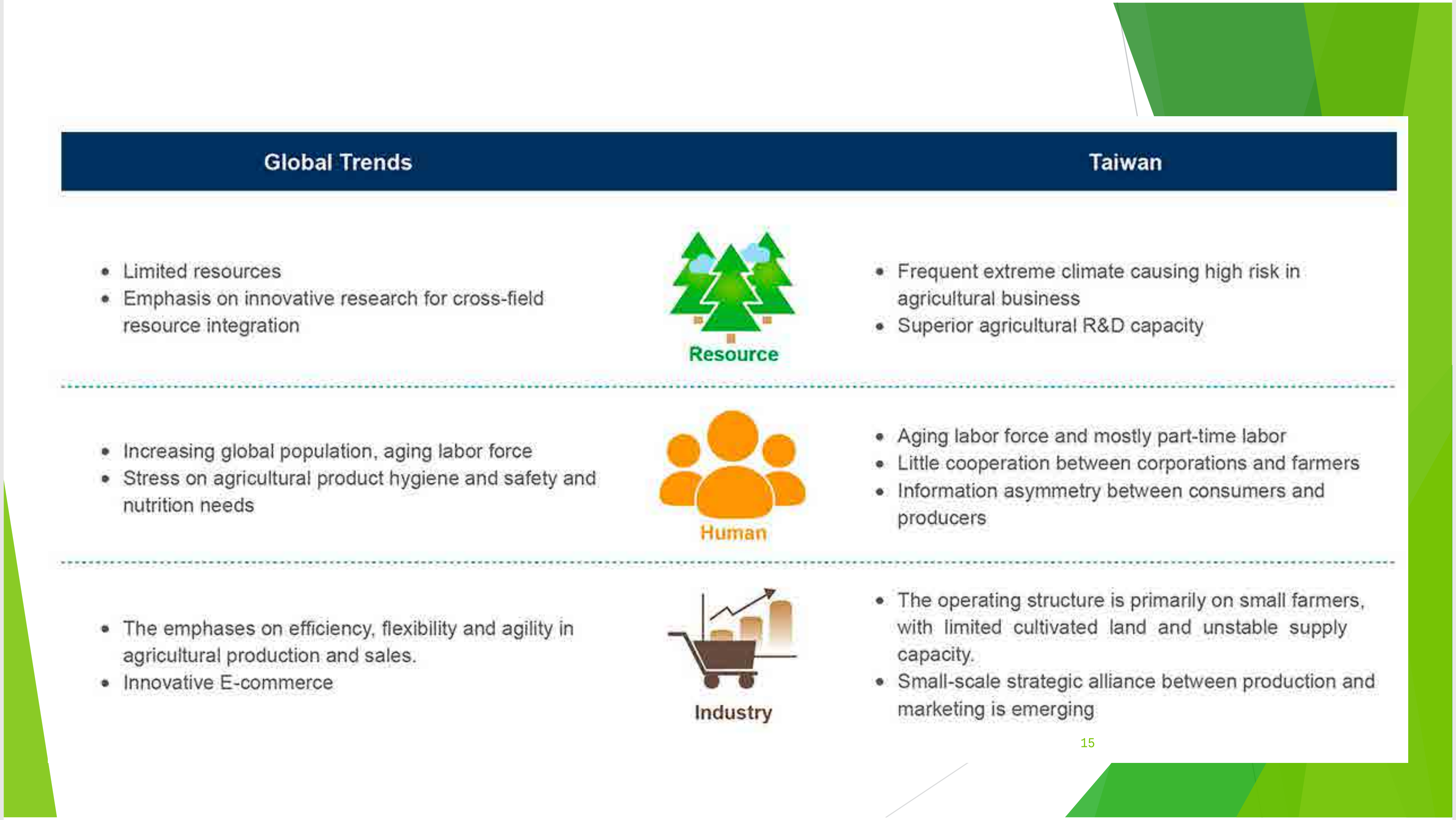




Percentage of agricultural workers over the age of 65

The calorie-based food self-sufficiency rate for Taiwan was only 31.01% in 2016

14

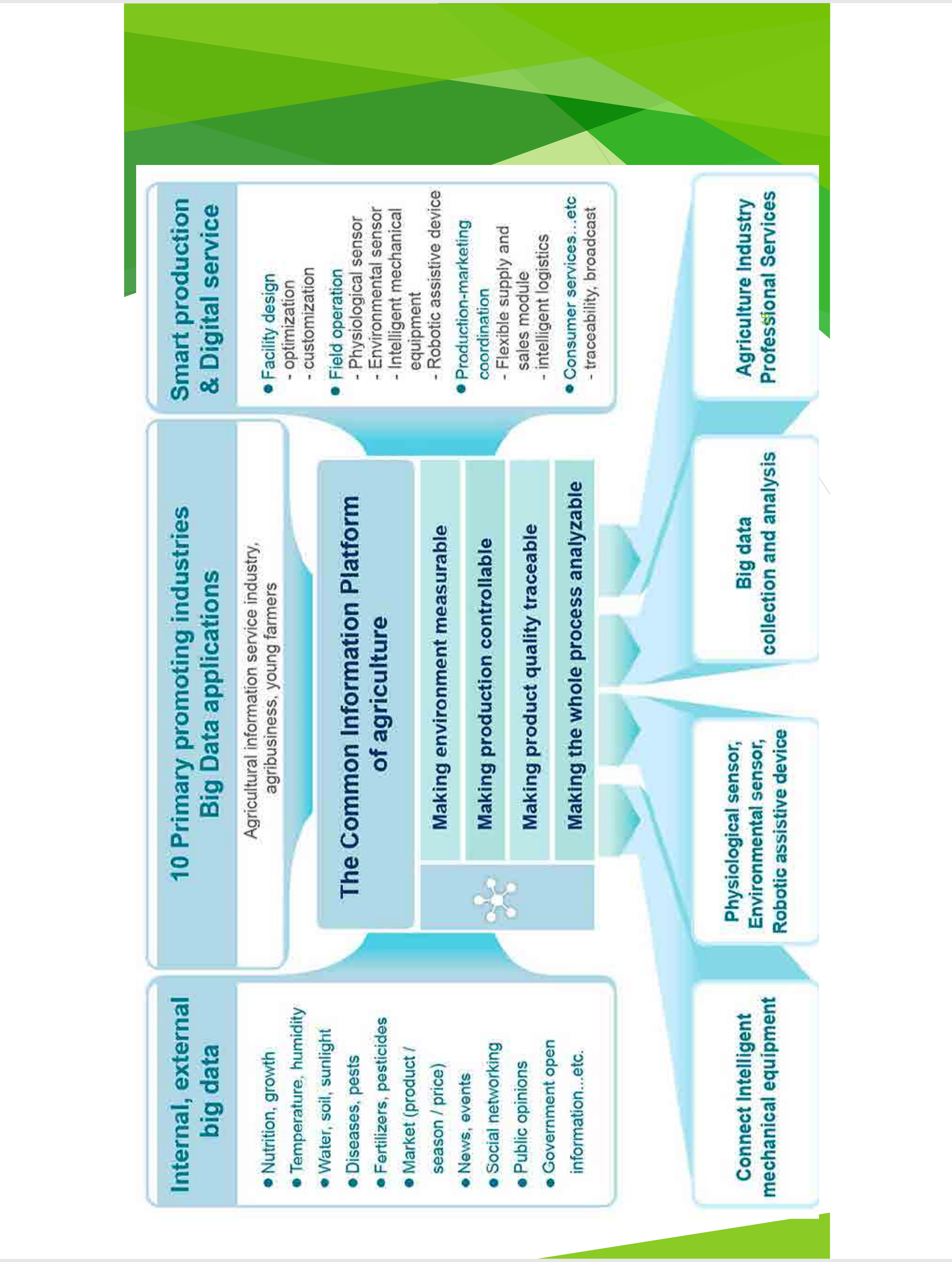


Global Trends		Taiwan
• Limited resources • Emphasis on innovative research for cross-field resource integration	Resource	• Frequent extreme climate causing high risk in agricultural business • Superior agricultural R&D capacity
• Increasing global population, aging labor force • Stress on agricultural product hygiene and safety and nutrition needs	Human	• Aging labor force and mostly part-time labor • Little cooperation between corporations and farmers • Information asymmetry between consumers and producers
• The emphases on efficiency, flexibility and agility in agricultural production and sales. • Innovative E-commerce	Industry	• The operating structure is primarily on small farmers, with limited cultivated land and unstable supply capacity. • Small-scale strategic alliance between production and marketing is emerging

15

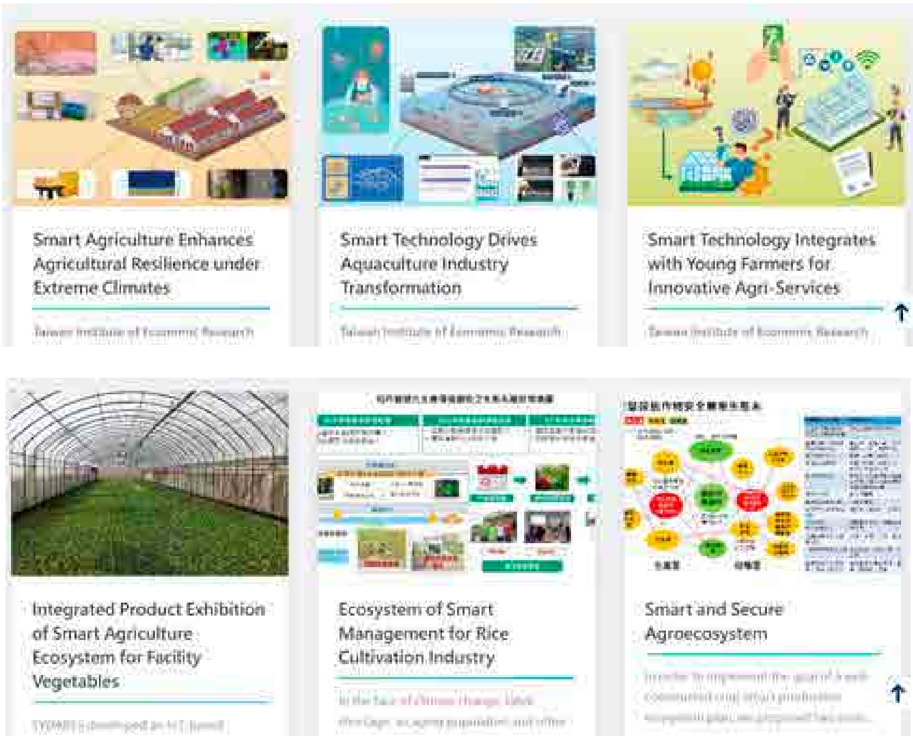

The ministry of Agriculture (MOA) implements the Smart Agriculture Program with two main strategies:
Smart Production
Digital Service
To systematically link up agricultural production, marketing, and consumer market
By introducing sensors, smart devices, Internet of Things (IoT) and big data analysis, it is possible to achieve digital knowledge, smart production, optimized products, convenient operation, and tracing
which facilitate the establishment of smart agricultural production and marketing, as well as digital service system.
16
https://www.intelligentagri.com.tw/en


Vision
Creating a better working environment for agricultural workers
To develop more efficient agricultural production models
Objective
Efficiency
Safety
Low Risk
To boost efficiency and performance
To improve safety and enhance the quality
To improve risk management
Strategy
Smart Production
Digital Service
People
Smart Farmers Union
Group cultivation
Object
Intelligent mechanical equipment
Robotic assistive device
Robotic arms
UAV
Intelligent facilities
Sensors
Technology
IoT, Big Data, AI
Common information platform, AI-OISP innovative R&D platform
Intelligent monitoring/ inspection system, intelligent logistics, intelligent integrated environmental sensing system
Traceability service
Field
Pilot industries
Demonstration farms
Cross-field cooperation between agriculture and industry
17


Internal, external big data
Nutrition, growth
Temperature, humidity
Water, soil, sunlight
Diseases, pests
Fertilizers, pesticides
Market (product / season / price)
News, events
Social networking
Public opinions
Government open information...etc.
10 Primary promoting industries Big Data applications
Agricultural information service industry, agribusiness, young farmers
Smart production & Digital service
Facility design
- optimization
- customization
Field operation
- Physiological sensor
- Environmental sensor
- Intelligent mechanical equipment
- Robotic assistive device
Production-marketing coordination
- Flexible supply and sales module
- intelligent logistics
Consumer services...etc
- traceability, broadcast
The Common Information Platform of agriculture
Making environment measurable
Making production controllable
Making product quality traceable
Making the whole process analyzable
Connect Intelligent mechanical equipment
Physiological sensor, Environmental sensor, Robotic assistive device
Big data collection and analysis
Agriculture Industry Professional Services


The Common Information Platform
Rice industry
Agricultural facility industry
Orchid industry
Seedling industry
Mushroom industry
Industries of the major export crops
Livestock
Poultry industry
Aquaculture industry
Marine fishery industry
19

2023 Smart Agricultural Achievement



https://www.intelligentagri.com.tw/en/xmdoc?xsmsid=0N240562719482009359

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International Conference on Smart Agriculture
October 31 & November 1, 2023 | Online
Date
October 31st - November 1st, 2023
2023智慧農業國際研討會暨聯合成果展
International Conference on Smart Agriculture
10月31日(二)~11月01日(三)
臺大醫院國際會議中心 401廳

INDIA

Readiness in countries for implementing climate-change mitigation and adaptation technologies

Dr Niveta Jain

ICAR-Indian Agricultural Research Institute, India

Land use pattern and climate of India

- India has a diverse geography varied climate regimes ranging from continental to coastal, from extreme heat /cold, with aridity and negligible rainfall to excessive humidity and torrential rainfall.
- Geographical area: 328.73 million ha
- Gross cultivated area: 204.76 million ha; 53% is irrigated
- Net sown area: 139.44 million ha: 53.7% irrigated
- Agriculture accounts for ~19 per cent of the GDP of India
- Approximately two-thirds of the population is dependent on agriculture
- Food grain production: 315.72 million tons
- Ranks second in rice production and wheat production
- Most of the farmers are marginal with small landholding (> 1 hectare)

Emission from agriculture sector of India

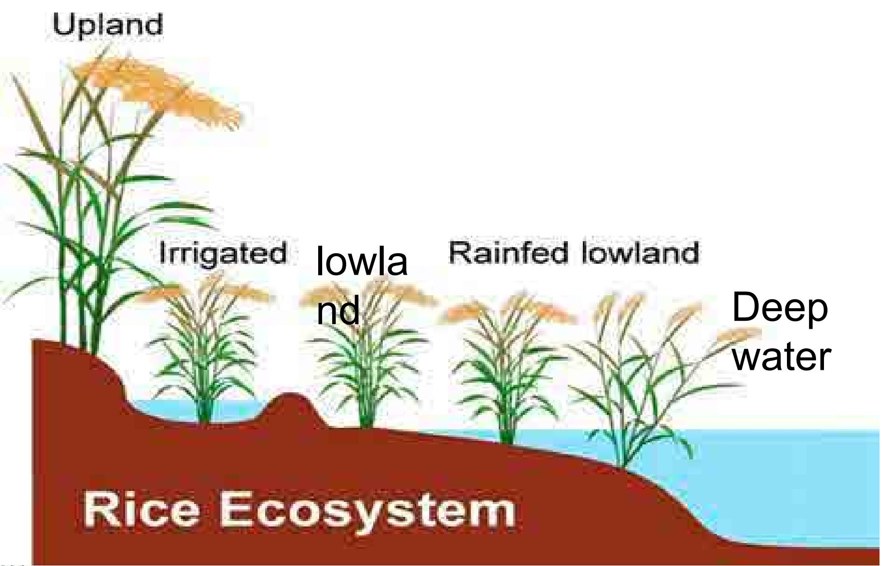
2016

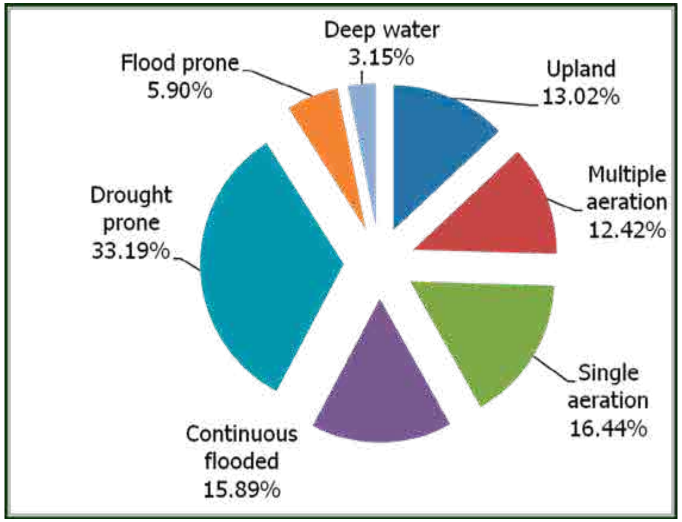
- India has 17.8 per cent of the global population with per capita GHG emissions (including LULUCF) of only 1.96 t CO_2e
- Total agriculture sector emission: 407821 Gg CO_2 eq (14% of India's total GHG emission from different economic sector)
- Methane emissions from paddy : 71322 Gg CO_2 eq (17.5 % of agriculture sector emission)
- N_2O emission from managed soils : 77781 Gg CO_2 eq (19%)
- Manure management : 6.7 %
- Field burning of agricultural residues: 2.2 %

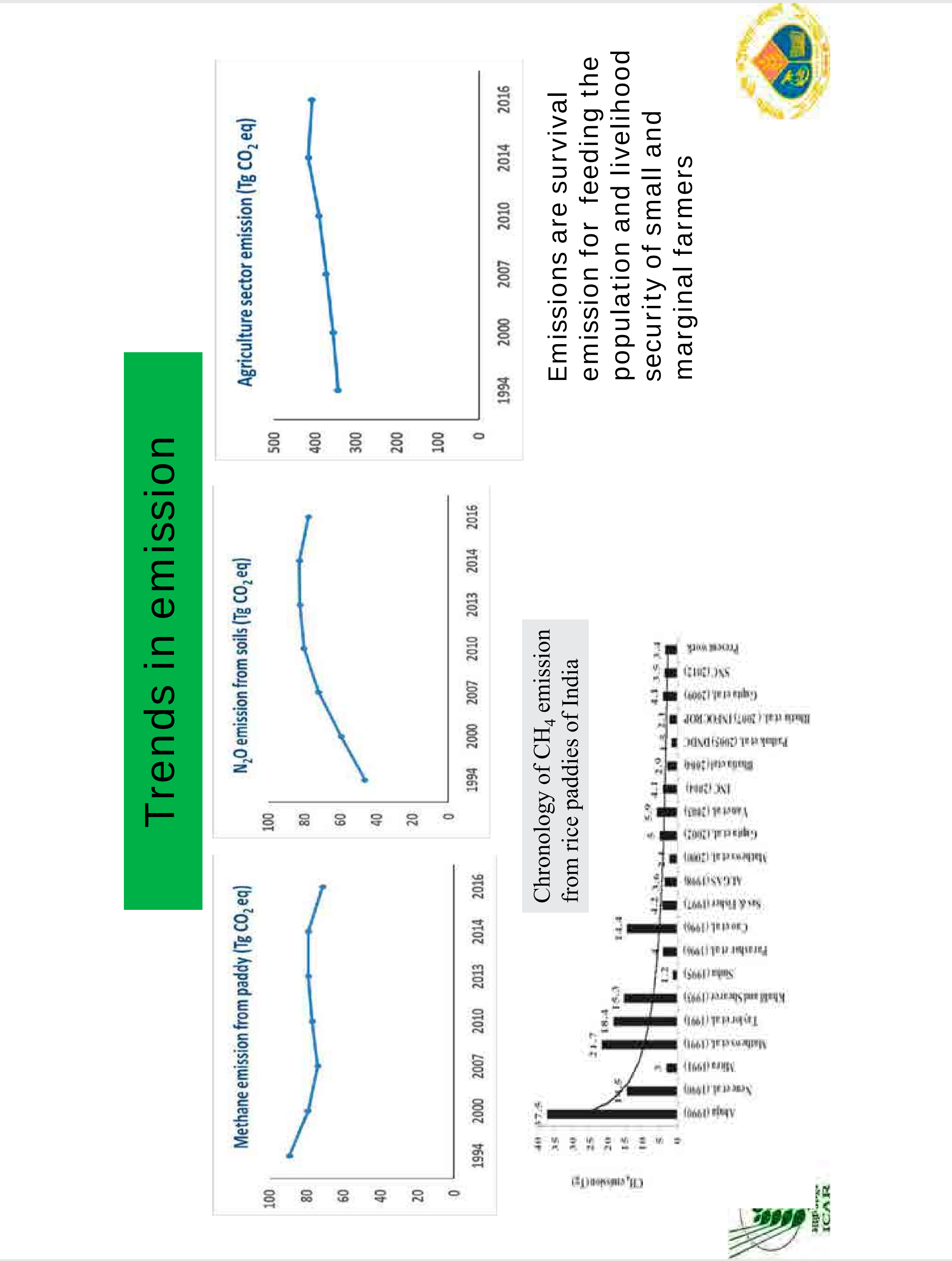
Rice-ecosystems in India

Total area 43-45 M ha; production ~130 M tons

Distribution of Area under Rice






Trends in emission
Methane emission from paddy (Tg CO_2 eq)
N_2O emission from soils (Tg CO_2 eq)
Agriculture sector emission (Tg CO_2 eq)
Emissions are survival emission for feeding the population and livelihood security of small and marginal farmers
Chronology of CH_4 emission from rice paddies of India
ICAR

Government initiatives

Ministry of Agriculture and Farmers Welfare, Government of India develops Policies and action plan for Climate Resilient Agriculture in India, supports the technologies for adaptation to climate change with various policies like National Mission on Sustainable Agriculture, National Food Security Mission, PM Krishi Sinchai Yojna Natural/organic farming etc.

- National Mission for Sustainable Agriculture (NMSA)-crop diversification program
- National Food Security Mission (NFSM)- SRI and DSR promotion to save water
- The national action plans such as National Project on Organic Farming (NPOF), National Mission on Sustainable Agriculture (NMSA), Soil Health Card (SHC) Scheme are directly or indirectly promoting soil C sequestration.
- Use of solar pumps for irrigation of crops (3.9 million installed)
- GOBARdhan, a multi-ministerial initiative of GoI covers schemes/programs/policies promoting the conversion of organic waste like agri-residue along with cattle dung etc. to biogas/ CBG/ Bio CNG and helps in in addressing the problems of crop residue burning.

Government initiatives

Government of India initiated carbon credit trading scheme through Ministry of Power and the other one on green credits through Ministry of Environment Forest and Climate Change.

- A green credit will be a unit of an incentive provided for a specified activity, delivering a positive impact on the environment.
- An activity generating Green Credits under Green Credit Programme may also get Carbon Credits from the same activity under carbon market.
- There are eight sectors proposed to be included in the scheme- tree plantations, water, sustainable agriculture, waste management, air pollution, mangrove conservation, eco-mark, sustainable buildings and infrastructure.

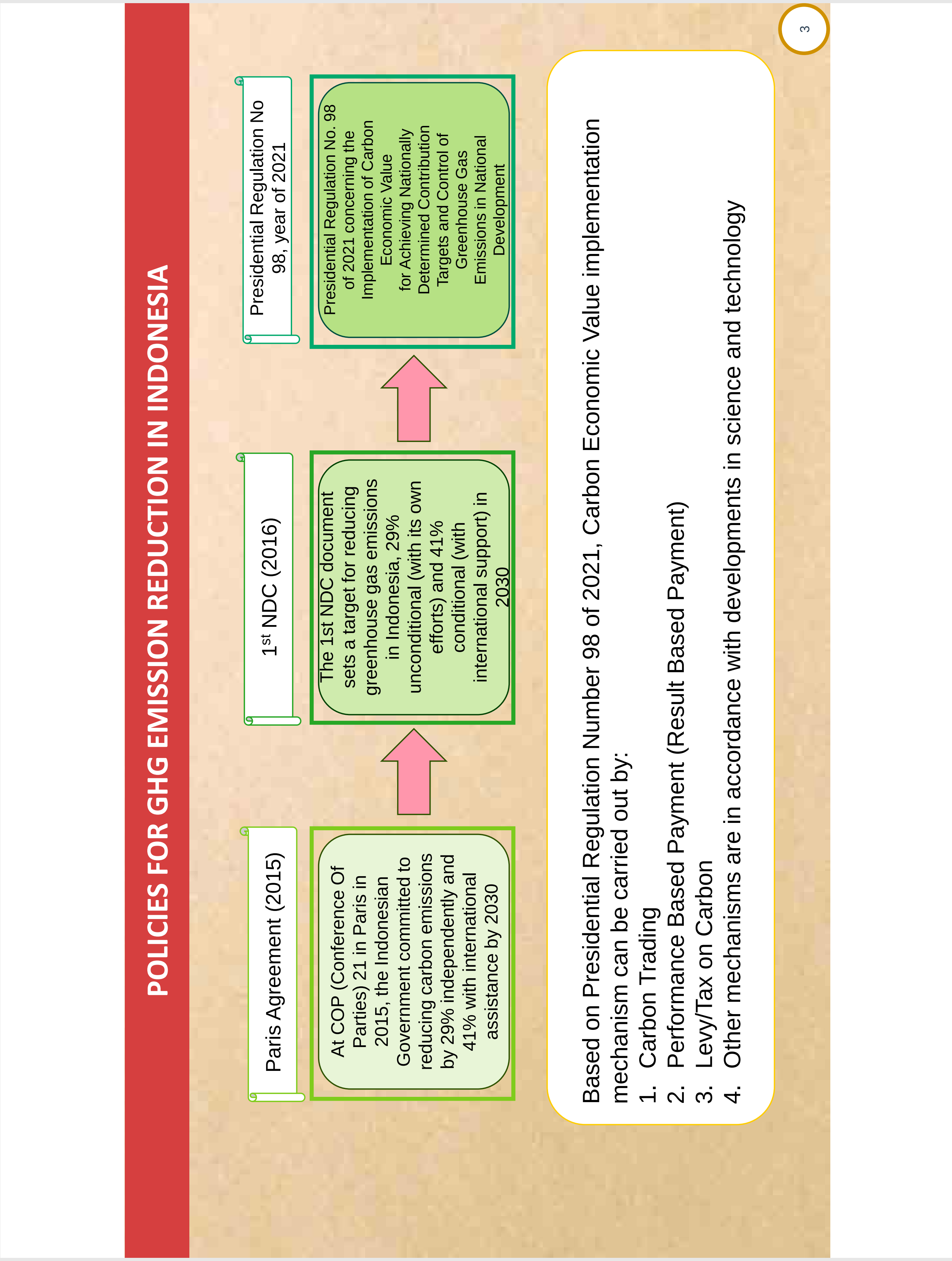
Constraints

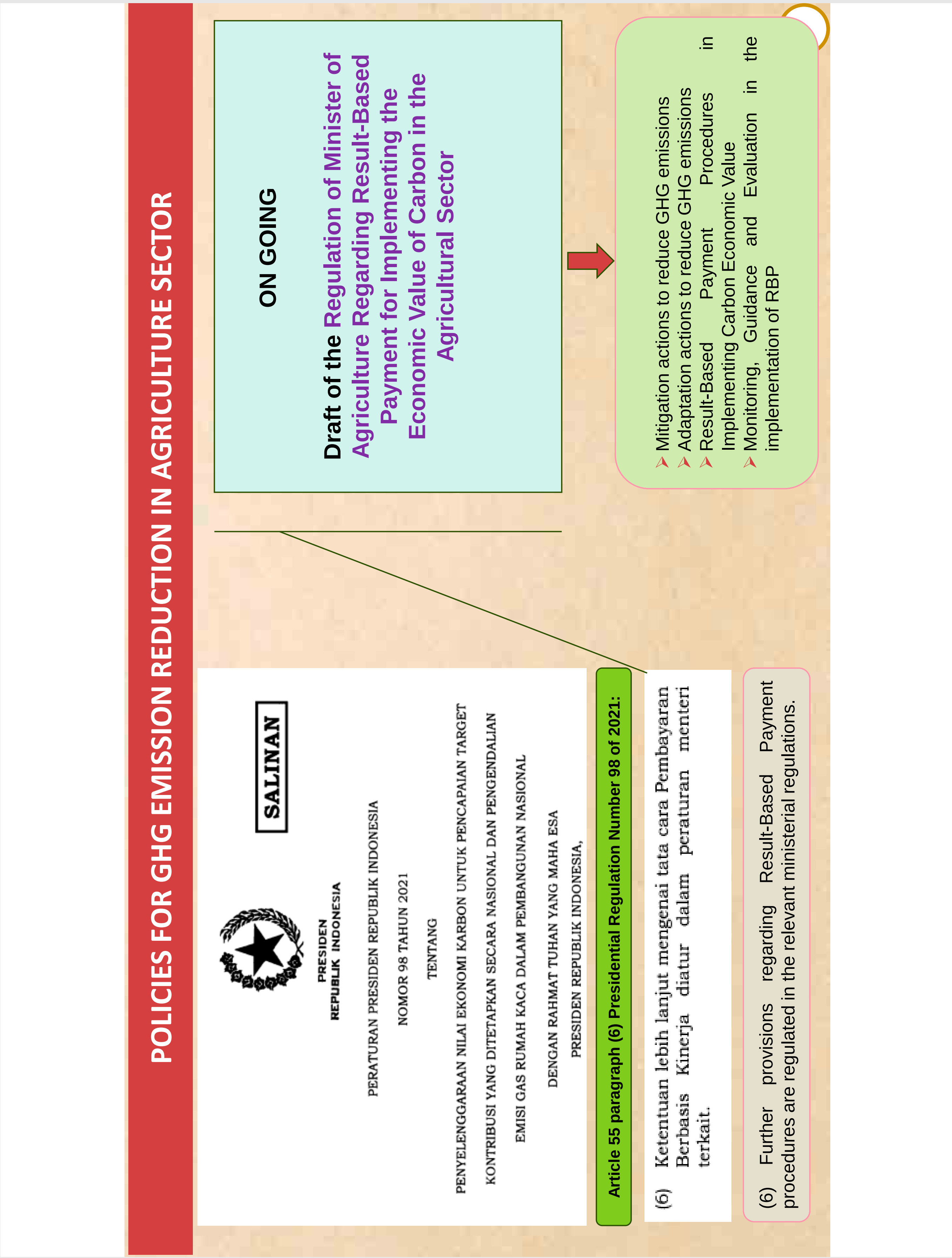
- Small and marginal farmers with small land holding
- High cost associated with mitigation
- Uncertainty of livelihood security due to climatic extremes
- Preference is for Climate Resilient Agriculture for livelihood security

INDONESIA


AGRICULTURE EXTENSION CENTER
AGRICULTURAL HUMAN RESOURCES EXTENSION
AND DEVELOPMENT AGENCY
INDONESIAN MINISTRY OF AGRICULTURAL
Pusluhtan
bppsdmp
Profesional
Daya Saing
Wirausaha
CLIMATE SMART AGRICULTURE (CSA) APPLICATION TO SUPPORT LOW CARBON PROGRAM IN AGRICULTURE SECTOR
Presented by:
AGRICULTURAL EXTENSION CENTER OF BPPSDMP
MINISTRY OF AGRICULTURE
Tsukuba, 8 - 9 November 2023
SIMURP


FOOD SUPPLY CHALLENGES IN INDONESIA
SOIL FERTILITY
Absorption of nutrients by plants, evaporation of nutrients into the atmosphere, seepage into the soil and erosion. Unbalanced chemical fertilizers and lack of organic fertilizers
DISTRIBUTION ASPECT
Indonesia is an archipelagic country. Consists of 38 Provinces, 514 Districts/cities and 7277 sub Districts. Accessibility and more efficient of transportation are needed
INCREASING POPULATION AND DECREASED HUMAN RESOURCES IN AGRICULTURE SECTOR
278 Million Population needs food
Young generation in village is more prefer work to city than as farmer (capital, land converted,, higher salaries received by other sectors compared to the agricultural sector
PROVISION IRRGATION CANAL
Limited irrigation channels and water supply to Paddy fields. are caused by factors such as seepage, leaks, evaporation, and even exploitation.
PADDY LAND CONVERSION
• Paddy field conversion: 7,9 to 7,4 Milion Ha (ATR BPN 2019)
• Housing, Industrial area, Highway construction
GLOBAL CLIMATE CHANGE
Climate change can affect the agriculture sector through extreme rainfall, the occurrence of El Nino and La Nina, increased pest attacks, decreasing adaptability, and saltwater instructions to land
VOLATILE GLOBAL FOOD PRICES
▪ Covid-19/Pandemic (Lockdown/ restrictication)
▪ War (Ukraina vs Rusia, Palestinevs Israel)
▪ Global economic issue (war trade)
2


POLICIES FOR GHG EMISSION REDUCTION IN INDONESIA
Paris Agreement (2015)
At COP (Conference Of Parties) 21 in Paris in 2015, the Indonesian Government committed to reducing carbon emissions by 29% independently and 41% with international assistance by 2030
1st NDC (2016)
The 1st NDC document sets a target for reducing greenhouse gas emissions in Indonesia, 29% unconditional (with its own efforts) and 41% conditional (with international support) in 2030
Presidential Regulation No 98, year of 2021
Presidential Regulation No. 98 of 2021 concerning the Implementation of Carbon Economic Value for Achieving Nationally Determined Contribution Targets and Control of Greenhouse Gas Emissions in National Development
Based on Presidential Regulation Number 98 of 2021, Carbon Economic Value implementation mechanism can be carried out by:
1. Carbon Trading
2. Performance Based Payment (Result Based Payment)
3. Levy/Tax on Carbon
4. Other mechanisms are in accordance with developments in science and technology
3


POLICIES FOR GHG EMISSION REDUCTION IN AGRICULTURE SECTOR
SALINAN
PRESIDEN
REPUBLIK INDONESIA
PERATURAN PRESIDEN REPUBLIK INDONESIA
NOMOR 98 TAHUN 2021
TENTANG
PENYELENGGARAAN NILAI EKONOMI KARBON UNTUK PENCAPAIAN TARGET
KONTRIBUSI YANG DITETAPKAN SECARA NASIONAL DAN PENGENDALIAN
EMISI GAS RUMAH KACA DALAM PEMBANGUNAN NASIONAL
DENGAN RAHMAT TUHAN YANG MAHA ESA
PRESIDEN REPUBLIK INDONESIA,
Article 55 paragraph (6) Presidential Regulation Number 98 of 2021:
(6) Ketentuan lebih lanjut mengenai tata cara Pembayaran Berbasis Kinerja diatur dalam peraturan menteri terkait.
(6) Further provisions regarding Result-Based Payment procedures are regulated in the relevant ministerial regulations.
ON GOING
Draft of the Regulation of Minister of Agriculture Regarding Result-Based Payment for Implementing the Economic Value of Carbon in the Agricultural Sector
Mitigation actions to reduce GHG emissions
Adaptation actions to reduce GHG emissions
Result-Based Payment Procedures in Implementing Carbon Economic Value
Monitoring, Guidance and Evaluation in the implementation of RBP

5

GREENHOUSE GAS EMISSION IN INDONESIA

Table 1. Summary of National GHG emissions in 2000 and 2019 by gas (Gg CO_2e)

No	Sectors	Year	CO_2	CH_4	N_2O	CF_4	C_2F_6	CO	NOx	NMVOC	SOx	Total 3 Gases
1	Energy	2000	284,503	29,728	3,378			NE	NE	NE	NE	317,609
		2019	615,262	16,464	4,726			NE	NE	NE	NE	636,453
2	IPPU	2000	42,401	98	149	250	22	NO	NO	NO	NO	42,648
		2019	57,252	91	784	46	0	NO	NO	NO	NO	58,128
3	Agriculture	2000	4,710	39,940	39,888			2,737	74	NE	NE	84,537
		2019	7,343	46,407	51,552			2,436	66	NE	NE	105,301
4	FOLU	2000	529,815	1,505	1,040			NE	NE	NE	NE	532,360
		2019	910,280	8,527	6,045			NE	NE	NE	NE	924,853
5	Waste	2000	2,216	57,431	2,544			NE	NE	NE	NE	62,191
		2019	3,026	113,702	3,606			NE	NE	NE	NE	120,333
Total (CO_2-eq)		2000	863,645	128,702	46,998	250	22	2,724	70	0	0	1,039,345
		2019	1,593,163	185,191	66,713	46	0	1,500	41	0	0	1,845,067
Percentage (%)		2000	83.10	12.38	4.52	-	-	-	-	-	-	100.00
		2019	86.35	10.04	3.62	-	-	-	-	-	-	100.00

NE = Not Estimated; NO = Not Occurring

In 2019, the national GHG emissions reached 1,845,067 Gg CO2e for 3 gases (CO2, CH4, N2O), And GHG emissions from the **agricultural sector** in 2019 amounted to **105,301 GgCO2eq.**

Source: GHG emissions from the agricultural sector in 2019 https://unfccc.int/BURs , https://unfccc.int/non-annex-I-NCs

GHG Emission From Agriculture Sector 2018 - 2019

No.	Source Category	Number of Emission (Gg CO2e)	
		2018	2019
1	CH4 Rice Cultivations	22712	25235
2	Indirect N2O Manure Management	3059	4343
3	Indirect N2O Managed Soils	7972	7526
4	Direct N2O Managed Soils	33404	31800
5	CO2 Urea Fertilization	5715	5182
6	CO2 Liming	2125	2160
7	Non-CO2 Biomass Burning GL	843	822
8	Non-CO2 Biomass Burning CL	1385	1255
9	Direct N2O Manure Management	6914	7307
10	CH4 Manure Management	1668	1772
11	CH4 Enteric Ferementation	18266	17898
	Total	104,053	105,301

Source: Third biennial update report – UNFCC 2021
https://unfccc.int/sites/default/files/resource/IndonesiaBUR%203_FINAL%20REPORT_2.pdf

6

TARGET GHG EMISSION REDUCTION INDONESIA ON 2030

Source by:
ENHANCED NATIONALLY DETERMINED CONTRIBUTION
REPUBLIC OF INDONESIA 2021

Sector	GHG Emission Level 2010* (MTon CO2-eq)	GHG Emission Level 2030			GHG Emission Reduction			
		MTon CO_2-eq			MTon CO_2-eq		% of Total BaU	
		BaU	CM1	CM2	CM1	CM2	CM1	CM2
1. Energy*	453.2	1,669	1,311	1,223	358	446	12.5%	15.5%
2. Waste	88	296	256	253	40	43.5	1.4%	1.5%
3. IPPU	36	69.6	63	61	7	9	0.2%	0.3%
4. Agriculture	110.5	119.66	110	108	10	12	0.3%	0.4%
5. Forestry and Other Land Uses (FOLU)**	647	714	214	-15	500	729	17.4%	25.4%
TOTAL	**1,334**	**2,869**	**1,953**	**1,632**	**915**	**1,240**	**31.89%**	**43.20%**

Notes: CM1= Counter Measure 1 (unconditional mitigation scenario)
CM2= Counter Measure 2 (conditional mitigation scenario)
(*) Including fugitive
(**) Including emission from estate and timber plantations

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TARGET GHG EMISSION INDONESIA FROM AGRICULTURE SECTOR ON 2030

Source by:

ENHANCED NATIONALLY DETERMINED CONTRIBUTION
REPUBLIC OF INDONESIA 2021

SECTOR : AGRICULTURE			
	BAU	CM1	CM2
1. The use of low-emission crops.	No mitigation actions.	Total use of land for low emission crops up to 902,000 hectares in 2030*.	Total use of land for low emission crops up to 932,000 hectares in 2030*.
2. Implementation of water-efficient concept in water management.	No mitigation actions.	Implementation of water efficiency up to 2,583,000 hectares in 2030*.	Implementation of water efficiency up to 3,376,000 hectares in 2030*.
3. Organic fertilizers	No mitigation actions	Application of organic fertilizer up to 1,287,000 ton in 2030**	Application of organic fertilizer up to 1,368,000 ton in 2030**
4. Manure management for biogas.	No mitigation actions.	Manure used for biogas will come from 166,000 cattle in 2030***.	Manure used for biogas will come from 249,000 cattle in 2030***
5. Feed supplement for cattle.	No mitigation actions.	Up to 6,942,000 of ruminants in 2030 will be supplied by feed supplement****	Up to 8,075,000 of ruminants in 2030 will be supplied by feed supplement****

Note:

* The use of best available technology will increase crop productivity and lead to the decrease of land use change for agricultural purposes.

** The application of synthetic nitrogen fertilizer will reduce by 0.15 ton for every one-ton organic fertilizer

*** With assumption that government's subsidy will continue taking into consideration its high cost of investment).

**** For CM1, it is about 27.4% of big ruminant population and 20% of small ruminant population and for CM2 it is about 37.4% of big ruminant population and 20% 20% of small ruminant population.

CM1: Counter Measure 1 (Unconditional Mitigation Scenario)
CM2: Counter Measure 2 (Conditional Mitigation Scenario)

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CARBON VALIDATION AND VERIFICATION INSTITUTION IN INDONESIA

- PT TUV Rheinland Indonesia
  Menara Karya Lt. 10,
  Jl. H.R. Rasuna Said Block X-5 Kav 1-2,
  Jakarta Selatan, DKI Jakarta
  LVV-002-IDN

- PT TUV NORD Indonesia
  Perkantoran Hijau Arkadia Tower F. Lt. 6 & 7,
  Jl. TB Simatupang Kav.88,
  Jakarta Selatan, DKI Jakarta
  LVV-004-IDN

- PT Superintending Company of Indonesia
  (PT Sucofindo) - SBU Sertifikasi & Eco Framework
  (Sucofindo International Certification Services)
  Graha Sucofindo, Jl. Raya Pasar Minggu Kav 34, Pancoran, DKI Jakarta

- PT Mutuagung Lestari
  Jl. Raya Bogor KM. 33,5,
  Cimanggis, Depok, West Java

Source: Ministry of Environment and Forestry https://srn.menlhk.go.id/index.php?r=home%2Findex

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NATIONAL CLIMATE CHANGE REGISTRATION SYSTEM

Managing by Ministry of Environment and Forestry

Source: Ministry of Environment and Foresty
https://srn.menlhk.go.id/index.php?r=home%2Findex

10

THE ENVIRONMENTAL FUND MANAGEMENT AGENCY (BPDLH)

The Environmental Fund Management Agency (BPDLH) was established in September 2019 and launched in October 2019. BPDLH was established as an umbrella body and distributor of several sources of environmental funding so that they can be used through various instruments in various sectors, including forestry, energy and resources minerals, carbon trading, environmental services, industry, transportation, **agriculture**, marine and fisheries. **BPDLH is an official Indonesian government agency with an environmental funding mechanism to channel and distribute environmental and climate funds.**

Source: **The Environmental Fund Management Agency (BPDLH)**
https://bpdlh.id/about-us

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Continue...

GOVERNMENT ACTION ON CLIMATE RESILIENCE AND LOW CARBON ON AGRICULTURE SECTOR

- Grand Design for Climate Resilient and Low Carbon Development in the Agricultural Sector - 2022
- Climate Smart Agriculture (CSA) on Strategic Modernization Management and Urgent Rehabilitation Project (SIMURP) - On going (2019 -2024)
- Regulation of Minister of Agriculture Regarding Result-Based Payment for Implementing the Economic Value of Carbon in the Agricultural Sector – On Going
- Upcoming Program “Climate Resilient And Low Carbon Agricultural Development” 2025 -2029

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GREEN HOUSE GAS EMISSION REDUCTION ACTION ON AGRICULTURE SECTOR THROUGH CLIMATE SMART AGRICULTURE PROGRAM

BPPSDMP
Badan Penyuluhan dan Pengembangan Sumber Daya Manusia Pertanian

SIMURP
Strategic Irrigation Modernization and Urgent Rehabilitation Project

SIMURP Program at Agency of Agriculture Extension and Human Resource Development (BPPSDMP) , Ministry of Agriculture of Indonesia, (2019 -2024).

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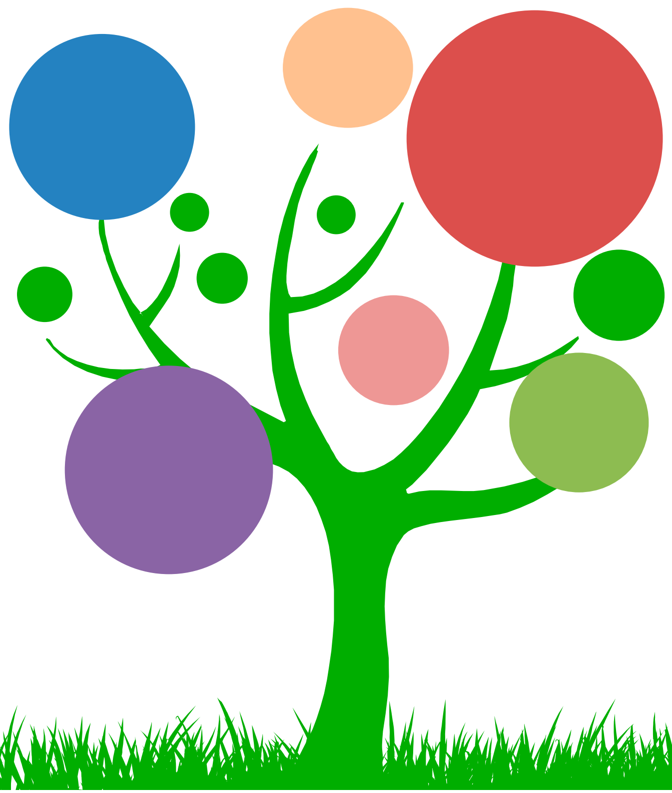
CSA SIMURP SUMMARY 2019 -2023



PERIOD IMPLEMENTATION

2019 - 2024

FUND RESOURCES

IBRD and AIIB

IDR 235 BILLION

LOCATION

10 Provinces:
North Sumatra, South Sumatra, West Java, Central Java, East Java, Central Kalimantan, South Sulawesi, West Nusa Tenggara, Southeast Sulawesi and East Nusa Tenggara.

PATNER IMPLEMENTATION

- Ministry of Finance,
- BAPPENAS
- Ministry of Public Works and Housing,
- Ministry of Home Affairs

COMMUNITY GROUP PARTCIPATION

- Farmer Groups WUA affiliated (P3A),
- Farmer Economic Institutions (KEP) ,
- Farmer Woman's Group (KWT),
- Farmer Millennial's Group

PROJECT IMPLEMENTATION

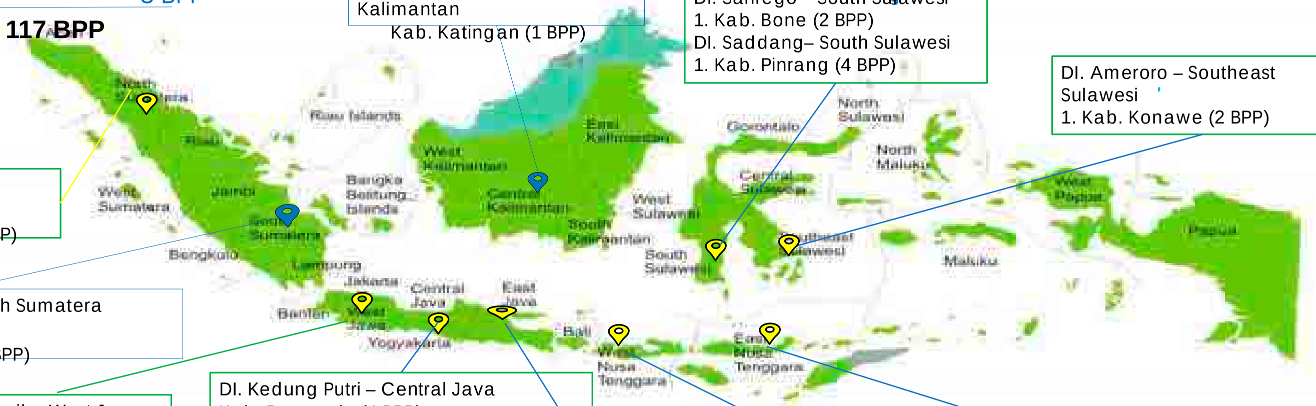
- NPIU BPPSDMP Agriculture,
- 10 PIU Provincial Agriculture Office/Agency,
- 24 KPIU District Agriculture Office/Agency,
- 117 Aagricultural Extension Office/Agency in the Sub-district

PROJECT LOCATION

20 Daerah Irigasi **114 BPP**

2 Daerah Irigasi Rawa 3 BPP

Total 117 BPP



DIR. Katingan - Central Kalimantan
Kab. Katingan (1 BPP)

DI. Pamakkulu – South Sulawesi
1. Kab. Takalar (3 BPP)
DI. Tabo-tabo – South Sulawesi
1. Kab. Pangkajenen Kepulauan (5 BPP)
DI. Sanrego – South Sulawesi
1. Kab. Bone (2 BPP)
DI. Saddang– South Sulawesi
1. Kab. Pinrang (4 BPP)

Profesional Daya Saing Wirausaha
http://bppsdmp.pertanian.go.id

DI. Ameroro – Southeast Sulawesi
1. Kab. Konawe (2 BPP)

DI. Sei Ular - North Sumatera
Kab. Deli Serdang (4 BPP)
Kab. Serdang Bedagai (4 BPP)

DIR. Karang Agung Ilir - South Sumatera
Kab. Banyuasin (1 BPP)
Kab. Musi Banyuasin (1 BPP)

DI. Cikeusik - West Java
1. Kab. Cirebon (3 BPP)
DI. Cipancuh - West Java
1. Kab. Indramayu (5 BPP)
DI. Jatiluhur - West Java
1. Kab. Indramayu (4 BPP)
2. Kab. Krawang (11 BPP)
3. Kab. Subang (14 BPP)

Komponen B (29 BPP)

DI. Kedung Putri – Central Java
Kab. Purworejo (4 BPP)

DI. Banjarcahyana – Central Java
Kab. Banjarnegara (2 BPP)
Kab. Purbalingga (2 BPP)

DI. Glapan Timur – Central Java
Kab. Demak (2 BPP)
Kab. Grobogranb (2 BPP)

DI. Jengkelok– Central Java
Kab. Brebes (3 BPP)

DI. Wadas Lintang – Central Java
Kab. Kebumen (12 BPP)
Kab. Purworejo (1 BPP)

DI. Sempor– Central Java
Kab. Kebumen (8 BPP)

DI. Jurang Sate Hilir & DI Jurang Batu – West Nusa Tenggara
Kab. Lombok Tengah (6 BPP)

DI. Mbay Kanan – East Nusa Tenggara
Kab. Nagekeo (1 BPP)

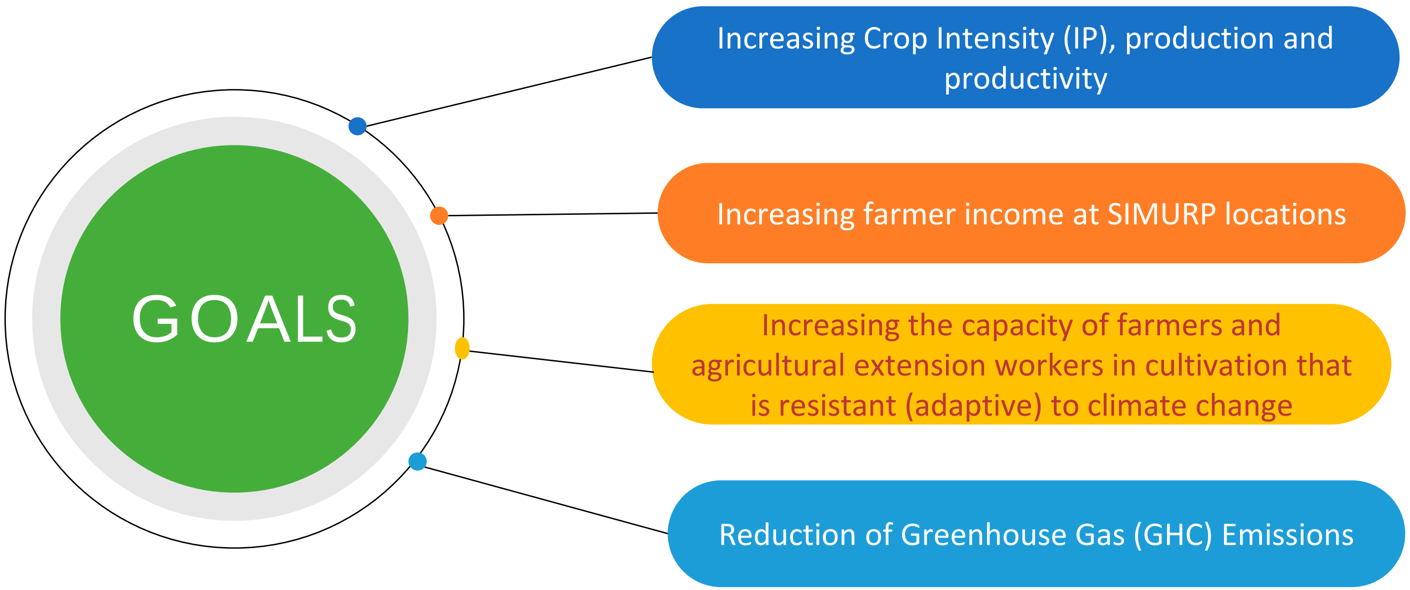
DI. Talang & DI Pondok Waluh – East Java
Kab. Jember (4 BPP)

Cover Area:
2019-2021: 8 Provinces
2022-2024: 10 Provinces

SIMURP Strategic Irrigation Modernization and Urgent Rehabilitation Project
THE WORLD BANK
AIIB

PROVINCE	DISTRICT	IRIGATION AREA	SUB DISTRICT	BPP	VILLAGE	FARMER GROUP
10	24	22	127	117	1017	4.632

CLIMATE SMART AGRICULTURE (CSA)
STRATEGIC IRRIGATION MODERNIZATION AND URGENT REHABILITATION PROJECT (SIMURP)



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SIMURP ACTIVITY PERIOD 2019 -2024

- Capacity Building: Training of Master (TOM), Training of Trainer (TOT) and Training of Farmer (TOF)
- Supporting CSA technology through a field school approach (demplot, farmer discussion/field meeting) implemented by Farmer group and Farmer and facilitated by Agriculture Extension staff (BPP)
- Strengthening BPP through 5 BPP roles (Data and Information Center, Development Movement Center, Learning Center, Agribusiness Consultation Center, Partnership Network Center)
- Product and Market Linkage Development through Farmer's Economic Institutions (KEP) involving young farmers in SIMURP locations
- Facilitation of Agricultural Products Home Industry Processing Equipment involving Farmer Women's Group (KWT)
- Measurement of Greenhouse Gas (GHG) Emissions in collaboration with Agricultural Environmental Research Institute (BPSI LINGTAN PATI) Central Java

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CSA SIMURP TECHNOLOGY APPLICATION

Water Saving Technology (AWD/Intermittten/ Macak-macak)

Superior Varieties Seed (low emission, drying, marinade)

Balancing Fertilizer – using PUTS/ PUTR tools

Organic Fertilizer – Self production of organic Fertilizer using organic materials

Spacing Plant- Method 2:1, 4:1 or adjustment based on location

Bio Pest Control – Making Bio Pesticide using organic material ;

Note:
The applied technology is tailored to each location while considering local wisdom and culture of local farmers.

Rice Productivity of CSA SIMURP Demonstration Plots for 2020-2023*

Productivity on CSA SIMURP vs Non CSA
Ton/Ha GKP (Harvested Dry Grain)/ Demplot

Paddy Per Ton/Ha/ Seasons	2021			2022			2023*		
	CSA	Non CSA	Increase	CSA	Non CSA	Increase	CSA	Non CSA	Increase
Productivity	6,98	6,34	0,64	6,74	6,09	0,65	6,94	6,07	0,87

Note:
- Data samples from SIMURP Location in 10 Province SIMURP Location
- 2023 data is temporary (In progress)
- Productivity Increase average 12% compare to Non CSA Productivity

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PADDY BUSINESS ANALYSIS CSA VS NON CSA 2022

No.	Province	Production Cost (Rp./Ha)		Revenue (Rp./Ha)		Profit		R/C	
		CSA	Non CSA	CSA	Non CSA	CSA	Non CSA	CSA	Non CSA
1	Sumatera Utara	19.512.848	19.586.813	38.216.737	35.057.988	18.703.890	15.471.175	1,96	1,79
2	Sumatera Selatan	8.704.017	11.799.667	21.866.667	21.520.000	13.162.649	9.720.333	2,51	1,82
3	Jawa Barat	18.747.880	20.233.014	34.275.344	29.215.503	15.527.464	8.982.488	1,83	1,44
4	Jawa Tengah	24.087.864	25.481.307	30.067.459	27.635.309	5.979.595	2.154.002	1,25	1,08
5	Jawa Timur	26.650.000	27.150.000	31.682.500	29.296.250	5.032.500	2.146.250	1,19	1,08
6	Kalimantan Tengah	15.054.000	15.095.000	19.250.000	17.118.750	4.196.000	2.023.750	1,28	1,13
7	Sulawesi Selatan	22.085.000	23.079.643	28.967.696	26.929.913	6.882.696	3.850.270	1,31	1,17
8	Sulawesi Tenggara	13.760.000	13.776.500	20.664.000	17.640.000	6.904.000	3.863.500	1,50	1,28
9	Nusa Tenggara Barat	14.659.875	15.070.262	32.231.069	27.819.318	17.571.194	12.749.056	2,20	1,85
10	Nusa Tenggara Timur	14.000.000	15.000.000	28.875.880	28.836.923	14.875.880	13.836.923	2,06	1,92
Total		**177.261.484**	**186.272.206**	**286.097.352**	**261.069.954**	**108.835.868**	**74.797.748**	**1,61**	**1,40**
Average		**17.726.148**	**18.627.221**	**28.609.735**	**26.106.995**	**10.883.587**	**7.479.775**	**1,61**	**1,40**
SeBalance		**-**	**901.072**		**2.502.740**		**3.403.812**		**0,21**
		-4,84%		**9,59%**					

Note: Sample from 1084 CSA Demplots, 10 Province, 14 Districts,44 sub district SIMURP location.

PROFESSIONAL, COMPETITIVENESS, ENTREPRENEURS 20

AWD WATER USAGE MEASUREMENT (CSA VS NON CSA) 2022-2023

Location	Method	Cover Area	Total Rainfall	Total Water Supply Volume	Total Water Usage Volume	Total Water Volume	Water Saving
		(ha)	(m3)	(m3)	(m3)	(m3/ha)	(%)
North Field Area	CSA	0,09	0,79	972,15	972,15	10.810,52	**21% (CSA vs Non CSA)**
	Non CSA	0,09	0,79	1.236,69	1.237,48	13.749,82	
South Field Area	CSA	0,08	0,56	963,70	963,70	12.046,30	**12% (CSA vs Non CSA)**
	Non CSA	0,08	0,56	1.099,28	1.099,48	13.748,06	

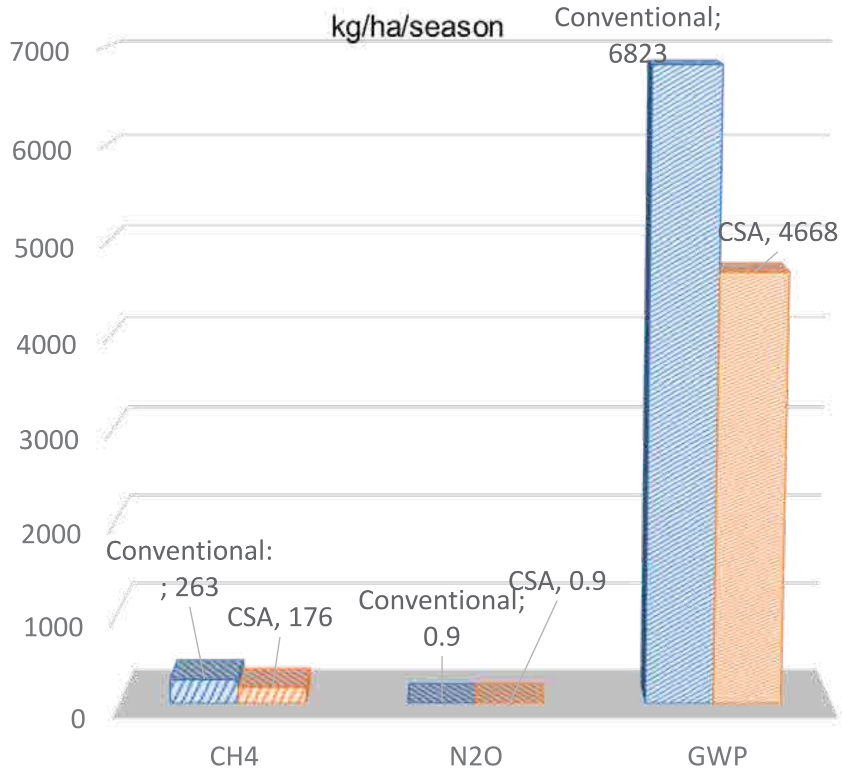
1st Cropping Period Data

Notes:
1st Cropping Period at Pilot CSA Scaling Up location in Patoek Beusi, Subang, West Java - Done
2nd Cropping Period at Pilot CSA Scaling Up location in Patoek Beusi, Subang, West Java – On Progress

Measurement by **BPSI AGRO KLIMAT DAN HIDROLOGI**

21

GHG EMISSION REDUCTION 2021

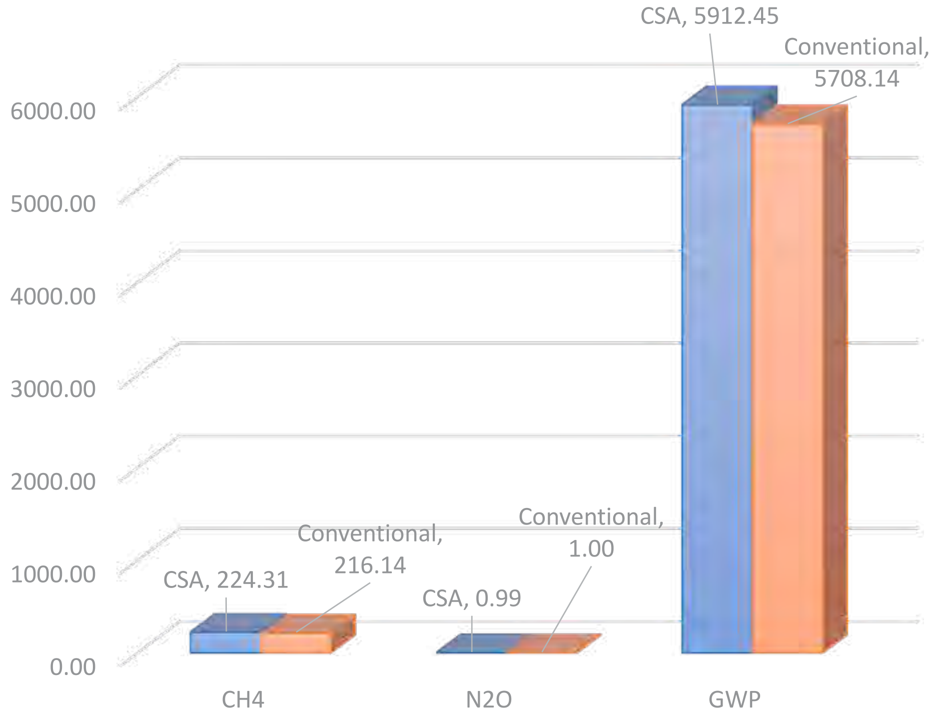


Notes:

- Sample from demonstration 68 plots project location
- Measurement by BPSI LINGTAN PATI:
- CH4 gas emissions range between 31,1 959,1 kg/ha/season,
- N2O gas emissions range between 0,3 – 7,2 kg/ha/season.
- Global warming potential (GWP) reduction ranges from 277 – 24.098 kg CO2-e/ha/season.
- CSA treatment reduces GHG emissions by Average 32 % compared to non-CSA.

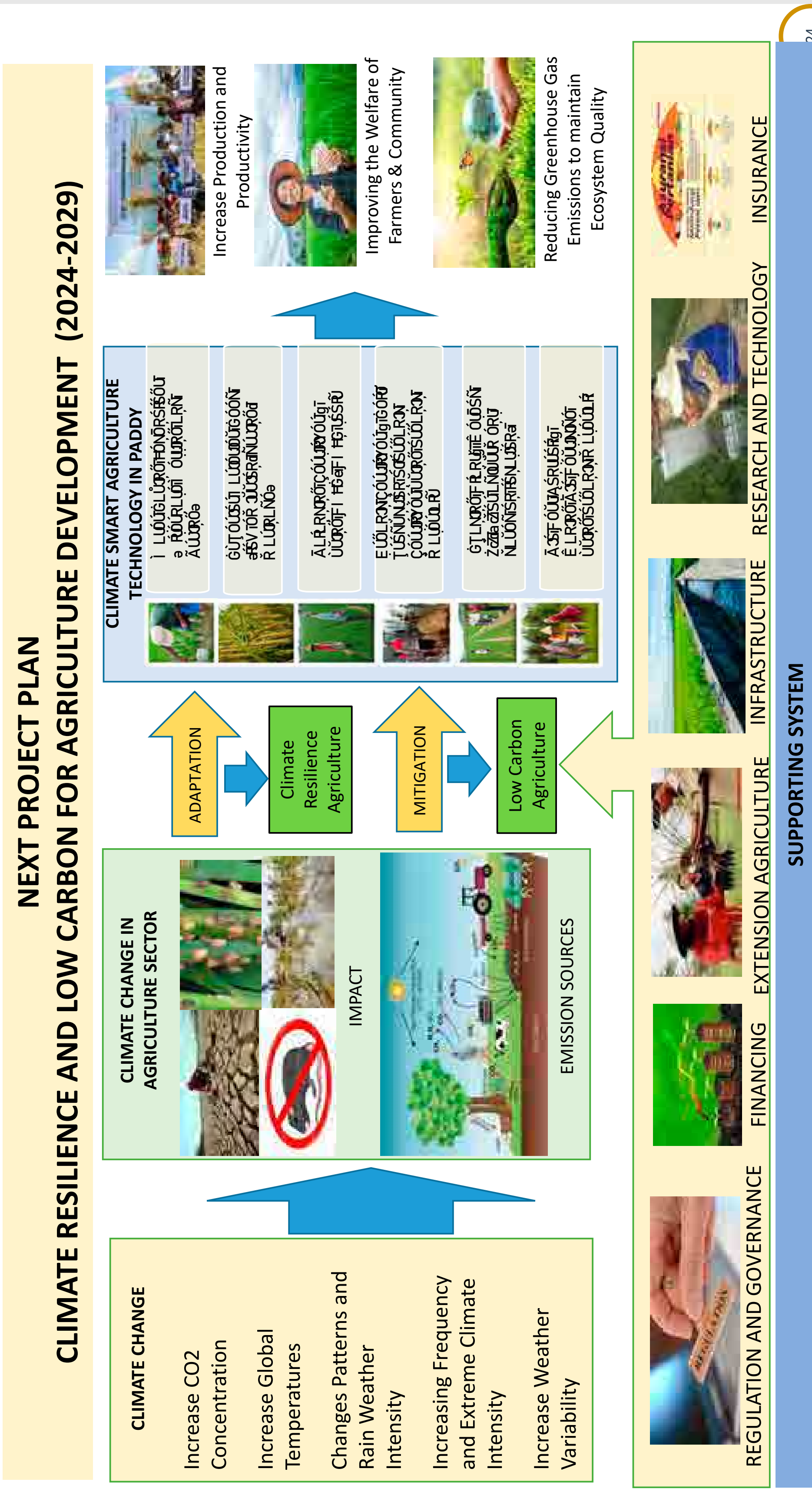
22

GHG EMISSION REDUCTION 2023



Notes:
Measurement by BPSI LINGTAN PATI
2023 – Temporary data

- A total of 15 BPPs in 6 provinces
- CH4 gas emissions range between 49 – 747 kg/ha/season,
- N2O gas emissions range between 0.27 – 2.22 kg/ha/season.
- Global warming potential (GWP) reduction ranges from 1,546 – 18,994 kg CO2-e/ha/season.
- CSA treatment reduces GHG emissions by Average 32% compared to non-CSA.



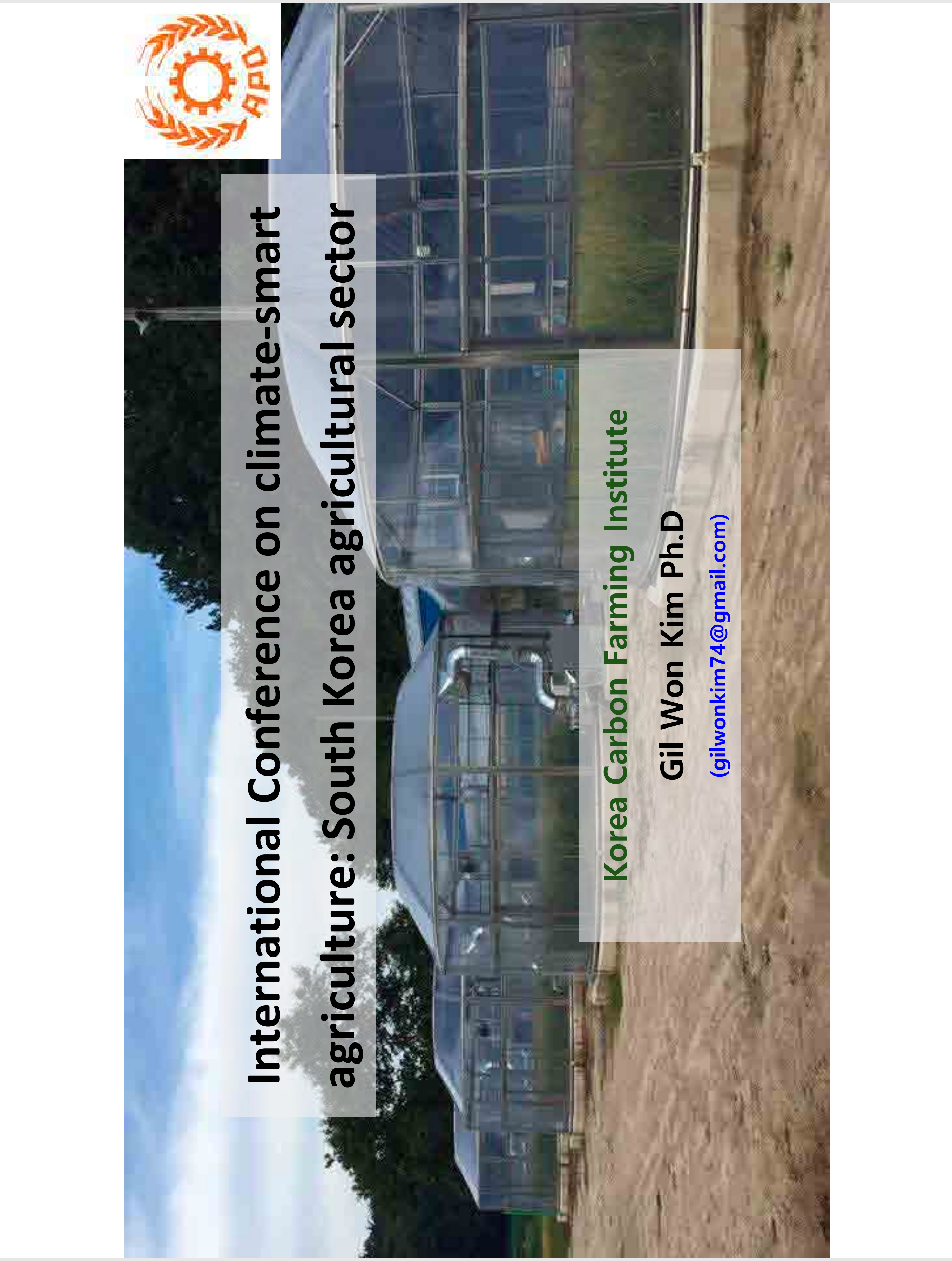
Source: Ministry of Agriculture Indonesia

CONCLUSION

- To support Presidential Regulation Number 98 of 2021, the Ministry of Agriculture is currently drafting a Minister of Agriculture Regulation concerning Result-Based Payments (RBP) for the Application of Carbon Economic Value (CEV) in the Agricultural Sector.
- For RBP operations, it will contain action plans, emission reports, validation and verification of emission reports and regulation of RBP benefits. The benefits received must be used for activities related to reducing GHG emissions as well as other supporting activities (increasing institutional capacity, increasing human resources, research, etc.).
- The application of CSA technology is mitigation and adaptation solution to reduce GHG emissions and increase rice yields in agriculture sector;
- Capacity building for Agriculture Extension officers is needed to supervise farmer in the application of CSA Technology (Water-saving Technology (AWD), Balanced Fertilization, produces/use of organic fertilizers, Jarwo, etc.);
- Farmers' awareness on CSA application will be effected GHG emission reduction besides increasing production/productivity and farmers' income;
- To support CSA technology through water-saving / AWD / Intermittent technology, it requires cooperation from all agencies, both central and regional government as well as extension workers in optimizing farmers through poktan, P3A, (Continuous improvement and maintenance of primary, secondary and tertiary channels is needed)

25


Profesional
Daya Saing
Wirausaha
Pusluhtan
PUSAT PENYULUHAN PERTANIAN
BADAN PENYULUHAN DAN
PENGEMBANGAN SUMBER DAYA
MANUSIA PERTANIAN
KEMENTERIAN PERTANIAN
THANK YOU
SIMURP
Strategic Irrigation Modernization
and Urgent Rehabilitation Project
27
KALENDER
TANAM
TERPADU


International Conference on climate-smart
agriculture: South Korea agricultural sector
Korea Carbon Farming Institute
Gil Won Kim Ph.D
(gilwonkim74@gmail.com)

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Efforts for carbon neutral (climate change mitigation)

- Declare Net-Zero 2050 (Oct, 2020)
- Long-term low greenhouse gas Emission Development (Dec, 2020)
- Declare of 2030 NDC upward goals (Oct, 2021)
- Establishment of the 2050 Agricultural and Food Carbon Neutrality Promotion Strategy (Dec, 2021)

  ① Low-carbon agricultural structure transition
  ② Decrease greenhouse gas emission
  ③ Reduction of fossil fuel use and energy conversion
  ④ Expansion of rural renewable energy supply

- Establishment of 2050 carbon-neutral agricultural technology development and distribution

  ① Establishment of GHGs inventory and improve statistics
  ② Expansion of carbon reduction agricultural technology
  ③ Increase GHGs absorption strategies
  ④ On-site spread

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

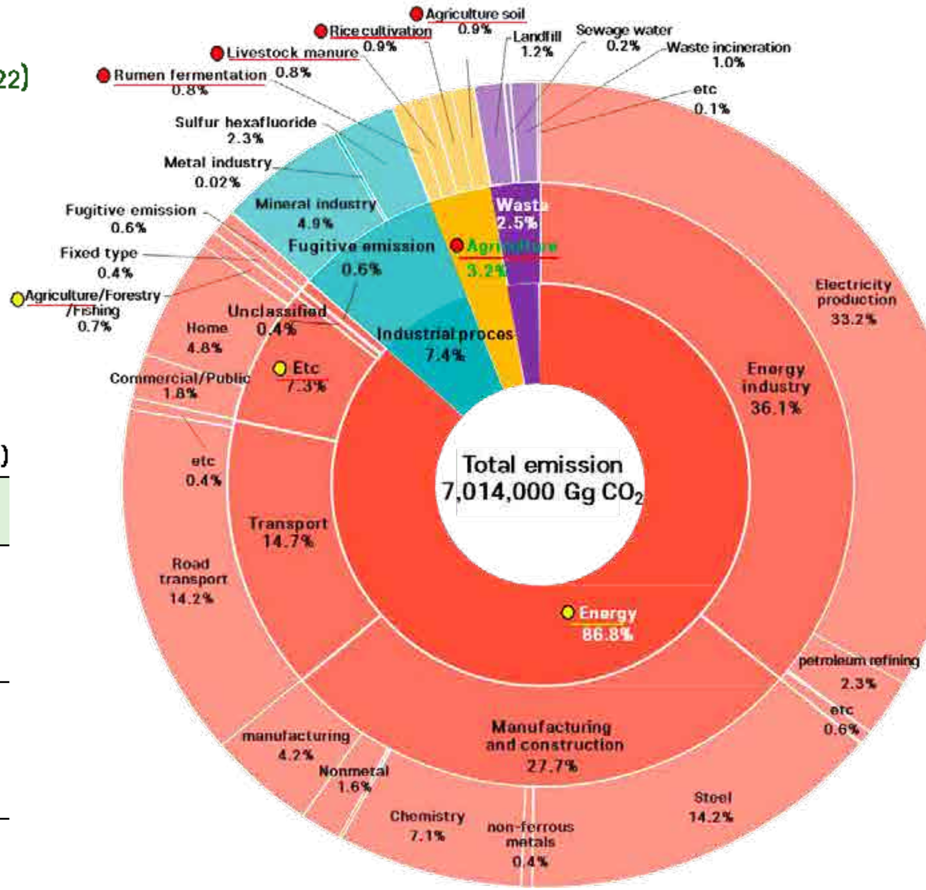
Proportion of GHGs in Korea

(2020, Based on 2022 inventory report, published in Apr. 2022)

- Agricultural sector emissions
  - -Total: 21,100 Gg CO_2 in 2020 (3% of total)
  - -Crop cultivation: 11,300 Gg CO_2 (54.8%)
  - -Livestock area: 9,700 Gg CO_2 (45.2%)

(Gg CO_2 eq.)

Sector	Category	Main Gas	Emission
Livestock	Fermentation	CH_4	4,700
	Manure treatment	CH_4, N_2O	5,000
Agriculture	Rice cultivation	CH_4	5,700
	Agricultural soil	N_2O	5,600



I. Climate change and the response of the Korean Government

Gyeongsang national university

Developed agricultural greenhouse gas emission factor

Rice cultivation area

Categories	Sub-factors	Value	Registration year
Default value	Continuously flooded	2.32 kg CH_4 ha^{-1} day^{-1}	2014
Cover crop application	0Mg/ha	1	2014
	3Mg/ha	2.96	2014
	6Mg/ha	4.92	2014
	9Mg/ha	6.88	2014
	12Mg/ha	8.84	2014
Rice straw application	1-3Mg/ha	1.2	2014
	3-5Mg/ha	1.7	2014
	5-7Mg/ha	2.5	2014
	>7Mg/ha	3.4	2014

Categories	Sub-factors	Value	Registration year
Water management before rice cultivation	Non-flooded <180 d	1	2014
	Non-flooded >180 d	0.8	2014
	Flooded preseason >30 d	1.09	2014
Water management during rice cultivation	Continuously flooded)	1	2014
	1 week drainage period	0.83	2014
	2 week drainage periods	0.66	2014
	3week drainage periods	0.49	2014
Rice straw application and tillage	Spring input with tillage	1	2019
	Autumn input with spring tillage	0.79	2019
	Autumn input with tillage	0.58	2019

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Developed agricultural greenhouse gas emission factor

Agricultural sector

Categories	Sub-factors	Value (kg N_2O-N/kg N)	registration year
N_2O emission (chemical fertilizer)	Upland soil	0.0060	2014
	Red pepper	0.0086	2014
	Soy bean	0.0119	2014
	Potato	0.0049	2014
	Spring cabbage	0.0056	2014
	Autumn cabbage	0.0058	2014
Indirect emission	Leaching/runoff	0.0135	2015
N_2O emission (livestock manure)	Cow	0.0101	2019
	Swine	0.0136	2019
	Chicken	0.0088	2019

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Developed agricultural greenhouse gas emission factor

Livestock farming

Categories	Sub-factors	Value (CH_4 kg/head/yr)	Registration year
Rumen fermentation	Korean beef male <1yr	43	2018
	Korean beef male >1yr	61	2018
	Korean beef female <1yr	45	2018
	Milk cow female >2yr	139	2020
	Milk cow female 1-2yr	83	2020
	Milk cow female <1yr	33	2020

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Developed agricultural greenhouse gas emission factor

Soil amendments

Categories		Sub-factors	value	registration year
Urea		Rice paddy	0.0148	2018
		Summer upland	0.0619	2018
		Winter upland	0.0517	2018
		Upland total	0.054	2018
Lime	$CaCO_3$	Summer upland	0.0086	2018
	$CaMg(CO_3)_2$	Summer upland	0.0157	2018
Silicate fertilizer		0.5-1 ton/ha	0.92	2021
		1.0-2.0ton/ha	0.86	2021
		2.0-3.0 ton/ha	0.78	2021
		3.0-4.0ton/ha	0.69	2021

I. Climate change and the response of the Korean Government — Korea Carbon farming institute

Silicate fertilizer

- 2-6% recycling as a soil amendment in KOREA & JAPAN
- Guarantee the safety of iron slag on human health & environmental quality

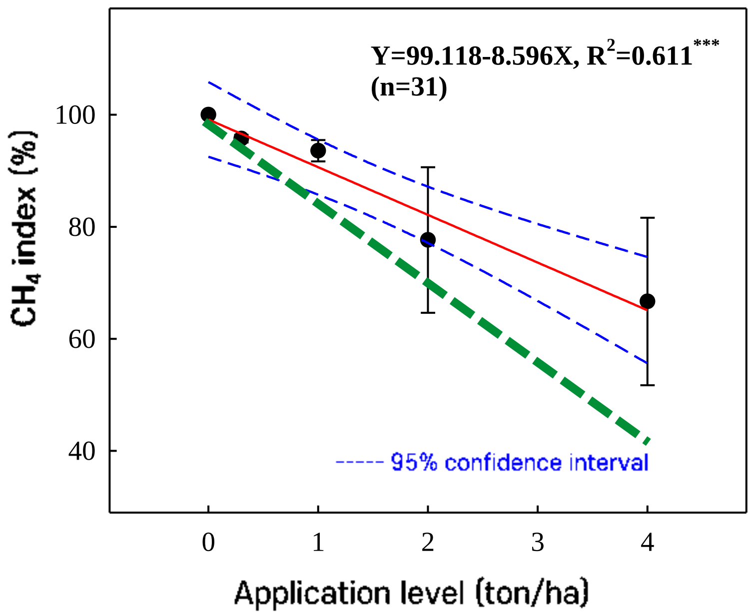
Property	Mean
pH (1:5, H_2O)	9.5
Total concentration (%)	
CaO	42
SiO_2	33
Fe_2O_3	5.4
Al_2O_3	14
MgO	4
Active Fe (mg kg^{-1})	3,078
Free Fe (mg kg^{-1})	1,570
Water-soluble Fe (mg kg^{-1})	56

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Silicate fertilizer

Emission factor development



(Lim et al., 2021. Sci. Total Environ. 806, 150961)

Level (ton/ha)	메탄 배출량 감축효과		
	Factor (SF_{sf})	Range	Reduction (%)
0.5-1.0	0.93	0.91-0.95	7
1.0-2.0	**0.86**	**0.82-0.91**	**14**
2.0-3.0	0.78	0.73-0.82	22
3.0-4.0	0.69	0.65-0.73	31

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Voluntary emission reduction programs in Korea

Methodology

➢ Total 16 methods

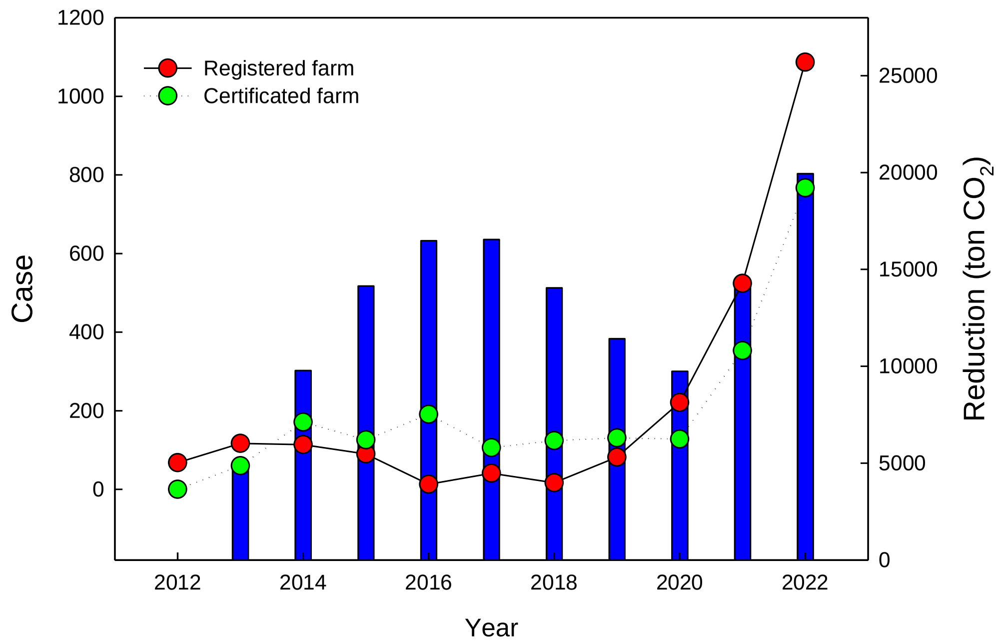
Categories	Methods
Energy use efficiency	Unused energy use Circulating water film cultivation LED lighting equipment installation Use of high-efficiency thermal insulation materials Using geothermal energy Renewable energy
Chemical fertilizer reduction	Cover crop use Slow release fertilizer use by-product fertilizer
Biomass utilization	woody biomass use (pellet) Biogas plant power generation RPC grain drying using rice husk
Other projects	Water management in rice paddy Conservation tillage Land use change (paddy -> upland) Carbon sequestration using biochar

I. Climate change and the response of the Korean Government

Korea Carbon farming institute

Voluntary emission reduction programs in Korea

Implementation performance



- Price: 10,000 ₩ / ton CO_2 (=7.5US$)
- Reduction amount

  (`13) 4,859 ton -> ('22) 19,944 ton

I. Climate change and the response of the Korean Government

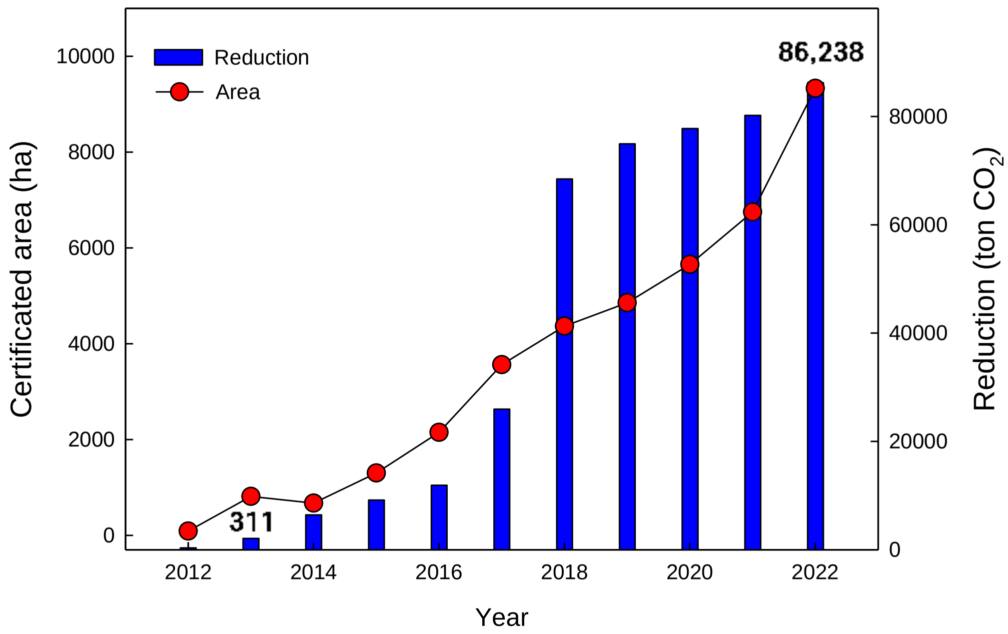
Korea Carbon farming institute

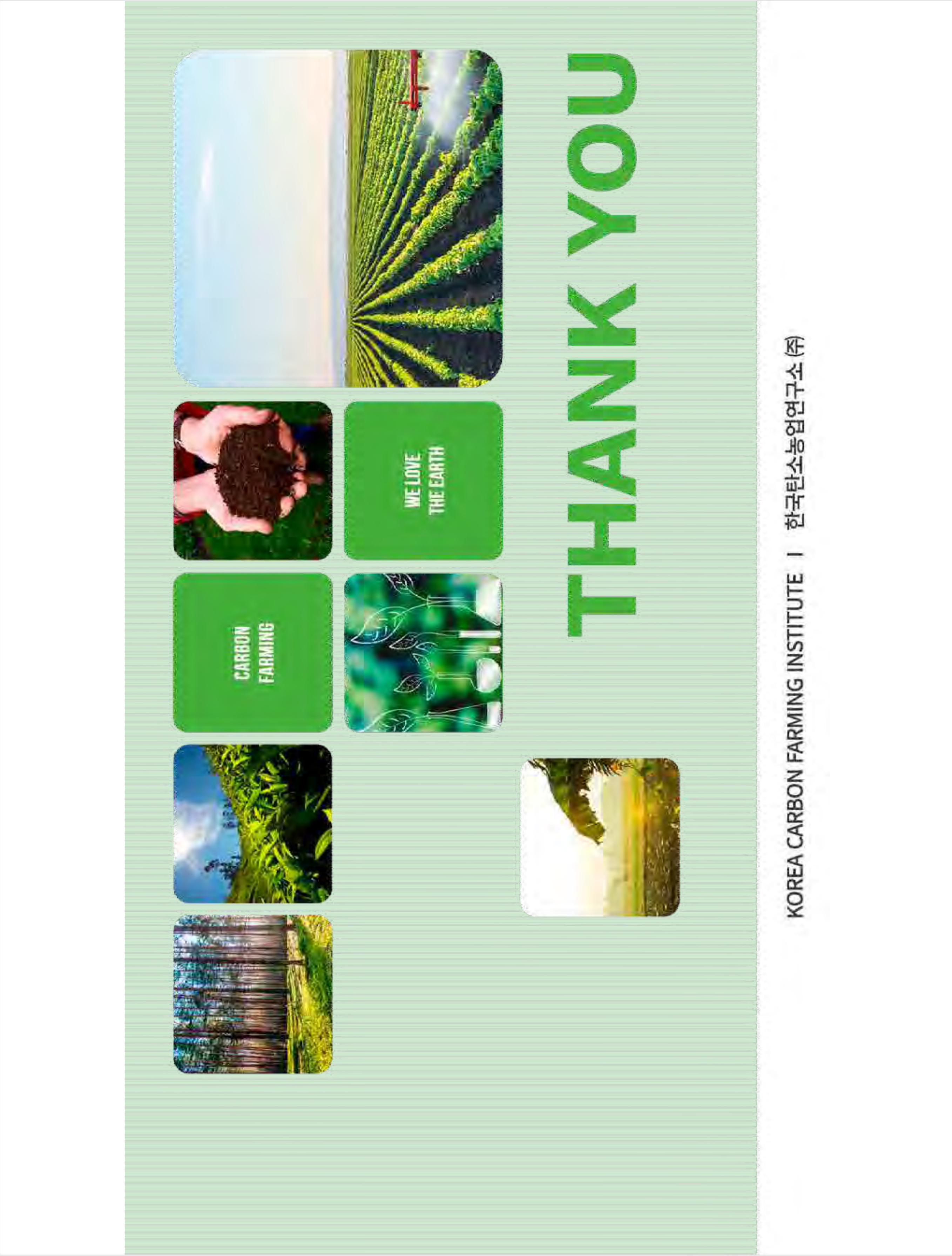
Low-carbon agricultural and livestock product certification system

Low carbon products

- A certification system granted to our agricultural products that reduce greenhouse gas emissions throughout the entire production process by applying low-carbon agricultural technology to safe agricultural products that have received eco-friendly and GAP certification

Implementation performance

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Need and Readiness of Pakistan for Implementing climate-change mitigation and adaptation technologies developed by NARO Japan

Dr Ghani Akbar
Principal Scientific Officer
Program Leader, Integrated Watershed Management Program
Islamabad, Pakistan

Climate, Energy and Water Research Institute (CEWRI), National Agricultural Research Centre (NARC)
Pakistan Agricultural Research Council (PARC), Ministry of National Food Security and Research (MNFS&R)
Email: ghani_akbar@hotmail.com
ORCID ID: https://orcid.org/0000-0002-2162-5881, Google Scholar ID: https://scholar.google.com/citations?user=G9SFh8wAAAAJ&hl=en

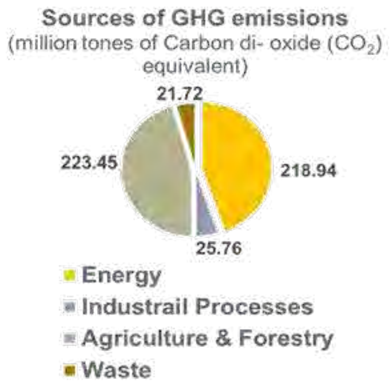
Background - Pakistan

- Pakistan is ranking fifth by population (*241.49 million, 2023 census*) and thirty-fourth by area spanning 88.19 million hectares in the world;
- Cultivated Area is around 22.74 million hectares;
- Total irrigated land is around 19 million hectares;
- More than 90% of available water is used in agriculture;
- The contribution of agriculture to GDP is around 25%;
- Agriculture contributes 65% of raw materials to industries;
- Agriculture employs 43% of the workforce;
- The share of agriculture in exports is 60%;
- The livelihood of 60% rural population depends on agriculture;
- Land holding: Less than 1 ha = 43% and >2 ha = 36% of farmers

Global Food-Security Implications
World Ranking – Crop Production

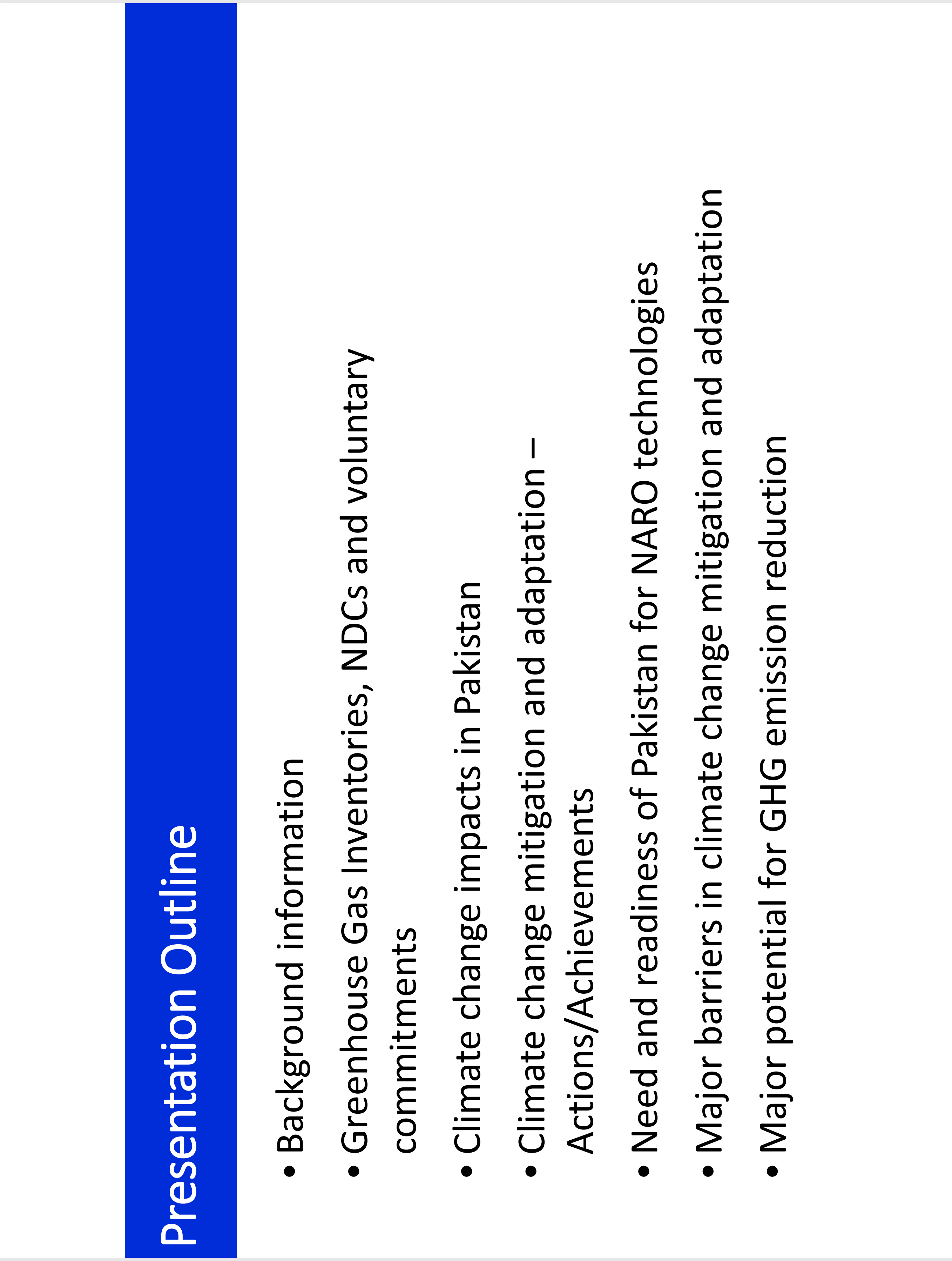
- ❑ Chickpea (3rd)
- ❑ Apricot (6th)
- ❑ Cotton (4th)
- ❑ Milk (5th)
- ❑ Date Palm (5th)
- ❑ Sugarcane (5th)
- ❑ Onion (7th)
- ❑ Kino, mandarin oranges, clementine (6th)
- ❑ Mango (4th)
- ❑ Wheat (7th)
- ❑ Rice (4th)

National GHG Inventories of 1994, 2012, 2015 and 2018 by Sector (m t CO_2 Eq.)



National GHG profile 2018

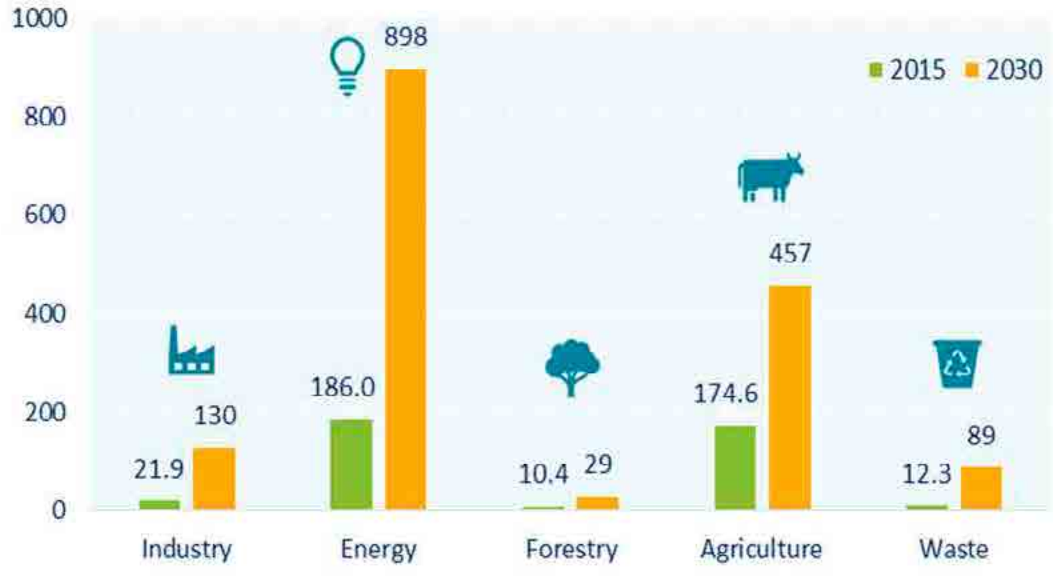
Sectors	1994	2012	2015	2018
Energy	85.81(47%)	171.44(46%)	185.97 (46%)	218.94 (45%)
Industrial Processes	13.29 (7%)	19.59 (5%)	21.58 (5%)	25.76 (5%)
Agriculture	71.63 (39%)	162.86 (44%)	174.56 (43%)	223.45 (46%) {198.59 + 24.86}
Land Use Change and Forestry (LUCF)	6.52 (4%)	9.67 (3%)	10.39 (3%)	
Wastes	4.45 (2%)	10.54 (3%)	15.65 (4%)	21.72 (4%)
TOTAL	181.70	374.11	408.15	489.87


Presentation Outline
• Background information
• Greenhouse Gas Inventories, NDCs and voluntary commitments
• Climate change impacts in Pakistan
• Climate change mitigation and adaptation – Actions/Achievements
• Need and readiness of Pakistan for NARO technologies
• Major barriers in climate change mitigation and adaptation
• Major potential for GHG emission reduction

Summary of GHG emissions from Agriculture, Forestry and other Land use (AFOLU) sectors (m t CO_2 e) in 2018

Category	CO_2	CH_4	N_2O	Total
Livestock	---	99.99	9.13	109.12
Land	28.70	1.94	0.89	31.52
Managed soils	4.25	---	70.73	74.98
Rice Cultivation	---	7.83	---	7.83
Total	32.95	109.75	80.75	223.45

Pakistan's 1st NDC (2016)



**Projected GHG emission in 2030 according to BAU - All figures in m t CO_2 e*

Pakistan committed 20% reduction in GHG emission of its 2030 projected GHG emissions, subject to the availability of international grants, which was estimated at about US$ 40 billion (US$7-14 billion/year) at current prices.

Pakistan's Nationally Determined Contribution

Pakistan's Updated NDC (2021)

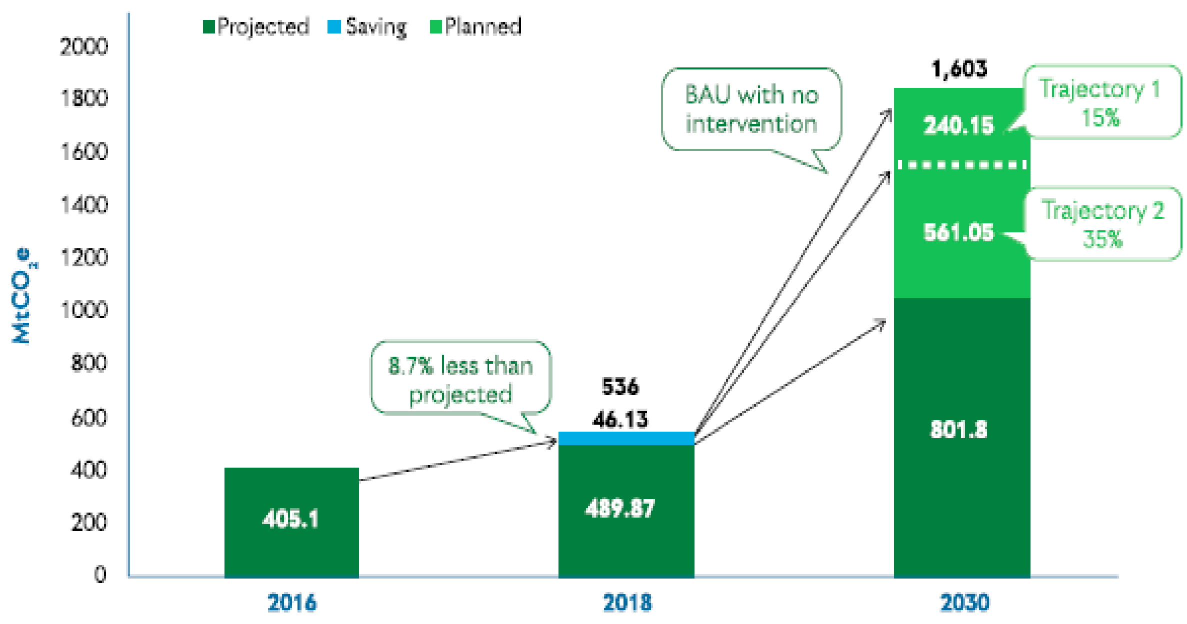
Highlights of the Revised Nationally Determined Contributions (NDC)

Pakistan Revised NDC, 2021 Commitments

High Priority Actions

<u>**Pakistan's priority contributions by 2030**</u>: around 1.7 mt CO_2eq from shelving of two <u>imported coal power</u> plants, 24 m t CO_2e from the introduction of <u>Electric Vehicles</u>, and around 45 m t CO_2e from converting 60% energy generation to <u>renewable energy</u>

Voluntary and Conditional GHG Emission Reduction Targets

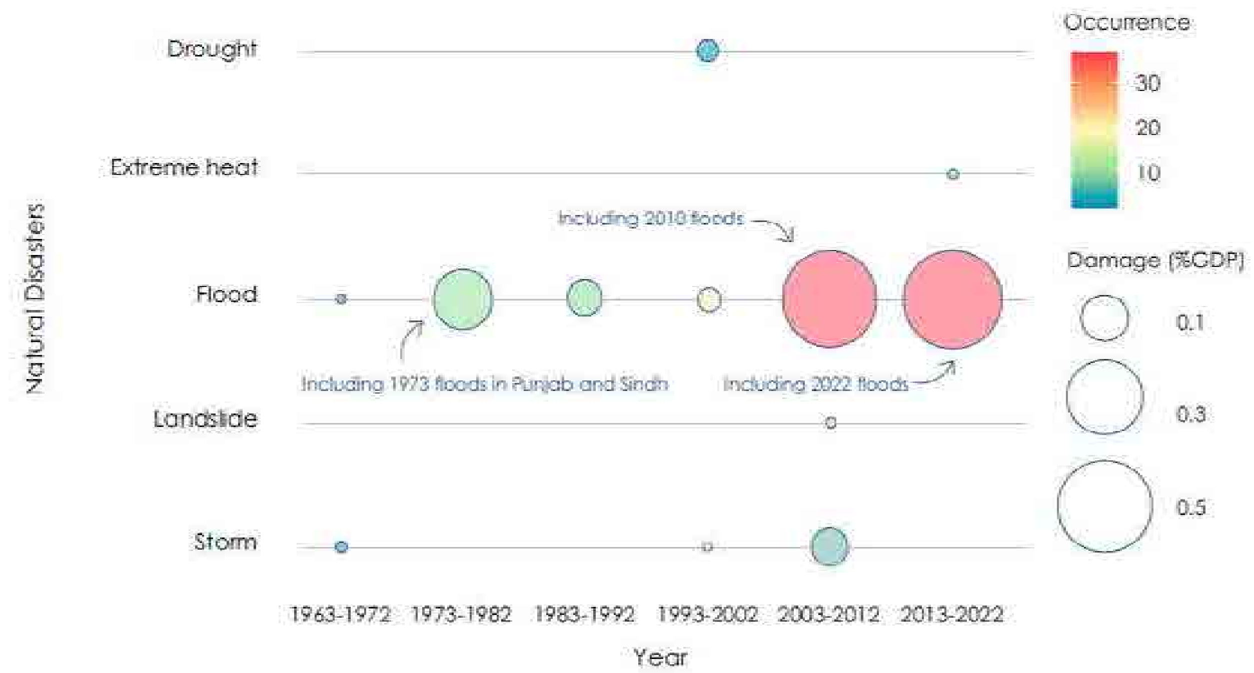


Pak NDC, 2021

Climate Change Impacts in Pakistan

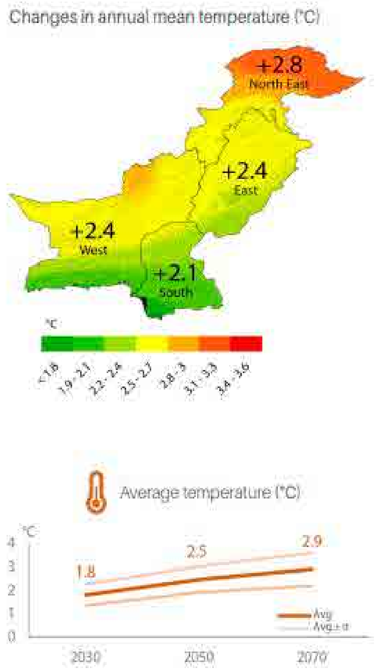
Sr. No.	Extreme Events	Period 1985 - 2000	Period 2001 - 2020
1	Large Scale Floods	[illegible]	[illegible]
2	Localized Cloud Bursts	[illegible]	[illegible]
3	Droughts	[illegible]	[illegible]
4	Intense Heat Waves	—	[illegible]
5	Severe Cyclonic Storms	[illegible]	[illegible]

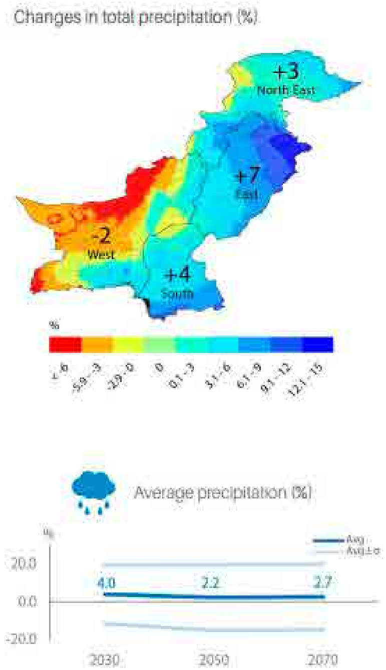
Table 11 Extreme Climate Events during the periods 1985-2000 and 2001-2020



Total occurrence and average economic damage from natural disasters in Pakistan between 1963 and 2022
(as a percentage of GDP) NAP 2023

Projected changes in temperature and precipitation in Pakistan



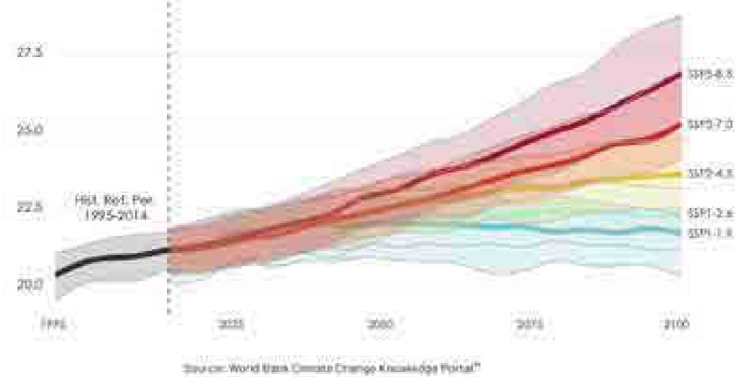


- The change in temperature shows 2.1 ^{0}C to 2.8 ^{0}C increase across the spatial boundaries of Pakistan
- Precipitation is expected to increase by 3% to 7% in the north-east and reduce by 2% in the south-west

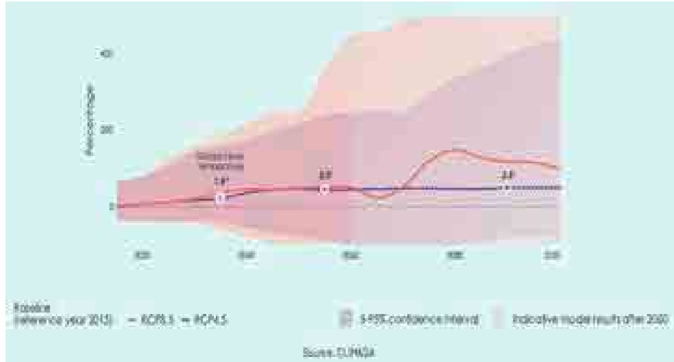
World Bank 2019
CSA in Pakistan

Projected Impacts of Climate Change in Pakistan

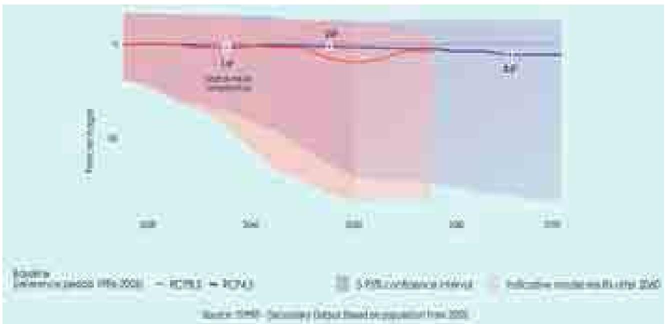
NAP 2023



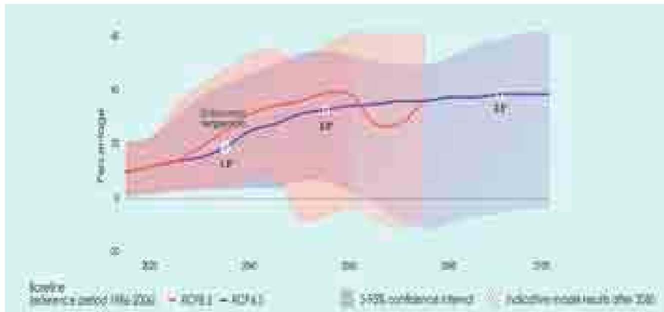
Projected annual mean temperatures between 2015 and 2100 in Pakistan



Annual expected damage from river floods in percentage (CLIMADA)

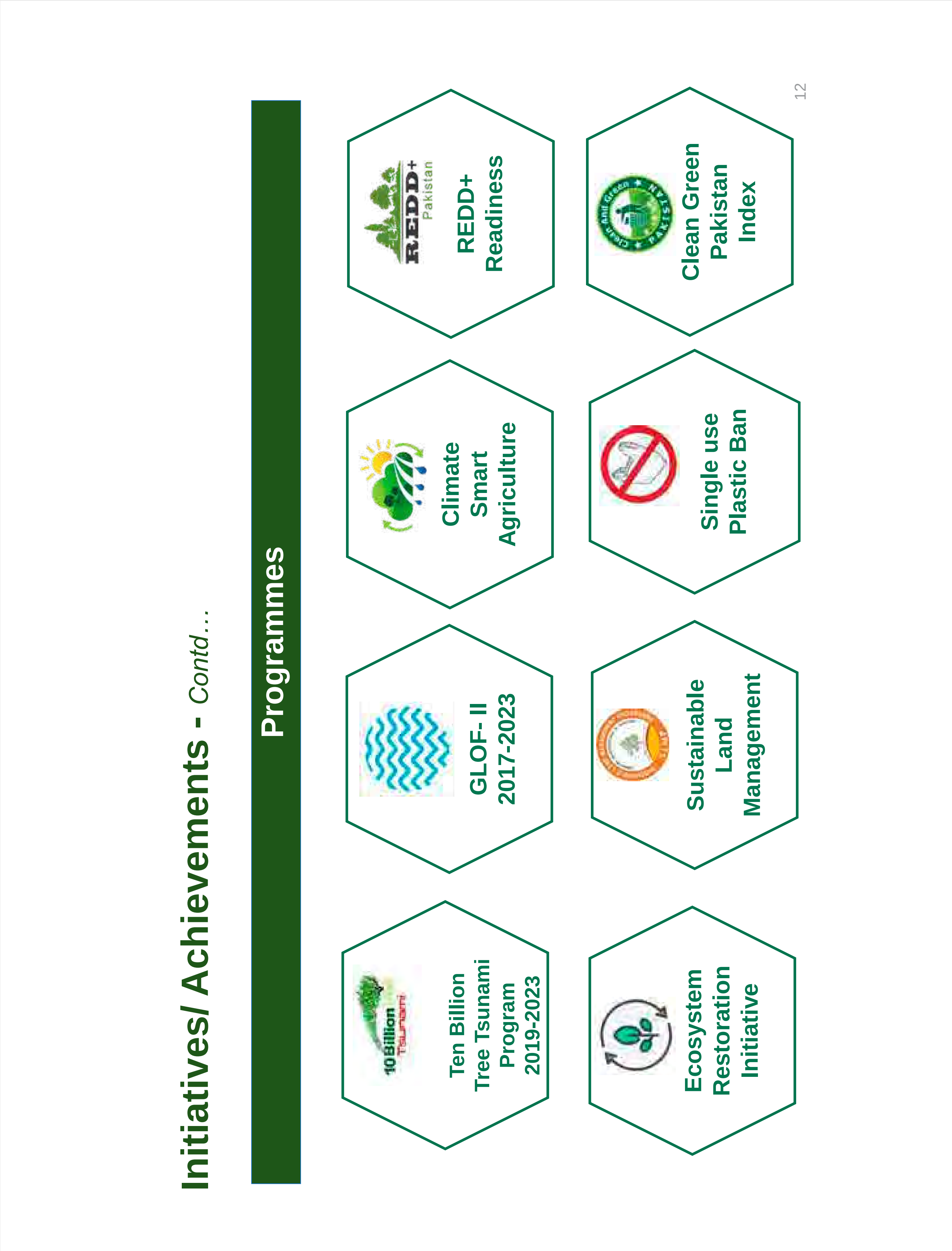


Annual mean wheat yield in percentage



Fraction of population annually exposed to heatwaves in percentage

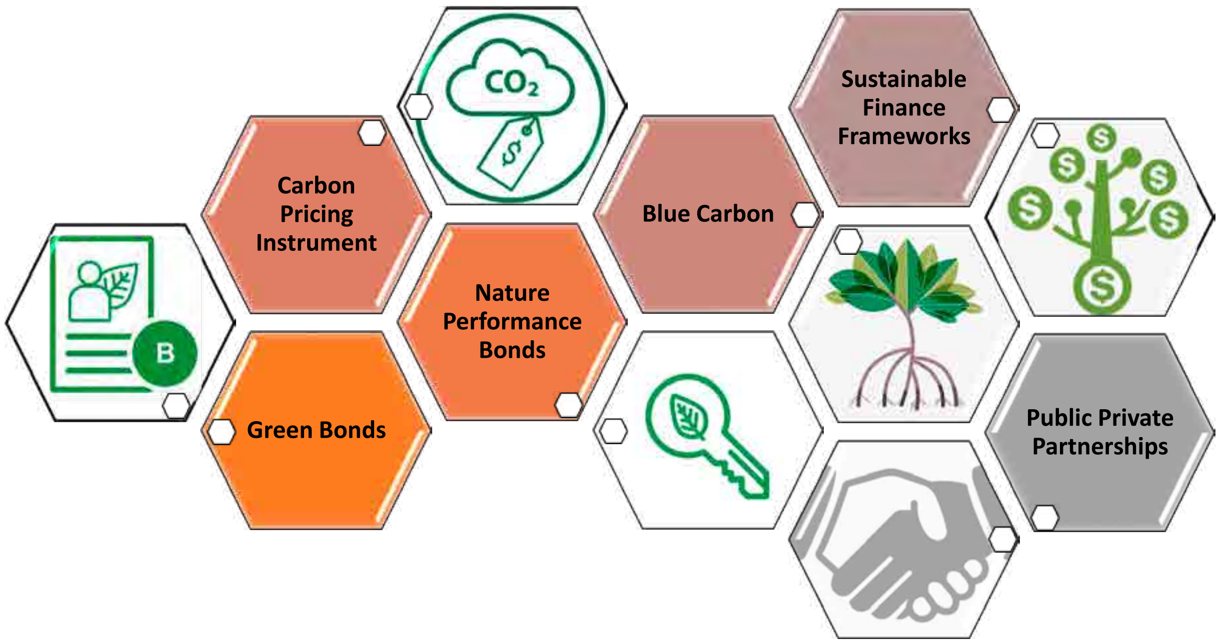

Initiatives/ Achievements
Policies and Strategies
National Climate change Policy/2012 Update 2021
Framework for Implementation (2014-30)
Nationally Determined Contributions (2016, 2021)
National Adaptation Plan (2023)
Biodiversity Strategy & Action Plan - 1999, 2023-2027
Electric Vehicle Policy 2020-2025
Strengthened Compliance with *MEAs
New Sectors Blue Carbon, Ecosystems, Health, Waste, Carbon Markets
*MEA: Multilateral Environmental Agreements
11


Initiatives/ Achievements - Contd…
Programmes
Ten Billion Tree Tsunami Program 2019-2023
GLOF- II 2017-2023
Climate Smart Agriculture
REDD+ Readiness
Ecosystem Restoration Initiative
Sustainable Land Management
Single use Plastic Ban
Clean Green Pakistan Index
12

Climate Finance
Market and non-market-based approaches

Pakistan considers employing the instruments on enhanced ambition provided in Article 6 of the Paris Agreement

Market and non-market-based approaches help in diversifying the funding sources for commissioning capital-intensive projects. Some of the initiatives that Pakistan has embarked upon include:



Climate Finance and Pakistan

Current Portfolio

Green Climate Fund (GCF) ongoing portfolio of $124 million

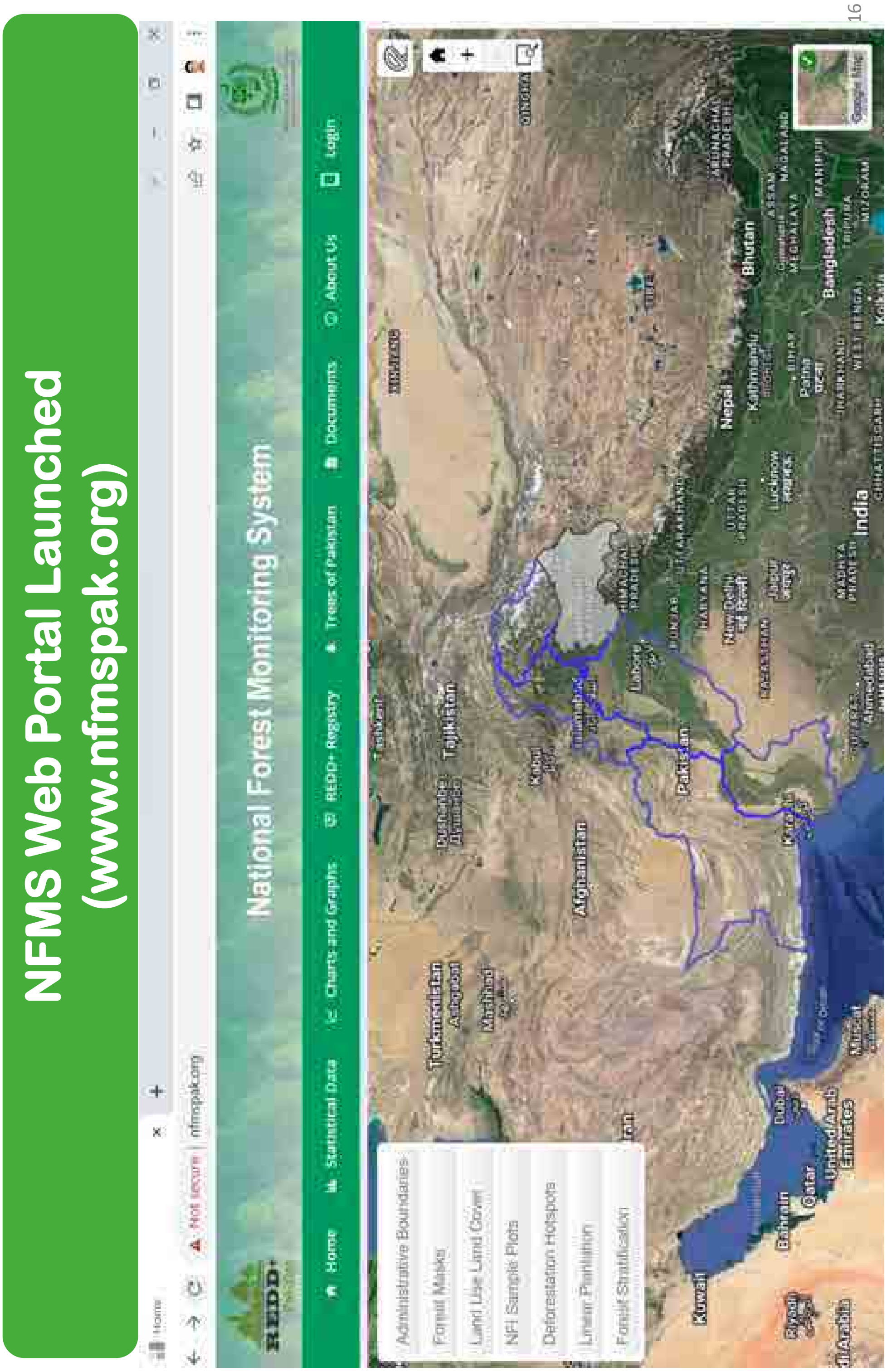
- Transforming the Indus Basin with Climate Resilient Agriculture & Water Management
- Building a zero-emissions bus rapid transit (BRT) system in Karachi
- Scaling-up of Glacial Lake Outburst Flood (GLOF) risk reduction in Northern Pakistan

Global Environment Facility (GEF) ongoing portfolio of $19.4 million

Others

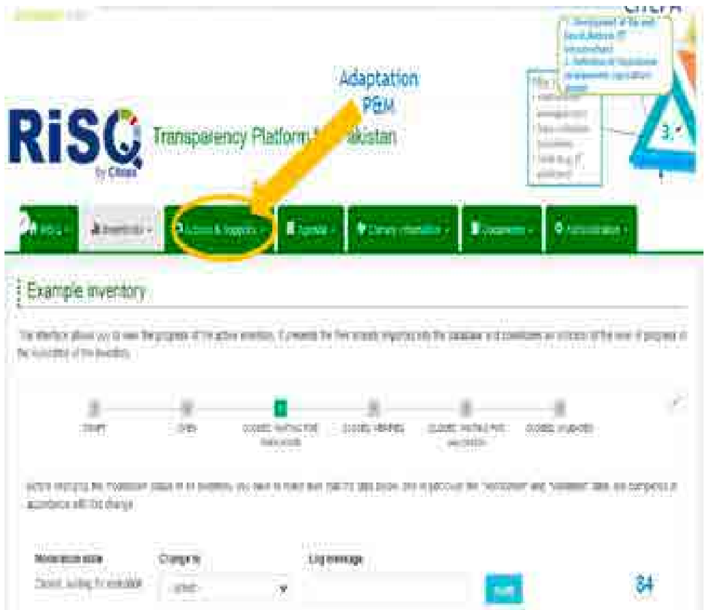
- Multilateral Development Partners (World Bank's portfolio of $188 m)
- Bilateral partners mostly small scale funding for technical assistance

13


NFMS Web Portal Launched
(www.nfmspak.org)
National Forest Monitoring System
Home
Statistical Data
Charts and Graphs
REDD+ Registry
Trees of Pakistan
Documents
About Us
Login
Administrative Boundaries
Forest Masks
Land Use Land Cover
NFI Sample Plots
Deforestation Hotspots
Linear Plantation
Forest Stratification
16

National transparency web platform

- Pakistan in collaboration with GIZ Germany and CITEFA France is working on developing a national Transparency Web Platform to ensure MRV & ETF for managing climate change.
- The platform is dedicated to:
  - ✓ Monitor the inventory preparation, its ongoing state of play, and the archiving of different past annual editions;
  - ✓ Store and share the emission inventory results and selected background data/information;
  - ✓ Report inventory results according to the defined reporting template consistent with the UNFCCC reporting requirements (MPGs and coming CRT format);
  - ✓ Tracking/recording the Verification and checks – QA/QC activities for the national GHG inventories;
  - ✓ Track and monitor adaptation efforts



Donor funded initiatives

PMI (Partnership for Market Implementation): GHG data infrastructure, Emission trading scheme, Knowledge management

GGGI / SPAR6C (Supporting Preparedness for Article 6 Cooperation): Art. 6 Paris Agreement Readiness

giz (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH): GHG accounting framework & Work platform for GHG inventory

Foreign & Commonwealth Office: Not specific to carbon markets, but climate finance

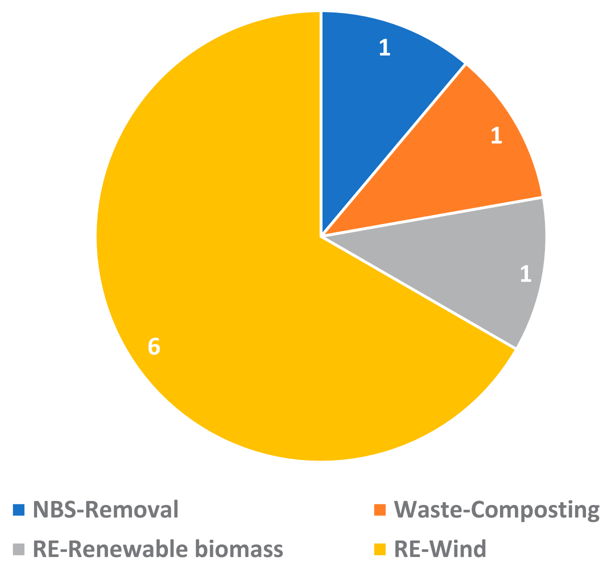
Ministry of Foreign Affairs of Denmark (Denmark in Pakistan): Capacity building and knowledge sharing on carbon markets

ADB (Asian Development Bank): National climate change dashboard

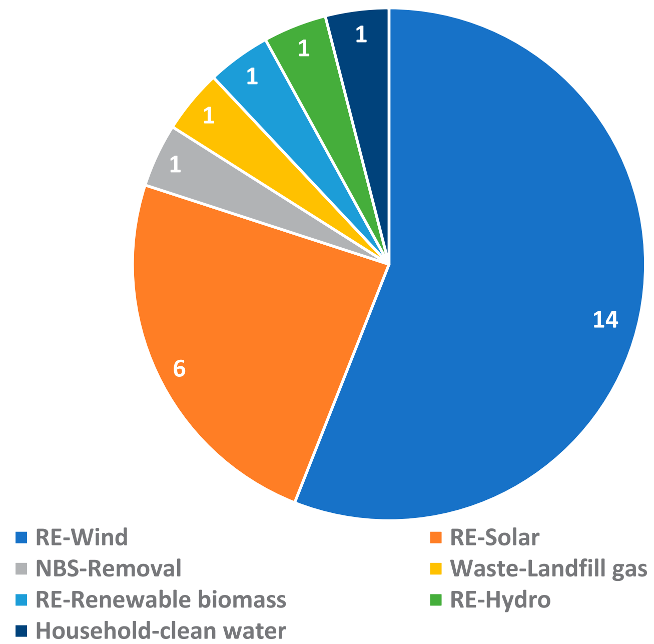
VCM activities in Pakistan

VCM potential is yet to be explored but there is growing investor interest

Registered Projects in Pakistan (9)

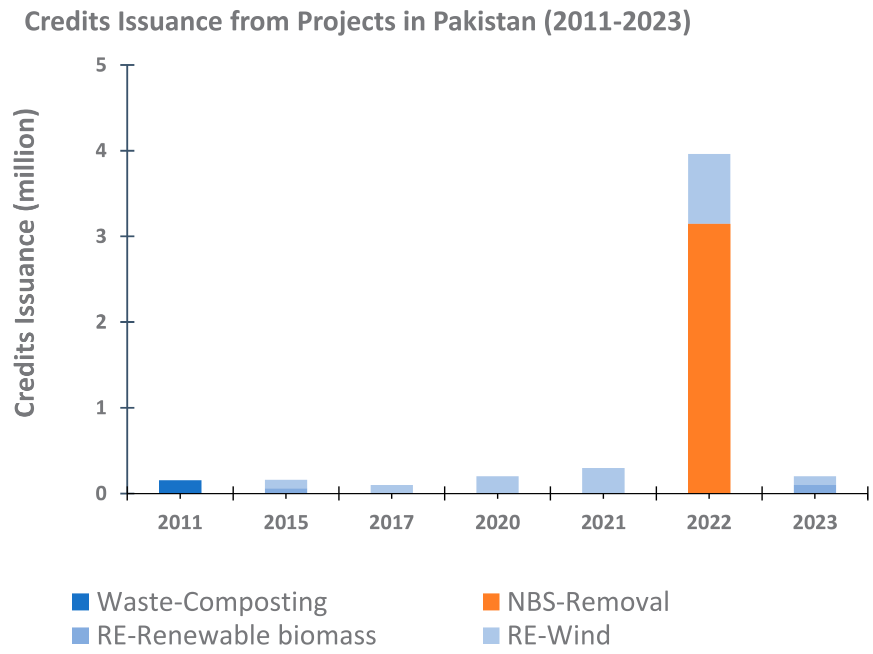


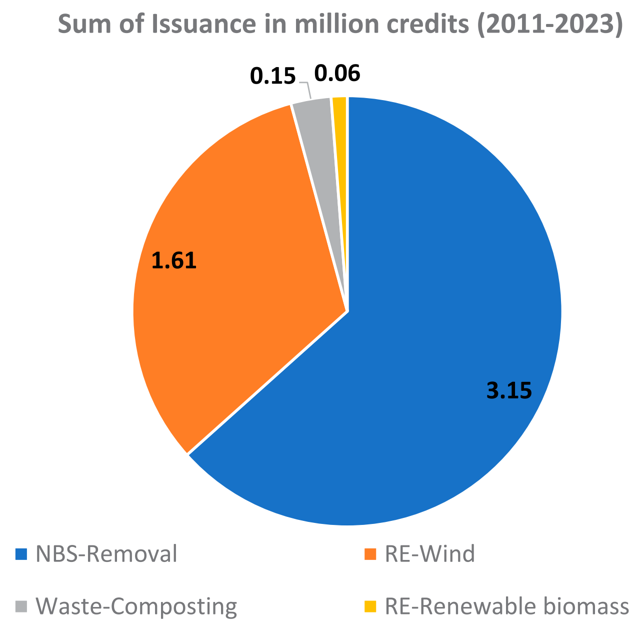
Projects in the pipeline (25)



Credits issuance from projects in Pakistan

Substantial increase in credit issuances in 2022





National Adaptation Plan of Pakistan (NAP), 2023

Sectors	Priority areas	Number of suggested interventions
Agriculture-water nexus	i. Promote Climate Smart Agriculture Practices ii. Modernize the Irrigation Systems iii. Formulate Long-Term Agriculture Growth Strategy	16
Natural capital (Land, Water and Air)	i. Sustainable Land Management ii. Integrated Watershed Management iii. Coastal and Marine Protection iv. Investing in Air Quality Management	19

Sectors	Priority areas	Number of suggested interventions
Urban resilience	i. Promoting Climate-Informed Urban Planning ii. Improving Municipal Service Delivery iii. Leveraging Nature-Based Solutions (NBSs) iv. Strengthening Municipal Financial Capacity	20
Human capital (Health, education, and Labor and economic Productivity)	i. Mainstreaming Climate Adaptation in Health and Education Policies ii. Enhancing Community Resilience through Emergency Preparedness and Response iii. Building Workforce Capacities to Address Climate Risks	19

Sectors	Priority areas	Number of suggested interventions
Disaster risk management	i. Strengthening Hydromet, Climate and Early-Warning Systems and Services ii. Strengthening Disaster Risk Governance iii. Bolstering the Resilience of Communities and Critical Infrastructure iv. Enhancing Disaster Response and Recovery	25
Gender, youth, and social inclusion	i. Supporting Capacity Development of Vulnerable Groups ii. Ensuring Inclusion Policy Making and Development Planning	19

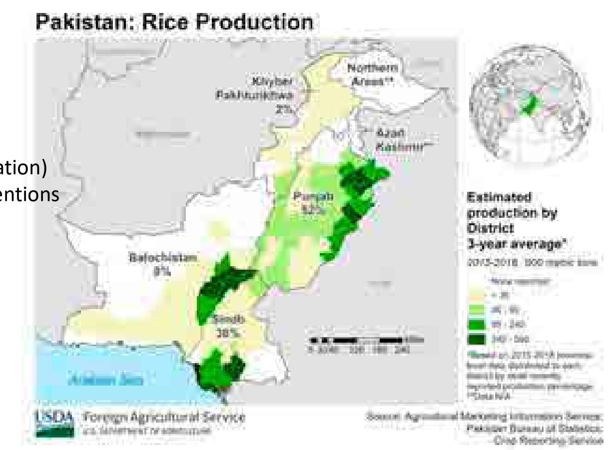


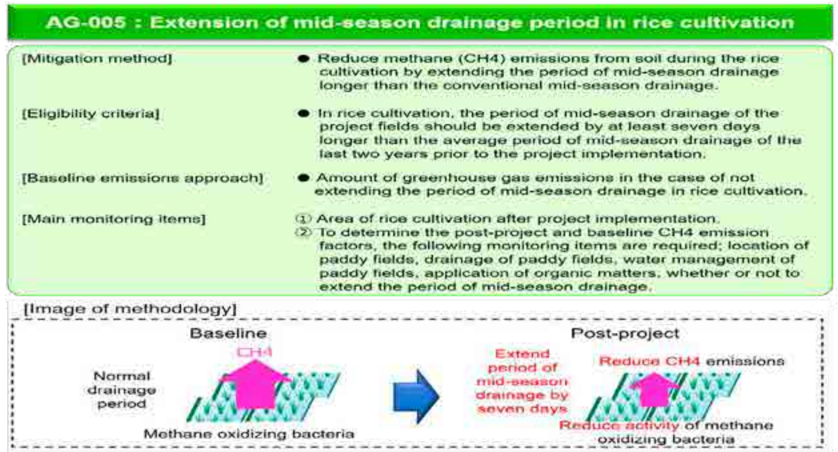

Need and Readiness of Pakistan for NARO Technologies

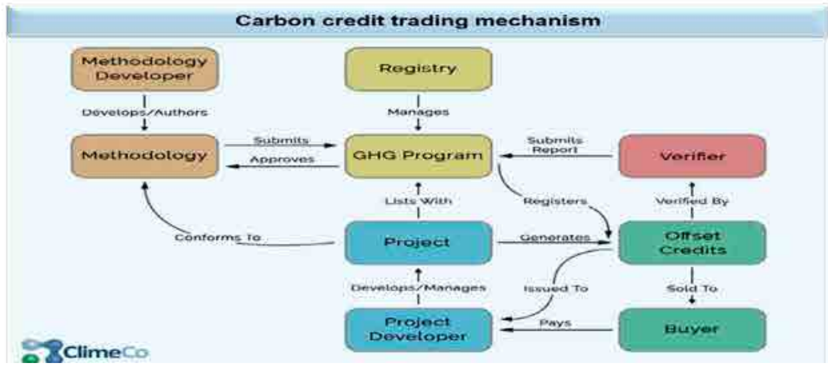
AG005: Reduction of mid-season drainage period in rice

Total GHG emission = 2,23,450 GgCO_2eq (2018 - BUR-I 2022)
Methane emission from paddy soils = 7830 GgCO_2eq
Total rice area = 3.5 m ha
Rice yield = 3.6 t/ha
Current water management = Prolonged flooding
Scope AG005 = > 90% area of rice cultivation
Importance = High-priority area

Input Data
Area – Location (Agri-Statistics)
Irrigation- Canal & tubewell
(Warabandi system & t/w operation)
Fields selection for MSD interventions
(Primary data for project)







Methodology for calculating and reporting soil carbon stock in agricultural soils

AG004: Biochar addition to mineral soil in cropland/grassland

- Biochar- soil amendment to improve fertility, yield and also used for carbon sequestration
- Biochar has the potential to remove 6% of GHG in 155 countries
- AG004 use biochar Calculating and reporting of Carbon stock
- AG004 can generate tradable carbon credit
- Pakistan is interested in collaborating for this intervention
- Positive impacts of biochar on productivity and fertility identified
- Pakistan is a member of the Biochar Network of South Asia (BNSA)

The potential quantity of organic materials for biochar

(World Bank)

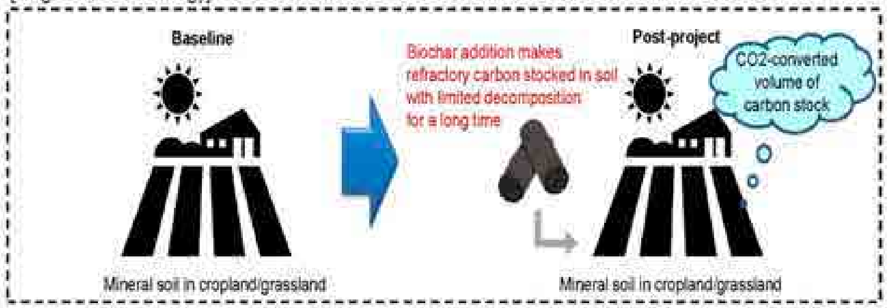
- Rice Straw = 16.754 million tons
- Rice Husk = 3.351 million tons
- Sugarcane trash = 7.831 million tons
- Sugarcane bagasse = 19.577 million tons
- Maize straw = 5.325 million tons
- Maize Cobs = 1.406 million tons
- Maize shell (husk) = 0.937 million tons

Note: They are used for animal fodder, domestic burning (cooking), selling to biomass suppliers, selling to industry, organic fertilizer or open-field burning

AG-004: Biochar addition to mineral soil in cropland/grassland

[Mitigation method]	● Stock refractory carbon in mineral soil by adding biochar to cropland and/or grassland.
[Main eligibility criteria]	① To add biochar to mineral soil in cropland and/or grassland as defined in Article 2 of the Cropland Act. ② Added biochar is: a type to which the default values of organic carbon content and fraction of biochar carbon after 100 years are applicable; or made from/at certifiable feedstocks/temperature that make such default values applicable. ③ Feedstocks of added biochar are: produced within Japan; unutilized (including the case of by-product of biochar fuel); and free of paint, adhesive, etc.
[Credit volume calculation approach]	● CO2 stock (=Added biochar volume × Organic carbon content × Fraction of biochar carbon × 44/12) − CO2 emissions resulted from biochar production and transportation
[Main monitoring items]	● Quality of biochar as confirmed by its organic carbon content or degree of refinement, which are measured by one of the following methods when applying for validation or first certification ① Measuring the degree of refinement (electric conductivity) by a charcoal refinement meter, etc ② Measuring the organic carbon content at an industrial experimental station, etc., being based on JIS M 8812: 2004, "Coal and coke – Methods for approximate analysis" ③ Measuring the organic carbon content, being based on the Japan Biochar Association's specification on the measurement of biochar for carbon stocks in soil

[Diagram of methodology]



Soil Carbon Sequestration Visualization Tool

FUNTIONS

Calculate changes in soil carbon content for 20 years and display total GHG (CH_4, N_2O, CO_2) emissions (require input location, crop, organic material management practices).

PURPOSE

- Used to calculate soil carbon stock and greenhouse gas emissions
- Identify effects of activities eligible for the Direct Payment for Environmentally Friendly Agriculture
- Can be used for direct payment subsidies in exchange for their efforts to shift from conventional to environmentally friendly farming, on global warming prevention

RELEVANCE FOR PAKISTAN

- Highly relevant and most needed
- Soil texture, NPK content, fertilizer application, and micronutrients maps are available for parts of the country
- Organic matter maps are not available but short-term experimental data may be available

Web-based visualization tool for agricultural soil carbon sequestration and GHGs emission

Agrometeorological grid square data system

FUNCTIONS

- This system provides daily meteorological data;
- It can cover the entire country in a 1 km grid;
- Require 13 different meteorological elements,
- Flexile to combine with crop development models and other techniques for real-time crop responses to stresses

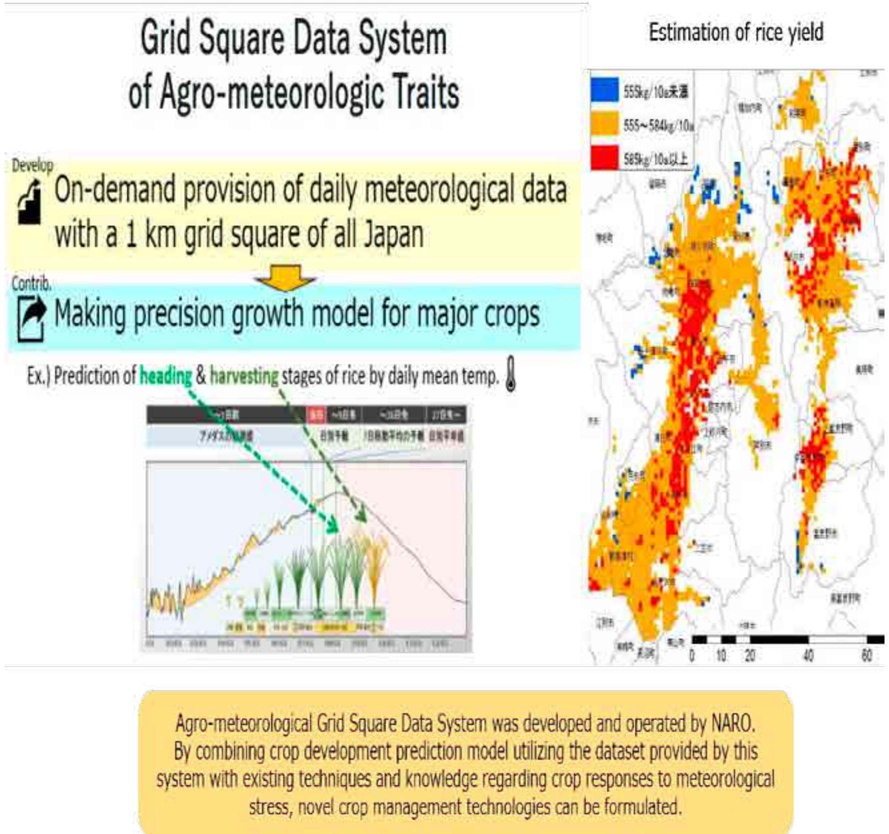
PURPOSE

Novel crop management technique for identifying real-time crop responses to meteorological stress and predicting crop growth and development

RELEVANCE FOR PAKISTAN

- Pakistan is interested in agroecological and crop zoning systems for decision-making & currently pursuing such initiatives a top-level priority
- Pakistan is also collaborating with FAO in developing a subnational food systems dashboard
- The PMD uses the satellite-based crop monitoring system in Pakistan to forecast and estimate crop statistics
- SUPARCO also forecasts and estimates crop statistics using repetitively taken synoptic images
- Weather data since 1960 is available for selected station

Note: Pakistan is interested to collaborate and utilize this system for Pakistantop-level



Key stakeholders in climate-smart agriculture

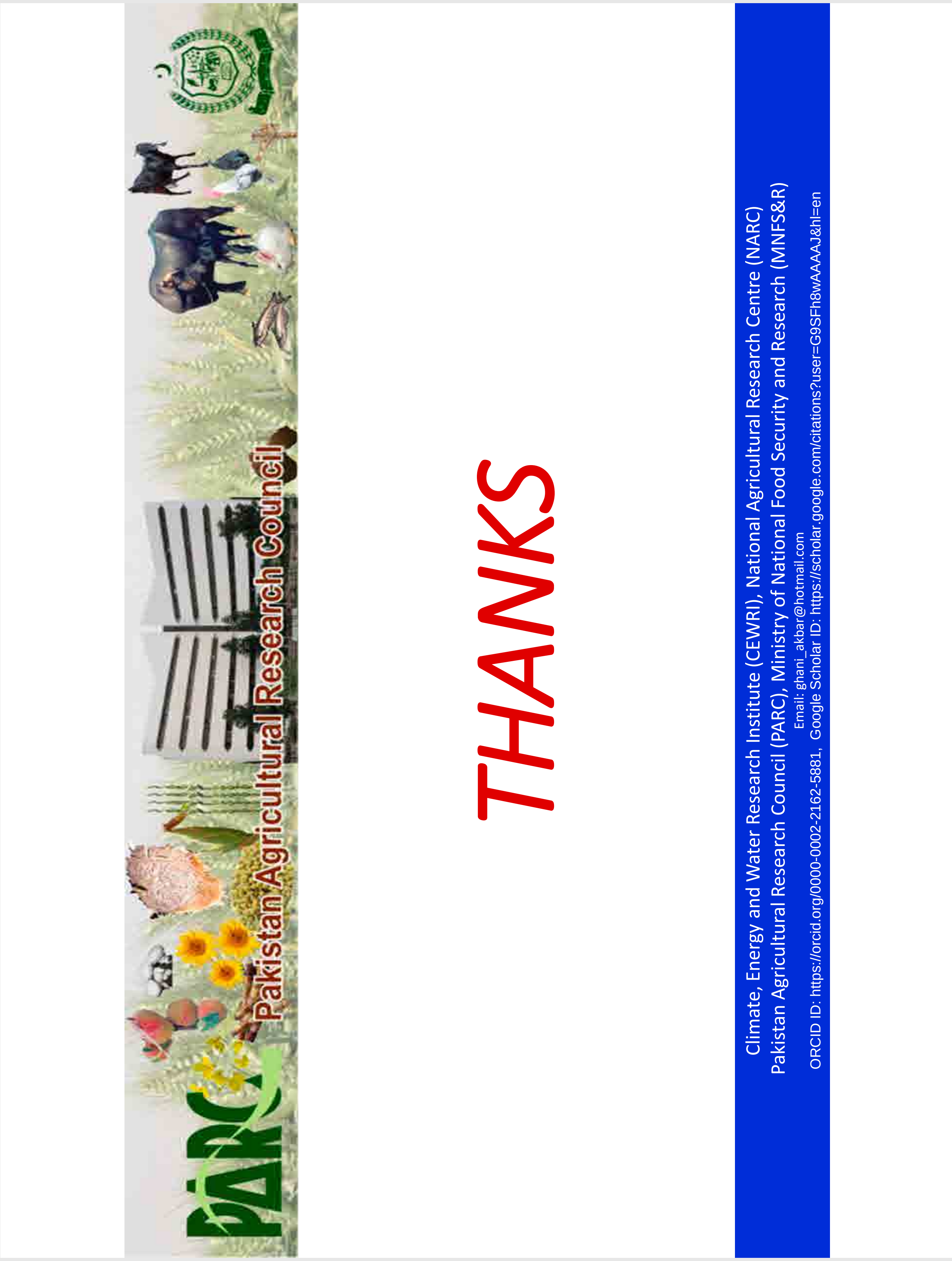
- **Government Agencies**
  - ✓Ministry of national food security and research (MNFS&R)
  - ✓Ministry of climate change and environmental coordination (MOCC&EC)
  - ✓Ministry of Planning Development and Special Initiatives (PD&SI),
  - ✓Provincial Governments – Agriculture ministries/departments
- **University or Research Institutes**
  - ✓Climate, Energy and Water Research Institute (CEWRI), NARC
  - ✓University of Agriculture Faisalabad (UAF)
  - ✓University of Agriculture Peshawar (UAP)
  - ✓National University of Science and Technology (NUST)
  - ✓Global Climate Change Impact Study Centre (GCISC)

Major barriers

- Lack of up-to-date GHG emission data and MRV systems
- Lack of effective national database or registry systems for GHG emissions
- Lack of active private sector participation
- No overarching strategy, guidelines or regulatory framework
- Climate-change induced frequent disasters overlook the GHG mitigation efforts
- Lack of strong institutional coordination and capacities in GHG emission reduction
  - ✓ Ministries’ roles and responsibilities are not clear
  - ✓ Weak institutional framework
  - ✓ Weak collaboration between federal and provincial entities
  - ✓ Knowledge gap and awareness issues

Major potential for GHG emission reduction

- Huge potential for GHG emission reduction and Carbon credit earning in the Agriculture, Forestry and land use sectors:
  - ✓Livestock = 109120 Gg CO_2 e
  - ✓Land use = 31520 Gg CO_2 e
  - ✓Managed soil = 74980 Gg CO_2 e
  - ✓Rice cultivation = 7830 Gg CO_2 e
  - ✓**Total = 2,23,450 Gg CO_2 e**
- The government is supportive and keen on developing partnerships
- Government policies are aligned and conducive to climate change mitigation and adaptation initiatives
- Local expertise and institutions are available for collaboration


PARC
Pakistan Agricultural Research Council
THANKS
Climate, Energy and Water Research Institute (CEWRI), National Agricultural Research Centre (NARC)
Pakistan Agricultural Research Council (PARC), Ministry of National Food Security and Research (MNFS&R)
Email: ghani_akbar@hotmail.com
ORCID ID: https://orcid.org/0000-0002-2162-5881, Google Scholar ID: https://scholar.google.com/citations?user=G9SFh8wAAAAJ&hl=en


November 7-11, 2023
PHILIPPINES' CLIMATE-SMART AGRICULTURE
Needs and Readiness Based on APO-NARO COE CSA Survey
ENGR. EDUARDO JIMMY P. QUILANG, PhD
DEPUTY EXECUTIVE DIRECTOR FOR RESEARCH
ENGR. KRISTINE S. PASCUAL
ENGR. EVANGELINE B. SIBAYAN
ENGR. LEA CAGUIAT
MR. ALDRIN G. CASTRO
DEPARTMENT OF AGRICULTURE-CLIMATE RESILIENT AGRICULTURE OFFICE
DEPARTMENT OF AGRICULTURE
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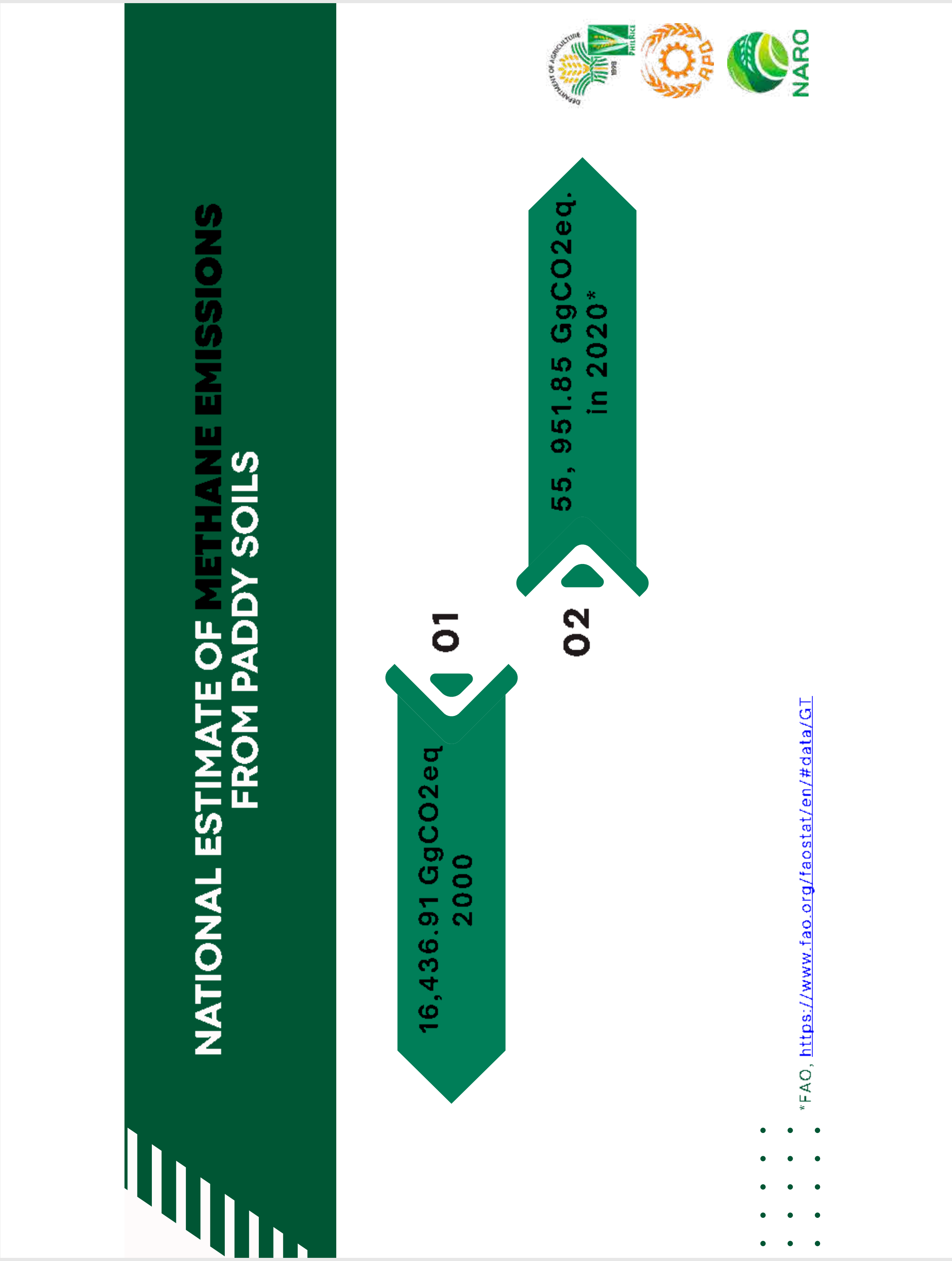
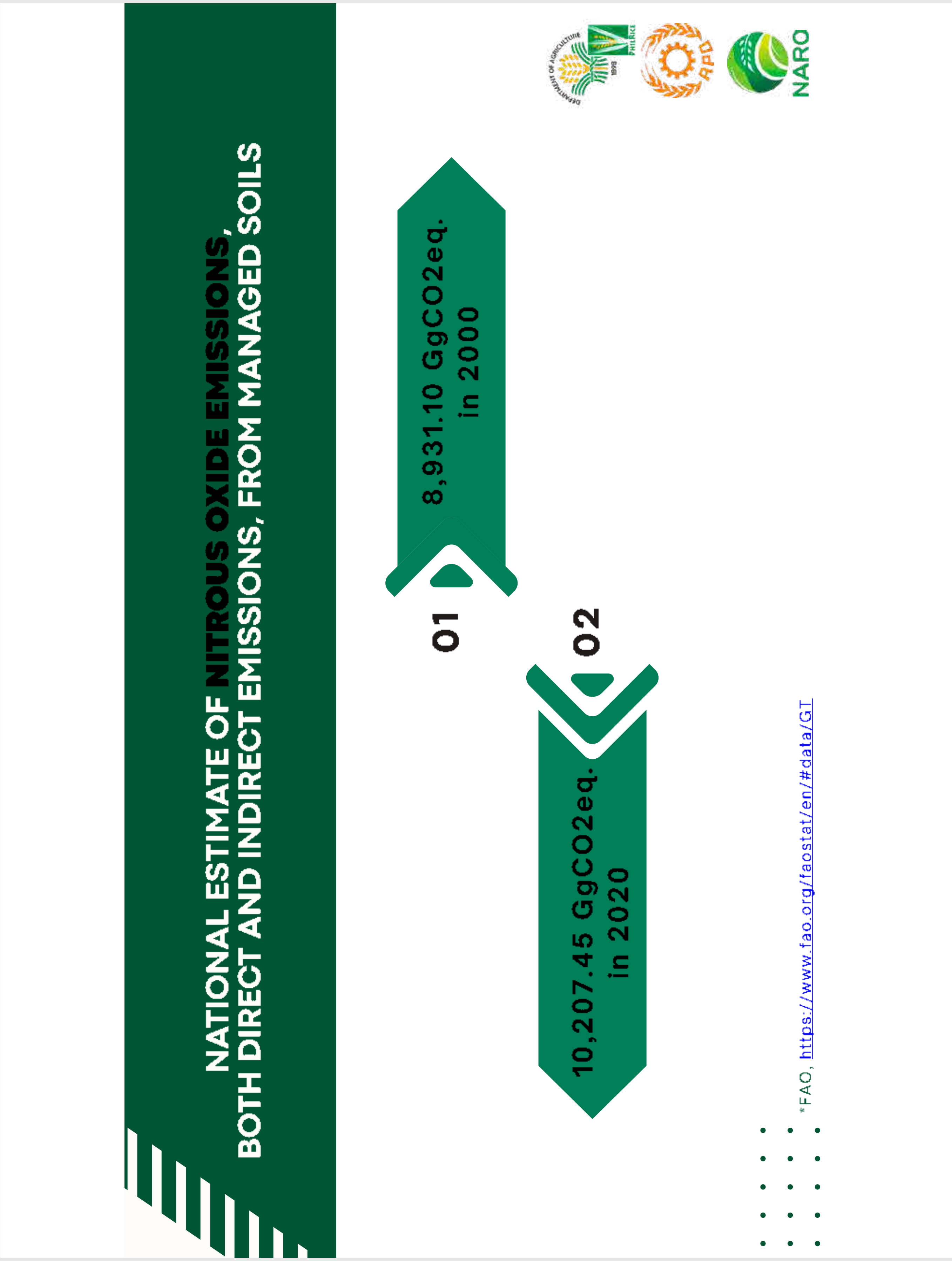
GREENHOUSE GAS EMISSIONS FROM AGRICULTURAL SECTOR IN THE PHILIPPINES


NATIONAL ESTIMATE OF GREENHOUSE GAS EMISSIONS FROM THE AGRICULTURAL SECTOR
01
37,002.69 Gg CO2eq. in 2000***
02
51.3 MtCO2eq in 2012**
03
66,159.30 GgCO2eq. in 2020*
*FAO, https://www.fao.org/faostat/en/#data/GT
**2016 USAID Philippines GHG Emissions Fact Sheet
***Second National Communication to the United Nations Framework Convention of Climate Change
NARO


NATIONAL ESTIMATE OF METHANE EMISSIONS
FROM PADDY SOILS
01
16,436.91 GgCO2eq
2000
02
55, 951.85 GgCO2eq.
in 2020*
*FAO, https://www.fao.org/faostat/en/#data/GT


NATIONAL ESTIMATE OF NITROUS OXIDE EMISSIONS,
BOTH DIRECT AND INDIRECT EMISSIONS, FROM MANAGED SOILS
01
8,931.10 GgCO2eq.
in 2000
02
10,207.45 GgCO2eq.
in 2020
*FAO, https://www.fao.org/faostat/en/#data/GT
NARO

GOVERNMENT POLICIES OR SUPPORT MEASURES FOR REDUCING GREENHOUSE GAS EMISSIONS FROM THE AGRICULTURAL SECTOR IN THE PHILIPPINES

GOVERNMENT POLICIES OR SUPPORT MEASURES FOR REDUCING **GREENHOUSE GAS EMISSIONS FROM THE AGRICULTURAL SECTOR**

The **National Greening Program or NGP** is the country's most ambitious reforestation program to date. It seeks to plant 1.5 billion trees in 1.5 million hectares for a period of six (6) years, from 2011 to 2016. Executive Order No. 26, signed on February 24, 2011 by President Benigno S. Aquino III serves as the legal basis for the implementation of the NGP. **Executive Order 193, s. 2015 expands its coverage from 2016 to 2028.**

GOVERNMENT POLICIES, ONGOING ACTIONS, OR FUTURE PLANS FOR **METHANE EMISSION REDUCTIONS FROM PADDY SOILS**

- **Republic Act 9729 - also known as the Climate Change Act of 2009** - an Act mainstreaming climate change into government policy formulations, establishing the framework, strategy, and program of climate change.
- **Agriculture and Fisheries Modernization Act (AFMA) of 1997 (RA 8435)** underscores the importance of integrating climate change plans, weather variability, and annual productivity cycles into formulating and predicting relevant agricultural and fisheries programs.

GOVERNMENT POLICIES, ONGOING ACTIONS, OR FUTURE PLANS FOR CARBON SEQUESTRATION IN AGRICULTURAL SOILS

- **Republic Act 10068, known as the Organic Agriculture (OA) Act**, is a state policy that promotes, propagates, further develops and implements the practice of organic farming in the country addressing farm productivity, depletion of natural resources, and health benefits of both farmers and consumers.
- **Philippines NDC PA** for carbon sequestration in agricultural soils Implementation of carbon sequestration measures: a) use of organic fertilizers b) use of biochar c) expansion of coconut bands along storm surge prone shores d) rehabilitation/expansion of mangrove areas and e) establishment of bamboo plantation.

NATIONAL CARBON CREDIT TRADING MECHANISMS, INCLUDING VOLUNTARY EMISSION REDUCTION PROGRAMS, FOR PROMOTING GREENHOUSE GAS EMISSION REDUCTIONS AND REMOVALS

- **Carbon trading venture through the initiative of the Philippine Rice Institute (PhilRice) along with the National Irrigation Administration (NIA), in partnership with Ostrom Climate Solution Inc.**
- **PCAF Resolution No. 7 series of 2023 "Recommending to the DA, through Climate Resilient Agriculture Office (CRAO) and DENR to spearhead the establishment of Guidelines/Standards on Carbon Credit Trading for the Agri-Fisheries Sector**.
- **DA - PhilRice, CRAO on Alternate Wetting and Drying (AWD) Carbon Credit**

AGRICULTURAL PROJECTS REGISTERED IN THE NATIONAL CARBON CREDIT TRADING MECHANISMS, INCLUDING VOLUNTARY EMISSION REDUCTION PROGRAMS

- One of these projects is intended for registration with the **Verified Carbon Standard (VCS) using VM0042** - Improved Agricultural Land Management under Article 6.4 of the Paris Agreement.
- The second project is slated for registration once the **Joint Crediting Mechanism (JCM)** agreement between the Philippines and Japan is established, and it will fall under Article 6.2 of the Paris Agreement.

IS THE PHILIPPINES PARTICIPATING IN THE CLEAN DEVELOPMENT MECHANISM (CDM)?

Our country is participating in the CDM, Department of Environment and Natural Resources (**DENR)** as the designated national authorities (DNA) for the CDM in the Philippines

- Project/projects related to the treatment of animal waste.
- Project/projects related to the utilization of animal waste or agricultural residues for electricity generation.


IS THE PHILIPPINES PARTICIPATING IN ANY BILATERAL OFFSET CREDITING MECHANISM UNDER THE ARTICLE 6 OF THE PARIS AGREEMENT, SUCH AS JOINT CREDITING MECHANISM (JCM) OF JAPAN, CLIMATE PROTECTION AND CARBON OFFSET (KLIK) OF SWITZERLAND?
JCM THE JOINT CREDITING MECHANISM
• Our country is participating only in the JCM of Japan.
NARO
APO
PHILRICE
IS THE PHILIPPINES PARTICIPATING IN ANY BILATERAL OFFSET CREDITING MECHANISM UNDER THE ARTICLE 6 OF THE PARIS AGREEMENT, SUCH AS JOINT CREDITING MECHANISM (JCM) OF JAPAN, CLIMATE PROTECTION AND CARBON OFFSET (KLIK) OF SWITZERLAND?
The Philippines collaborates with international organizations such as the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) frequently provides assistance to countries like the Philippines in developing MRV capabilities.
In addition, the country, through the DA-Philippine Rice Research Institute, has contributed to the "Handbook of Monitoring, Reporting, and Verification (MRV) for a Greenhouse Gas Mitigation Project with Water Management in Irrigated Rice Paddies," version 1, published in February 2018 by the Institute for Agro-Environmental Sciences, NARO, Japan.

GREENHOUSE GAS VALIDATION AND VERIFICATION BODIES, WITH OR WITHOUT UNITED NATIONS CERTIFICATION IN THE PHILIPPINES

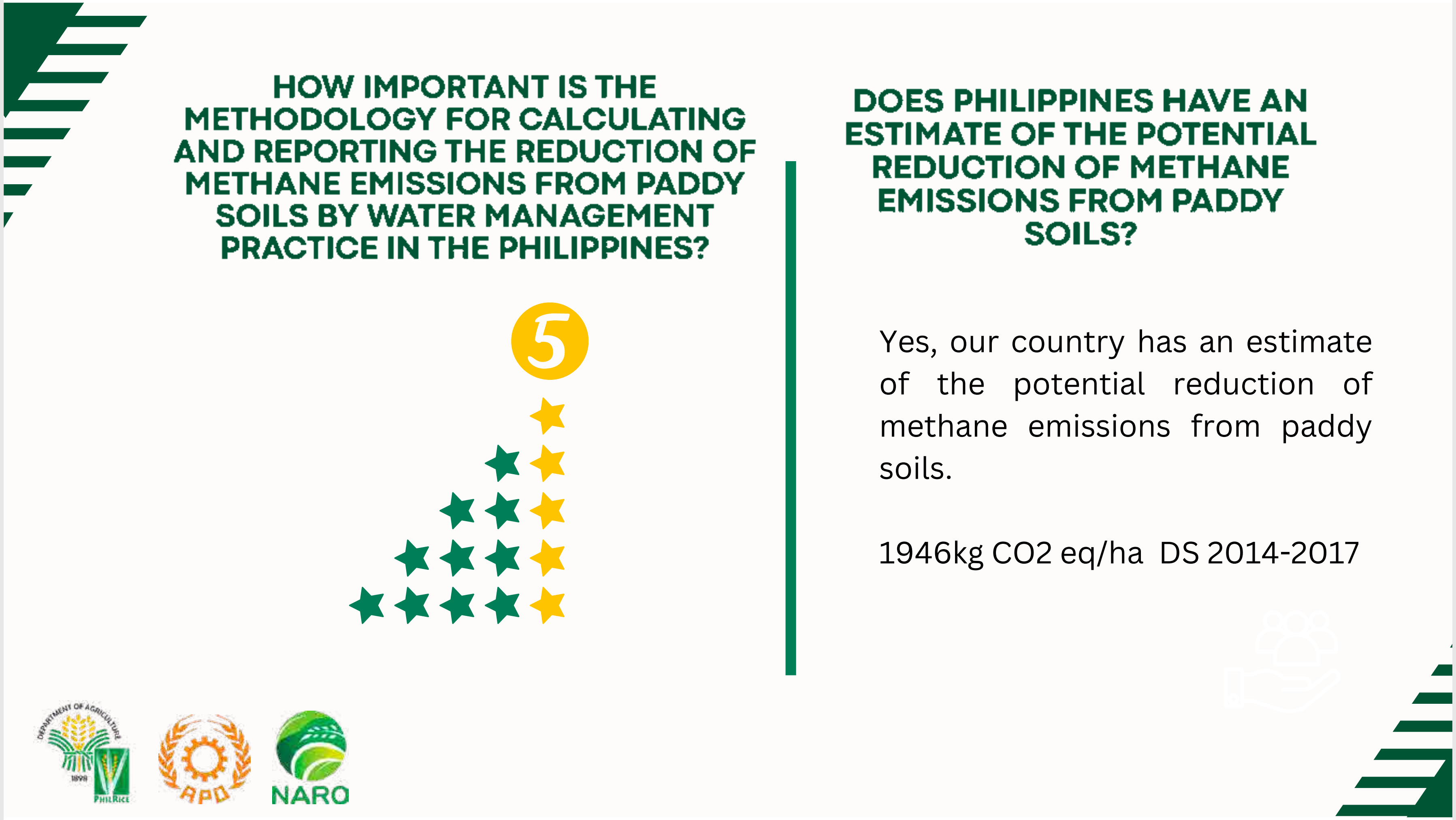
The Philippines does not yet have a dedicated national greenhouse gas (GHG) validation and verification body. GHG validation and verification processes are typically carried out following internationally accepted and approved standards and protocols. Government agencies, research institutions, and private consultancies may perform GHG validation and verification activities following established international guidelines.

The country will adhere to internationally approved guidelines issued by the UNFCCC when implementing projects for emission reductions and removals. One such example is the **"Guidelines on the Use of the Closed Chamber Method for GHG Measurement from Rice Cultivation,"** for which the country has also made contributions as an author through the DA-Philippine Rice Research Institute.

METHODOLOGY FOR CALCULATING AND REPORTING METHANE EMISSION REDUCTIONS FROM RICE CULTIVATION

HOW IMPORTANT IS THE METHANE EMISSION REDUCTIONS FROM PADDY SOILS IN THE PHILIPPINES?

This is reflected in research results by IRRI and PhilRice conducted from 1994 to 1998 - Methane Emission from Irrigated and Intensively managed rice fields in Central Luzon, Philippines (2000) by Corton et.al. as well as by Sibayan et.al 2018 - Effects of Alternate Wetting and Drying technique on GHG emissions from irrigated rice paddy in Central Luzon, Philippines.


HOW IMPORTANT IS THE METHODOLOGY FOR CALCULATING AND REPORTING THE REDUCTION OF METHANE EMISSIONS FROM PADDY SOILS BY WATER MANAGEMENT PRACTICE IN THE PHILIPPINES?
5
DOES PHILIPPINES HAVE AN ESTIMATE OF THE POTENTIAL REDUCTION OF METHANE EMISSIONS FROM PADDY SOILS?
Yes, our country has an estimate of the potential reduction of methane emissions from paddy soils.
1946kg CO2 eq/ha DS 2014-2017
NARO

TECHNOLOGIES PRACTICED OR PROMOTED TO REDUCE METHANE EMISSIONS FROM PADDY SOILS IN THE PHILIPPINES

- Water management
- Soil/organic matter management
- Other agronomic management
- Land use change

Others:
- Direct Seeding
- Aerobic Rice
- CSA (i.e., Precision Agriculture)



SHARED OR APPROVED METHODOLOGIES FOR CALCULATING AND REPORTING THE REDUCTION OF METHANE EMISSIONS FROM PADDY SOILS ASSOCIATED WITH THE TECHNOLOGIES MENTIONED

Yes. The approved Standardized Baseline ASB0008 “Standardized Baseline for Methane Emissions in Rice Cultivation in the Republic of the Philippines”.

The SB was developed by the Philippine Designated National Authority for CDM (DNA) in cooperation with the United Nations Development Programme (UNDP). The specific methodology is the “AMS-III.AU.: "Methane emission reduction by adjusted water management practice in rice cultivation" (Version 4.0)” which was entered into force on October 6, 2020, and with a validity of five years (until February 19, 2025).

*https://cdm.unfccc.int/methodologies/standard_base/2015/sb175.html

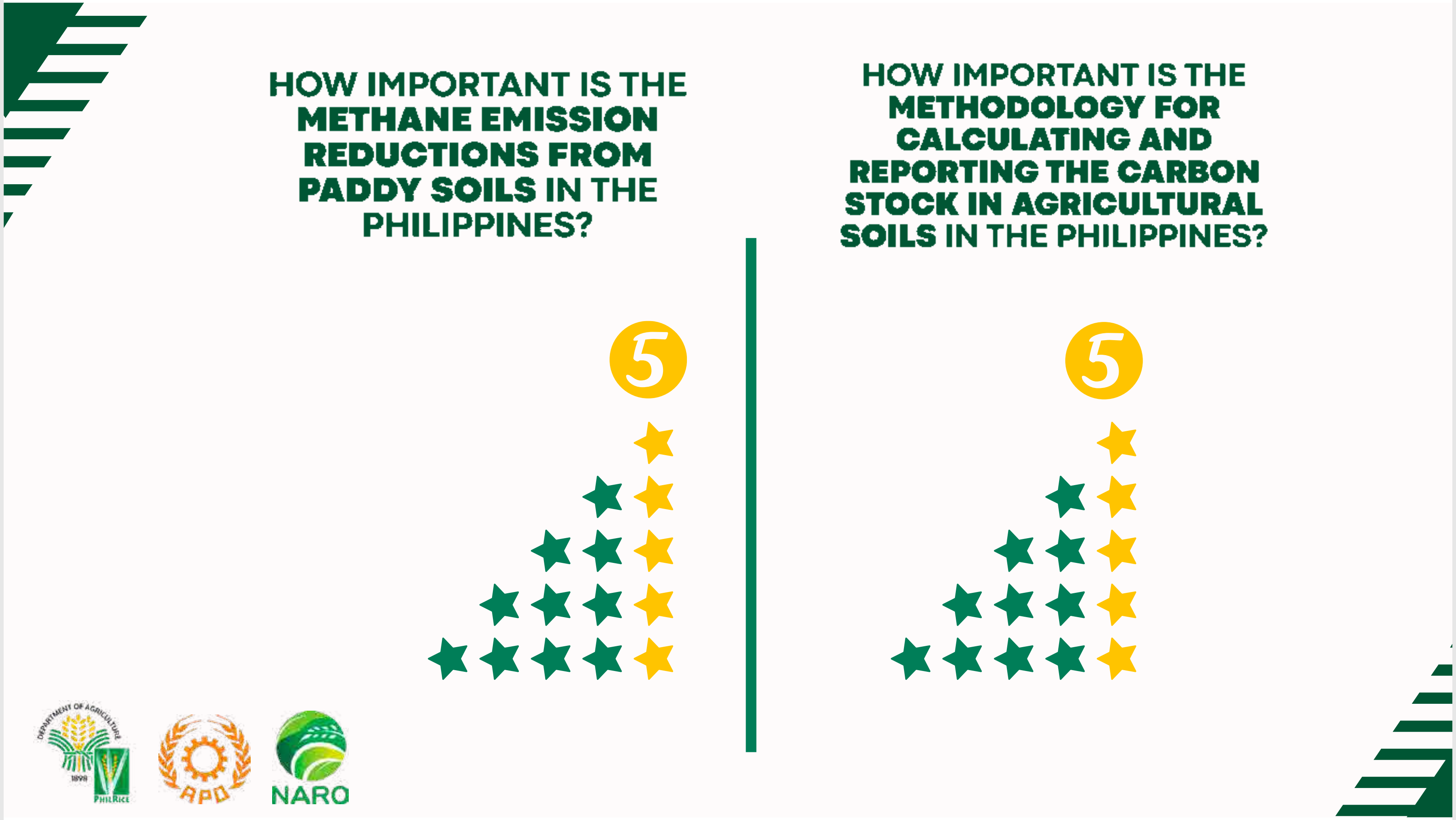
HOW LARGE IS THE POTENTIAL AREA OF PADDY FIELDS THAT CAN IMPLEMENT WATER MANAGEMENT PRACTICES FOR REDUCING METHANE EMISSIONS FROM PADDY SOILS IN THE PHILIPPINES?

- All irrigated rice area - 3.29 M ha of the total 4.8 million ha of area harvested (PSA, 2018).
- The potential area (all irrigated rice area) which is included in the Philippines NDC PAMs is about 68%.

- 70% (Irrigated Area (2022):
- **3.34 million ha**, National (2022): 4.80 million ha)

Source: https://www.philrice.gov.ph/ricelytics/harvestareas

METHODOLOGY FOR CALCULATING AND REPORTING CARBON STOCK IN AGRICULTURAL SOILS


HOW IMPORTANT IS THE METHANE EMISSION REDUCTIONS FROM PADDY SOILS IN THE PHILIPPINES?
5
HOW IMPORTANT IS THE METHODOLOGY FOR CALCULATING AND REPORTING THE CARBON STOCK IN AGRICULTURAL SOILS IN THE PHILIPPINES?
5
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DOES PHILIPPINES CONSIDER OR INTEND TO CONSIDER BIOCHAR AS A SOIL AMENDMENT FOR CARBON SEQUESTRATION IN AGRICULTURAL SOILS?
YES
POTENTIAL ORGANIC MATERIALS FROM AGRICULTURAL SECTOR THAT CAN BE USED TO PRODUCE BIOCHAR FOR CARBON SEQUESTRATION IN AGRICULTURAL SOILS IN THE PHILIPPINES
• Rice straw
• Rice husks
• Sugarcane bagasse
• Corn cobs
• Poultry manure
• Others: Coconut husk
NARO
APO
PHILRICE

Estimated quantity of the potential organic materials

The table below shows the estimated quantity of the potential organic materials from the agricultural sector of the Philippines.

Organic materials from agricultural sector	Quantity	Year	Reference
Rice straw	11,000,000 metric tons	2018	**IRRI** https://news.irri.org/2018/06/ricestrawph-irri-teams-up-with.html
Rice husk	3,952,000 metric tons (calculated by 19.76 million metric tons of rice production in 2022 x 0.2 ton/ton of Residue-to-crop ratio)	2022	**PhilRice** https://www.philrice.gov.ph/ricelytics/productions
Sugarcane bagasse	4,372,764 metric tons based on 397,524 ha planted to sugarcane (calculated by 11 tons of agricultural wastes in the form of leaves and stalks per one hectare of land planted to sugarcane)	2021	**Philippine Sugar Statistics Sugar Regulatory Authority** https://www.sra.gov.ph/wp-content/uploads/2022/09/Sugar-Stats-as-of-08-21-2022.pdf Philippine Center for Postharvest Development and Mechanization https://www.philmech.gov.ph/assets/publication/Annual%20Report/PHilMech%20Annual%20Report%202018.pdf

Estimated quantity of the potential organic materials

The table below shows the estimated quantity of the potential organic materials from the agricultural sector of the Philippines.

Organic materials from agricultural sector	Quantity	Year	Reference
Corn cobs	1,486,009.74 metric tons based on 8,255,609.68 metric tons of corn produced in 2022 (calculated by 18 kg of corn cob produced from 100 kg of corn ear)	2022	**PSA OpenSTAT** (https://openstat.psa.gov.ph/PXWeb/pxweb/en/DB/DB__2E__CS/0012E4EVCP0.px/table/tableViewLayout1/?rxid=bdf9d8da-96f1-4100-ae09-18cb3eaeb313)
Poultry manure	934,073.82 metric tons based on 821,984,973 heads of chicken and duck in 2022 (calculated by 1.14 kg of manure production per head)	2022	**Philippine Statistics Authority** https://openstat.psa.gov.ph/PXWeb/pxweb/en/DB/DB__2E__LP__INV__NEW/0022E4FINC2.px/table/tableViewLayout1/?rxid=bdf9d8da-96f1-4100-ae09-18cb3eaeb313 **UGA Extension** https://extension.uga.edu/publications/detail.html?number=B1245&title=maximizing-poultry-manure-use-through-nutrient-management-planning
Coconut husk	6,400,000 metric tons based on (Ave. weight of husk of coconut fruit is 0.4kg multiplied by 14,931,158.30 coconuts produced in 2022)	2022	**Philippine Statistics Authority** https://openstat.psa.gov.ph/PXWeb/pxweb/en/DB/DB__2E__CS/0062E4EVCP1.px/table/tableViewLayout1/?rxid=bdf9d8da-96f1-4100-ae09-18cb3eaeb313

Competing uses and utilization rate of the potential organic materials from the agricultural sector of the Philippines

Organic materials from agricultural sector	Competing users	Utilization rate	Year	Reference
Rice Straw	Bioenergy, biofuel, mushroom production, animal feed, feed	No data	N/A	N/A
Rice husk	Biochar, fuel, bedding	No data	N/A	N/A
Sugarcane bagasse	Fuel, raw materials for paper, feed, molasses	No data	N/A	N/A
Corn cobs	Fuel, bioenergy feedstock	No data	N/A	N/A
Poultry manure	Fuel, fertilizer, feed	No data	N/A	N/A
Coconut husk	Cocofiber, fuel, particle, board, ropes	No data	N/A	N/A


SOIL CARBON SEQUESTRATION
VISUALIZATION TOOL
NARO
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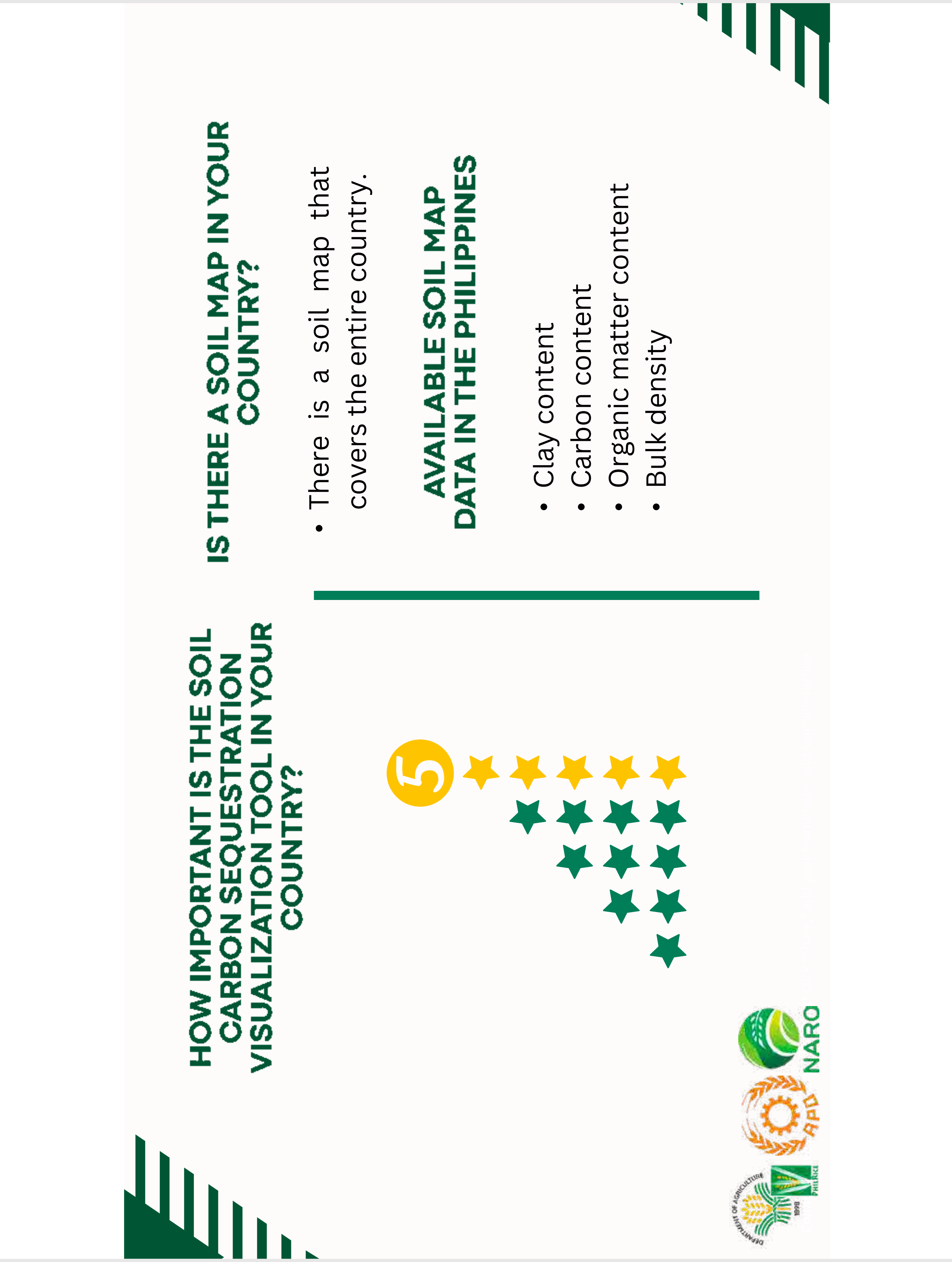

HOW IMPORTANT IS THE SOIL CARBON SEQUESTRATION VISUALIZATION TOOL IN YOUR COUNTRY?
5
IS THERE A SOIL MAP IN YOUR COUNTRY?
• There is a soil map that covers the entire country.
AVAILABLE SOIL MAP DATA IN THE PHILIPPINES
• Clay content
• Carbon content
• Organic matter content
• Bulk density
APO
NARO

IS THERE ANY DATA OF ACTIVITY RELATED TO ORGANIC MATTER (SUCH AS CROP RESIDUE AND COMPOST) INPUTS IN THE PHILIPPINES?

- There are few data.

IS THERE A LONG-TERM CONTINUOUS EXPERIMENT DATA OF ORGANIC MATTER INPUTS IN YOUR COUNTRY?

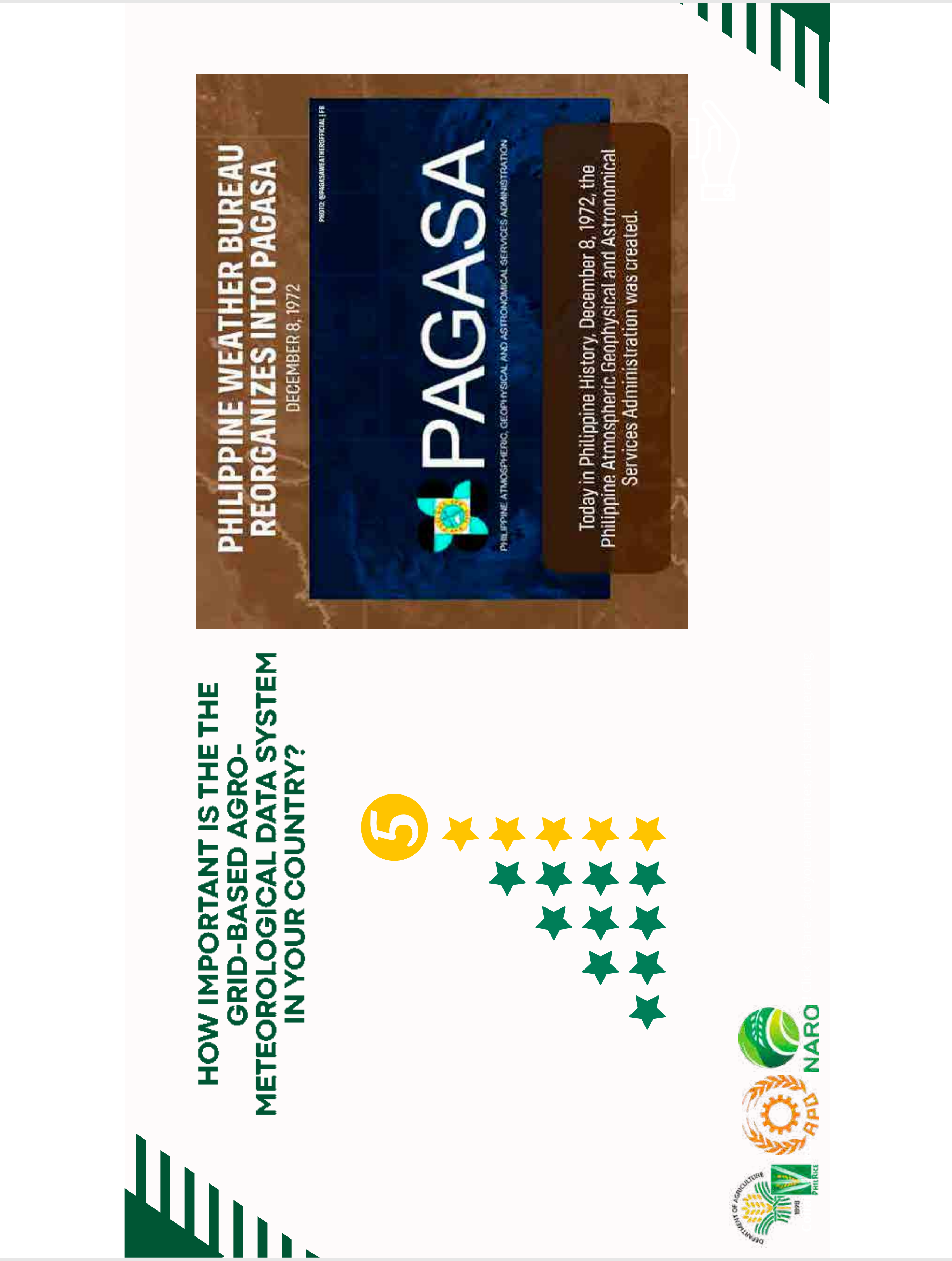
- There is long-term continuous experiment data in the country.

IS THERE A LONG-TERM SOIL CARBON OBSERVATION DATA IN YOUR COUNTRY?

- There is long-term soil carbon observation data in the country.

APO NARO

AGRO-METEOROLOGICAL GRID SQUARE DATA SYSTEM


PHILIPPINE WEATHER BUREAU REORGANIZES INTO PAGASA
DECEMBER 8, 1972
PAGASA
PHILIPPINE ATMOSPHERIC, GEOPHYSICAL AND ASTRONOMICAL SERVICES ADMINISTRATION
Today in Philippine History, December 8, 1972, the Philippine Atmospheric Geophysical and Astronomical Services Administration was created.
HOW IMPORTANT IS THE THE GRID-BASED AGRO-METEOROLOGICAL DATA SYSTEM IN YOUR COUNTRY?
5
APO
NARO

GOVERNMENT POLICIES OR PLANS THAT SUPPORT AGRO-METEOROLOGICAL DATA SYSTEM IN THE PHILIPPINES

The **Republic Act No. 10692- An Act providing for the modernization of the Philippine Atmospheric, Geophysical and Astronomical Service (PAGASA)**. PAGASA is the government agency responsible for weather forecasting and monitoring. They have ongoing programs to improve meteorological and climate data collection, dissemination, and capacity-building for various sectors, including agriculture.

Moreover, **different government agencies have also various plans, programs and policies that support and complement the agro-meteorological data system in the country**. For example, the **DA-Philippine Rice Research Institute has institutionalized the Philippine Rice Information System (PRISM)**, which harnesses satellite technology and agro-meteorological data to deliver timely information to rice farmers. This empowers the rice farmers to make well-informed decisions pertaining to rice production.

GOVERNMENT POLICIES OR PLANS THAT SUPPORT AGRO-METEOROLOGICAL DATA SYSTEM IN THE PHILIPPINES

Furthermore, the **SARAI project (Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines) is an initiative under the Department of Science and Technology (DOST)** in the Philippines. SARAI aims to modernize and enhance the agricultural sector in the country through the application of advanced technologies, including remote sensing, information technology, and data analytics. It provides farmers and policymakers with valuable information and tools to make more informed decisions, improve crop management, and increase agricultural productivity. The project leverages data-driven insights and technology to address various challenges in Philippine agriculture, including crop forecasting, pest and disease management, and overall farm efficiency.

GOVERNMENT POLICIES OR PLANS THAT SUPPORT AGRO-METEOROLOGICAL DATA SYSTEM IN THE PHILIPPINES

Partnership with Sagri Company Ltd. was founded in 2018 in Japan.

Sagri has developed AI and machine learning technologies for automatic Polygon Technology for Agricultural Land and the detection of soil properties of farmland. The company is actively developing NVDI (Normalized Difference Vegetation Index) for farmlands to provide a comprehensive understanding of crop growth at a glance.

GRID-BASED AGRO-METEOROLOGICAL DATA SYSTEM AVAILABLE IN THE PHILIPPINES AND ITS SPATIAL AND TEMPORAL RESOLUTIONS

The Philippine Rice Information System (PRiSM), jointly developed by the International Rice Research Institute (PhilRice) and the Philippine Department of Agriculture, uses satellite imagery and other new technologies to generate information on planted rice area, seasonality, yield, and risks to crops. In 2018, the centralized operation of PRiSM was transitioned to PhilRice. The establishment and operation of the PRiSM Unit were carried out by the Department of Agriculture (DA) through an Administrative Order, while the continued implementation of PRiSM at the DA Regional Field Offices nationwide.
https://prism.philrice.gov.ph/

Another is the **SARAI project (Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines)** which is an action-research program, funded by the Department of Science and Technology – Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development that works towards reducing climate risks by providing agricultural stakeholders with site-specific crop advisories for rice, corn, banana, coconut, coffee, cacao, sugarcane, soybean, and tomato.
https://sarai.ph/about-us

The **Agrometeorological Station (Agro-Met)** is another derivative station using the advanced remote data-acquisition unit (arQ) geared with multi-parameter weather sensors which can simultaneously measure wind speed and direction; air temperature; air humidity; air pressure, rain amount, duration and intensity, soil moisture and temperature, solar radiation, and sunshine duration. The station gets data from the sensor for transmission via SMS or Satellite network

GRID-BASED AGRO-METEOROLOGICAL DATA SYSTEM AVAILABLE IN THE PHILIPPINES AND ITS SPATIAL AND TEMPORAL RESOLUTIONS

- In the Philippines, meteorological observations are carried out at about **90 weather stations**.
- There are **56 stations that are characterized as synoptic and radar stations while 34 are characterized as agrometeorological stations**. These stations are maintained and operated by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).
- In addition, there are about **104 Automated Weather Stations (AWS)** strategically situated throughout the country.

Inaugurated by President Benigno "Noynoy" Aquino last May 2, 2012, the **PAGASA-DOST Weather Radar Station in Brgy. Buenavista, Municipality of Bato, Catanduanes** is considered as one of the most advanced radar station in the world. It is the eight radar station installed in the country at an estimated cost of 500 million pesos with funding from **Japan International Cooperation Agency (JICA).**

LIST OF WEATHER ELEMENTS AVAILABLE FROM THE WEATHER STATIONS IN THE PHILIPPINES WITH INFORMATION REGARDING TIMESTEP AND OBSERVATION PERIODS OF EACH WEATHER ELEMENT

- Element: Mean air temperature, Timestep: Daily, Observation periods: 1985-present
- Element: Minimum air temperature, Timestep: Daily, Observation periods: 1985-present
- Element: Maximum air temperature, Timestep: Daily, Observation periods: 1985-present
- Element: Relative humidity, Timestep: Hourly, Observation periods: 1985-present
- Element: Wind speed, Timestep: Hourly, Observation periods: 1985-present
- Element: Wind direction, Timestep: Hourly, Observation periods: 1985-present
- Element: Precipitation, Timestep: Daily, Observation periods: 1985-present

Source: PAGASA (https://www.pagasa.dost.gov.ph/

KEY STAKEHOLDERS IN CLIMATE-SMART AGRICULTURE AND THEIR EFFORTS

1ST KEY GOVERNMENT AGENCY IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Department of Agriculture (DA) develops comprehensive initiatives to address climate change in the agricultural sector and implements measures to enhance the resilience of farmers to climate-related challenges, including the development of climate-smart technologies. Additionally, the department has been actively engaged in capacity-building and awareness campaigns to empower farmers with knowledge and tools for climate adaptation. The multifaceted approach aims to both mitigate emissions and help the agricultural sector adapt to the changing climate. The department also provides some funds to implement a few exploratory research on GHG measurements from animals and rice paddies.

Furthermore, the **Philippine Rice Research Institute (PhilRice)**, an attached agency to the DA is the premier research body that conducted research on GHG emissions from rice paddies together with IRRI (1994-2000) and NARO-MAFF, Japan (2013-2017). The institute is the only government agency that has trained, experienced, and competent staff to implement GHG measurement projects in the country as defined by the UNFCCC.

Moreover, the **Climate Resilient Agriculture Office (CRAO)** of DA that cuts across policy instruments and agencies of the department implements seven programs that include Mainstreaming Climate Change Adaptation and Mitigation Initiative in Agriculture, Climate Change Information System, Philippine Adaptation and Mitigation in Agriculture Knowledge Toolbox, Climate-Smart Agriculture Infrastructure, Financing and Risk Transfer Instruments on Climate Change, Climate-Smart Agriculture and Fisheries Regulations and Climate-Smart Agriculture Extension System

2ND KEY GOVERNMENT AGENCY IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Department of Science and Technology (DOST) supports research and development initiatives related to climate science, weather forecasting, and the development of climate-resilient technologies for agriculture.

3RD KEY GOVERNMENT AGENCY IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Climate Change Commission (CCC) is the government agency responsible for coordinating climate change policies and programs. They work on developing strategies and action plans to reduce greenhouse gas emissions across all sectors, including agriculture.

1ST KEY PRIVATE ENTERPRISE IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Ostrom Climate Solutions Inc., Vancouver Canada, provide members of Irrigators Associations in the Upper Pampanga River Integrated Irrigation Systems with capacity buildings and support for the adoption of alternate-wetting and drying (AWD) technology through farmer field school, and eventually generate carbon credits from which incentives for participating farmers is derived.

2ND KEY PRIVATE ENTERPRISE IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Creattura Company Ltd., Tokyo, Japan

Establishing a pilot project (The Climate Resilient Rice Farming in Pangasinan, Philippines) of 1,000 hectares in Dipalo River Irrigation System with main irrigation source from the San Roque Dam. The focused technology is AWD.

3RD KEY PRIVATE ENTERPRISE IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Waste X, Supports agricultural producers in the Philippines to utilize biomass waste while generating additional income and reducing carbon emissions.

1ST KEY UNIVERSITY OR RESEARCH INSTITUTE IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

DA-Philippine Rice Research Institute (DA-PhilRice) conducts research and development activities focused on rice production, including the development of climate-smart rice varieties and sustainable farming practices that reduce emissions and enhance climate resilience. PhilRice has partnered with IRRI (1994-2000) and NARO-MAFF, Japan (2014-2017) on several projects related to mitigating GHGs and adaptation to climate change

2ND KEY UNIVERSITY OR RESEARCH INSTITUTE IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

REPUBLIC OF THE PHILIPPINES

PHILIPPINE COUNCIL FOR AGRICULTURE, AQUATIC AND NATURAL RESOURCES RESEARCH AND DEVELOPMENT (DOST-PCAARRD)

DEPARTMENT OF SCIENCE AND TECHNOLOGY

DOST-PCAARRD supports R&D agenda related to Agriculture 4.0 which is smart, green and S&T-based. One of their priority projects is geared towards Climate Change Adaptation and Mitigation, and Disaster Risk Reduction in the agriculture and forestry sectors.

3RD KEY UNIVERSITY OR RESEARCH INSTITUTE IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

University of the Philippines Los Baños (UPLB) is one of the country's premier agricultural universities and has various research units and departments dedicated to agricultural and environmental sciences. They also conduct research on climate-resilient crop varieties, sustainable farming practices, and environmental conservation.

Central Luzon State University (**CLSU)** conducts research on Climate Change, Established the **Institute of Climate Change and Environmental Management (ICCEM)** and included subjects in their curriculum, also offers MS degree in Environmental Science.

1ST KEY INTERNATIONAL ORGANIZATION OR NGO, NPO IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

International Rice Research Institute (IRRI) has been at the forefront of developing and promoting climate-resilient rice varieties to withstand various climate-related challenges, including drought, flood, and temperature extremes while improving yield stability and food security. It also conducts research to reduce methane emissions from rice fields and is the pioneering organization in the research and development of AWD which is a widely known water-saving technique in Asia.

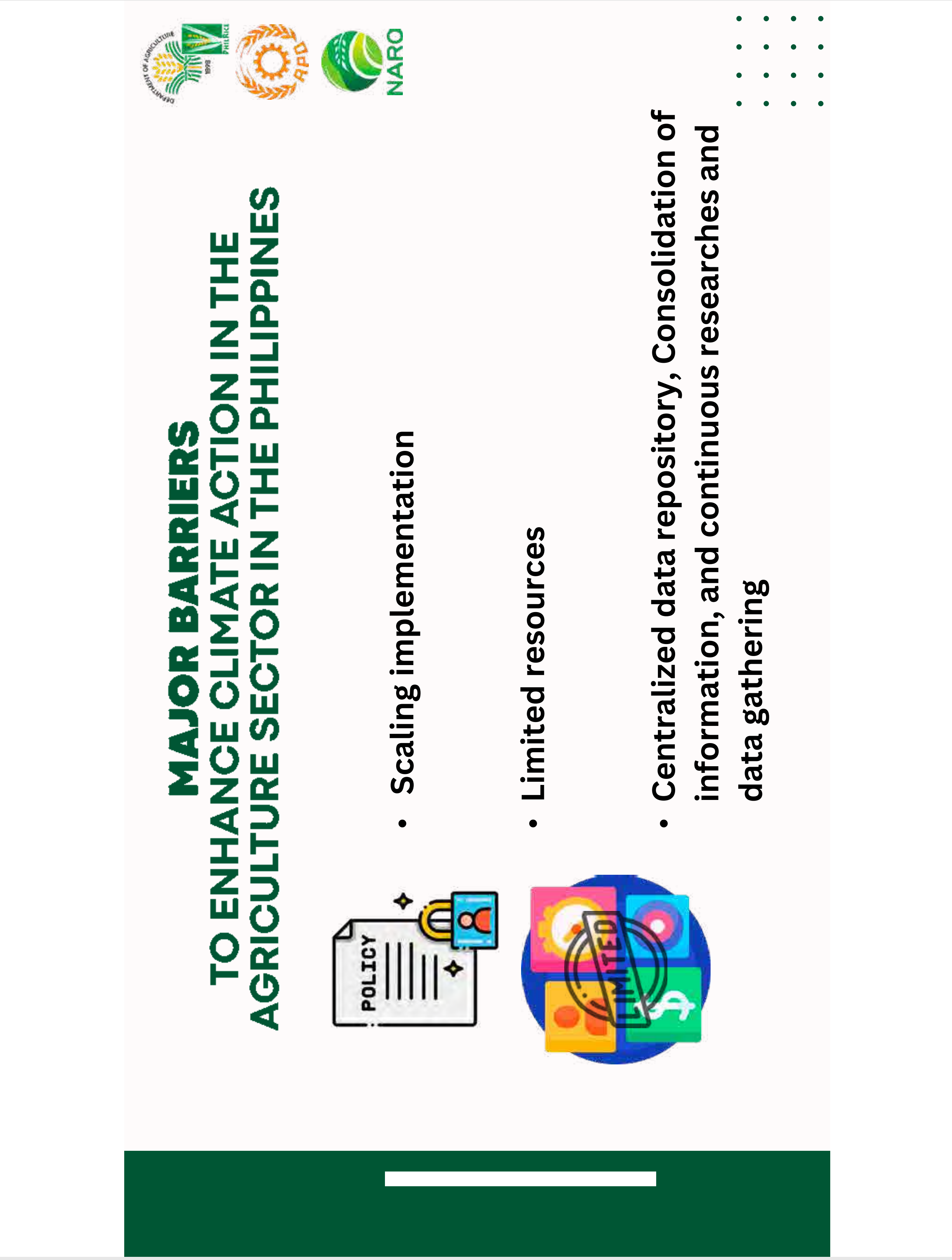
2ND KEY INTERNATIONAL ORGANIZATION OR NGO, NPO IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

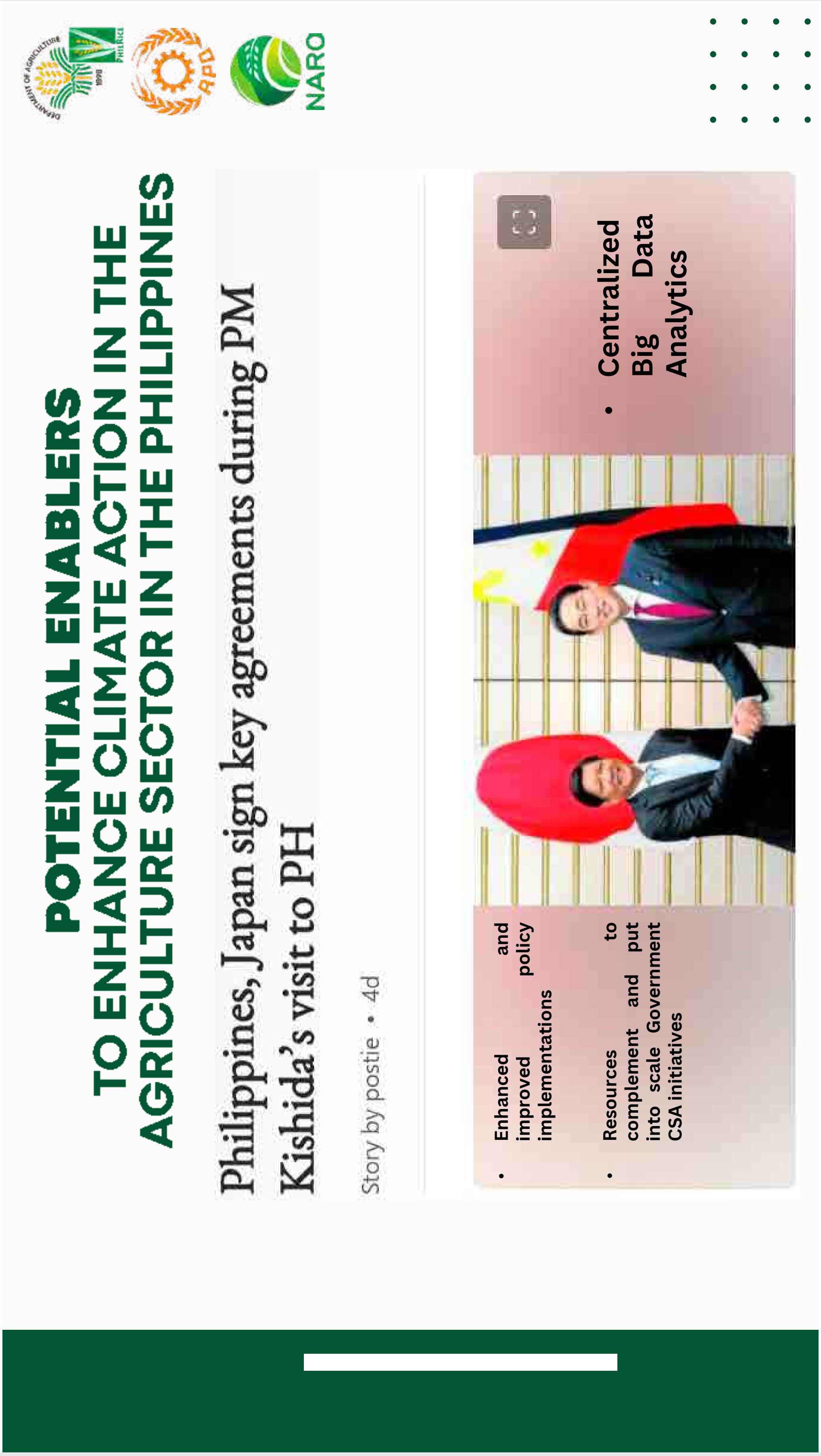
The Green Climate Fund (GCF) is an international fund designed to aid developing nations in addressing the impacts of climate change. It assists these countries in mitigating their greenhouse gas (GHG) emissions and adapts to climate change's effects.

GREEN CLIMATE FUND

3RD KEY INTERNATIONAL ORGANIZATION OR NGO, NPO IN CLIMATE-SMART AGRICULTURE AND ITS EFFORTS TO REDUCE AND ABSORB GREENHOUSE GAS OR ADAPT TO CLIMATE CHANGE IN THE AGRICULTURAL SECTOR

Asian Development Bank (ADB) funds projects related to climate-smart agriculture in the Philippines, which aim to enhance the resilience of agricultural systems, reduce emissions, and increase resource use efficiency. It provides a policy-based loan for the Climate Change Action Program in support of the Government of the Philippines' implementation of its national climate policies, including its Nationally Determined Contribution which is projected to have a peak emission by 2030 and reduce greenhouse gas emissions by 75% from business-as-usual, with a just transition to an inclusive, low-carbon, and climate- and disaster-resilient economy.


MAJOR BARRIERS
TO ENHANCE CLIMATE ACTION IN THE AGRICULTURE SECTOR IN THE PHILIPPINES
• Scaling implementation
• Limited resources
• Centralized data repository, Consolidation of information, and continuous researches and data gathering
POLICY
LIMITED
NARO
RPD


POTENTIAL ENABLERS
TO ENHANCE CLIMATE ACTION IN THE AGRICULTURE SECTOR IN THE PHILIPPINES
Philippines, Japan sign key agreements during PM Kishida's visit to PH
Story by postie • 4d
• Enhanced and improved policy implementations
• Resources to complement and put into scale Government CSA initiatives
• Centralized Big Data Analytics


NARO
COMMUNICATING
CLIMATE CHANGE
IN THE RICE SECTOR
JAIME A. MANALO IV
Compendium of Climate-Resilient Agriculture Technologies & Approaches in the Philippines
Romeo V. Labios
Leocadio S. Sebastian
Jocelyn D. Labios
Christine Mae B. Santos
PhilRice Magazine
Be Water-Smart
PhilRice Magazine


NARO
APO
PHILRICE
THANK YOU
EDUARDO JIMMY P. QUILANG, PHD
ejpquilang@philrice.gov.ph
philrice.gov.ph
DA-PHILRICE, Science City of Munoz, Nueva Ecija, Philippines

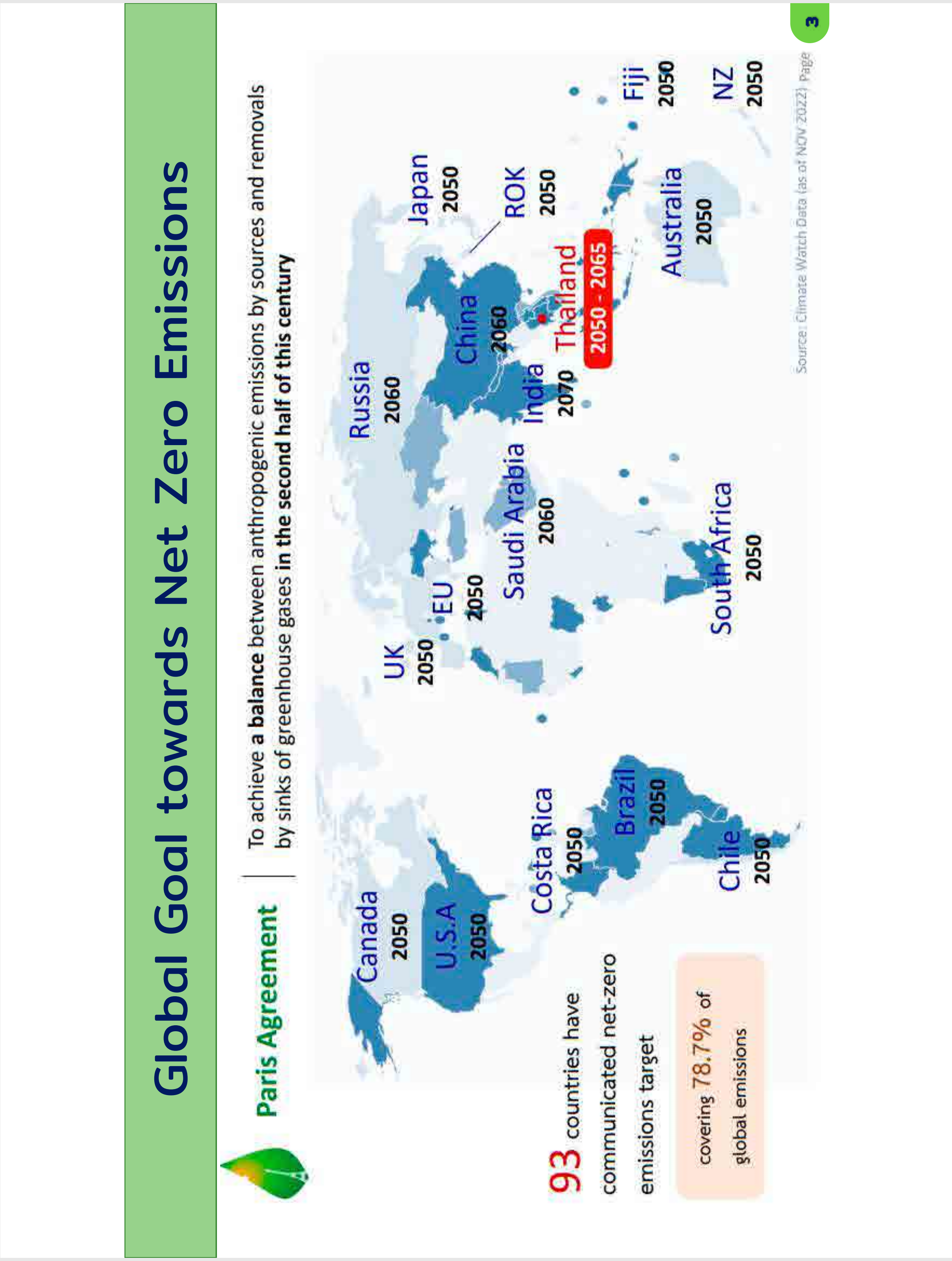
THAILAND


"Thailand Current Situation Regarding Climate Change Mitigation and Adaptation"
Theerawut Chutinanthakun (Ph.D.)
Department of Agriculture (DOA)
Ministry of Agriculture and Cooperatives (MOAC)
THAILAND
DOA TOGETHER
DEPARTMENT OF AGRICULTURE

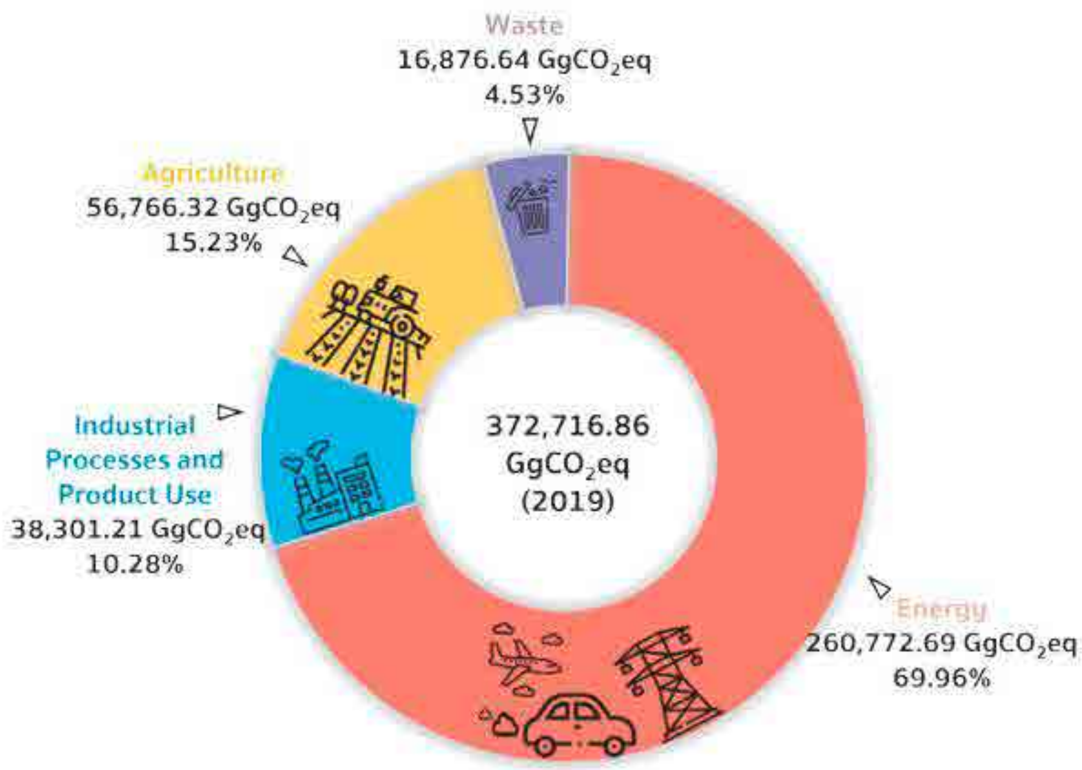
2

Outlines

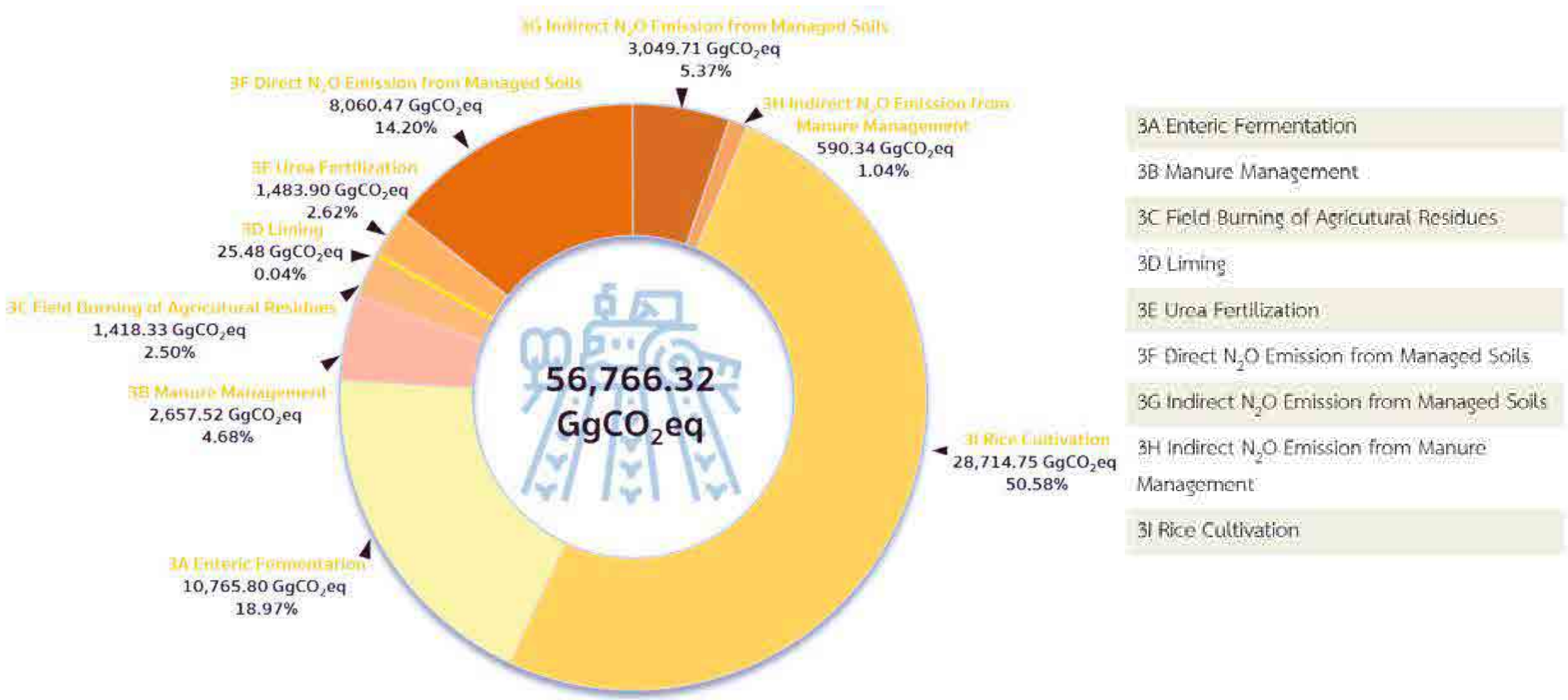
- Overview situation
- Policy on climate changes
- Pilot project


Global Goal towards Net Zero Emissions
Paris Agreement
To achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century
Canada 2050
U.S.A 2050
Costa Rica 2050
Brazil 2050
Chile 2050
UK 2050
EU 2050
Saudi Arabia 2060
South Africa 2050
Russia 2060
India 2070
China 2060
Thailand 2050 - 2065
Japan 2050
ROK 2050
Australia 2050
Fiji 2050
NZ 2050
93 countries have communicated net-zero emissions target
covering 78.7% of global emissions
Source: Climate Watch Data (as of NOV 2022) Page
3

GHG emission by sector of Thailand in 2019



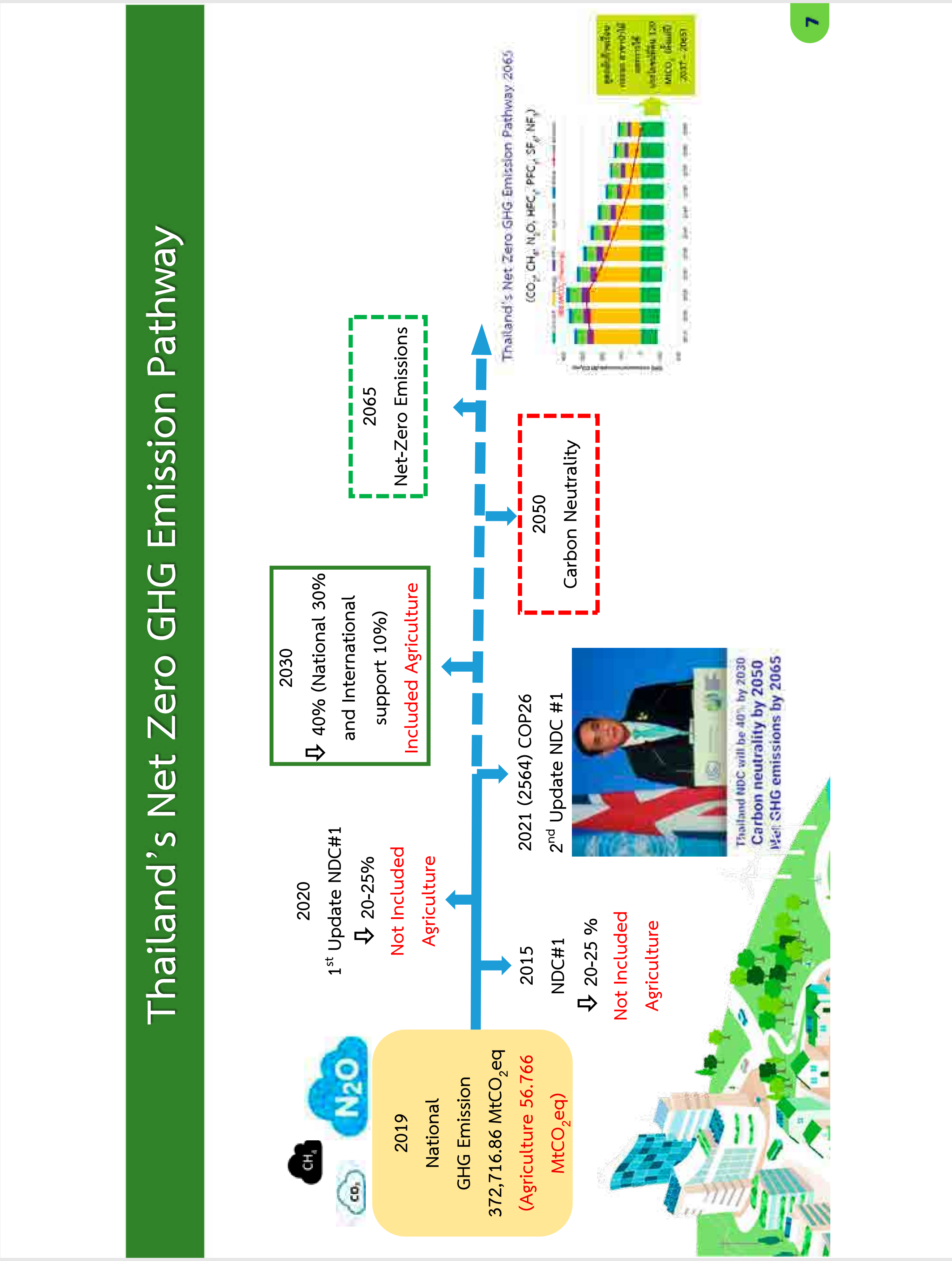
Agriculture sector in 2019

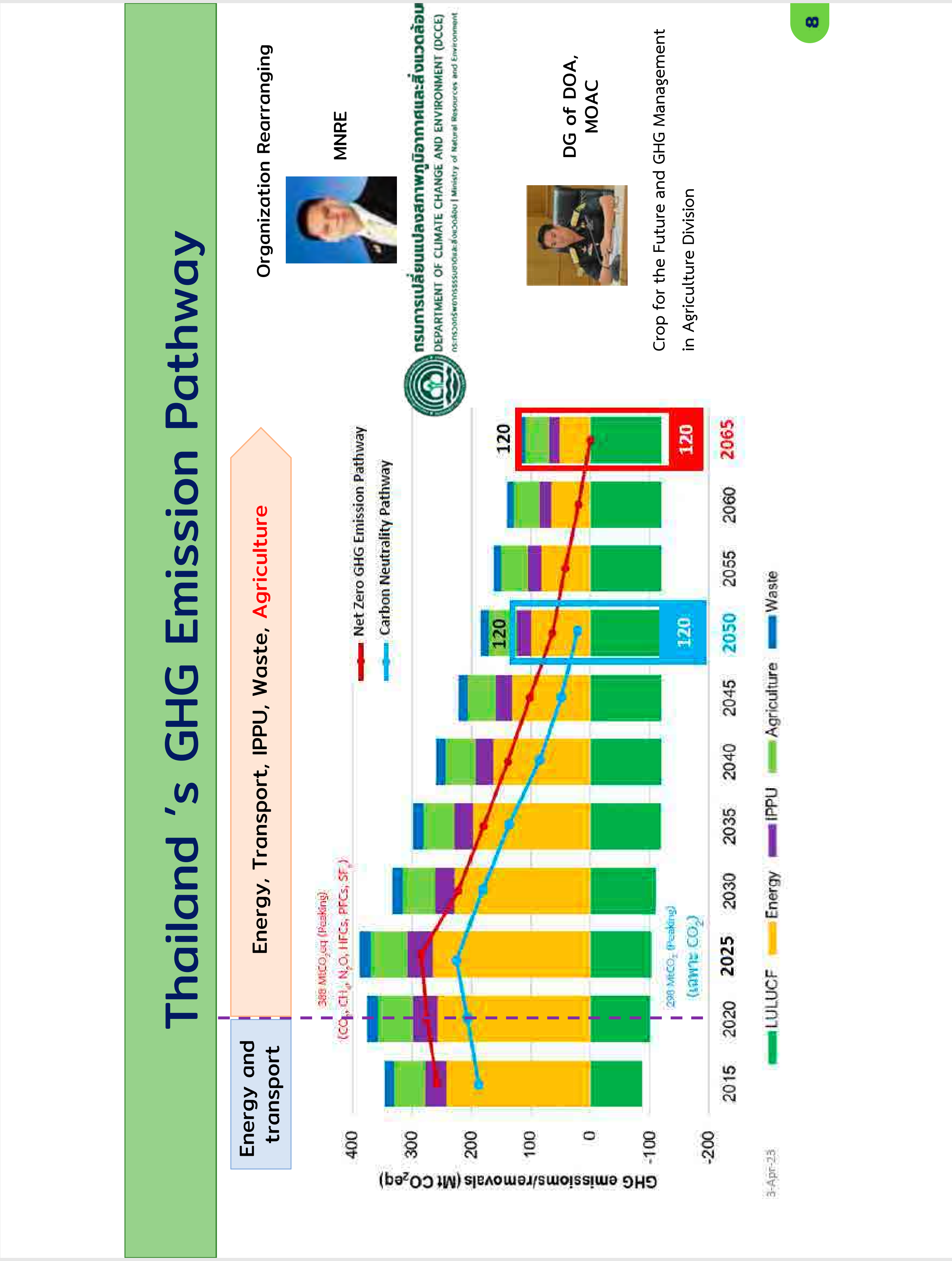


Source: Thailand's Fourth Biennial Update Report, ONEP

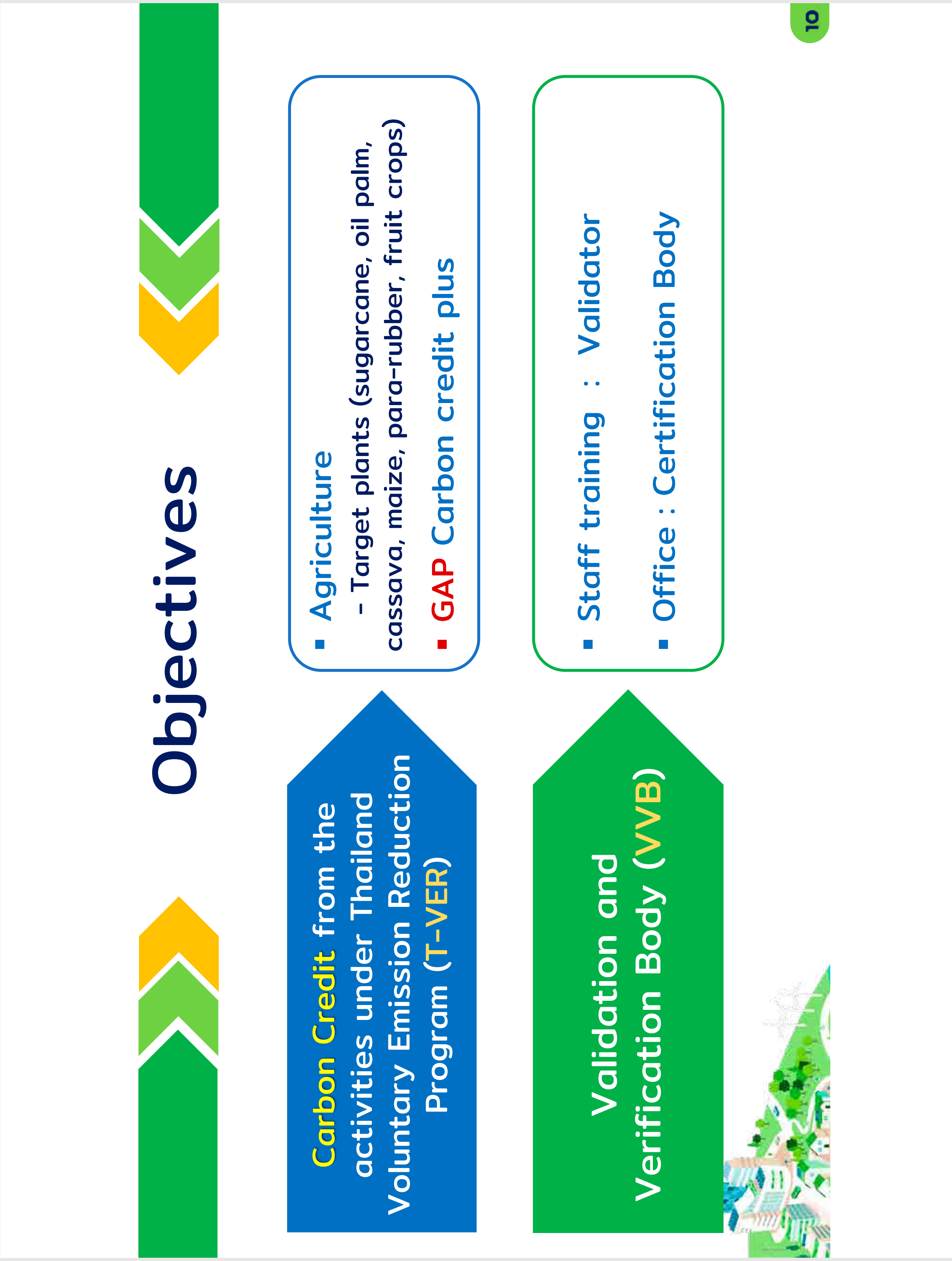
5

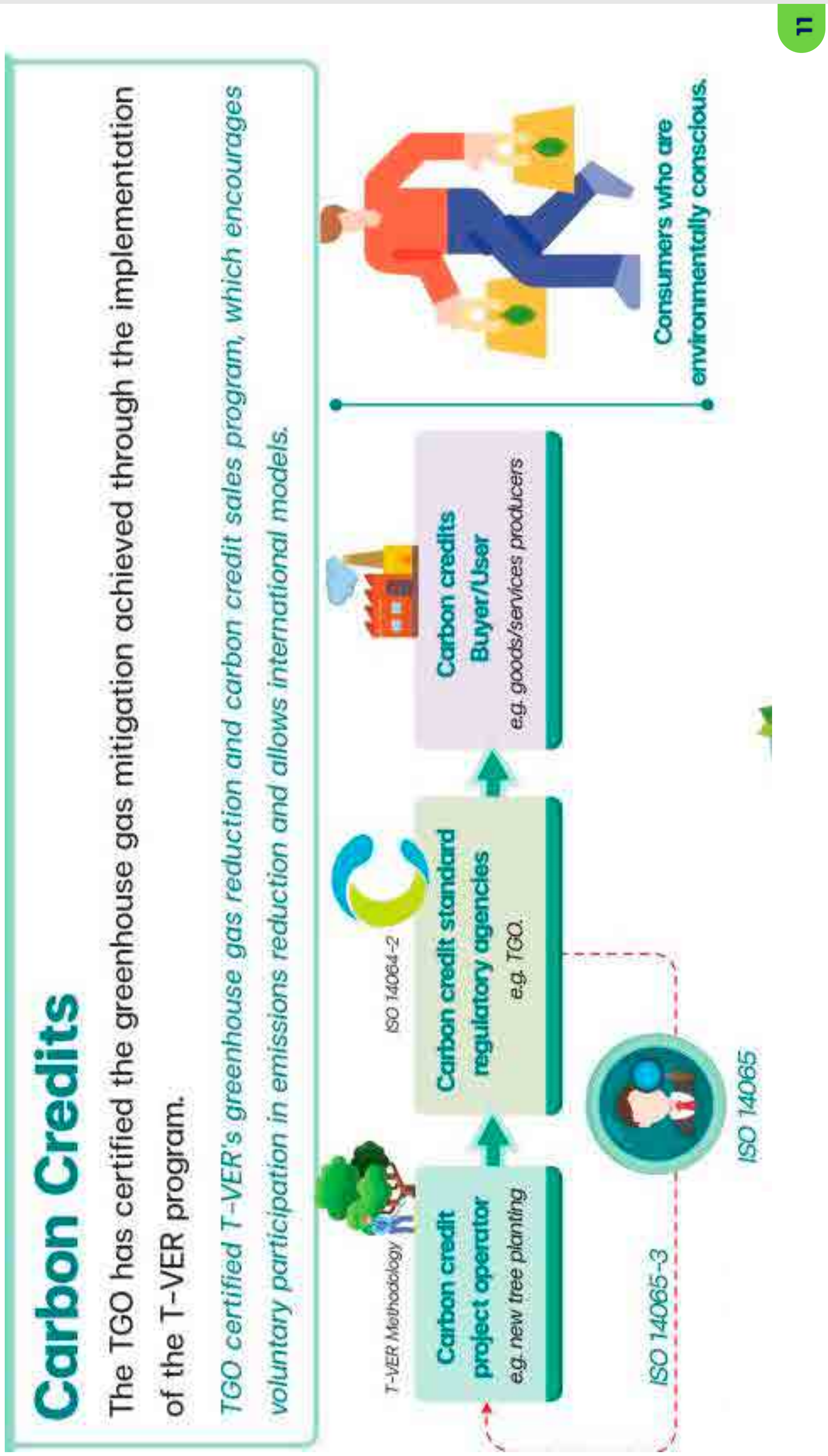

Thailand's
Ambition
2050 : Carbon Neutrality
2065 : Net-Zero GHG Emissions
2030 : NDC 40%
* with International Support
6
United Nations
Climate Change
พลเอก ประยุทธ์ จันทร์โอชา
นายกรัฐมนตรี
วันที่ 1 พฤศจิกายน 2564


Thailand's Net Zero GHG Emission Pathway
CH4
CO2
N2O
2019
National
GHG Emission
372,716.86 MtCO2eq
(Agriculture 56.766
MtCO2eq)
2015
NDC#1
20-25 %
Not Included
Agriculture
2020
1st Update NDC#1
20-25%
Not Included
Agriculture
2021 (2564) COP26
2nd Update NDC #1
Thailand NDC will be 40% by 2030
Carbon neutrality by 2050
Net GHG emissions by 2065
2030
40% (National 30%
and International
support 10%)
Included Agriculture
2050
Carbon Neutrality
2065
Net-Zero Emissions
Thailand's Net Zero GHG Emission Pathway 2065
7


Thailand 's GHG Emission Pathway
Energy and transport
Energy, Transport, IPPU, Waste, Agriculture
388 MtCO2eq (Peaking)
(CO2, CH4, N2O, HFCs, PFCs, SF6)
298 MtCO2 (Peaking)
(เฉพาะ CO2)
Net Zero GHG Emission Pathway
Carbon Neutrality Pathway
GHG emissioms/removals (Mt CO2eq)
400
300
200
100
0
-100
-200
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
120
120
120
120
LULUCF
Energy
IPPU
Agriculture
Waste
3-Apr-23
Organization Rearranging
MNRE
กรมการเปลี่ยนแปลงสภาพภูมิอากาศและสิ่งแวดล้อม
DEPARTMENT OF CLIMATE CHANGE AND ENVIRONMENT (DCCE)
กระทรวงทรัพยากรธรรมชาติและสิ่งแวดล้อม | Ministry of Natural Resources and Environment
DG of DOA, MOAC
Crop for the Future and GHG Management
in Agriculture Division
8


DEPARTMENT OF AGRICULTURE
DOA TOGETHER
Hearing for Changing, Acting for Moving forward
GHG Emission Reduction in Agriculture
DOA Green Together
50 ปีกรมวิชาการเกษตร
DOA TOGETHER

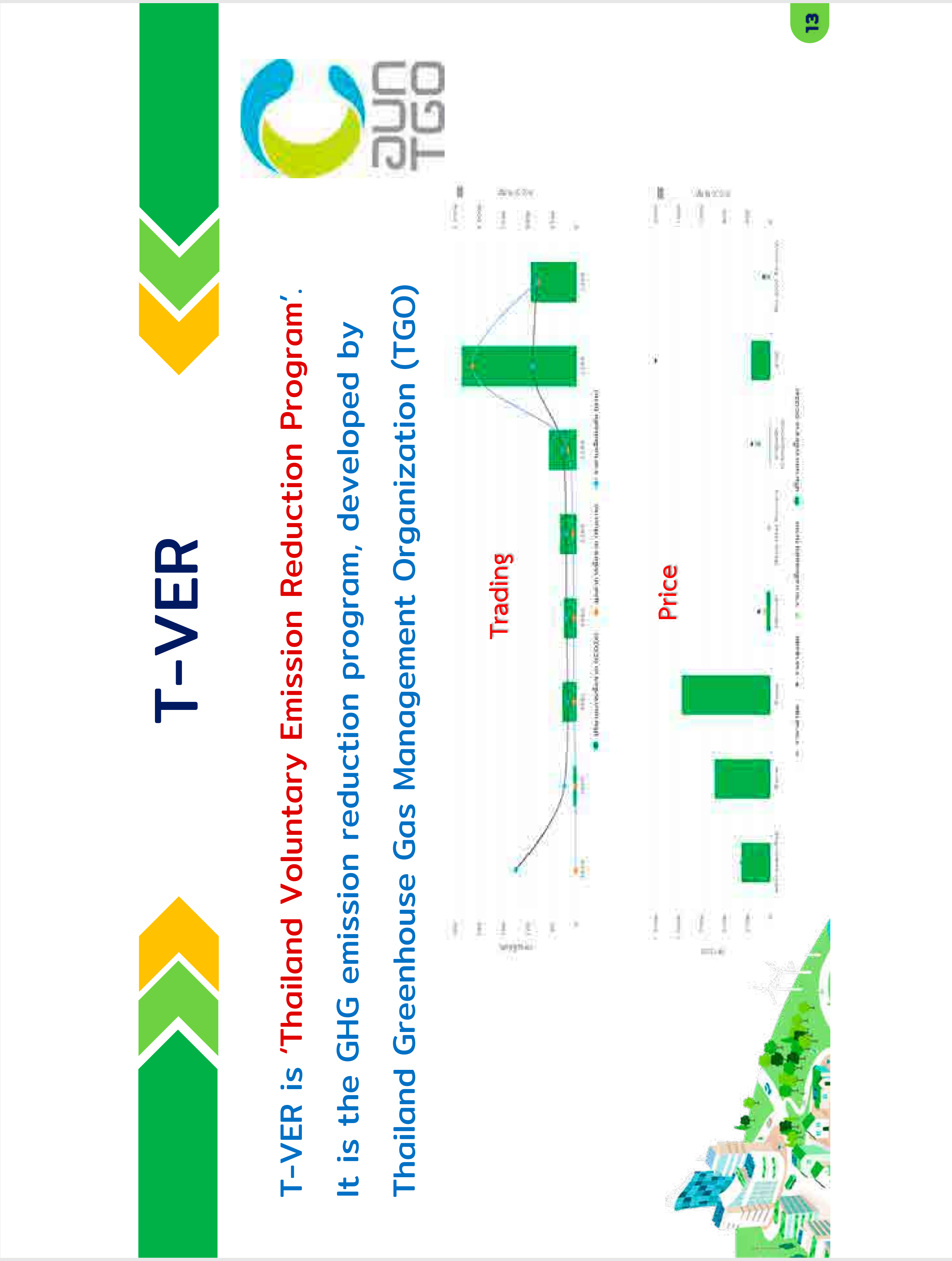

Objectives
Carbon Credit from the activities under Thailand Voluntary Emission Reduction Program (T-VER)
▪ Agriculture
- Target plants (sugarcane, oil palm, cassava, maize, para-rubber, fruit crops)
▪ GAP Carbon credit plus
Validation and Verification Body (VVB)
▪ Staff training : Validator
▪ Office : Certification Body
10


11
Carbon Credits
The TGO has certified the greenhouse gas mitigation achieved through the implementation of the T-VER program.
TGO certified T-VER's greenhouse gas reduction and carbon credit sales program, which encourages voluntary participation in emissions reduction and allows international models.
T-VER Methodology
Carbon credit project operator
e.g. new tree planting
ISO 14064-2
Carbon credit standard regulatory agencies
e.g. TGO.
Carbon credits Buyer/User
e.g. goods/services producers
Consumers who are environmentally conscious.
ISO 14065-3
ISO 14065

Carbon Credit Project

Type of Market	Level	Samples mechanism of Carbon Credit
Mandatary market	under UNFCCC	Clean Development Mechanism : CDM
Voluntary market	International	Verified Carbon Standard: VCS Gold Standard American Carbon Registry Climate Action Reserve etc.
	National	Thailand Voluntary Emission Reduction Program: T-VER J-Credit Scheme China GHG Voluntary Emission Reduction Program Republic of Korea Offset Credit Mechanism Australia ERF Spain FES-CO2 Program etc.

12


T-VER
T-VER is 'Thailand Voluntary Emission Reduction Program'.
It is the GHG emission reduction program, developed by
Thailand Greenhouse Gas Management Organization (TGO)
TGO
Trading
Price
13

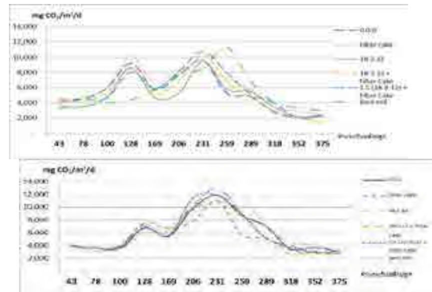
Technology / Mechanism

App. TSFM
(Thai Soil Fertilizer Management)

Breeding

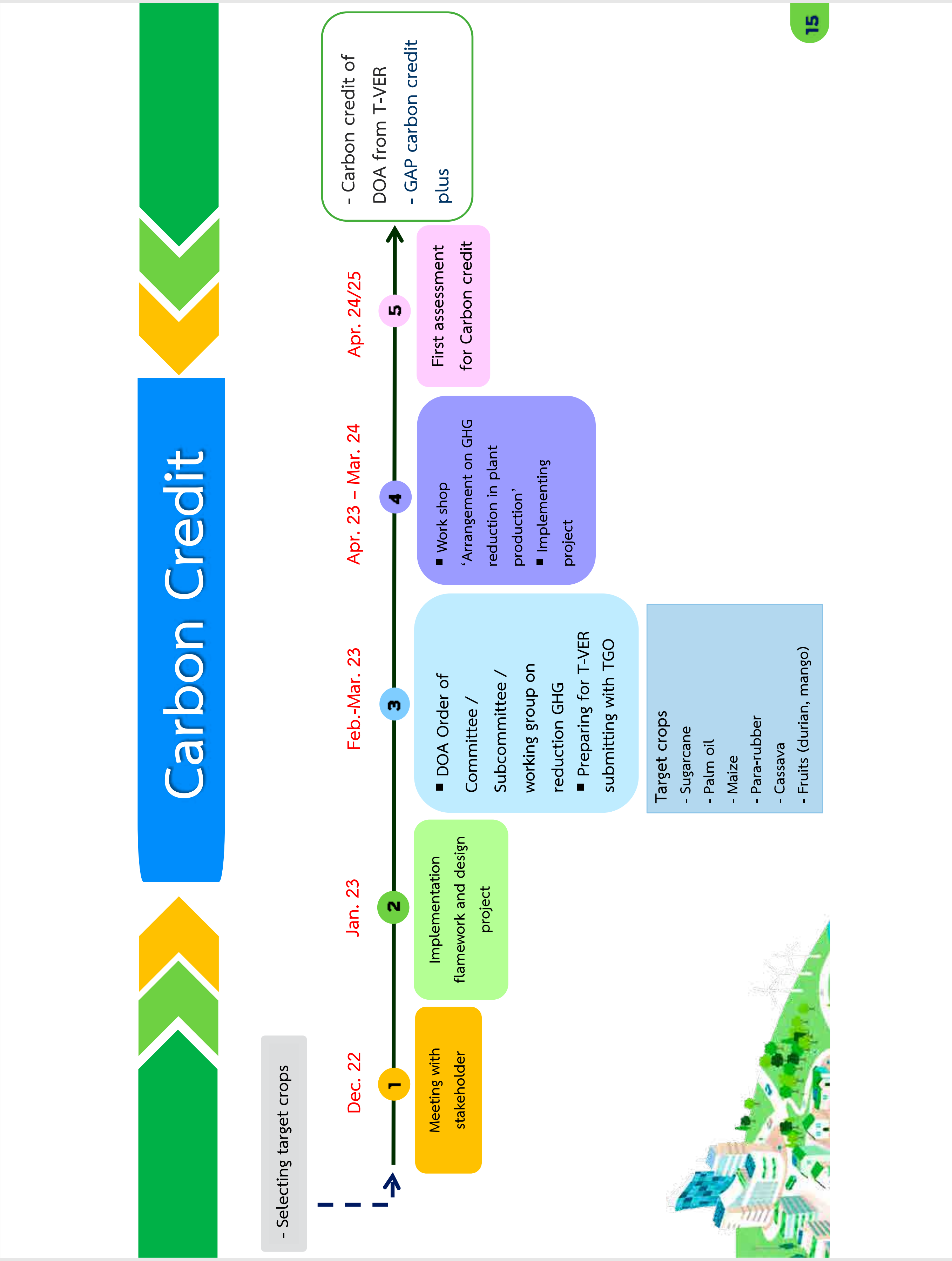
Chemical fertilizer application as Soil/Plant analyze

Fertilizer application
as soil of lease
and analyzation



GAP standard

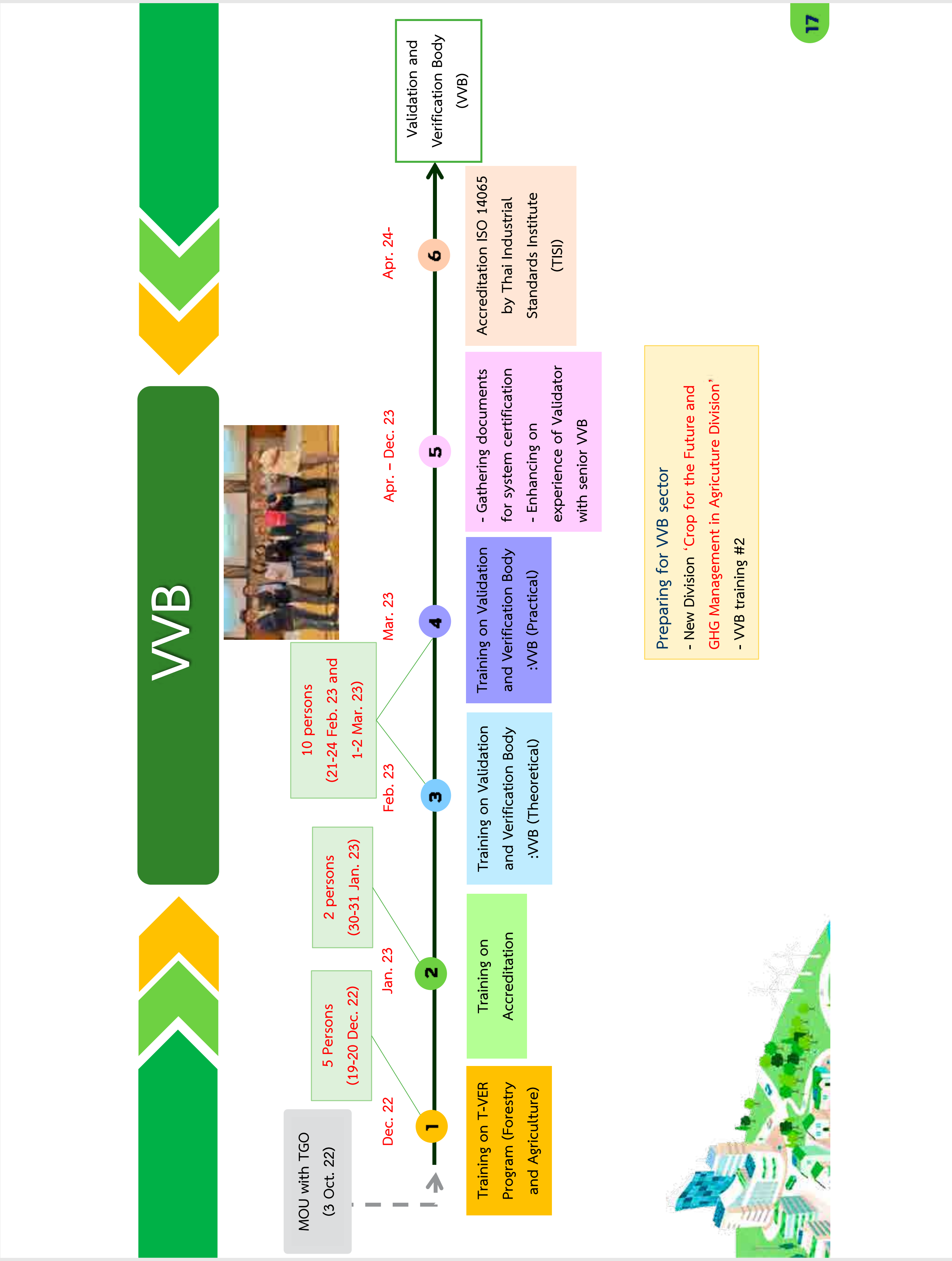
14


Carbon Credit
- Selecting target crops
Dec. 22
1
Meeting with stakeholder
Jan. 23
2
Implementation flamework and design project
Feb.-Mar. 23
3
■ DOA Order of Committee / Subcommittee / working group on reduction GHG
■ Preparing for T-VER submitting with TGO
Target crops
- Sugarcane
- Palm oil
- Maize
- Para-rubber
- Cassava
- Fruits (durian, mango)
Apr. 23 – Mar. 24
4
■ Work shop 'Arrangement on GHG reduction in plant production'
■ Implementing project
Apr. 24/25
5
First assessment for Carbon credit
- Carbon credit of DOA from T-VER
- GAP carbon credit plus
15

Pilot Area

- **Sugarcane**
  Khonkean, Ratchaburi, Mukdahan
- **Oil palm**
  Suratthani, Krabi
- **Cassava**
  Rayong
- **Maize**
  Nakhon-sawan, Petchaboon, Nakhonratchasima
- **Para-rubber**
  Suratthani, Chacheangsao
- **Fruit crops (mango, durain)**
  Chanthaburi, Srisaket, Sukhothai

16


VVB
MOU with TGO
(3 Oct. 22)
Dec. 22
1
Training on T-VER
Program (Forestry
and Agriculture)
5 Persons
(19-20 Dec. 22)
Jan. 23
2
Training on
Accreditation
2 persons
(30-31 Jan. 23)
Feb. 23
3
Training on Validation
and Verification Body
:VVB (Theoretical)
10 persons
(21-24 Feb. 23 and
1-2 Mar. 23)
Mar. 23
4
Training on Validation
and Verification Body
:VVB (Practical)
Apr. – Dec. 23
5
- Gathering documents
for system certification
- Enhancing on
experience of Validator
with senior VVB
Apr. 24-
6
Accreditation ISO 14065
by Thai Industrial
Standards Institute
(TISI)
Validation and
Verification Body
(VVB)
Preparing for VVB sector
- New Division 'Crop for the Future and
GHG Management in Agricuture Division'
- VVB training #2
17

International Impelling

'Pathways to Net Zero for Agrifood and Land Use Systems in Asia', 14-16 Dec 2022, Bangkok

'ASEAN-CRN Knowledge Exchange Event and Partners Meeting', 28-30 Mar 2023, Bangkok

8th ASEAN – CRN Annual Meeting
4 April 2023 (Virtual Meeting)

18

THE ASEAN Joint Work on Greenhouse Gas Reduction Emission Program on Crops or AGERcrops

1. Knowledge exchanges to develop guidelines in the agricultural sector to be recognized both in the national and international level.
2. Knowledge excahnges to develop standard methodology for baselining for GHG emission reduction in the agricultural sector for major economic.
3. Knowledge exchanges to develop operational guidelines for obtaining carbon credit certification for crops in farming communities and the private sectors.
4. Scaling-up of the carbon credits schemes in the agricultural sectors.

19

20

GAP

GAP Carbon Credit Plus

Tentative guidelines for auditing production sites of the GAP plants combine to the Thailand Voluntary Emission Reduction Program (T-VER)

- Guidelines being developed to audit GAP plant sites in Thailand for T-VER program.
- Aiming to upgrade agriculture production and reduce greenhouse gas emissions.
- Linking GAP standards to greenhouse gas reduction.
- Includes reducing nitrogen fertilizer, increasing organic matter, using cover crops, and reducing fuel oil usage on farms.
- Results in greenhouse gas reduction used as carbon credit.
- Standard benefits farmers with quality products while maintaining environmental balance.

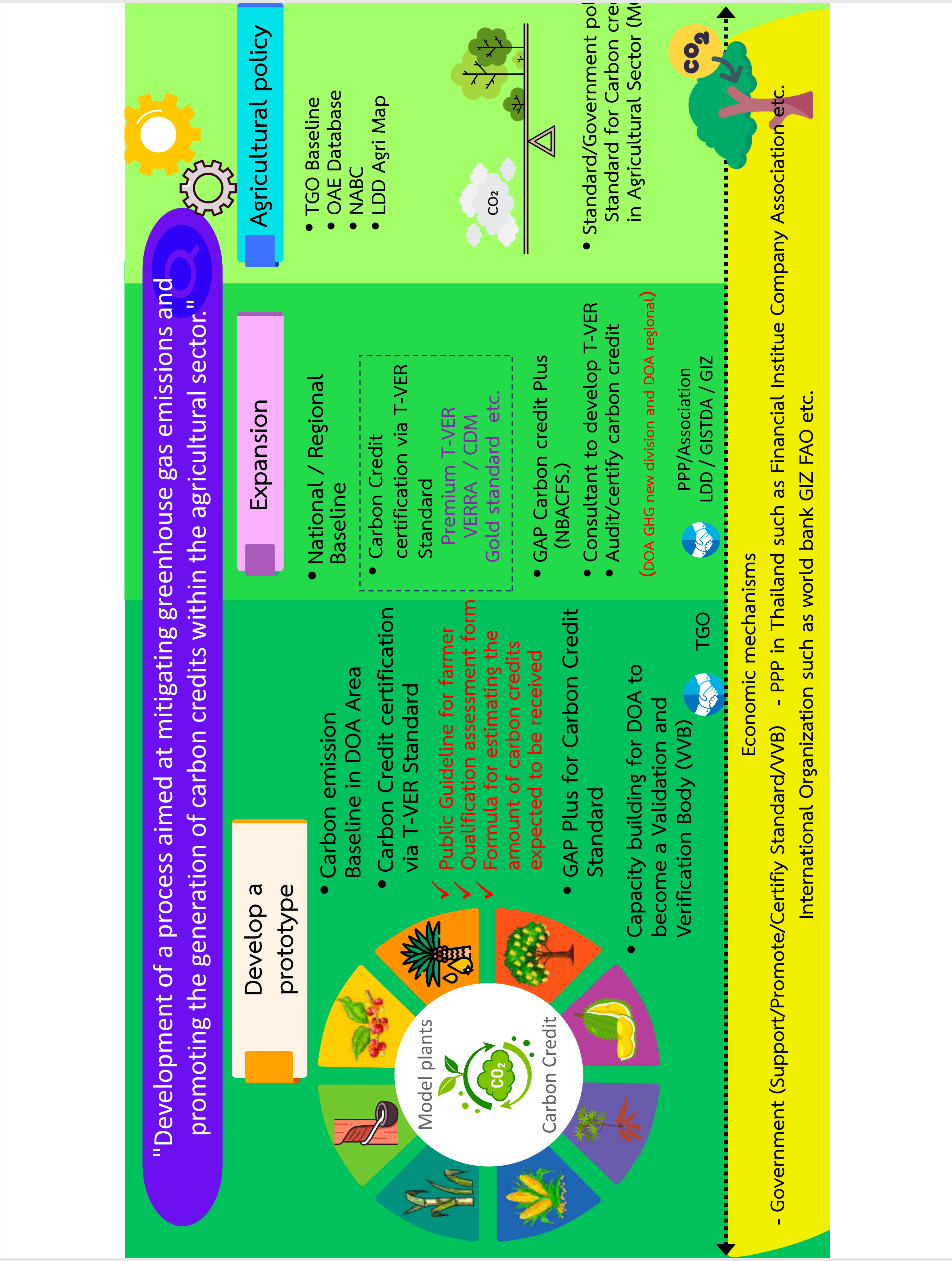
Impact

Increase distribution channels for entrepreneurs to countries with trade barrier measures such as CBAM or Carbon Tax, etc.

Farmers will gain more income from the purchase of carbon credits by entrepreneurs.

Preparing for the carbon credit market, the green market which can be accessed to green finance in the future.

Reducing greenhouse gas emissions CO_2


"Development of a process aimed at mitigating greenhouse gas emissions and promoting the generation of carbon credits within the agricultural sector."
Develop a prototype
Model plants
Carbon Credit
CO_2
• Carbon emission Baseline in DOA Area
• Carbon Credit certification via T-VER Standard
Public Guideline for farmer
Qualification assessment form
Formula for estimating the amount of carbon credits expected to be received
• GAP Plus for Carbon Credit Standard
• Capacity building for DOA to become a Validation and Verification Body (VVB)
TGO
Expansion
• National / Regional Baseline
• Carbon Credit certification via T-VER Standard
Premium T-VER
VERRA / CDM
Gold standard etc.
• GAP Carbon credit Plus (NBACFS.)
• Consultant to develop T-VER
• Audit/certify carbon credit
(DOA GHG new division and DOA regional)
PPP/Association
LDD / GISTDA / GIZ
Agricultural policy
• TGO Baseline
• OAE Database
• NABC
• LDD Agri Map
CO_2
• Standard/Government pol
Standard for Carbon cre
in Agricultural Sector (M
CO_2
Economic mechanisms
- Government (Support/Promote/Certifiy Standard/VVB) - PPP in Thailand such as Financial Institue Company Association etc.
International Organization such as world bank GIZ FAO etc.


TOGETHER
Thank you

ABBREVIATION AND ACRONYMS

ADB	Asian Development Bank
AFOLU	Agriculture Forestry and Other Land Use
APO	Asian Productivity Organization
AWD	Alternate Wetting and Drying
AWS	Automatic Weather Station
BRRI	Bangladesh Rice Research Institute
CCC	Climate Change Commission, the Philippines
CDM	Clean Development Mechanism
COE	Center of Excellence
CRIDA	Central Research Institute for Dryland Agriculture, Hyderabad, India
CSA	Climate-Smart Agriculture
DOST	Department of Science and Technology, the Philippines
EC	Electrical Conductivity
ESP	Exchangeable Sodium Percentage
FAO	Food and Agriculture Organization
FYM	Farmyard Manure
GCF	The Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Gesellschaft für Internationale Zusammenarbeit (international cooperation agency established by the German government)
GS	Gold Standard (international carbon credit certification organization)
IAF	International Accreditation Forum
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IMD	Indian Meteorological Department
INCAS	Indonesian National Carbon Accounting System
IoT	Internet of Things
IRRI	International Rice Research Institute
JCM	Joint Crediting Mechanism
JIRCAS	Japan International Research Center for Agricultural Sciences
KAN	National Accreditation Committee (Komite Akreditasi Nasional), Indonesia

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LVV GRK	Lembaga Validasi dan/atau Verifikasi Sektor Informasi Lingkungan Lingkup Gas Rumah Kaca, Indonesia (Validation and/or Verification Institution for the Greenhouse Gas Environmental Information Sector)
MLA	MultiLateral recognition Agreement
MOAC	The Ministry of Agriculture and Cooperatives, Thailand
MoEFCC	Ministry of Environment Forest and Climate Change, India
MRV	Monitoring Reporting and Verification
NARO	National Agriculture and Food Research Organization, Japan
NFMS	National Forest Monitoring System, Pakistan
NIEAS	NARO Institute for Agro-Environmental Sciences, Japan
OA	Organic Agriculture
OC	Organic Carbon
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Service Administration
PRISM	Philippine Rice Information System
RBP	Result Based Payment
RDE	Research, Development and Extension
SARAI	Smarter Approaches to Reinvigorate Agriculture as an Industry, the Philippines
T-VER	Thailand Voluntary Emission Reduction program
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VVB	Validation and Verification Body
WINDS	Weather Information Network and Data System

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LIST OF CONTRIBUTORS

RESOURCE PERSONS AFFILIATED WITH THE COE ON CSA

CHIEF RESOURCE PERSON

JAPAN

Dr. Hasegawa Toshihiro
Executive Scientist
NARO, Institute for Agro-Environmental Sciences, (NIAES)

OTHER RESOURCE PERSONS AFFILIATED WITH THE COE ON CSA JAPAN

Dr. Kuwahata Kenya
Senior Principal Scientist
NARO Development Strategy Center (NDSC)

Tsurusaki Ichiro
Senior Principal Scientist
NARO Development Strategy Center (NDSC)

Dr. Lurhathaiopath Puangkaew
Senior Scientist
Central Region Agricultural Research Center (CARC),
former NARO Development Strategy Center (NDSC)

Yasue Davaasuren
Contract staff
NARO Development Strategy Center (NDSC)

NATIONAL RESOURCE PERSON

BANGLADESH

Dr. S.M. Mofijul Islam
Senior Scientific Officer
Soil Science Division Bangladesh Rice Research Institute (BRRI)

THE ROC

Dr. Szu-Meng Wu
Professor/Director
Department of Life Science Chinese Culture University

INDIA

Dr. Niveta Jain
Principal Scientist
Division of Environment Science, Indian Agricultural Research Institute (ICAR)

INDONESIA

Dr. Sri Mulyani
Manager
Division of Environment Science Agriculture Extension Center Ministry of Agriculture

PAKISTAN

Dr. Ghani Akbar
Principal Scientific Officer
Climate Energy and Water Research Institute (CEWRI), National Agricultural Research Centre (NARC), Pakistan Agricultural Research Council (PARC)

THE PHILIPPINES

Dr. Eduardo Jimmy P. Quilang
Chief Science, Research Specialist
Department of Agriculture, Philippine Rice Research Institute

THE ROK

Dr. Gil Won Kim
Academic Research Professor
Department of Applied Life Science, Gyeongsang National University

THAILAND

Dr. Theerawut Chutinanthakun
Director
Department of Agriculture, Ministry of Agriculture and Cooperatives

APO SECRETARIAT

Gozde Bosnali
Program Officer
Asian Productivity Organization

APO