Studi Kelayakan Kredit Karbon Beras Berkelanjutan di Indonesia

Executive Summary

Climate change is the biggest challenge facing humanity. It is affecting all of us especially agriculture sector is the most vulnerable and affected by climate change. Climate change cannot be separated from carbon emissions. Efforts to reduce carbon emissions are an effort to prevent or reduce the negative impacts of climate change.

The Indonesian government has committed to reducing GHG emissions through the implementation of a National Carbon Economy by carbon trading mechanisms, performance-based payments and carbon tax. However, for the agricultural sector it cannot yet be implemented because the policy guidelines are not yet complete and the amount of value has not been determined yet.

The Alternative to get economic benefits can be obtained through the climate change control action label scheme can be used to procure environmentally friendly goods and/or services (ecolabel) and payment for environmental services in collaboration with companies that have commitment and interest in the agricultural sector.

Climate change is the biggest challenge facing mankind, with far-reaching impacts on many sectors of life, including agriculture. In fact, the agricultural sector is the most vulnerable and suffers from climate change. Climate change cannot be separated from carbon emissions. Efforts to reduce carbon emissions are an attempt to prevent or reduce the negative impacts of climate change.

The Indonesian government has committed to reducing GHG emissions through the national implementation of the carbon economy through the mechanisms of carbon trading, performance-based payments and carbon levies (carbon tax). However, this has not yet been implemented for the agricultural sector due to incomplete policy guidelines that must be set by the Ministry of Agriculture and also the amount of value that has not been set by the Ministry of Finance.

The economic benefits that can be obtained through the climate change action label scheme can be used for the procurement of ecolabelled goods and/or services and payment for environmental services in collaboration with companies that have a commitment and interest in the agricultural sector.

TABLE OF CONTENTS

FIGURE LIST

LIST OF TABLES

CHAPTER I. INTRODUCTION

1.1. BACKGROUND

The agriculture sector contributes 13% of greenhouse gas emissions to Indonesia's total greenhouse gas emissions, yet it is the most vulnerable and sensitive sector to climate change. Projections of greenhouse gas emissions in the Agriculture Sector to greenhouse gas emissions in Indonesia are estimated in 2030 to be 478,503.66 Gg CO2 eq. The achievement of GHG emission reduction potential in 2019 for the agricultural sector is 13,395.76 Gg CO2 eq.

Greenhouse gas (GHG) emissions are the release of gases that have a greenhouse effect in an area into the atmosphere within a certain period of time, whether caused by natural and biological processes or chemical and physical processes due to human activities, including agriculture. An increase in GHG emissions will directly increase the concentration of GHGs in the atmosphere, causing global warming due to the greenhouse effect or the blocking of heat or longwave radiation outward or into the atmosphere by GHGs. Another impact GHGs is climate change.

The agriculture sector is one of the national priority sectors in the RPJMN 2020 - 2024. In the RPJMN 2020 - 2024, the Ministry of National Development Planning (BAPPENAS) has committed to reducing emissions from the land sector (including agriculture) by 58.3% (by 2024). In 2020-2045, there is a projected increase in rice production decline due to climate change in all provinces in Indonesia. High to very high levels of rice production decline occur in several provinces in the east-north. Emission reduction also considers the development sector, especially the agricultural sector, the main target is food production and maintaining food security. In food production and maintaining food security, the most important thing is the availability of agricultural land.

Today's farming systems are a combination of modern agronomic principles, plant breeding, *agrochemicals* (such as pesticides and fertilisers), and

technological developments that can significantly increase food productivity. However, the application of modern agriculture seems to have an impact on environmental and ecological damage. Some of the environmental and ecological issues facing the agricultural sector are (1) environmental degradation due to the massive use of chemicals, (2) loss of biodiversity due to monoculture farming, (3) deforestation due to agricultural land clearing on forest and peatland, and (4) deforestation due to agricultural land clearing on forest and peatland.
(4) *desertification* due to land use that is not restored. These issues contribute to global warming due to the massive release of carbon into the atmosphere and the loss of carbon stocks from the soil.

The strategies used to address climate change are climate change mitigation and adaptation. The focus of climate change mitigation programmes is on reducing carbon emissions, which are the main cause of climate change, based on specific targets in selected sectors (OECD, 2008). Meanwhile, the focus of climate change mitigation programmes lies on efforts to reduce the impacts that may arise from climate change (OECD, 2016).

The government, in this case the Ministry of Agriculture, has identified and taken various anticipations and actions against the negative impacts of global climate extremes although not all areas have been reached, including:
(1) degradation of land and water resources; (2) damage to agricultural/irrigation infrastructure; (3) flood and drought disasters; and (4) increased pest and plant disease attacks. The method is called Climate Smart Agriculture.

As an effort to reduce greenhouse gas emissions, the government has issued PERPRES No. 98 of 2021 Implementation of NEK for Achieving Target Contributions for GHG Control in National Development, where there are 4 NEK mechanisms that will be implemented in Indonesia, one of which is the Carbon Credit.

The Indonesian carbon exchange was inaugurated on 26 September 2023 as a form of concrete contribution in accordance with the ratification of the Paris Agreement, especially from businesses in Indonesia, to overcome the climate change crisis due to rising temperatures. The proceeds of carbon trading will be invested in environmental efforts aimed at reducing carbon emissions.

This presents an opportunity for the efforts undertaken under the LCRP project and the businesses involved to gain economic value for their contributions to greenhouse gas reduction efforts. For this reason, it is necessary to conduct a feasibility study on the mechanism that has been established by the Government of Indonesia.

1.2. PURPOSE

1. To find out the impact of global warming and climate change caused by greenhouse gases on the agricultural sector.
2. To review low carbon development plans and strategies for climate change prevention efforts in the agricultural sector.
3. To assess sources of greenhouse gas emissions in rice and GHG reduction efforts
4. To assess the mechanism of Carbon Economic Value for Achieving Target Contribution for GHG Control
5. To find out the type of NEK mechanism that can be used to utilise the value of carbon emissions from GHG reduction efforts in LCR projects.

1.3. BENEFITS

1. Knowing the mitigation and adaptation efforts to overcome climate change in the agricultural sector, especially rice.
2. Knowing the mechanisms that can be used to obtain benefits from GHG emission reductions that have been carried out
3. To serve as a guideline for agricultural agencies in making GHG reduction action programme policies at the regional and national levels.
4. Serve as a basis for consideration in making the Climate Change Mitigation Action Plan Document for Paddy Rice

CHAPTER II. IMPACTS OF GLOBAL WARMING AND CLIMATE CHANGE ON AGRICULTURE

Global Warming is an imbalance in the earth's ecosystem due to an increase in the average temperature of the earth's atmosphere, ocean, and land caused by an increase in the concentration of greenhouse gases (GHGs) in the atmosphere such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2 O), hydrofluorocarbons (HFCs), perfluorocarbons (CFCs), and sulfur hexa fluoride (SF6) (Triana, 2008). GHGs have special properties like glass, which transmits shortwave radiation or sunlight, but absorbs and reflects longwave radiation that is hot so that the temperature in the atmosphere increases.

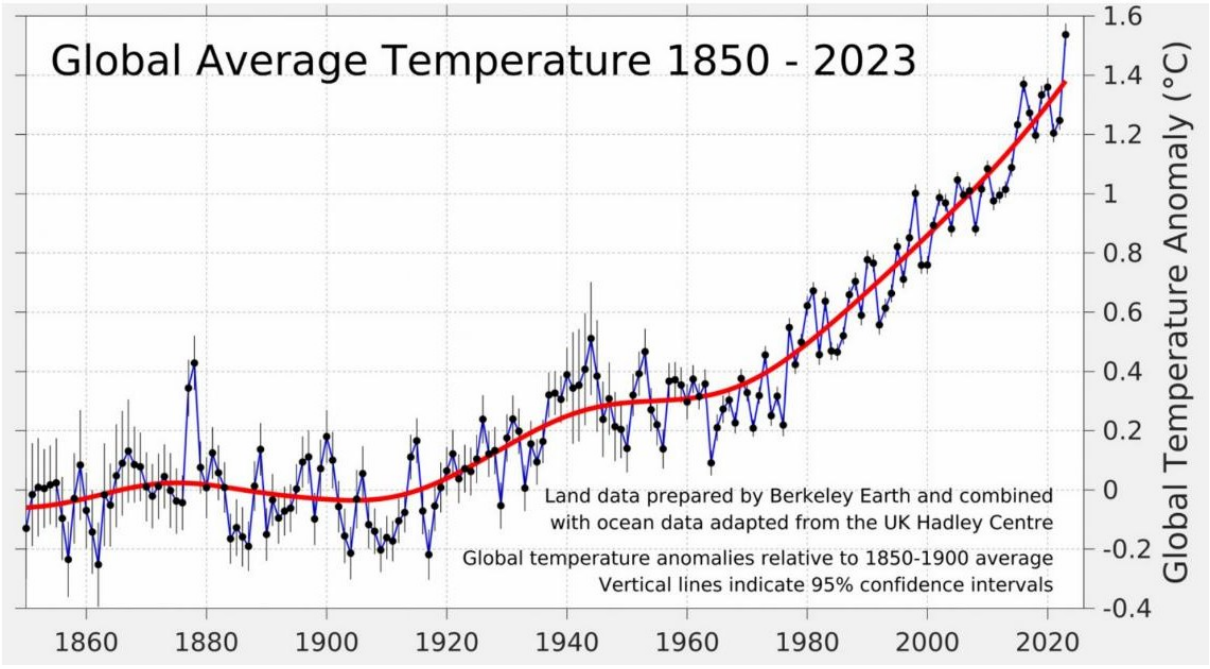


Figure 1: Global increase in Earth's temperature

Global warming occurs because sunlight emits shortwave and longwave radiation where most of the shortwave radiation is absorbed and heats the earth's surface and the longwave (infrared) back radiation emitted by the earth's surface is partly emitted out of the atmosphere and partly heats the atmosphere (Triana, 2008). Due to the presence of

an increase in the concentration of GHGs in the atmosphere causes some of the heat from the sun to not be transmitted (trapped) thus causing an increase in the earth's temperature resulting in global warming

With the increase of GHGs especially (CO2), more solar heat waves or infrared reflected from the earth's surface will be absorbed by the atmosphere so that the earth's surface temperature increases. The higher the concentration of greenhouse gases in the atmosphere, the more they become insulators that hold more heat from the sun emitted to the earth. The earth heats up as a result of sunlight that has entered the earth cannot escape because these greenhouse gases form a layer in the atmosphere that reflects sunlight. This process will eventually lead to global warming which will affect climate change.

The definition of climate change according to Law No. 31/2009 is a change in climate caused directly or indirectly by human activities that causes changes in the composition of the atmosphere globally and changes in natural climate variability observed over a comparable period of time. Examples include more intense rainfall in the wet season or a longer dry season than in previous years. In today's modern parlance, climate change is also known as the term associated with changes in climate parameters caused by the Earth's increasing heat.

Climate change occurs as a result of internal variability in the climate system and external factors (both natural and anthropogenic). Natural factors such as volcanic activity contribute to the increase of GHGs in the atmosphere, while anthropogenic factors that contribute to the increase of GHGs in the atmosphere come from the burning of fossil fuels. The magnitude of climate change impacts on agriculture depends on the level and rate of climate change and the nature and flexibility of agricultural resources and production systems. The agricultural sector is the most vulnerable sector to the impacts of climate change that occur due to global warming. Climate change can trigger changes in seasonality, planting patterns, planting time, production and quality of agricultural products (Hidayati and Suryanto, 2015).

The magnitude of climate change impacts on agriculture depends on the level and rate of climate change and the nature and flexibility of agricultural resources and production systems. The agricultural sector is the most vulnerable sector to the impacts of climate change that occur due to global warming. Climate change can trigger changes in seasonality, cropping patterns, planting time, production and quality of agricultural products (Hidayati and Suryanto, 2015).Surmaini et al. (2011) stated that there are three important factors in global climate change that have an impact on the agricultural sector, namely changes in rainfall patterns, increased extreme weather events (floods and droughts), increased air temperature and sea level.

According to BMKG, 2024. This climate change is already very real, as for the signs of

- Max temperature increases at a rate of 0.18 C/10 years
- Min temperature is increasing at a rate of 0.30 C/10 years
- Yearly rainfall increases in the north, decreases in the south
- Changes in rainfall patterns on Java Island
- There is shrinking ice at the peak of Wijaya, and it is predicted to disappear before 2030.

Climate change can have both direct and indirect impacts on agricultural production. The direct impact of climate change is the decline in agricultural production due to rising temperatures, soil salinity, and long dry or rainy seasons. Indirect impacts include reduced irrigation water supply, reduced potential land area in coastal areas due to tidal flooding, the emergence of new pests and diseases, and so on (Faqih and Boer, 2013). The climate in Indonesia is projected to become drier. Therefore, the agricultural sector must be able to adapt to climate change in order to maintain or even increase agricultural productivity for the next few decades to meet the increasing demand for food along with the increasing global population.

Climate change also results in increased rainfall in certain areas and drought in others (Kusnanto, 2011). Floods and droughts can disrupt crops from seedling to harvest. Crop disruption can be in the form of crop failure after seedling, crop damage due to flooding, and even crop loss. In addition, an increase in flood intensity will indirectly affect production due to increased pest and plant disease attacks.

Some categories of emission sources from the agricultural sector include: conventional cultivation, animal husbandry, biomass burning of agricultural residues, application of agricultural lime and urea fertiliser on agricultural land, direct and indirect nitrous oxide (N2O) emissions from managed soils. Efforts to suppress the increase in global warming and climate change are very urgent and important, if mitigation efforts are not carried out optimally which results in an increase in air temperature cannot be suppressed, it can have a wider impact on all aspects of human life.

CHAPTER III. LOW-CARBON DEVELOPMENT IN AGRICULTURE

3.1. LOW CARBON DEVELOPMENT PLAN

Since 2011, the Government of Indonesia has issued Presidential Regulation (Perpres) 71/2011 on the Implementation of the National GHG Inventory, which is an activity to obtain data and information on the level, status, and trend of changes in GHG emissions on a regular basis from various *sources* of emissions (*sources*) and absorption (*sinks/sequestration*), including *carbon stocks*. Based on Presidential Regulation 71 Year 2011, the agricultural sector must reduce its emission level by 8 Gg CO2eq. The main GHG emission from the agricultural sector is methane (CH4), at 67%, followed by nitrous monoxide (N2O) at 30% and carbon dioxide (CO2) at 3%. In 2000, total greenhouse gas emissions in the agricultural sector reached 75,419.73 Gg CO2eq. The main sources of these greenhouse gas emissions are paddy fields (69%) and livestock enteric (28%).

As part of Indonesia's commitment to reduce GHG emissions and eliminate *trade-offs* between the economy and the environment in the context of sustainable development towards a *green economy*, since 2017, the Government of Indonesia has launched the Low Carbon *Development Platform*. Low Carbon Development (LCD) is a development *platform* that aims to sustain economic and social growth through activities that produce low GHG emissions and emissions intensity, and reduce the use of natural resources, as stated in the RPJMN 2020-2024 low carbon development depicted in Figure 2.

Figure 2. RPJMN for Low Carbon Development

The achievement of low carbon development results from 2 indicators, namely carbon emissions produced and reduction of greenhouse gas emissions, where the emission reduction target in 2020-2030 is 31.89% (unconditional) to 43.2% (conditional) compared to the business-as-usual scenario in 2030.

Figure 3. Low Carbon Development outcome indicators

In addition, Indonesia's performance has improved with scores increasing in the range of 1-5% over 10 years. Indonesia ranks well in the aspect of natural capital protection, but still needs improvement in the aspect of efficient and sustainable use of resources and the utilisation of opportunities from the green economy.

***Green Growth Index* (GGI) 2022**

		Dimension scores (2020)				2010		2020		
Country	Sub-region	ESRU	NCP	GEO	SI	Index	Rank	Index	Rank	Performance
Japan	Eastern Asia	58.05	70.84	34.11	80.71	62.19	2	64.50	1	↗
Thailand	South-eastern Asia	56.17	73.82	46.29	70.73	62.98	1	64.08	2	↗
Cyprus	Western Asia	54.89	68.17	34.20	80.08	62.03	3	62.58	3	→
Georgia	Western Asia	53.27	72.17	30.84	72.25	56.16	9	60.54	4	↑
China	Eastern Asia	50.93	63.48	43.18	74.63	57.13	6	60.02	5	↗
Philippines	South-eastern Asia	56.48	73.94	29.27	64.06	58.44	4	59.55	6	↗
Singapore	South-eastern Asia	50.06	59.47	36.23	80.73	57.57	5	58.91	7	↗
Vietnam	South-eastern Asia	55.08	61.84	27.62	72.57	53.83	13	57.82	8	↑
Indonesia	South-eastern Asia	55.43	64.86	26.62	66.68	55.74	11	57.08	9	↗
Turkey	Western Asia	54.73	53.44	30.00	76.92	56.31	8	56.67	10	→

Figure 4. Green Growth Index

Low Carbon Development in the agricultural sector can be identified into several categories, namely paddy field management, the use of organic fertiliser and biogas to absorb GHG emissions, and improved animal feed through green feed and concentrates. GHG absorption in activities in the agricultural sector is through the use of organic fertiliser and biogas.

In managing paddy fields, the use of irrigation water with continuous inundation of rice plantation areas will emit higher amounts of methane gas (CH4) to the atmosphere, when compared to the use of *intermittent* irrigation water. Meanwhile, emissions from fertilisers are calculated based on fertilisers applied to the field which will emit GHGs in the form of N2O and CO2.

The Ministry of Agriculture has developed an action plan for climate resilient and low carbon development in the agriculture sector as illustrated in Figure 4. The main strategy is to increase adaptation, mitigation of GHG emissions and efficient use of agricultural inputs with a focus on reducing land degradation, environmental pollution and increasing land productivity in order to achieve a sustainable development.

NDC target of 10 million tonnes of CO2. However, this action plan has not been made into an official guideline that can serve as a reference in the preparation of mitigation and adaptation programmes, including benefits for actors involved in the programme.

Figure 5. Scenarios for reducing emissions from the agriculture sector

3.2. REGULATIONS RELATED TO GREENHOUSE GASES

The general guidelines for climate change mitigation were prepared based on various references, study results, and analyses from various documents, including:

1. Law Number 32 Year 2009 About Protection And Environmental Management
2. Law 17 of 2004 on the ratification of the Kyoto Protocol to the United Nations framework convention on climate change.
3. Presidential Regulation 71 of 2011 on the Implementation of the National GHG Inventory.
4. NAMAs, Nationally Appropriate Mitigation Actions (developing country commitments to reduce emissions) as per the Cancun Agreement, 2010.

5. RPJMN 2020-2024: Transform Indonesia into an upper middle-income country with equitable and sustainable development.
6. PERPRES Number 18 of 2020 Climate Resilience Development has become one of the RPJMN's national priorities (PN)
7. PERPRES No. 98 of 2021 Implementation of NEK to Achieve Target Contribution for GHG Control in National Development
8. Decree of the Minister of Environment and Forestry of the Republic of Indonesia Number: SK. 1 13 /MENLK / PPR / PPT.2 / RO / 2023 Regarding the Indonesian Greenhouse Gas Emission Reduction Certification Scheme
9. Presidential Regulation 61 of 2011 on the National Action Plan for GHG Emission Reduction.
10. Government Regulation No. 46 of 2021 on Environmental Economic Instruments
11. Presidential Regulation No. 77/2018 on Environmental Fund Management
12. Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 21 of 2022 concerning Procedures for Implementing the Value of Carbon Economy
13. Presidential Regulation (PERPRES) Number 129 of 2022 on the Ratification of the Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, Kigali, 2016 (Amendment to the Montreal Protocol on that Deplete the Ozone Layer, Kigali, 2016)
14. Regulation of the Minister of Energy and Mineral Resources Number 16 of 2022 concerning Procedures for Implementing the Value of Carbon Economy in the Electricity Generation Subsector
15. Regulation of the Coordinating Minister for Maritime Affairs and Investment Number 5 of 2022 on the Structure and Work Procedures of the Steering Committee for the Implementation of Carbon Economic Value for Achieving the Nationally Determined Contribution Target and Controlling Greenhouse Gas Emissions in National Development

The other supporting regulations that are being prepared are as follows:

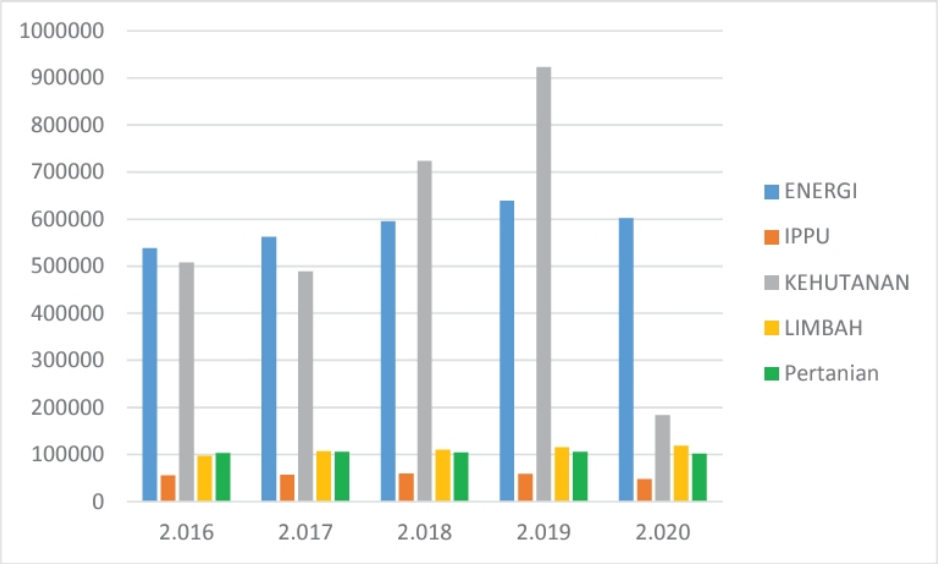
3. Draft Permen LHK on the Implementation of Nationally Determined Contribution; IN PROGRESS.
4. Draft of Minister of Environment and Forestry Regulation on the Implementation Procedure of Carbon Economic Value in the Folu sector is in progress
5. Draft of Minister of Environment and Forestry Regulation on Procedures for Implementing Carbon Economic Value in the Waste Sector, IN PROGRESS
6. Draft Permen of ESDM on Procedures for Implementing the Economic Value of Carbon in Power Plants
7. Draft of Minister of Finance Regulation on Procedures for Calculation, Collection, Payment or Deposit, Reporting, and Mechanism of Carbon Tax Imposition and Carbon Tax Deduction;
8. Draft Finance Ministerial Regulation on Carbon Tax Rate and Basis;
9. Regulation of the Minister of Home Affairs or Joint Decree of the Minister of Home Affairs and the Minister of Environment and Forestry related to the Role of Local Governments in the Implementation of Carbon Economic Value in the Framework of achieving NDC Targets;

3.3. GREENHOUSE GASES IN RICE CULTIVATION AND RICE PROCESSING

Greenhouse gases (GHGs) are gases contained in the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation. The main GHGs from agriculture are CO2 (carbon dioxide), CH4 (methane), and N2 O (nitrous oxide), CFCs (chlorofluorocarbons), etc. GHG Inventory is an activity to obtain data and information on the level, status, and trend of changes in GHG emissions on a regular basis from various emission sources (sources) and sinks, including carbon stocks. GHG emission is the release of greenhouse gases into the atmosphere in a certain area within a certain period of time. Activity Data is the quantitative amount of human activities or activities that can release and/or absorb GHGs. Emission Factor is the amount of GHG emissions released to the atmosphere per unit of a particular activity.

According to the United Nations Convention on Climate Change (UNFCCC), there are 6 types of gases that are classified as Greenhouse Gases (GHG), namely: Carbon Dioxide (CO2, Nitrogen

oxides (N2 0), Methane (CH4), Sulfur hexafloride (SF6), Perfloro carbon (PFCs), and Hydrofloro carbon (HFCs) (Killeen 1996). The agricultural sector is the fourth largest emitter compared to other sectors, and every year there is an increase in emissions produced as illustrated in Figure 6.



GHG EMISSIONS (Gg CO_2) from 2016-2020 (Balingtan, 2021)

Climate change is also influenced by unstable weather conditions such erratic rainfall, frequent storms, extreme air temperatures, drastically changing wind direction, and so on (Ratnaningayu, 2009). Global climate change will affect many things, including four climate elements and natural components that are closely related to agriculture, namely:

a. Rising air temperatures also impact other climate elements, particularly humidity and atmospheric dynamics,
b. Changing rainfall patterns,
c. Increasing intensity of extreme climate events (climate anomalies) such as elnino and la-nina, and
d. Rising sea levels due to melting icebergs in the north pole.

The agricultural sector is one of the sectors that acts as both a contributor to Greenhouse Gas (GHG) emissions and a victim (Surmaini et al., 2011).

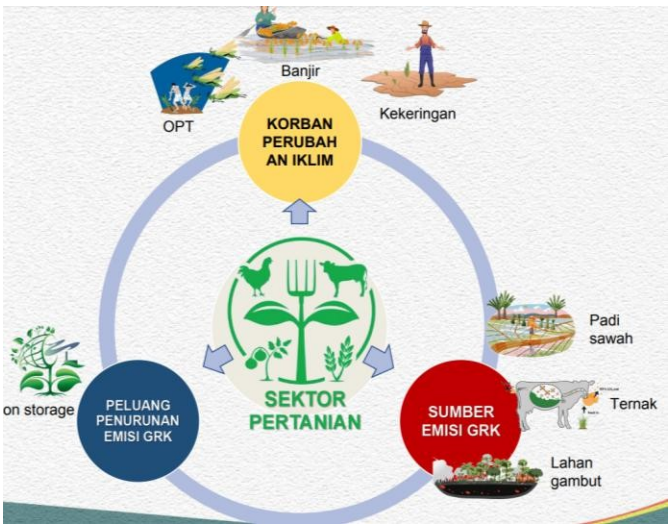


Figure 7. Climate Change Impacts in the Agriculture Sector

Climate change will have an impact on the development of plant pests and plant diseases. Pests and pathogens are living things whose activities are strongly influenced by environmental changes. The occurrence of a plant disease will be influenced by three important factors, namely *susceptible host* plants, virulent pathogens and suitable environmental conditions. If these three factors are achieved, the plant disease will emerge. Environmental factors that influence disease development include low temperatures that can increase disease intensity, high humidity and rainfall tend to increase disease intensity. This certainly indicates that environmental factors are important in supporting the occurrence of plant diseases. Likewise, plant pests will be greatly influenced by environmental changes. Some factors that influence pest development include temperature, rainfall, humidity and feed quality. Every 2^{o}C increase in temperature will result in an increase of one to five insect life cycles per season.

Climate change is no longer an issue, but a reality that requires concerted action at the global, regional and national levels. The preparation of a strategy that includes three aspects, namely anticipation, mitigation and adaptation.

a. Anticipation strategies are carried out by assessing climate change to minimise its negative impacts on the agricultural sector.

b. Adaptation strategies are actions to adjust natural and social systems to deal with the negative impacts of climate change. Such efforts will be beneficial and more effective if the rate of climate change does not exceed the ability of adaptation efforts.

It needs to be balanced with mitigation efforts, namely reducing the source and increasing the sink of greenhouse gases GHG). Climate change needs to be addressed by increasing consolidation and coordination among stakeholders on its causes and impacts on humans and the environment. Especially for farmers, the role of agricultural insurance needs to be more socialised in an effort to avoid farmer losses due to crop failure due to climate change either due to drought or pest attacks.

Changes in rainfall behaviour that cause shifts in the dry and rainy seasons mean that current rice cropping patterns are no longer as suitable as in the past. In extreme dry climate conditions, the availability of irrigation water is limited, causing production to decline due to crop losses.

In extreme wet seasons, flooding will also reduce production. Therefore, the need for accurate rainfall predictions accompanied by socialisation of timely shifts in the planting season will be needed in the future to minimise crop failures due to climate change impacts.

3.4. SOURCES OF GREENHOUSE GAS EMISSIONS IN RICE CULTIVATION

Emission sources from the agricultural sector come from agricultural activities such as; animal digestion system (enteric fermentation), livestock manure waste, straw burning, agricultural biomass burning, agricultural tillage, urea fertiliser use, agricultural lime use, and paddy rice cultivation system. The largest source of GHG emissions is contributed by paddy fields, which is 46.2%, then from Emissions

Soil by 28.1% and livestock by 19.4%, and for other factors can be seen in Figure 8. So that the largest GHG emission reduction in the agricultural sector is by reducing emission sources from rice cultivation through soil management, water use and fertiliser efficiency.

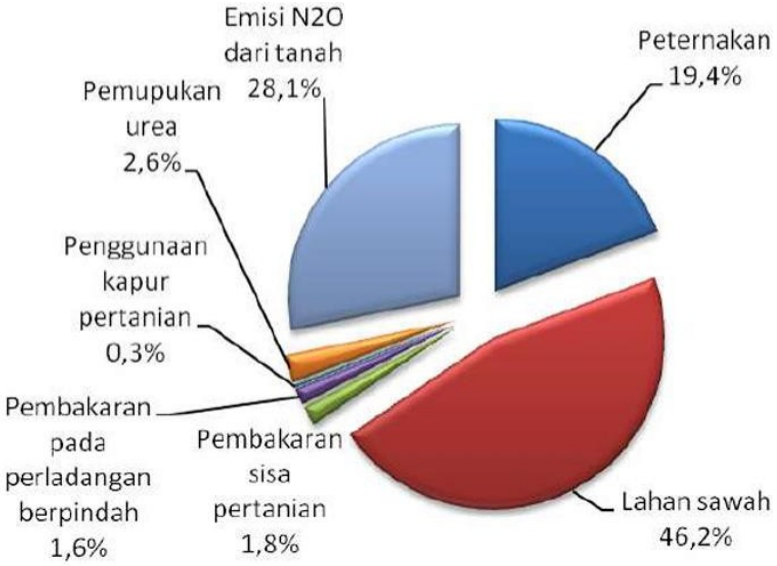


Figure 8: Sources of GHG Emissions in the Agriculture Sector

The main sources of GHGs consist of CO2, N2 O and CH4. CO2 gas is absorbed from the atmosphere through photosynthesis and released through respiration, decomposition, and combustion of organic matter. N2O gas is emitted as a side effect of nitrification and denitrification processes. CH4 gas, on the other hand, is emitted through the process of methanogenesis under anaerobic conditions in soil, manure storage through enteric fermentation, and due to incomplete combustion of organic matter. Other gases produced in the combustion process are NO2, NH3, NMVOC and CO, which are called indirect emissions. These gases are precursors in the formation of GHGs in the atmosphere. Indirect emissions also occur from the process of washing or surface flow that carries nitrogen compounds, especially NO which can then be converted into N2 O through the process of denitrification, briefly the process of greenhouse gases in rice can be seen in Figure 9.

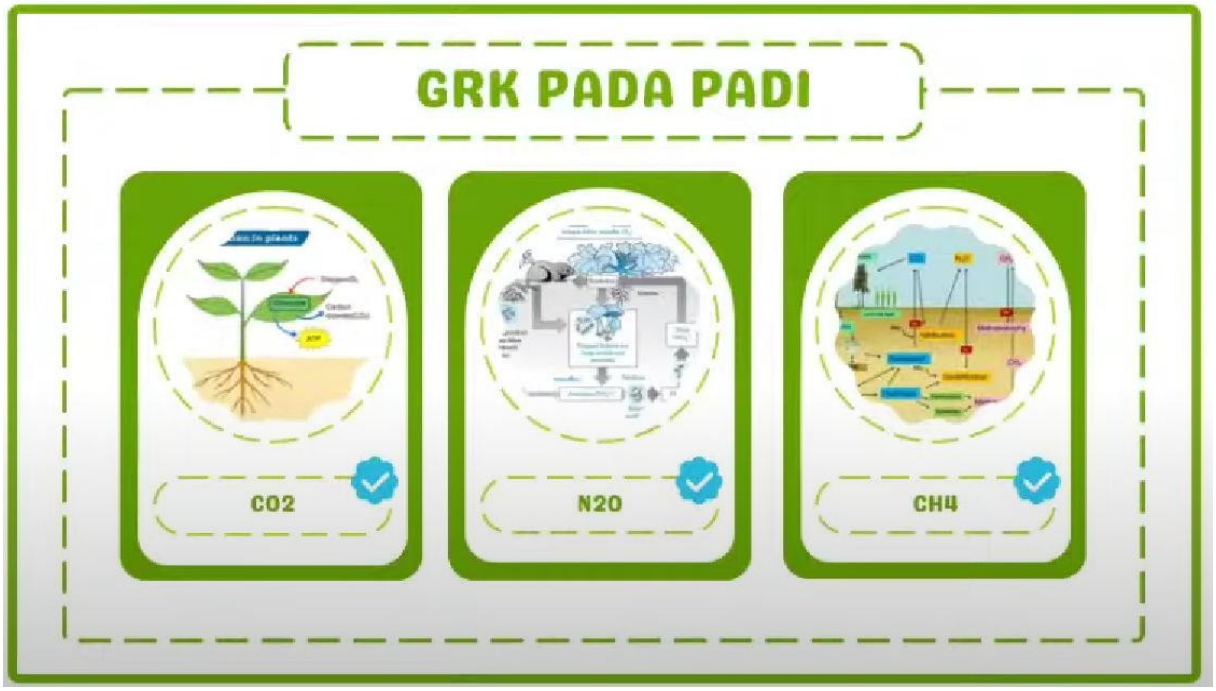


Figure 9. Greenhouse Gases in Rice Cultivation

The fertilisation process, especially urea fertiliser on agricultural land, has the potential to produce CO_2 emissions. CO_2 emissions occur because urea turns into ammonium (NH_4^+), hydroxyl ions (OH-), and bicarbonate (HCO_3^-) when it meets water and the enzyme urease. This process is similar to the addition of lime in the soil, where the bicarbonate formed turns into CO_2 and water. CO2 emissions from urea fertiliser application vary depending on cultivation management practices (Iqbal, et al. 2009).

Several N sources cause direct emissions of N2 O (Grace, 2017):

1. N from Urea, ZA and NPK fertilisers (artificial fertilisers)
2. N from organic materials or fertilisers (manure, compost)
3. N from crop residues
4. N from mineralisation associated with soil BO

Indirect N_2O emissions from managed soils are N_2O produced due to the transfer of agricultural system N into the soil and surface water through drainage and surface runoff, which is emitted as ammonia or oxides of nitrogen that are deposited and cause N_2O production. Some N sources of indirect N_2O emissions:

1. Total N from Urea, ZA and NPK fertilisers (artificial fertilisers)
2. Amount of N from organic materials or fertilisers (manure, compost)
3. Total N from crop residues
4. Amount of N mineralisation associated with soil BO loss

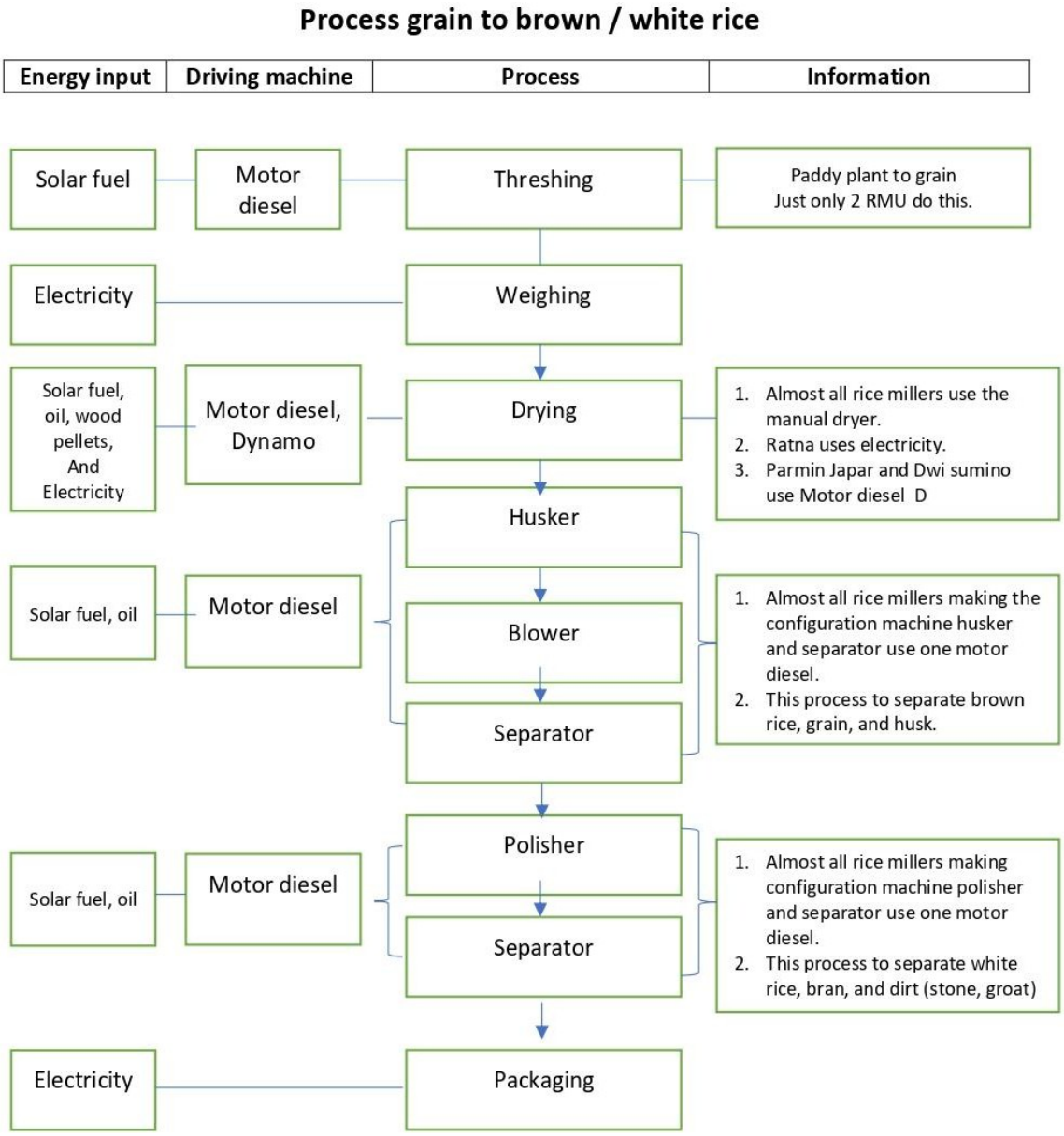
Routine application of organic fertiliser not only improves soil structure and aeration, but can also reduce CO_2 emissions if some of the urea fertiliser as a nitrogen source can be replaced by organic fertiliser.

3.5. SOURCES OF GREENHOUSE GAS EMISSIONS IN RICE MILLING

There are five sources of emissions in the rice milling process, namely

1. Combustion emissions from grid-connected electricity
2. Combustion emissions from on-site energy generation
3. Industrial process emissions
4. Fugitive emissions
5. Waste emissions

The value of emissions produced, refers to the stages of the rice milling process, which is described in the rice milling process as follows:



Energy Sources Used in the Rice Milling Process (LCRP Baseline Study, 2021)

3.6. GREENHOUSE GAS REDUCTION EFFORTS IN RICE AND PADDY

The increase in greenhouse gases resulting in climate change is a challenge for the agricultural sector, especially the rice sub-sector. Handling the impacts of climate change requires cooperation and the active role of various parties through adaptation and mitigation efforts, as illustrated in Figure 11.

Intervention	Adaptasi	Mitigasi	Catatan
Pengairan berselang padi sawah	Dengan ketersediaan air yang sama, areal tanam lebih luas	Emisi CH_4 menurun	Pengairan berselang tidak selalu meningkatkan hasil padi
Pemupukan berimbang dan efisien	Hasil dan pertumbuhan tanaman lebih tinggi/baik	Penurunan emisi dari pupuk	Perlu evaluasi ulang rekomendasi pemupukan
Pertanian multistrata	Komponen tanaman tahunan masih tetap menghasilkan pada musim masa kemarau panjang	CO_2 Removal (sequestration)	Perlu penguatan diseminasi
Perbaikan kualitas pakan ternak	Perbaikan pertumbuhan berat badan dan populasi	Penurunan emisi CH_4 dari fermentasi enteric	Perlu penanaman rumput dan legume serta BIMTEK secara luas
Pengurangan kedalaman drainase lahan gambut	• Subsidens lebih lambat • Penurunan risiko kebakaran	Penurunan emisi CO2	Perlu diseminasi dan bantuan sekat kanal untuk smallholders

Greenhouse Gas Reduction Strategy

Climate change mitigation, which aims to reduce greenhouse gas (GHG) emissions from agricultural land, can also be done through the use of low-emission varieties, the use of organic fertilisers, and adjustments to cultivation techniques through water and land management that can reduce GHG emissions.

One of the government's strategies to anticipate the negative impacts of extreme changes in global climate is to develop Climate-Smart Agriculture and Agricultural Modernisation. In this case, policy interventions on funding, technology, institutions and socio-economics are very important. The government, in this case the Ministry of Agriculture, has identified and taken various anticipations and actions against the negative impacts of global climate extremes although not all areas have been reached, including: (1) degradation of land and water resources; (2) damage to agricultural/irrigation infrastructure; (3) flood and drought disasters; and (4) increased attacks of pests and plant diseases, and the magnitude of the rate of decline in greenhouse gas emissions in rice fields can be seen in table 1.

Skenario	Teknologi mitigasi	Potensi aplikasi	Laju adopsi teknologi (% luas area)					
			2005*	2010	2015	2020	2025	2030
S0	Sawah irigasi dengan pupuk an organik (berdasarkan Kepmentan)	100	100	100	100	100	100	100
S1	Irigasi berselang (termasuk SRI, PTT)	70	3	5	10	20	25	30
S2	Suplemen Pupuk (ZA dan urea briket)	100	0	0	1	2	3	5
S3	Varietas rendah emisi *	30	20	25	30	40	45	50
S4	Irigasi berselang + suplemen pupuk (kombinasi S1 and S2)	70	3	5	8	10	15	20
S5	Irigasi berselang + suplemen pupuk + varietas rendah emisi (kombinasi S1, S2 & S3)	30	3	5	8	10	15	20
S6	S5 + *iron material*/silikat	30	0	0	1	2	4	6

Keterangan: Asumsi luas sawah 7,8 juta ha. Potensi aplikasi adalah luas sawah yang sesuai untuk aplikasi teknologi mitigasi; sisa sawah lainnya masih menggunakan teknologi konvensional. Varietas rendah emisi antara lain Ciherang, Cisantana, Tukad Balian, dan Way Apo Buru (KP3I, 2008)

Table 1. Mitigation Scenarios to Reduce Methane Gas Emissions from Rice Fields

Climate Smart Agriculture (PCI) is a system of rice cultivation that is carried out intensively starting from the management of fertilisers, water, seeds to pest and disease control. Rice cultivation using the PCI method is not only water-efficient but also adaptive to climate change, reducing greenhouse gas emissions. In addition, PCI also aims to restore the structure and ecology in the soil so that the soil is fertile again and the microorganisms in it can also develop and can provide nutrients for plants so that it is useful, both for farmers and the environment and ecosystems around rice fields and furthermore as a solution to the impact of climate change in the event of drought.

Climate Smart Agriculture (PCI) has 3 basic principles, namely

1. Productivity

   PCI aims to sustainably increase agricultural productivity and farmers' income from crops, livestock and fish, without negative impacts on the environment. This, in turn, will increase

food security and nutrition. A key concept associated with increased productivity is sustainable crop intensification.

2. Adaptation

   PCI aims to reduce farmers' vulnerability to short-term risks, while strengthening them to adapt in the face of long-term shocks. Special attention is given to protecting ecosystem services to farmers and other communities. These services critical to maintaining farmers' productivity and ability to adapt to climate change.

3. Mitigation

   PCI should help reduce and/or eliminate GHG emissions. This implies that we must reduce emissions for every calorie or kilo of food, fibre and fuel produced. We should also avoid deforestation by managing soils and trees to their full potential as carbon and CO2 sinks from the atmosphere.

PCI has a sustainable value by containing social, environmental, and economic elements. Some forms of PCI implementation include:

1. ***Water management*** involves managing water availability through irrigation, watersheds, groundwater and rainfall. This water management influences the cropping pattern in the future.

2. ***Soil management*** is done by adjusting the dose of fertiliser used in agriculture. The dose will be adjusted to the state of the soil and the needs of the plants, so that it is not excessive.

3. ***Crop management*** is the management of the planting commodity itself. This is done by selecting and using seeds that are superior and suitable for the planting conditions.

The forms of activities in the framework of climate smart agriculture include:

1. Water saving technology through *intermittent irrigation/Alternate Wet and Drying* (AWD)/macak-macak system,
2. Balanced fertilisation through the use of paddy/swamp soil test kits (PUTS/PUTR) to determine basic fertiliser doses of Nitrogen, Phospor and Potassium (NPK) or using fertiliser recommendations from the Agricultural Research and Development Agency,
3. Use of high-yielding varieties that are resistant to stress and low in emissions,
4. Use of organic materials to make organic fertiliser,
5. The jajar legowo rice cultivation system uses young seedlings and the use of seeds (2-3 seeds/ hole),
6. Implementation of integrated plant pest control by prioritising the use of plant-based pesticides,
7. Use of planting calendar to determine planting time,
8. GHG emissions measurement.
9. Intermittent and alternate wet and drying (AWD) water-saving irrigation technologies in wet rice fields.
10. Low-loss harvest
11. Post-harvest handling and storage

A. Variety Usage.

The GHG emitted by rice plants is mainly CH_4 . About 90% of CH4 gas is released through the aerenchymal vessels of the plant. However, the ability to release CH_4 gas varies depending on the characteristics of rice varieties, such as nature, age, and root activity. Rice that has tillers will increase the number of aerenchyma, resulting in greater CH_4 gas emissions. Long-lived (deep) varieties produce greater CH_4 gas emissions than short-lived (early maturing) varieties. This is related to the life cycle of rice plants. The longer the growing period of the plant, the more exudates and root biomass are formed so that CH_4 gas emissions become high.

Exudates are organic compounds that contain sugars, amino acids, and organic acids as constituents of materials that are easily available to CH_4 gas-producing bacteria. The more and more evenly plant roots, the greater the distribution of exudates into the soil. The formation of CH_4 gas is inseparable from the ability of roots as oxidisers in the soil. Varieties that have good root oxidising capacity have the potential to reduce CH_4 emissions. Through the oxidising capacity of the roots, gas exchange will lead to an increase in O_2 gas concentration, while CH_4 concentration will be oxidised biologically by methanotropic bacteria. Some of the varieties that produce low GHG emissions are IR64, Dodokan, Tukad Balian, Batanghari, Ciherang, and Inpari 1. Paddy rice, tidal rice, and soak-tolerant rice produce moderate CH_4 gas emissions, and hybrid rice produces high CH_4 gas emissions (Setyanto et al., 2010).

B. Fertilisation.

The application of N fertiliser (urea and ZA) on paddy fields is a must to increase rice production. However, the application of these fertilisers has the potential to produce GHGs. The use of ZA at a rate of 90-115 kg N/ha, spread three times (at 7, 21 and 42 days after planting), results in low CH_4 gas emissions. The use of urea also has the opportunity to reduce methane emissions. This is because the ammonium (CH_4^+) absorbed by the plants will be balanced by the release of H^+ around the roots, thus lowering the pH around the plant roots, which in turn will inhibit the development of methanogenic bacteria.

Another technique known to reduce CH_4 emissions is combining the use of organic fertiliser with N fertiliser, applying N fertiliser immersion. This method can also reduce N losses due to volatilisation. The use of inorganic fertilisers to be more efficient and effective needs to be based on the needs of the crop. This can be seen from the colour of rice leaves using the leaf colour chart (BWD). Organic fertiliser is applied at the time of tillage, equivalent to 2 t/ha.

The mechanism of using BWD is as follows: a. Measurement of green rice leaves with BWD starts when the plants are 25-28 HST and continues every 7-10 days until the primordia phase of the plant. b. Randomly select 10 clumps of healthy plants, place the middle of the leaf on the BWD and compare with the colour found on the BWD. If more than five out of 10 leaves are observed to have leaf colour below scale 4 of the BWD, the plants need to be fertilised with 75-100 kg urea/ha in the high yield season and 50-75 kg/ha in the low yield season. When measuring rice leaves with BWD, they should not face the sun as it will affect the measurement results. CH_4 emission mitigation can also be reduced by using silicate fertiliser. Total CH_4 emissions decreased by 16-20% with the use of silicate fertiliser at the rate of 4 Mg/ha and rice yield increased by 13-18%. Silicate fertiliser significantly promotes plant growth, especially root biomass, volume and porosity, which can increase oxygen concentration around the roots. This condition will increase CH_4 oxidation so as to reduce CH_4 emissions to the atmosphere (Kartikawati et al., 2011).

C. Water Management.

Besides affecting rice yield, water application also affects the volume of CH_4 gas emissions. In flooded conditions, CH_4 gas emissions higher than in dry conditions. Suppressing CH_4 gas emissions from the irrigation system needs to be done because in addition to reducing emissions, it can also save excessive water use. Intermittent irrigation is the most efficient irrigation management to reduce CH_4 gas emissions from paddy fields. The irrigation system combined with tillage (intermittent + tabela + no-till/ TOT) gave lower emissions compared to the tillage treatment with various irrigation conditions (flooded, intermittent and macakmacak), both with the combination of tabela and tapin.

Intermittent irrigation can reduce GHG emissions by 41-45% compared to continuous irrigation. Intermittent irrigation also has the opportunity to absorb carbon, because the net carbon produced is negative. In the intermittent irrigation system, land drying is carried out when the plants are 15-20 HST, 30-35 HST, and before harvest. High water to

land inundation is about 5 cm. Rice cultivated with the PTT (Integrated Crop and Resource Management) approach with intermittent irrigation also showed that the resulting CH_4 gas emissions low (78.3 kg/ha/season) with yields reaching 6.76 t/ha. On land with intermittent irrigation, an open and close system should be made on the beds to facilitate water management (Kartikawati et al., 2011).

D. Herbicides and Land Management.

The use of paraquat and glyphosate herbicides can reduce CH_4 gas emissions. Besides paraquat and glyphosate, the application of organochlorines and hexachloro-cyclohexane (HCH) can also suppress the development of methanogenic bacteria. Although herbicides can reduce CH_4 emissions, their use must be in accordance with recommendations so as not to leave residues in the soil that will cause environmental pollution. The perfect tillage system (OTS) combined with flood irrigation produces high CH_4 emissions. In this system, the soil is cultivated using a plough or hoe at the depth of the tillage layer (+20 cm).

In the OTS system, the physical soil has been degraded, while the no-till (TOT) system produces relatively smaller CH_4 emissions. In this condition, the physical soil is less disturbed except for planting furrows or holes for seed placement so that land degradation is more controlled. The TOT system effectively reduces CH_4 emissions, which means it also reduces the magnitude of global warming potential. The TOT system is 12% more effective than the OTS system. Efforts to reduce GHG emissions, especially N_2O gas, are to plant crops immediately after tillage (avoiding soil fallow) and plant cover crops during the fallow period to reduce nitrate and ammonia concentrations in the soil, and apply lime on acidic land.

The amount of CO_2 emissions that occur on agricultural land is inseparable from soil management techniques. On land that is left fallow, CO_2 gas generally emitted into the atmosphere. This is due to the absence of crops and photosynthesis processes, so there is no medium that functions as a CO_2 sink. Weeds (graminae family) found in the crops also contribute to the emission of CO2 to the atmosphere.

to CH_4 emissions, so efforts are needed to reduce emissions. Before planting, weeds are controlled with herbicides that are easily degraded, non-polluting and environmentally friendly. Crop residues from the previous season are used to cover the soil to suppress weed growth and preserve soil and water (Setyanto et al., 2009).

E. Use of Nitrification inhibitors

N fertiliser use management plays an important role in minimising soil nitrate residues that can help reduce the increase in N_2O emissions. Research results from the Agricultural Environment Research Centre (2009, 2010) showed that the use of urea+hydroquinone (HQ)+DCD can reduce N_2O and CH4 emissions by 30% and 50% respectively compared to the control.

Some nitrification inhibitors from the chemical industry include dicycendiamine (DCD), nitrapyrin, encapsulated calcium carbide (ECC), N-2,5-dichlorophenyl succinamic acid (DCS). These materials can significantly reduce N2 O emissions and increase rice production. In addition, the use of S-benzylisothiouronium butanoate (SBTbutanoate) and S-benzylisothiouronium furoate (SBT-furoate) in wheat crops can reduce global warming potential by 8.9-19.5%. Other nitrification inhibitors are 3,4-dimethylpyrazole phosphate (DMPP), 2-chloro-6(trichloromethyl)pyridine, sulfathiazole, 2-amino-4-chloro-6- methyl pyrimidine, 2 mercaptobenzothiazole, thiourea, 5-ethoxy-3-trichloromethyl1,2,4-thiadiazole (terrazole), and carbofuran (2,3-dihydro-2,2-dimethyl-7benzofuranyl methylcarbamate).

Apart from the chemical industry, some plant materials can function as nitrification inhibitors, including babadotan (Ageratum conyzoides), turmeric (Curcuma domestica Val.), randu leaves (Ceiba pentandra Gaertn.), mangroves (Rhizophora conjugata Linn.), neem (Azadirachta indica), and belimbing wuluh (Averrhoa bilimbi L). The use of neem seeds (20 kg/ha) can reduce N_2O flux by 48.9% in rainfed paddy fields. Neem seeds contain polyphenol compounds (0.13% tannins). Polyphenols in soil can inhibit the activity of nitrifying and denitrifying bacteria.

F. Application of Crop Cultivation Technology.

This activity plan focuses on the implementation of Integrated Crop and Resource Management (ICRM) in combination with several low GHG emission rice cultivation technologies. GHG mitigation from paddy fields is one of the main activities on the national agenda, because paddy fields are the largest source of CH_4 gas emissions that have a global warming potential of 23 times CO_2 and N2O gas from fertilisation activities with a global warming potential of 296 times CO_2 (IPCC, 1996).

For food crops, especially paddy rice, which is the largest source of GHG emissions in the agricultural sector, several mitigation technologies have been developed, one of which is listed in the road map of the national mitigation programme, namely the use of low-emission rice varieties. Rice plants have an aerenchymal network that functions as a chimney for the release of CH_4 gas from the soil into the atmosphere. Fertilisation technology, water management, , and the use of nitrification inhibitors are also technologies that can reduce GHG emissions from paddy fields (Setyanto et al., 2004).

Integrated Plant Management (PTT) of paddy rice is an approach to the application of several appropriate technology components in paddy rice farming, including superior varieties, quality seeds, young seedlings, number of seedlings and planting systems (population), N fertilisation based on Leaf Colour Chart (BWD), organic materials, intermittent irrigation, integrated weed control, integrated pest and disease control, harvest and post-harvest handling with the aim of maintaining or increasing rice productivity in a sustainable manner and production efficiency by taking into account the resources, abilities, and willingness of farmers (Suyamto et al., 2007), 2007).

The application of PTT in paddy rice in Sukamandi yielded 8-9 tonnes of MDG/ha/planting season, 1-2 tonnes/ha higher than the yield of conventionally cultivated rice. At the farmer field assessment level in 18 locations in 10 provinces, rice productivity increased by an average of 27% (6.5-8.0 tonnes/ha). With this approach combined with low-emission technology, it is hoped that the goal of mitigating GHG from paddy fields can be achieved without compromising productivity.

G. Eco-friendly Rice Milling Process

The rice milling industry is one of the most energy-consuming industries. Like capital, labour and materials, energy is one of the factors of production used to produce the final product. In economic terms, energy is a demand-derived good and can be considered as an intermediate good whose demand depends on the demand for the final product. In rice milling, several operations are performed manually i.e., cleaning, drying, feeding paddy to buckets, weighing and packaging, etc. So labour hours are also included in the energy calculation. Water is used for soaking and steam generation. Electricity is the main energy source for this rice mill and is imported from the state grid.

To address the potential impacts of climate change, Companies including rice mills are beginning to implement sustainable practices and reduce GHG emissions. This includes investing in more energy-efficient technologies, switching to renewable energy, reducing waste, improving transport efficiency, and implementing more sustainable production practices.

Rice mills consume significant amounts of fuel and electricity. The major energy consuming equipment in rice milling units are; boilers and steam distribution, blowers, pumps, conveyors, elevators, motors, transmission systems, weighing, etc. Most rice mills use old and locally available technologies and also rely heavily on locally available technical labour.

The mitigation action that plays the biggest role in efforts to reduce greenhouse gas emissions is the development of clean renewable energy as a transition step towards cleaner, less emission, and environmentally friendly energy, in the following ways:

- Reducing Emissions from Transport: Rice milling by mapping distribution routes and reducing transport distances reduces carbon emissions from the use of fossil fuels and conventional vehicles.

- Reducing Fossil Fuel Consumption:. i.e. by converting diesel energy sources into Electric energy sources in driving the rice milling production machine.
- More Efficient Energy Use: Energy use is often associated with more energy-efficient technologies, through the planning of production processes to minimise energy use and the modernisation of rice milling machinery and tools. The more efficient the use of energy, the less GHG emissions are produced.

CHAPTER IV. REVIEW OF *CARBON PRICING* MECHANISMS

4.1. NATIONAL CARBON ECONOMY

Indonesia is also committed to a low emission future through the ***Enhance Nationally Determined Contribution*** (ENDC) document by setting a voluntary GHG emission reduction target of 31.89% to 43.20% compared to BAU by 2030. Through Presidential Regulation No 98 of 2021, arrangements are made regarding the Economic Value of Carbon where one of the efforts to reduce emissions is through Carbon Trading.

Carbon trading is the buying and selling of certificates or permits to emit a certain amount of carbon dioxide (CO_2). The certification or permission to release carbon is also called a carbon *credit* or carbon emission quota (*allowance*). One carbon credit is equivalent to one tonne of CO_2 emission reduction. CO_2 emissions are produced by, among other things, burning fossil fuels (coal, gas and oil), burning forests, and decomposing organic waste.

One of the efforts to reduce emissions to achieve the NDC target is through the implementation of the value of carbon economy (NEK). NEK is the value of each unit of greenhouse gas (GHG) emissions resulting from human or economic activities. Carbon trading is new in Indonesia. In the long run, carbon trading will have a wide impact on government agencies and the private sector.

The implementation of NEK is carried out by ministries or institutions, local governments, business actors, and the community. The implementation of NEK through four mechanisms, including

a. Carbon trading
b. Performance-based pay
c. Levy on carbon by the finance minister (carbon tax)
d. Other mechanisms according to the development of science and technology.

The procedure for implementing the NEK can be seen in Figure 12.

Figure 12: Administration of NEK

4.2. CARBON TRADING

The implementation of NEK including carbon trading can only be done through the National Registry System (SRN) for Climate Change Control. This system will be connected to the carbon registry in the carbon exchange. All records such as emission reduction actors to the purchase of emission certificates will be traceable or traced through this system. The methodology is the basis for obtaining accurate, transparent and accountable emission reduction data. The criteria for this methodology are set by the director general and the National Standardisation Agency (BSN) and or approved by the United Nations Framework Convention on Climate Change (UNFCCC), in general the carbon trading ecosystem is illustrated in figure 13.

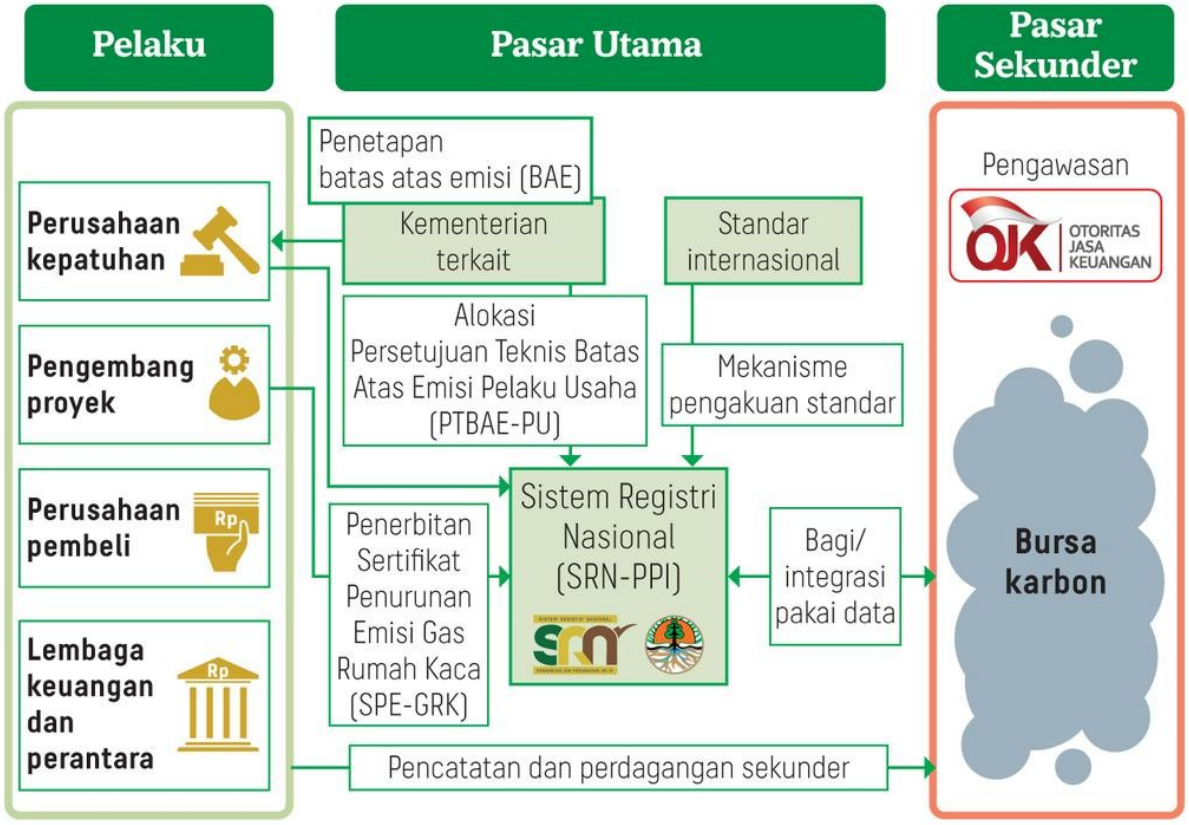


Figure 13. Carbon Trading Ecosystem Concept

Carbon credits are tradable certificates or permits that entitle a company, industry or country to emit 1 tonne (1,000 kg) of carbon dioxide or an equivalent amount of a different greenhouse gas (GHG). In other words, carbon credits embody a company's "right" to emit a certain amount of carbon in an industrial process.

The National Registry System for Climate Change Control, hereinafter abbreviated as SRN PPI, is a web-based system for managing, providing data and information on actions and resources for climate change mitigation, climate change adaptation, and carbon economic value in Indonesia. The National Registry System will be a forum for managing data and information on actions and resources for climate change adaptation and mitigation in Indonesia. This will enable standardisation and integration of data and information, thereby reducing data problems that have been occurring such as low data accuracy, redundancy, inconsistency and data inconsistency.

Carbon trading (exchange) is under the authority of OJK, and the exchange is conducted through the platform https://idxcarbon.co.id. Carbon Exchange is a system that regulates carbon trading and/or records ownership of Carbon Units Units are proof of carbon ownership in the form of certificates or technical approvals expressed in 1 (one) tonne of carbon dioxide recorded in SRN PPI.

Ministry of Environment and Forestry Regulation No. 21 sets out the criteria that must be met, including general criteria and specific criteria for carbon trading as described in Figure 14.

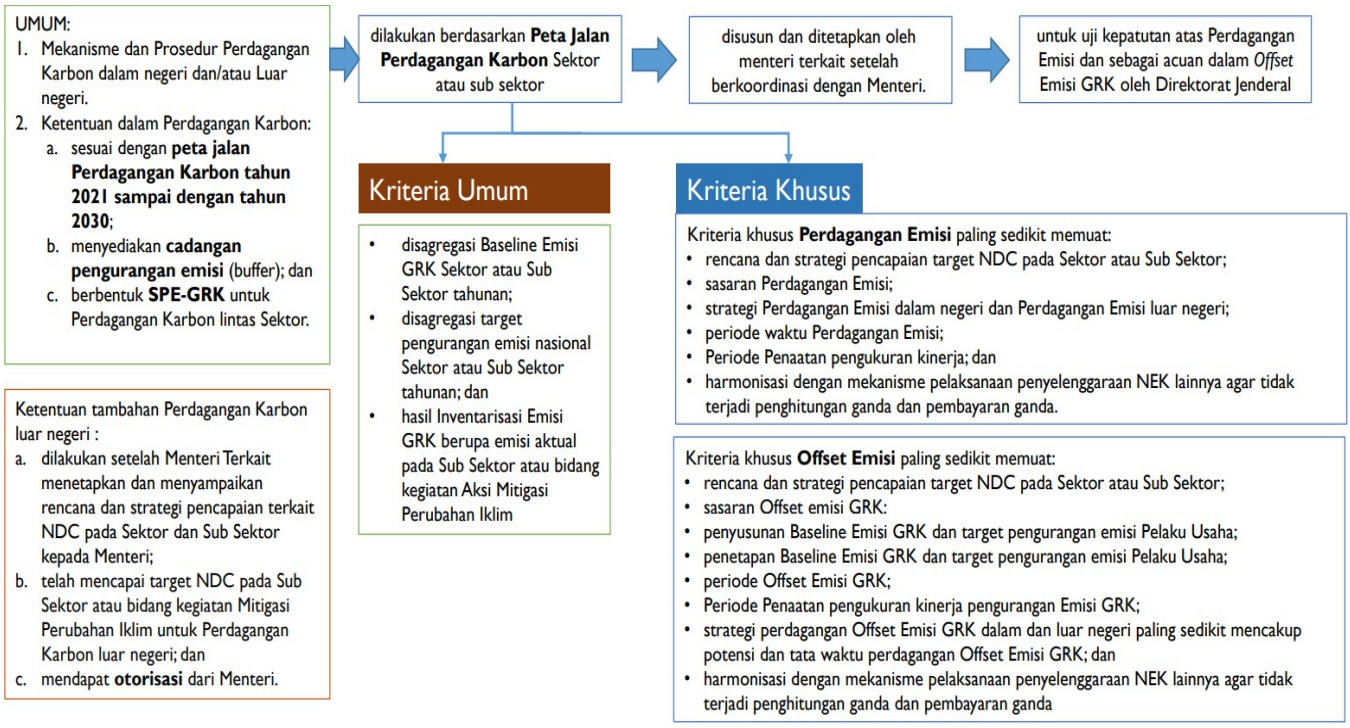


Figure 14. Carbon Trading Criteria

The mechanism of carbon economic value can be through 2 ways, namely Trade and Non-trade. for Non-trade there is no transfer of carbon rights.

A. Trade
    1. Emission trading system (ETS): Entities that emit more buy emission permits from those that emit less.
    2. Emission Offsets (Crediting Mechanism): Entities undertaking emissions reduction activities can offset emissions created elsewhere.

B. Non Trade

1. Carbon Tax : levied on carbon content or carbon-emitting activities
2. Result based payment : payment based on emission reduction result

In general, the implementation mechanism for Carbon implementation can be seen in Figure 15.

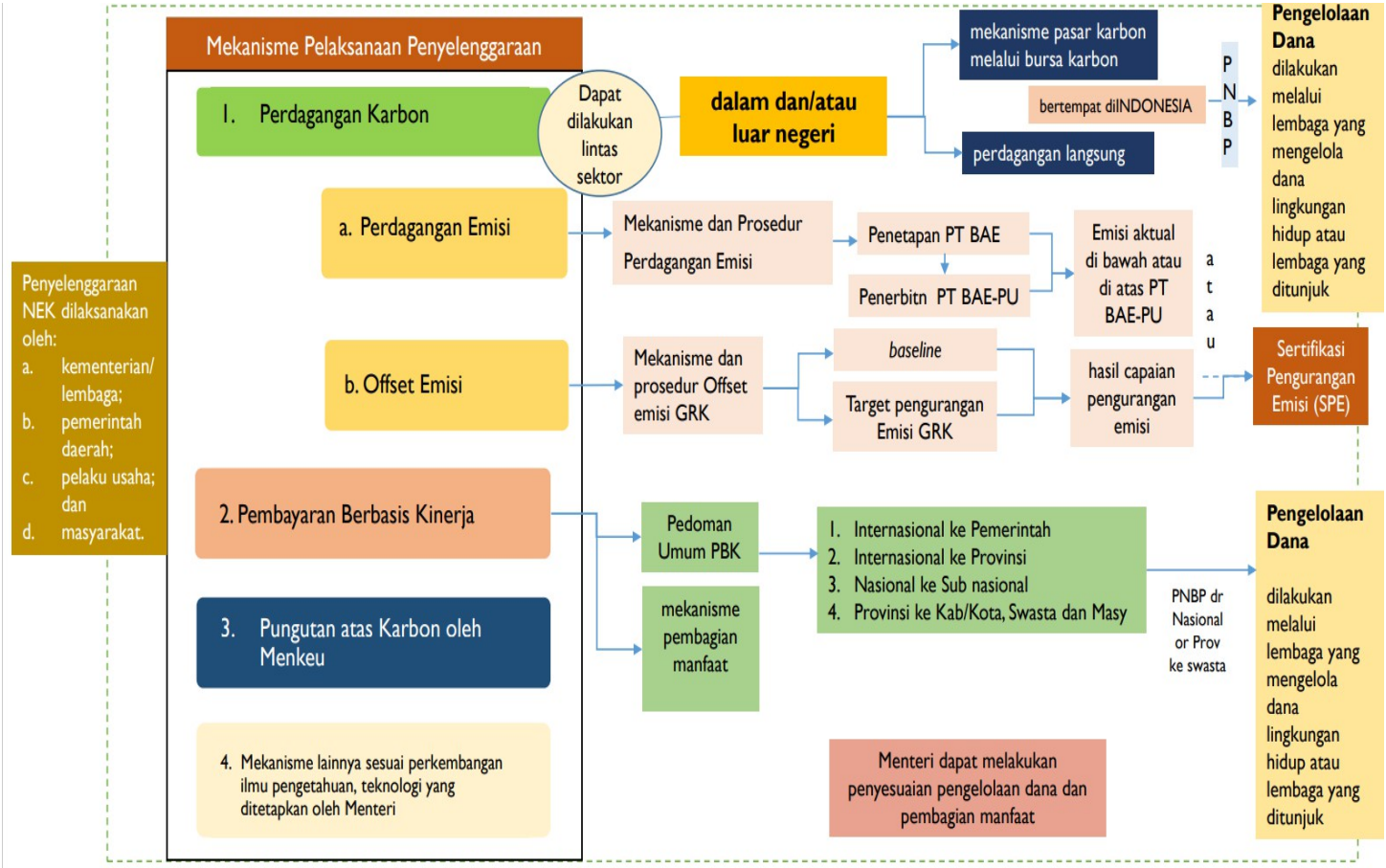


Figure 15: Mechanism of NEK Implementation

4.3. CARBON TRADING MECHANISM

The Carbon units traded at the Carbon Exchange Operator consist Technical Approval of Emission Limits for Business Actors (PTBAEPU) and Greenhouse Gas Emission Reduction Certificates (SPE-GRK). As described in figure 16.

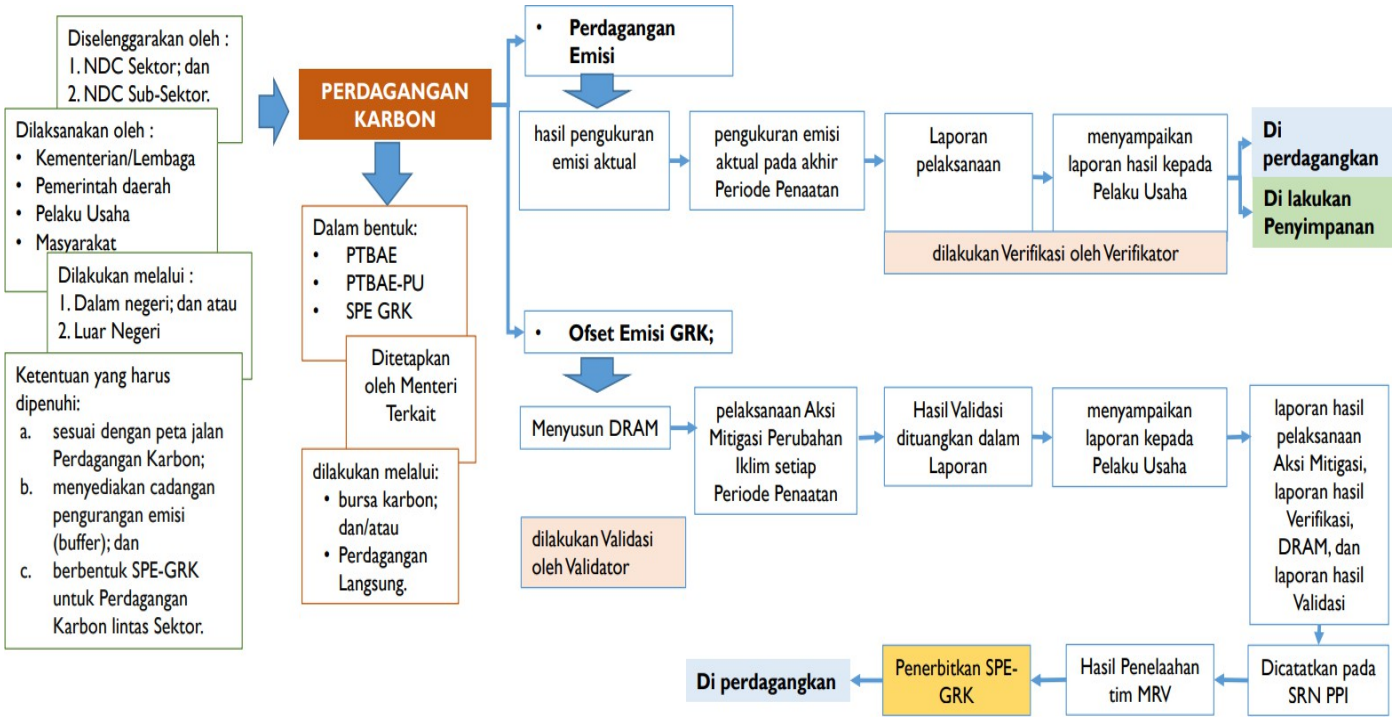


Figure 16. Carbon trading unit

A. Technical Approval of Emission Ceilings for Businesses (PTBAEPU) Technical

Approval of Emission Ceilings for Businesses (PTBAEPU) is a cap-and-trade mechanism generally applied to mandatory carbon markets.

Businesses that have been determined by the Government are given a stamp or Technical Approval of Emission Limits - Businesses (PTBAE-PU) in form of quota allocations (allowances) for a certain period. Businesses that exceed the given cap can purchase carbon units from businesses that have excess cap. PTBAE-PU can also be obtained through an auction mechanism organised by the relevant Ministry. This mechanism is also known as *Allowance Market*.

Allowance Market is a cap and trade mechanism that is generally applied to the mandatory Carbon Market. Certain businesses set by the government receive a "cap" in the form of an allocation of emission quotas for a certain period of time. Businesses that exceed the cap can purchase carbon units from other businesses with excess or unused quotas.

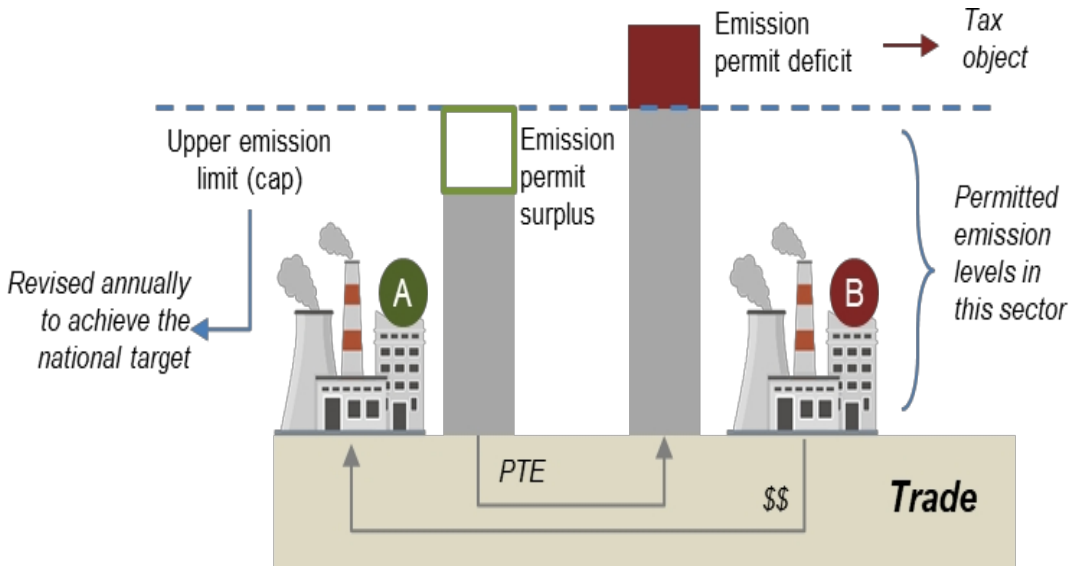


Figure 17. *Market Allowance* Mechanism

B. Certificate of Greenhouse Gas Emission Reduction (SPE-GRK).

Certificate of Emission Reduction - Greenhouse Gas (SPE-GRK), commonly known as Carbon Credit, is a form of proof of emission reduction by businesses and/or activities that have gone through *Measurement*, *Reporting*, and Verification, and recorded in the National Registry System for Climate Change Control in the form of a registry number and/or code. Companies can purchase carbon units to be used in meeting emission reduction targets or fulfilling commitments in *carbon neutral* or *net-zero emission*.

SPE-GRK can be traded per project through an Auction, Marketplace, or Negotiation mechanism, where businesses can trade for specific SPE-GRK through the Carbon Exchange. In addition to per project, SPE-GRK can also be traded according to the type of grouping in the regular market. In this market, each SPE-GRK traded on IDXCarbon will be grouped into a certain standard, and the buyer will know the details of the purchased project after the transaction is made.

Carbon trading through Certificates of Emissions Reduction - Greenhouse Gases (SPE-GHG) is commonly known as "*carbon offset*". Offset Market is a scheme

where businesses trade carbon units resulting from the reduction or removal of GHGs by certain businesses and/or other climate change mitigation actions. Businesses can purchase carbon units to achieve their emissions reduction targets and fulfil their commitment to carbon neutral or net-zero.

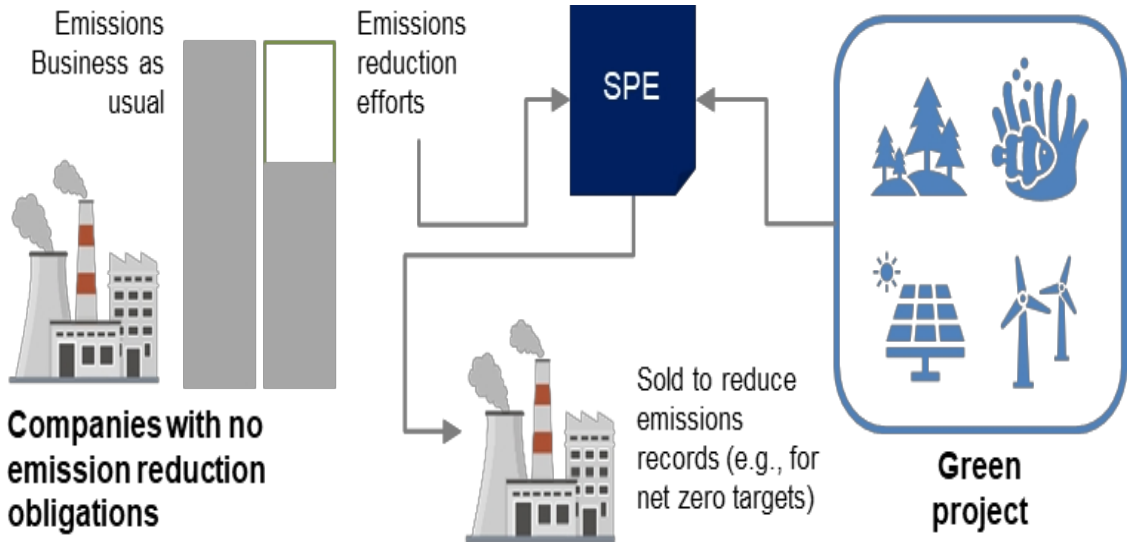


Figure 18. *Offset Market* Mechanism

Efforts to achieve NDC targets through the implementation of Climate Change Mitigation, Climate Change Adaptation, and NEK are carried out accurately, consistently, transparently, sustainably, and accountably through:

a. MRV;
b. SRN PPI; and
c. GHG emission reduction certification

The stages of the process in obtaining a carbon reduction certificate are as follows:

- Emission Source Identification
  identify the source of the carbon emissions you want to compensate. This could be from industry, transport, or other activities.
- Calculate Emissions:

Determine amount of carbon emissions produced by the source. For example, if you have a factory that emits 10,000 tonnes of CO_2 every year, this becomes the base figure for calculating carbon credits.

- Emissions Reduction:
  Take action to reduce emissions. This could be investing in green technology, using renewable energy, or managing waste more efficiently. Each emission reduction action will result in CO_2 savings.
- Conversion to Carbon Credits
  After reducing emissions, convert the CO_2 savings into carbon credits. One unit of carbon credit is equivalent to 1 tonne of CO_2 emission reduction. So, if you manage to reduce 1,000 tonnes of CO_2, the Company will get
  1,000 carbon credits.
- Verification and Certification
  This process involves an independent verification agency ensuring that emission reductions have taken place and are in line with international standards. Once verified, the Company will receive a carbon credit certificate.
- Carbon Market
  Carbon credits can be traded on the carbon market. Companies can sell carbon credits to companies or individuals who want to compensate for their emissions. The price of carbon credits varies depending on supply and demand in the market.
- Reporting and Transparency:
  Be sure to track and report the use of carbon credits transparently. This is important to ensure the integrity of the carbon credit system.

GHG Emission Reduction Certificates can be used by:

a. Certificate holders, to participate in Carbon Trading with authorisation from the Minister and Performance Based Payments to meet obligations related to achieving Indonesia's NDC targets;
b. Government, to serve as the basis for the calculation of the Carbon Levy;

c. Certificate holder, to serve as the basis for the organisation's or product's associated carbon label in accordance with the relevant label instrument certification standards and schemes;
d. Certificate holders, to form the basis for providing information to consumers, supply chain and sustainability reports and information instruments; and
e. Certificate holders, to be the basis for applying for access to green financing, or sustainability financing financing instruments

GHG Emission Reduction Certificates are prohibited from being used in contracts with other parties that involve the transfer of rights to the value of the GHG Emission Reduction Certification in international trade without authorisation from the Minister.

4.4. NON-CARBON TRADING MECHANISMS

Carbon pricing schemes can incentivise the achievement of NDC targets for climate change control. In addition to carbon trading mechanisms, non-trading mechanisms have also been established, in which there is no transfer of carbon rights. Non-trading instruments include carbon levies and result-based payments (RBP).

A. Levy on Carbon

The Minister who organises government affairs in the field of state finance Formulates policies and strategies for the implementation of Carbon Levy after coordinating with relevant Ministers and Ministers in accordance with the objectives of achieving NDC targets and controlling emissions for national development.

Currently, it is proposed to set Indonesia's carbon tax price at IDR 30 per kilogram (kg) of carbon dioxide equivalent (CO_2e) or equivalent unit, but some parties feel that this is still too low.

The basis for the levy on carbon refers to

a. Carbon content;
b. Potential carbon emissions;
c. Total carbon emissions; and/or
d. Performance of climate change mitigation actions

B. Performance Based Pay

Performance-based payments are made against the performance/benefits of GHG emission reductions produced by ministries/agencies, local governments, business actors and communities. The proceeds from these payments are used to

1. GHG emission reduction activities by sector and/or sub-sector
2. Support activities:
   a. Institutional capacity building
   b. Human Resources Improvement
   c. Policy Strengthening
   d. Research and development
   e. Creation of enabling conditions

Provisions in performance-based payment refer to

a. Based on verified GHG emission reduction performance achievements that have been reviewed by MRV team
b. Funding is disbursed by BPDLH to beneficiaries
c. GHG emission reduction performance achievements are recorded in the SRN PPI to access funding channelling

4.5. GREENHOUSE GAS CALCULATION METHOD IN RICE CULTIVATION

Referring to Permen LHK No 21/2022 Article 60 (2) letter f, the calculation of greenhouse gases must use a predetermined method. The criteria for the methodology are as follows:

1. Determined by the Director General;
2. Determined by the National Standardisation Agency; and/or
3. Approved by the United Nations Framework Convention on Climate Change

For the calculation of CH4 emission reduction from paddy fields, the number MSAP-002 has been assigned, which focuses on water management. The eligibility criteria for applying the methodology are as follows:

1. Land Cultivation Management technologies provide significant emission reduction potential when implemented nationwide.
2. SLPTT technology that uses less water regime provides more efficient production costs.
3. Use of low emission rice varieties provides better quality rice

GHG emission reduction achievements are measured by comparing the measurement results of GHG emission reduction and/or GHG uptake improvement with the GHG emission baseline. Measurement by relevant ministers, governors, regents/mayors, and Business Actors at least 1 (one) time in 1 (one) year.

The amount of achievement of Climate Change Mitigation Action is obtained from the reduction between the GHG Emissions Baseline and the amount of GHG Emissions or actual uptake. Measurement of national Climate Change Adaptation Action achievements is carried out by the Climate Change Adaptation Action implementer by comparing the indicators or target indicators in the planning with the results of implementation. Measurement of national Climate Change Adaptation Action achievements is carried out periodically at least 1 (one) time in 1 (one) year.

NEK measurement is conducted by the NEK implementer to obtain:

a. Technical approval of GHG emission ceiling;
b. The actual GHG emission or uptake amount; and
c. Amount of GHG emission reduction or GHG uptake increase
d. How to calculate Emissions

Emission Sources: Emissions from agricultural land management from both inundation regimes and using higher emitting varieties

Emission Type: CH4

Base line: Baseline daily CH4 emission factor assuming no inundation for 180 days prior to transplanting, and inundation of rice during the rice growing season without addition of organic matter.

Greenhouse Gas Calculation Formula

CH4 rice= ∑i,j,k(FEI,J,Kxt i,j,kxAI,J,Kx10-6) (Equation 5.1 IPCC2019) FEi =

Fec x SFw x SFp x Sfo x SFs x SFr (Equation 5.2 IPCC 2019)

Description

a. SFw (Scale factor of different types of irrigation). The scale factor for irrigation with continuous inundation is 1.
b. SFp (Pre-planting water regime scale factor) IPCC 2019 divides the pre-planting water regime scale factor based on the number of days that the paddy field is not waterlogged.
c. SFo = (1 + ROAi x CFOAi) 0.59 Scale factor for material addition. All organic matter from both animal manure and compost added to fields needs to be emitted using the IPCC Guide Line.
d. SFs (Scale factor for soil type) is 1. SFr (Scale factor for variety) is used based on the type of variety grown. The default is 1 for the IR64 variety, assuming that this is a variety that has been grown for a long time and is favoured by farmers and consumers.

How GHG Reduction is Calculated

Calculate methane emissions before mitigation actions with the formula: CH4 rice=

∑i,j,k(FEI,J,Kxt i,j,kxAI,J,Kx10-6) (Equation 5.1 IPCC2019)

Emissions after mitigation actions from paddy fields (a+b)

b. The area did not apply intermittent irrigation with the use of the IR 64 variety.
c. Area applying intermittent irrigation with the use of ciherang variety
d. then the emission reduction formula is
   PE = Step 1 - Step 2 (a+b)
   Converted units from CH4 to CO2 and from Gg to tonnes

Reporting on the implementation of Climate Change Mitigation Action and NEK contains general data and technical data on implementation reporting.

1. General data contained in the report on the implementation of Climate Change Mitigation Actions and NEK includes:
   a. Organiser and person in charge of implementing the action;
   b. Title and type of activity;
   c. Selected climate change mitigation action mechanisms and nec; and
   d. Climate change resources include technology transfer, capacity building, and financing.
2. Technical data contained in the implementation report of Climate Change Mitigation Action and NEK

   a. Calculation of GHG emission baseline;
   b. Selection of the reference period in order to establish the GHG Emissions Baseline; assumptions used in preparing the GHG Emissions Baseline;
   c. Calculation of the upper limit of GHG emissions related to NEK;
   d. Methodology for calculating Climate Change Mitigation Action achievements;
   e. Results of monitoring of activity data, including the size, location, and implementation period of Climate Change Mitigation Actions;

f. Climate Change Mitigation Actions undertaken, including the size, location and period of Climate Change Mitigation Actions;
g. The amount of GHG emission reduction and/or sequestration target achievement; and/or
h. Description of the managerial system, including the name of the person in charge of the action as well as the system established to monitor and collect data on activities related to Climate Change Mitigation and NEK Actions carried out.

Activity data for the calculation of GHG emissions from the agriculture sector are as follows:

Activities	**Data**
Biomass burning in Agricultural activities (biomass burning cropland)	• Rice production • Fraction of burnt plant • Biomass fraction • Emission factor
Urea fertilisation	• Urea consumption • Planted area • Urea dosage • Urea emission factor
Direct and emissions from soil	• Planted area • N fertiliser composition (Urea, NPK, AS) • Dosage of manure • Dose of inorganic N fertiliser • N content of manure and inorganic fertiliser • Irrigated rice field emission factor Dryland emission factor
Paddy Fields	• Rice field area by irrigation • Harvested area • Percentage of paddy field area by soil type • Soil type correction factor

Activities	Data
	• Water regime scale factor • Rice emission factor

In an effort to achieve the NDC target, each Business Actor is required to record and report the implementation of Climate Change Mitigation Actions, Climate Change Adaptation Actions, the implementation of NEK, and climate change resources in SRN PPI.

The results of recording and reporting serve as:

a. Basic recognition Government of contribution application NEK in achieving NDC targets
b. Data and information on mitigation actions and resources for NEK implementation
c. Efforts to avoid double counting of Climate Change Mitigation Actions; and
d. Diversion search material

Business Actors that do not carry out the obligation to record and report the implementation of Climate Change Mitigation Action, Climate Change Adaptation Action, implementation of NEK, and climate change resources in SRN PPI are subject to administrative sanctions.

4.6. GRK CALCULATION METHOD IN RICE MILLING

GHG accounting begins with establishing a baseline inventory of greenhouse gas emissions from rice milling. The quantification process follows the guidelines detailed by the Greenhouse Gas Protocol, the GHG Protocol's Corporate Accounting and Reporting Standard, and more specifically the GHG Protocol for Project Accounting.

The emissions in rice mills are divided into three types:

a. Scope 1: Direct GHG emissions from sources owned or controlled by the plant such as combustion for process equipment.

b. Scope 2: Indirect GHG emissions from purchased energy, such as electricity.

c. Scope 3: Indirect GHG emissions both upstream and downstream as a consequence of plant activities.

System boundaries in GHG accounting are set through financial and operational control parameters. Therefore, all rice milling activities that pay for fuel or purchase their own, and all other emissions that fall under their operational control. The study follows a cradle-to-gate approach, which includes all emissions from the source of the rice to the exit gate of the mill. This is to exclude activities that take place after the activities at the mill, such as transport to customers or packaging or processing that does not take place at the mill.

Specifically for the rice sector, these GHG sources can be categorised into Emission Categories according to the stages of the rice milling process in scopes 1, 2, and 3.

SCOPE	EMISSION CATEGORY	STAGE
Scope I	Combustion of fuels for process (owned vehicles, motors, wood pellets)	Milling - Threshing, Drying, Husker, Blower, Separator, Polisher, Transport of Co-products
Scope II	Purchased electricity (pumps, motors, lighting)	Milling - Threshing, Weighing, Drying, Packaging
Scope III	Employee commuting	Milling
	Emissions from by-products (if destroyed)	Milling - Separator
	Purchased goods and services (plastic packaging)	Milling - Packaging

To ensure the quality of the data collected, refer to the five key principles of the GHG Protocol for Project Accounting.

1. Relevance: ensuring the data collected, emission factors used, and methods are relevant to the project scope, expected outcomes, and study scope.
2. Completeness: all baseline and endline data were collected based on the study scope and system boundaries as described.
3. Consistent: methods, estimates, assumptions and data are consistent, allowing results to be generalised and compared.
4. Transparent: ensuring that data, analyses and calculations are clearly documented for review.
5. Accuracy: strive for the most accurate data and estimates possible and support growers and mills with knowledge and guidance to share accurate data.
6. Conservative: when estimates or uncertainties arise, use conservative values to overestimate rather than underestimate the carbon footprint

CHAPTER V. ANALYSING THE FEASIBILITY OF IMPLEMENTING A CARBON CREDIT MECHANISM IN THE RICE SECTOR

5.1. STUDY ON THE IMPLEMENTATION OF CARBON TRADING MECHANISM

Carbon credits are a form of climate currency, which means they are subject to supply and demand and can be bought and sold through cap and trade markets. This market limits the total amount of CO2 that can be emitted. The cap and trade market came into being after the Kyoto Protocol, an international treaty, set the maximum amount of GHG emissions that can be released into the atmosphere, both globally and nationally.

This project makes efforts to mitigate greenhouse gas reductions in rice and rice products, where these greenhouse gas reductions can be one of the potential income or economic benefits that can be traded through carbon exchanges.

The Carbon Exchange Organiser submits an application for registration of carbon unit listing to the Financial Services Authority through the work unit in charge of licensing the Carbon Exchange by attaching at least the following documents:

a. Identity of the applicant;
b. Project-related documents that form the basis of the carbon units to be applied for;
c. Evidence of registration, validation and verification by an institution accredited by an international registration system organiser, so that it can be concluded that the carbon units to be listed are eligible for trading on foreign carbon exchanges;
d. Carbon unit trading plan;
e. The results of the carbon exchange organiser's review of the required documents; and
f. Other documents deemed necessary by the financial services authority

However, this cannot be done yet because based on the rules of the Carbon Trading Organisation, the GHG Emission Upper Limit is selected if based on the evaluation it is known that there are businesses and/or activities:

a. Mitigation Actions carried out with emissions above the specified GHG Emission Threshold; or
b. Mitigation actions carried out with emissions below the specified GHG Emission .

Currently, the Ministry of Agriculture has not set a carbon emission limit for the Agriculture sector, so the carbon trading mechanism through the Allowance market cannot be done. However, there is another alternative mechanism, namely carbon trading can be done through the Emission Offset mechanism, namely through a statement of emission reduction using the results of Mitigation Action from other businesses and/or activities. The Emission Offset mechanism is applied in the case of a business and/or activity:

a. No Upper Emission Limit is specified;
b. results of GHG emission reduction achievements from climate change mitigation actions carried out are below the target and baseline set; or
c. GHG emission reduction results from Climate Change Mitigation Actions carried out are above the target and below the established Baseline

After the calculation of greenhouse gases, the value of greenhouse gas reduction can be known, the hope is that this emission surplus or emission reduction achievement is below the target and Baseline emissions can sell to other parties. However, the implementation of GHG emission purchase in GHG emission offset can only be done after the company has fulfilled its obligation to reduce GHG emission through climate change mitigation action.

Carbon trading is done by trading the value written in the Emission Reduction Certificate through the Indonesian Greenhouse Gas Emission Reduction Certification Scheme (SPEI).

GHG Emission Reduction Certification is intended as a tool to:

a. Evidence of GHG emission reduction performance;
b. Carbon Trading;
c. Payment for the results of Climate Change Mitigation Actions;
d. GHG emission compensation; and

e. Evidence of business performance and/or environmentally sound activities to obtain financing from bond and sukuk schemes.

GHG Emission Reduction Certificates are given to businesses and/or activities through stages:

a. Registration at SRN PPI;
b. Verification by an independent verifier; and
c. Verification results are reported to the Minister and form the basis for consideration of certificate issuance.

The stages of the SPEI Scheme Process are described in Figure 19.

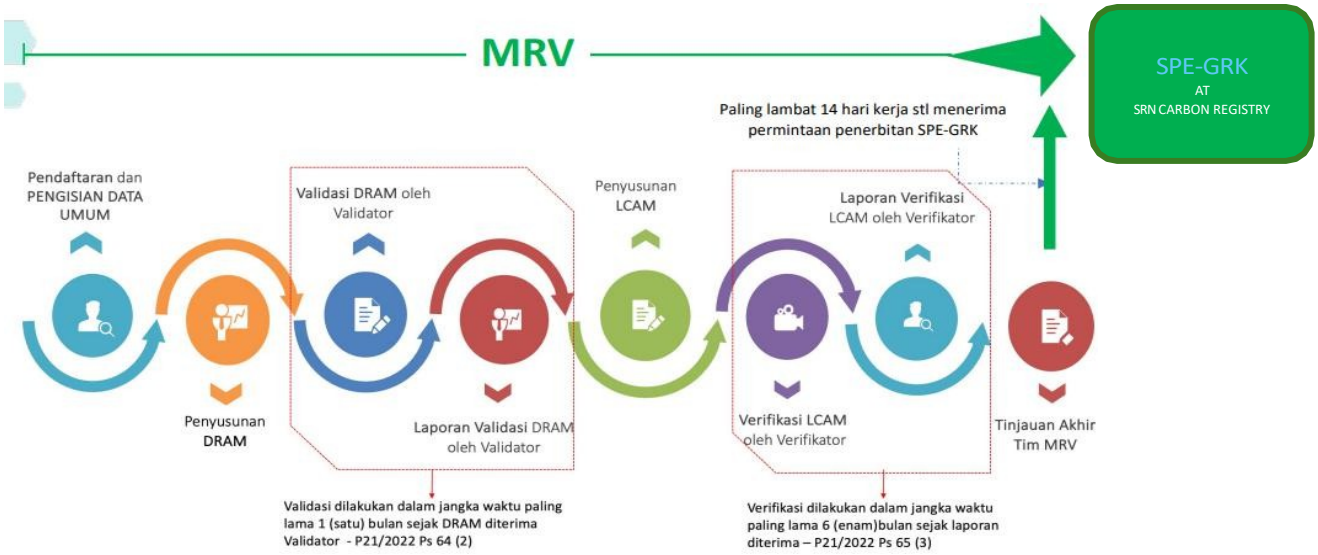


Figure 19. SPEI Certification Process

5.2. STUDY ON THE IMPLEMENTATION OF PERFORMANCE-BASED PAYMENT MECHANISM

Performance-Based Payment is made to the performance/benefits of GHG Emission reduction produced by ministries/institutions, local governments, Business Actors in this case is a small rice mill. The Performance-Based Payment mechanism is carried out based on the results of verification of the achievement of GHG emission reductions and/or conservation/enhancement of carbon stocks carried out by businesses and/or activities.

Performance-based payments for greenhouse gas reduction efforts in Central Java and East Java can be made in the following ways

a. National level, with the mechanism that the Government can provide to provincial governments, city districts, business actors, and or the community; and
b. The provincial level, with the mechanism that the provincial government can provide to the regency/city government, business actors, and/or the community.

Implementation of Performance-Based Payment, mitigation results become part of the achievement of NDC targets, so that the mitigation actions carried out in the LCRP project must be part of the government programme, The payment system must be determined by the Ministry through Performance-Based Payment guidelines which include

a. Implementation of Performance-Based Pay;
b. Procedures for receiving Performance-Based Payments to the Government, local governments, business actors, and the community; and
c. Monitoring, evaluation and coaching

The implementation of the Performance-Based Payment benefit sharing mechanism is based on the role and contribution of each party to the performance achievement of Climate Change Mitigation Action and/or Climate Change Adaptation Action. However, this mechanism also cannot be implemented because the provisions regarding the implementation of the benefit sharing of Performance-Based Payment have not been regulated in the Minister of Agriculture Regulation.

5.3. STUDY ON THE IMPLEMENTATION OF CARBON TAX MECHANISM

Implementation of NEK through the implementation of Carbon Levy (carbon tax) is carried out in the form of levies in the field of taxation both central and local, customs and excise, as well as other state levies, based on carbon content and/or carbon potential and/or amount of carbon emissions and/or performance of Climate Change Mitigation Actions.

The authority to regulate the carbon tax is exercised by the Minister who organises government affairs in the field of state finance to formulate policies and strategies for the implementation of Carbon Levy after coordinating with the Minister and relevant ministers in accordance with the objectives of achieving NDC targets and controlling emissions for national development.

The implementation of fund management and benefit sharing from the implementation of Carbon Trading, Performance-Based Payment, and Carbon Levy can be carried out through an institution that manages environmental funds or a designated institution, and currently the fund management is carried out by 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 conduit for multiple sources of environmental finance to be utilised through various instruments across multiple sectors, including: forestry, energy and mineral resources, carbon trading, environmental services, industry, transport, agriculture, marine and fisheries. BPDLH as an official body of the Indonesian government with an environmental funding mechanism to channel and distribute environmental and climate funds to support Indonesia's vision to maintain environmental functions and prevent environmental pollution and degradation. This includes efforts to achieve Indonesia's commitment to reduce greenhouse gas emissions and fulfil the Sustainable Development Goals (SDGs). The following is the mechanism for funding through BPDLH

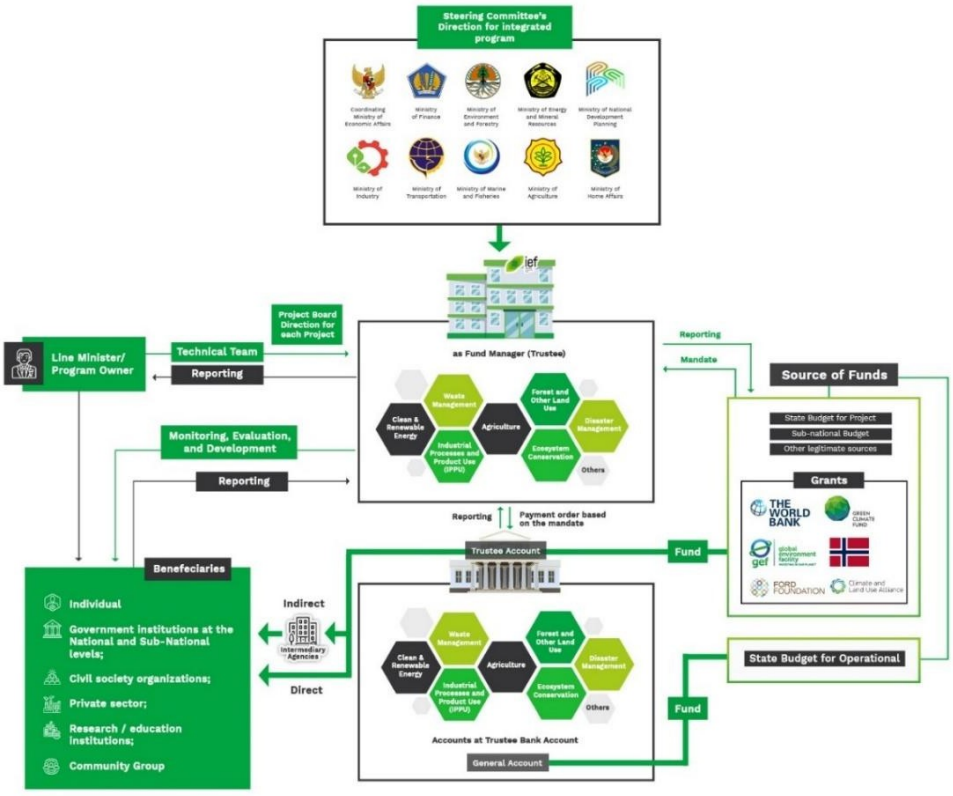


Figure 20. BPDLH Funding Mechanism

5.4. FUNDING OF MITIGATION ACTIONS

1. APBN - Revolving Fund Facility

The types of businesses that can be financed by FDB consist of:

- *On-farm* or *off-farm* forestry businesses, including industrial plantation forest businesses, community plantation forest businesses, community forest businesses, village forest businesses, community forest businesses, non-timber forest product utilisation businesses, natural forest utilisation businesses with intensive silviculture enrichment techniques, and ecosystem restoration businesses.
- Environmental investments, including waste utilisation and/or treatment equipment, production process improvements and/or replacement of environmentally friendly production equipment, replacement of environmentally friendly raw and auxiliary materials, and generation of new renewable energy.

2. Indonesia Impact Fund

With support from UNDP through the Joint SDG Fund, Indonesia Impact Fund (IIF) is the first impact-based private funder in Indonesia. IIF's main objective is to support the growth of impactful businesses in Indonesia and accelerate progress towards achieving the SDGs.

IIF invests in emerging and growing start-ups with business models that are aligned with SDG goals, including addressing resource or capacity gaps and implementing large-scale impact solutions in line with the programme's SDG targets. Start-ups receiving this investment fund will be referred to as "investees".

The programme incentivises start-ups receiving investment funds from the Indonesia Impact Fund (IIF) with the aim of accelerating private sector efforts to deliver impact through its business activities with measurable achievements against the national targets of the Indonesian Government's Sustainable Development Goals (SDGs).

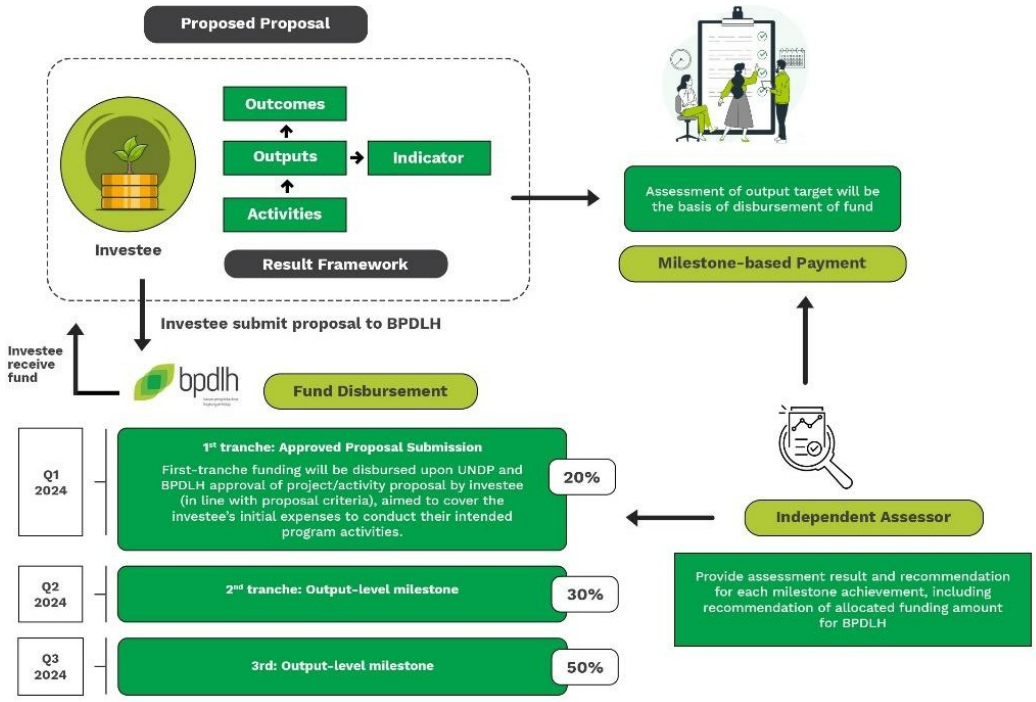


Figure 21. Indonesia Impact Fund (IIF) Funding

5.5. OVERSEAS CARBON TRADING THROUGH CO-OPERATION

Carbon trading transfers the ownership rights of carbon. Therefore, the carbon units sold can only be counted as GHG emission reduction achievements by the buyer. The Indonesian government emphasises that carbon trading abroad is not closed. However, it needs to be authorised by the state. This refers to the Minister of Environment and Forestry's regulation issued on May 5, 2023, which states that carbon trading must be authorised. Authorised overseas carbon trading is based on international conventions such as the 2015 Paris Agreement and the country's constitution, which mandates that natural resources be used for the greatest prosperity of the people.

The offshore carbon trading rules are aimed at encouraging as much green investment into Indonesia as possible while safeguarding national interests. To that end, there are requirements that must be met, including

1. As per Carbon trading roadmap
2. Provide buffer as risk management
3. SPE-GRK (foreign trade and cross-sector)
4. Achieved emission reduction target in NDC Sub-Sector or Sub-Sub-Sector
5. Received Authorisation from the Minister

Foreign carbon trade co-operation can be done between governments (G to G) and implemented by governments or companies (business), and can also be through business co-operation (B to B), with the following conditions:

1. For NDC Achievement
2. ITMO
3. CDM Transition or New Investment
4. Cooperation Agreement
5. Authorisation for Foreign Transfers
6. Recorded by SRN PPI and International Registry
7. Communicated through Indonesian DNA
8. In tonnes of CO2 e
9. Have communicated the NDC
10. Provide up-to-date IGRK Report
11. Paying International and National financing and levies

5.6. CONCLUSION OF ANALYSIS RESULTS

MECHANISM CARBON CREDIT	ANALYSIS RESULTS	CONCLUSIONS
PT BAE-PU (Technical Approval Emission Limits - Business Actors)	There is no GHG emission ceiling set for the agriculture sector yet	Not yet Applicable
Certificate of Emission Reduction - Greenhouse Gas (SPE-GRK)	The stages are quite long, and at the beginning it is necessary to prepare a Climate Change Mitigation Action Plan Document (DRAM). SPEI certification stages are quite long 1. DRAM Validation by Validator 2. Log the DRAM and validation result report on the SRN PPI 3. The Business Actor prepares a report on the results of the implementation of the Mitigation Action. 4. The implementation report is verified by the Verifier. 5. Record the implementation report and Verification result report on SRN PPI 6. Final review by MRV Team 7. Based on the results of the MRV team's review, the Director General issues the SPE-GRK.	Not yet Applicable
Payment Performance Based	LCRP programme should be part of the District or provincial NDV programme	Not yet Applicable

MECHANISM CARBON CREDIT	ANALYSIS RESULTS	CONCLUSIONS
	This mechanism has also not been implemented because the provisions regarding the implementation of the benefit sharing of Performance-Based Payment have not been regulated in the Minister of Agriculture Regulation.	
Carbon Tax	Applied to industries that exceed the upper limit of greenhouse gas emissions, and payment mechanisms in the form of levies in the field of taxation both central and local, customs and excise, and other state levies. carbon tax mechanism is not yet regulated in detail	No Wor kable

CHAPTER VI. PROPOSED MECHANISM FOR UTILISATION OF CARBON ECONOMIC VALUE IN THE RICE SECTOR

6.1. ECO-LABELLING SYSTEM

In the implementation of NEK, the climate change action label system is applied, which is part of the eco-labelling system. The climate change action label system provides verified information about the performance of climate change action on a product, activity, or institution. The application of the climate change action label aims to:

a. Meet market demand;
b. Increase market demand; and
c. Reinforcing an eco-friendly image to the public.

The climate change action label can be used for the procurement of environmentally friendly goods and/or services, one of which is through the self-declaration of ecolabels.

Figure 22. Indonesian Self-Declared Ecolabel Logo

Ecolabel is a logo or label statement that shows environmental aspects and is one of the tools in the framework of environmental management. This label provides information to consumers that the product in its life cycle has a relatively smaller negative impact on the environment compared to other similar products that do not apply this mark. Procedure

The application of the label has been regulated in the Minister of Environment and Forestry Regulation No. 5 of 2019, with the following submission mechanism

Figure 23. Registration Mechanism

6.2. PAYMENT FOR ENVIRONMENTAL SERVICES (PES)

In order to improve sustainable environmental management, PES can be used to encourage environmentally sound management actions by providing other income options beyond the provision of environmental services and also help prevent economic losses associated with environmental change, support environmental conservation, and encourage land user income, which is mutually beneficial. The concept of environmental services supports the development of natural resource management strategies that clearly benefit the economy and society.

PES allows the unpaid costs of environmental services to be reflected in the economy, thus building an environmentally efficient economy. Policies that favour PES also result in a multiplication of stakeholders, who can become investors in natural capital, and enlarge the financing available for the management of important environmental services.

Increasing other income options and population growth have led to land use change and depletion of ecosystem services that have reached alarming levels, as shown in Figure 24.

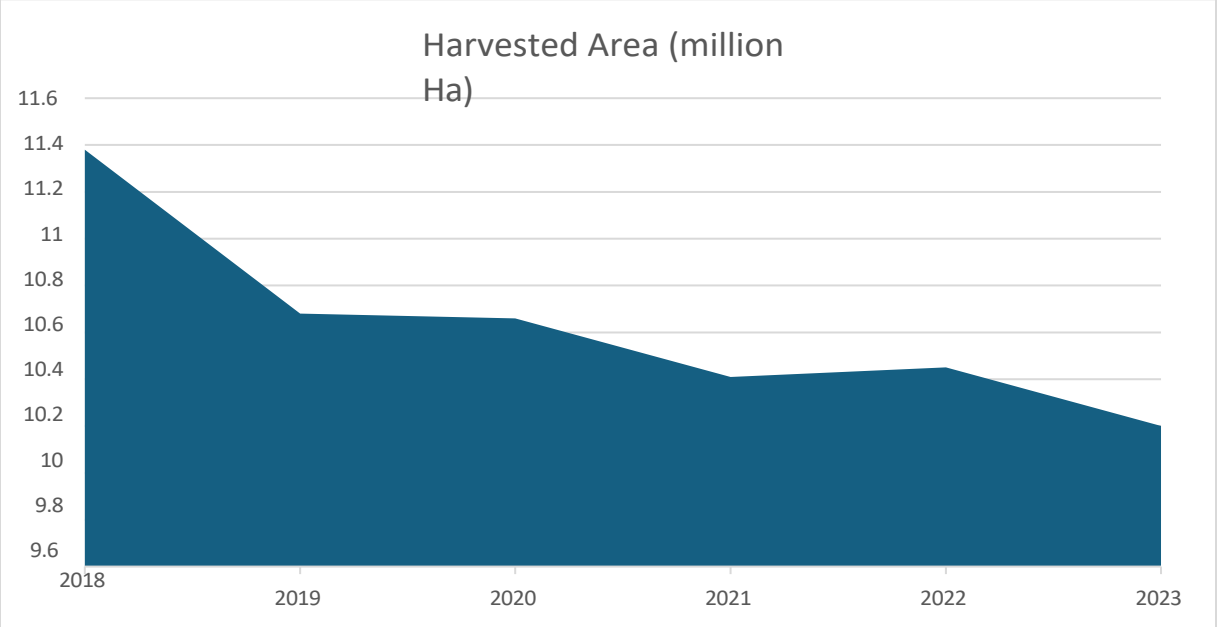


Figure 24. Rice Paddy Harvest Area in 2018 - 2023

PES is a voluntary transaction for a clearly defined environmental service (or land use that can guarantee such a service), purchased by at least one environmental service buyer from at least one environmental service provider, if and only if the environmental service provider fulfils the terms of the agreement and guarantees the provision of the environmental service.

In a PES transaction, the user of an environmental service pays or provides some other form of remuneration to the landowner or person entitled to use the environment (land or freshwater, sea), for managing the environment in such a way as to secure the environmental service. This payment or reward should be conditional on the provision of the service. In practice, it may be difficult to fulfil such PES requirements, and it may not be necessary or appropriate to do so in some cases. As Figure 25

Sumber: Pagiola, S dan G. Platais, "Pengantar mengenai imbal jasa lingkungan", pemaparan pada Hari-hari Pembelajaran 2005 – Pekan ESSD, Bank Dunia, Washington DC, 2005.

Figure 25. Flowchart of Environmental Services Fee (PES)

A key reason for service buyers to participate in PES programmes is the understanding that they will guarantee a service that is threatened in various ways. Either additional services will be provided (e.g. provision of raw material sources) or maintained (e.g. preventing the decline of productive agricultural land) if the opposite is the case. Because of this additional conditional reward, PES encourage service providers to fulfil their end of the agreement. PES also encourage the interest of service buyers to monitor and fulfil the agreement. The conditionality of PES rewards can encourage direct users of environmental services at large to be interested in investing through PES. The cost of this investment can be passed on to the final consumers or indirect users who are usually more willing to pay than expected. The returns that can be offered are as described in table 2.

Table 2. Return on Environmental Services Offered

Activities	Environmental Fee
Net Change of Energy Source	• Making it easier to obtain microcredit • Ease the transition to electricity and help with installation costs
More sustainable land management	• Funding for extension/training, plant nurseries, market infrastructure, and other support services for individual producers that are then

Activities	Environmental Fee
	will receive funding from participation in climate-smart agriculture activities • Funding for organic fertiliser inputs and production facilities
Low carbon rice provision	• Provide market incentives in the form of better prices • Farmer institutional strengthening - PPK • Assistance and financing of certification for sustainable rice

The stages that need to be carried out in the preparation of environmental service fee co-operation are as follows:

Stage 1: Recognising demand, setting goals and defining value

- Analyse the socio-economic needs of specific potential buyers (commercial and individual) of a particular environmental service.
- Defining, measuring and assessing specific environmental services and recognising current and future threats
- Determine whether PES is an appropriate policy tool, and what other tools will be required.
- Setting objectives
- Determine economic value and marketability through environmental assessment

Stage 2: Assess institutional & technical capability and feasibility

- Assess legal, policy and land tenure aspects
- Examine existing policies on PES - e.g. land users should be able to receive rewards and buyers should be able to reward (and if there are any levy, fee or tax obligations, these should be accessible under the PES programme).
- Conduct a survey of available PES support services and organisations

Stage 3: Establish institutional framework & agreements

- Design management, business and communication plans
- Establish an institutional framework based on existing institutions, look for other ways to reduce transaction costs, and enhance capabilities where necessary.
- Determine appropriate and fair ways of rewarding based on socio-economic and socio-cultural considerations
- Draft model agreements and other operational documents

Stage 4: Implementation

- Communication, marketing, negotiation and registration of agreements
- Carry out monitoring and substantiation
- Carry out financing and payments

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