MINISTRY OF AGRICULTURE

THE POLICY ON REDUCING GHG EMISSION IN AGRICULTURAL SECTOR

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THE POLICY ON REDUCING GREEN HOUSE GASES

Transformation towards green economy Post Pandemic COVID-19 as One of Indonesia Main strategies

Indonesia Economic Transformation

6 MAIN STRATEGIES

Qualified Human Resources
- Health system
- Education
- Research & Innovation

Strategy 1

Green Economi
- Low carbon economy
- *Blue Economy*
- Energy transition

Strategy 3

Domestic Economy Integration
- Connectivity Infrastructure
- *Domestic Value Chain*

Strategy 5

Economic Productivity
- Enhance Industrial Sector
- Strengthening SMEs
- Modernize Agricultural Sector

Strategy 2

Digital Transformation
- Digital Infrastructure
- Digital Utilization
- *Enabler* Strengthening

Strategy 4

Moving the Capital City
- New source of development
- Balancing economy among regions

Strategy 6

Green Economy

In principle, green economy is a development model that synergizes **economic growth** and **environment quality enhancement.**

Through the appropriate implementation, green economy provides tools needed for economic activities **transformation** to become more **environmentally friendly** and **inclusive.**

Game Changer

As One of Indonesia Main Strategies Post Pandemic COVID-19, particularly as *game changer*, **green economy** is a **crucial matter** and necessary to be initiated immediately

Green Fiscal Stimulus is one of the solutions as part of Build Back Better with Low Carbon Development (B3-LowCarbon)

BUILD BACK BETTER with LOW CARBON DEVELOPMENT

B3-LOWCARBON Membangun Kembali Lebih Baik dengan Pembangunan Rendah Karbon

B3-Low Carbon is a notion to implement the **Low Carbon Development (LCD)** as the base in **economic recovery**.

With B3-LowCarbon, economic recovery will overcome short term challenges, as well as become **the first *enabler* of Indonesian transformation towards *green economy***.

In Factual, the implementation of B3-LowCarbon may be done through **giving green fiscal stimulus** to all activities that support low carbon development in the context of economic recovery, **starting in 2022.**

Discussion on stimulus green fiskal

The question: **which way to stimuly?**

Or

- **National Economic Recovery Budget?**
- **Normal development mechanism?**

Which one is the most appropriate one?

Kebijakan penanganan Perubahan Iklim Sektor Pertanian di Indonesia dalam RPJMN 2020-2024?

National Priority | **Priority Program** | **Policy Direction** | **Activities**

PN 6: Membangun Lingkungan Hidup, Meningkatkan Ketahanan Bencana dan Perubahan Iklim

Enhancing natural disaster and climate resilience

Food security protection to Climate Change
(The percentage of potential loss reduction of GDP caused by climate change in agricultural sector)

- Climate change impact management and land and plantation/estates fire prevention
- Water conservation construction and climate anomaly anticipation
- Climate change adaptation technology
- Implementation Climate change impact Management
- Locations that acquire infrastructures for climate change management
- Enhancing public awareness on applied climate information through field school

Low Carbon Develop-ment

Sustainable land Rehabilitation
(The percentage of rice field area that has been stipulated as sustainable agricultural land/LP2B)

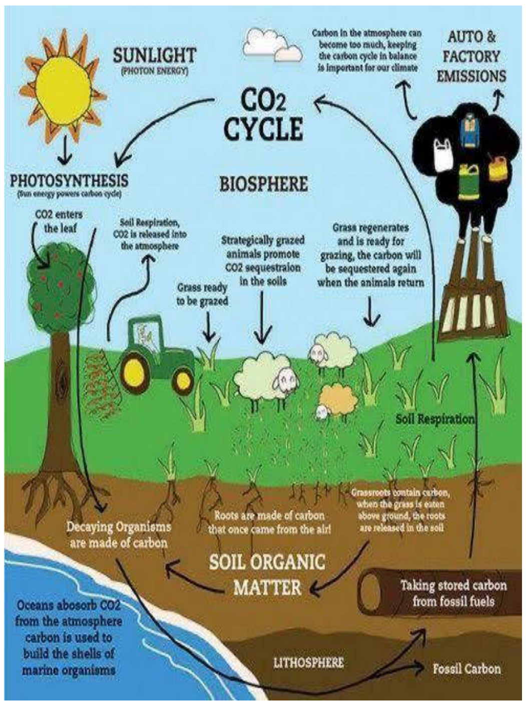
- Climate change mitigation technology
- Land optimization
- Grazing pastures for livestock
- Organic fertilizer processing unit
- Organic agricultural village (plantation-based commodities)
- Land conservation and rehabilitation
- Recommendation for land protection and anticipation of agricultural land use change

AGRICULTURAL SECTOR POSITION TO CLIMATE CHANGE

Pests and Desease

Flood

Drought



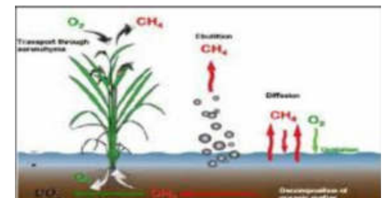
CLIMATE CHANGE VICTIMS

AGRICUL-TURAL SECTOR

POTENCY OF GHG EMISSION REDUC-TION

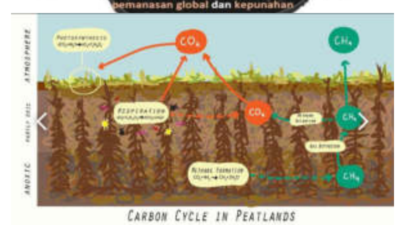
GHG EMISSION SOURCES

Low-land Rice



Livestock

Peat Land



Agricultural Development Strategic Policies to Encounter Climate Change

Priority adaptation action, as an effort to achieve sustainable food sovereignty (primary priority of agricultural development)

Mitigation action: the development of environmentally friendly agriculture (low carbon)

Adaptation and mitigation action is synergized to achieve food self-sufficiency and better farmer welfare; mitigation is the co-benefit of adaptation, and adaptation is the entry point of mitigation

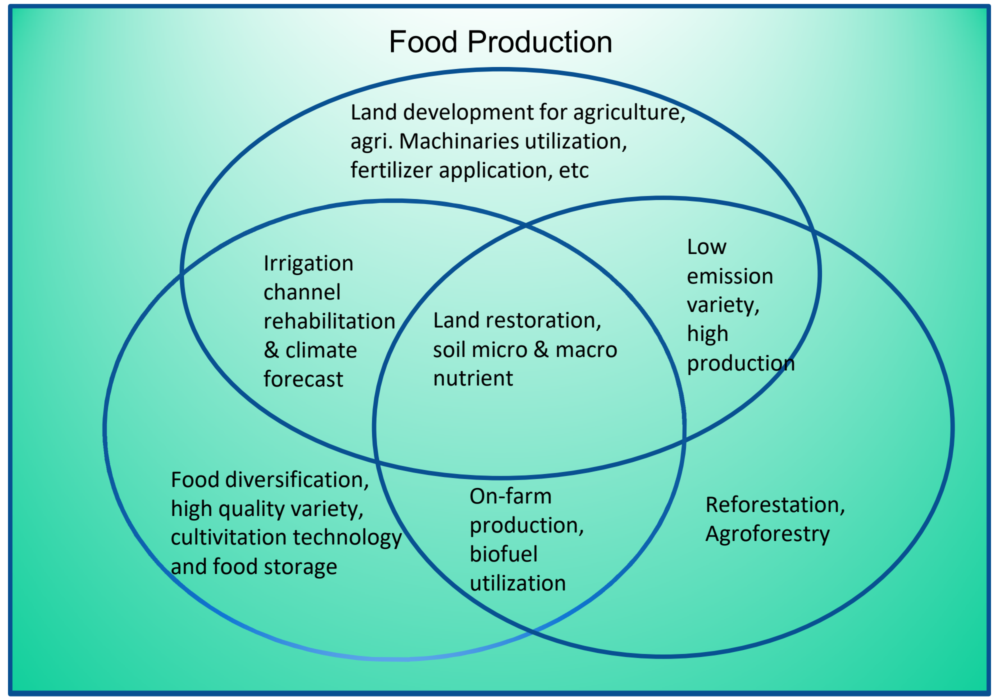
ADAPTATION ACTION

Adaptation Technology synergized with mitigation to enhance productivity (Campbel *et al.* 2011)

Sustainable productivity Enhancement

Adaptation capacity building

GHG Emission Reduction



GHG EMISSION FROM AGRICULTURAL SECTOR INVENTORY

Indonesia is committed unilaterally to reduce GHG emission, according to 1st NDC 2016

FIRST NATIONALLY DETERMINED CONTRIBUTION
REPUBLIC OF INDONESIA

Nov. 2016

November 2016

Table 1. Projected BAU and emission reduction from each sector category

No	Sector	GHG Emission Level 2010*	GHG Emission Level 2030 ($MTon\ CO_2e$)			GHG Emission Reduction ($MTon\ CO_2e$)		GHG Emission Reduction % of Total BaU		Annual Average Growth BAU (2010-2030)	Average Growth 2000-2012*
		$MTon\ CO_2e$	BaU	CM1	CM2	CM1	CM2	CM1	CM2		
1	Energy*	453.2	1,669	1,355	1,271	314	398	11%	14%	6.7%	4.50%
2	Waste	88	296	285	270	11	26	0.38%	1%	6.3%	4.00%
3	IPPU	36	69.6	66.85	66.35	2.75	3.25	0.10%	0.11%	3.4%	0.10%
4	Agriculture	110.5	119.66	110.39	115.86	9	4	0.32%	0.13%	0.4%	1.30%
5	Forestry**	647	714	217	64	497	650	17.2%	23%	0.5%	2.70%
	TOTAL	**1,334**	**2,869**	**2,034**	**1,787**	**834**	**1,081**	**29%**	**38%**	3.9%	3.20%

* Including fugitive **Including peat fire

Notes: **CM1** = Counter Measure (*unconditional mitigation scenario*)
CM2 = Counter Measure (*conditional mitigation scenario*)

Main Emission Source in Agricultural Sector

- **CH4 from low-land rice field: water management & varity**
- **CH4 from livestock (burp)**
- CH_4 from livestock manure/dung
- N_2O from livestock manure/dung
- N_2O from N fertilizer
- CO_2 from fertilizer
- CO_2 from dolomite
- CO_2 from the burning of biomass

EMISSION SOURCE IN AGRICULTURAL SECTOR

No	Category	Gas	Activities*
1	Livestock		
	a. Enteric Fermentation	CH_4	Number of head and breed of Livestock
	b. Manure processing management	CH_4, N_2O langsung	Number of head and breed of Livestock, manure management
2	Some sources on agricultural land		
	a. The burning of biomass	CH_4, N_2O, CO, NOx	Percentage of biomass left over after burning, variety of crops
	b. Dolomit	CO_2	Number of dolomit used
	c. Fertilizer (urea)	CO_2	Number of ure used
	d.1. Direct N_2O emission from the land/soil	N_2O	Number of chemical and organic N used
	d.2. Indirect N_2O emission	N_2O	Number of head and breed of Livestock, manure management
	Indirect N_2O emission,from livestock manure	N_2O	Number of head and breed of Livestock, manure management
3	Low-land paddy field	CH_4	Low-land paddy field area, irrigation system, and duration of flood

Column 2 and 3 according to IPCC (2006)
Column 4 according to PI team MOA

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CLIMATE CHANGE ADAPTATION ASSESSMENT IN AGRICULTURAL SECTOR

BATAMAS = Society Livestock Biogas Program

Emission reduction = Methane avoidance from Batamas + energy substitution

Emission reduction from **methane avoidance** = Biogas amount x number of cow/cattle x gas volume from manure per day in biodigester x biodigester pressure x 365 days x conversion of GWP from CH_4 to CO_2e

Energy Substitution = substitution to LPG + substitution to kerosene

Assumption: 90% of biogas produced is used for LPG substitution and 10% is used for kerosene substitution. Assumption is adjusted with field condition.

LPG Emission (substituted by biogas)

LPG Energy (ton CO_2) = biogas volume (m^3/thn) x 0,9 x 0,46 x LPG heating value (GJ/kg) x 10^{-3}x LPG emission factor (ton CO_2/TJ)

Kerosene Emission (substitued by biogas)

- **Kerosene (ton CO_2) = biogas volume (m^3/thn) x 0.1 x 0,62 x Kerosene heating value (GJ/liter) x 10^{-3} x Kerosene emission factor (ton CO_2/TJ)**

Assumption

- Number of livestock per BATAMAS = 75 heads
- 1 head of cow/cattle produces biogas = 2 m^3/day; with pressure of2 atm

Activity Data: BATAMAS unit amount

Average amount of livestock per BATAMAS unit

Organic Fertilizer Processing Unit (UPPO)

Emission Reduction = (Baseline emission – mitigation action emission) + carbon sequestration from organic fertilizer

Baseline Emission = CH_4 Emission from manure + N_2O direct emission from manure + N_2O indirect emission from manure

Mitigtion action emission = CH_4 emission from manure + N_2O direct emission from manure + N_2O indirect emission from manure that cows/cattle are NOT included in the UPPO

Carbon sequestration from organic fertilizer = UPPO unit x Number of cows/cattle in the UPPO x manure and hay weight (kg/tahun) x kandungan C pupuk kandang (kg/year) x C in the soil x 44/12

Assumption:

Manure and hay weight per head of livestock = 14,9 kg/day
C content in the organic fertilizer = 39,3% (Hartatik dan Widowati, 2006)
C content in the soil = 0,67%/year (Mailard and Anger, 2013)

Activity Data:

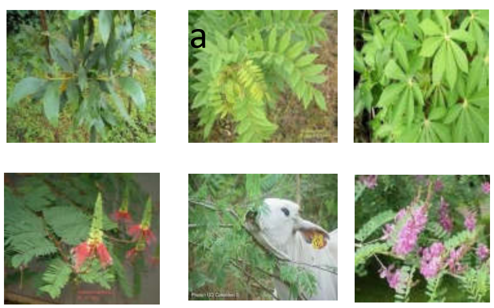
- Number of UPPO unit
- Number of cows/cattle in every UPPO unit

Perbaikan kualitas pakan sapi perah

Enteric Calculation of CH_4 Emission Reduction

Feed: Legumes

Feed concentrate



Legumes

Concentrate

CALCULATION OF GHG EMISSION REDUCTION IN AGRICULTURAL SECTOR

A. Methane Emission Baseline Calculation

$$CH_4\ (ton/tahun) = Livestock\ population\ (by\ age) \times Emission\ Factor \times 10^{-3}$$

Sub-category	GEI* (MJ/head/day)	CH_4 EF (kg/head/year)	All beef cattle** (CH_4 EF kg/head/year)
Weaning (0-1 year) female + male	42.65±0.998	18.18±0.426	
Yearling (1-2 year) female + male	63.75±0.893	27.18±0.381	
Young (2-4 year) female + male	97.98±1.112	41.77±0.474	33.14±0.757
Mature (>4 year) female + male	131.11±4.632	55.89±1.975	
Imported (fattening) male	394.00±8.167	25.49±0.528	

(Widiawati et al., 2016)

B. Fermentation Enteric Emission After Feed Improvement Calculation

$$CH_4\ (ton/tahun) = \sum livestock\ that\ has\ been\ given\ feed\ x\ emission\ factor\ x\ (1 - correction\ factor\ of\ legumes/concentrate)\ x\ 10^{-3}$$

Emission reduction factor from legumes	0,035 ~ 3,5%	Emission reduction is relatively small but the adaptation benefit (livestock production enhancement) is higher
Emission reduction factor from concentrates	0,045 ~ 4,5%	

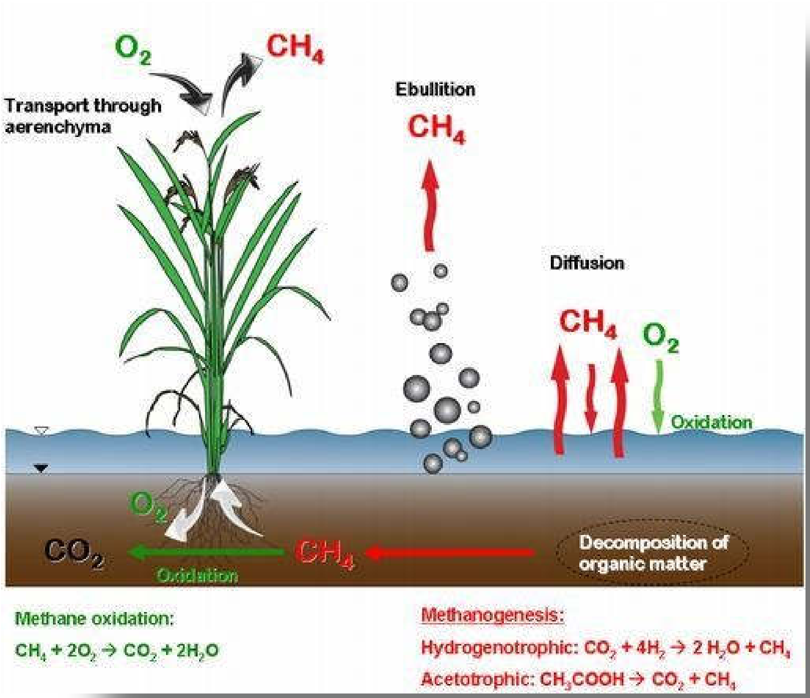
C. Emission Reductionafter Feed Improvement Calculation

$$CH_4\ (tones/year) = CH_4\ baseline - (CH_4\ improvemetn + CH_4\ without\ improvement)$$

Activity Data:

- Livestock po;ulation
- Percentage of livestock with the improvement of feed (legumes and concentrate)

Emission From Paddy Fields



CH_4 Emission from low-land paddy field is influenced by:

- Planting period,
- Irrigation system
- Organic & anorganic fertilizer,
- Soil types,
- Varieties

Activity Data:

- Low-land paddy field area (harvest area)
- Duration of flooding

Low Emission Variety

Selection of variety: production quality and quantity, pests and diseases resistance, climate and salinity resistance. The selection is not on the lowCH_4 emission.

EQUATION 5.1
CH_4 EMISSIONS FROM RICE CULTIVATION

$$CH_{4\ Rice} = \sum_{i,j,k} (EF_{i,j,k} \bullet t_{i,j,k} \bullet A_{i,j,k} \bullet 10^{-6})$$

CH_4 *Rice*	= Methane emission from from low-land rice cultivation, *Gg of CH_4 per year*
$EF_{i,j,k}$	= Emission factor for condition i, j, dan k; *kg of CH_4 per day*
$t_{i,j,k}$	= cultivation duration of low-land rice for condition i, j, dan k; *day*
$A_{i,j,k}$	= harvest area of low-land rice for condition I, j, dan k; *hectare/year*
i, j, dan k	= Different ecosystem: i: water regime, j: types and number of soil organic matter, and k: other condition that CH4 emission from low-land rice field may be varied

Emission factor and correction factor (emission reduction)

- Correction factor: flooded rice field = 1; less flooded = 0,71 ; intermittent = 0,46
- Emission factor CH_4 = 1,601 kg/hectares /day

BALANCED FERTILIZING (N EFFICIENCY)

Baseline emission from fertilizer =

Direct N_2O emission from soil + Indirect N_2O emission from soil + CO_2 emission from urea fertilizer

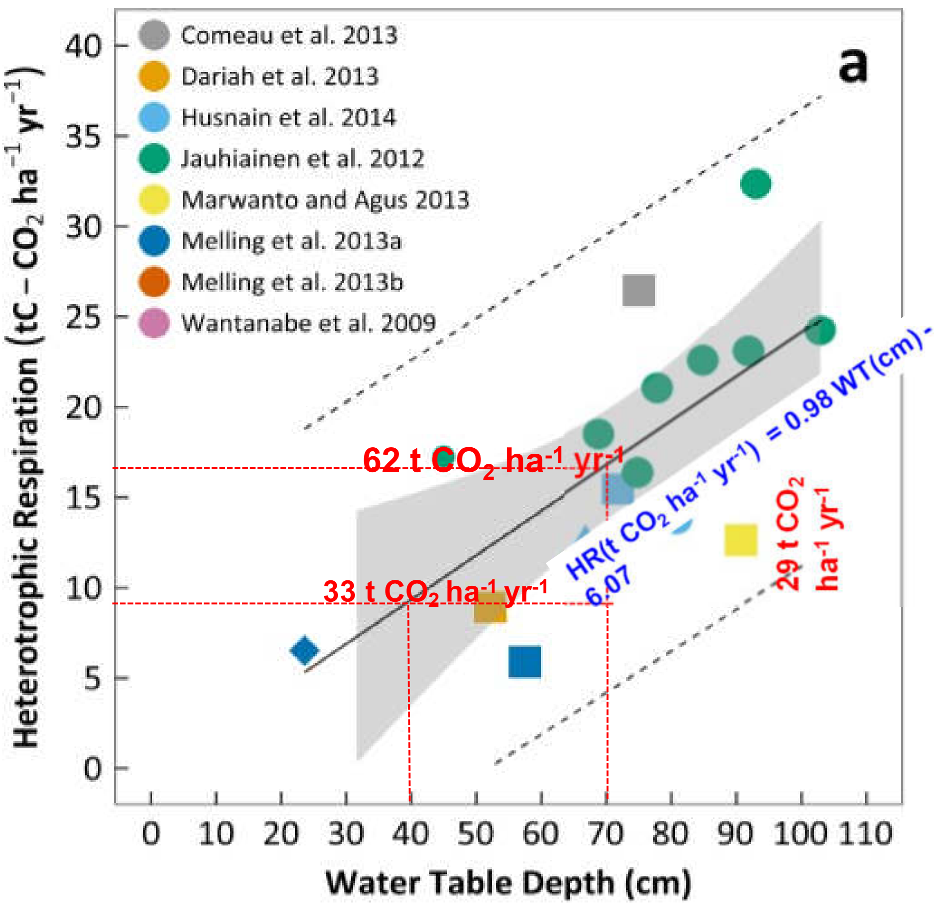
Direct N_2O emission from soil + Indirect N_2O emission from soil + CO_2 emission from urea fertilizer

Emission from balanced fertilizing =

Assumption:

1. 50% of harvest area of low-land paddy field that apply balanced fertilizing.
2. Fertilizer application recommendation: 250 kg of N and the threshold for fertilizer application of 280 kg of N ➔ the difference of fertilizer application: 30 kg

Activity Data: Amount of N fertilizer used



Adapted from Carlson et al. Environ. Res. Lett. 10 (2015) 074006

Water surface rice on Peat Land

CO_2 Emission reduction: 1 ton of CO_2 /hectare/year for every 1 cm increase of MAT

Base on research of Wakhid et al. (2017) every 10 cm of water level drop on peatland will raise 7,3 tones of CO_2 emission /hectares/year

IoT Application of Water Management in Swamp Land

- **Sensor** : Water level height, Water quality (pH and Salinity)
- **Actuator** : Electric motor (solar energy) pipe 4-6" to open/close water flow from tertiary to quarter channel (to the field)
- **Microprocessor**: Interface Android

Prototype: "**ELBOW AUTOMATIC TABAT SYSTEM DOOR**" in process of patent

The Development of GHG Emission Reduction (mill tones Co2e) 2010 - 2020

MITIGATION VALUE FROM AGRI-CULTURAL SECTOR

1	CH4 emission mitigation with the utilization of biogas particularly from Batamas Program	0.578	0.52	0.699	0.427	0.213	0.107	0.053	0.29	0.19	0.1027	0.0513
2	Carbon sequestration enhancement with the utilization of organic fertilizer from UPPO Program	0.0038	0.0165	0.0176	0.21	0.21	0.21	0.25	0.056	0.058	0.0103	0.0134
3	Field school, SRI program for organic rice, low emission rice variety	11.5	15.46	13.76	13	15.64	1.56	6.65	7.75	11.91	11.0924	11.3617
4	Organic Village	-	-	-	-	-	-	-	-	0.008	0.0035	0.0014
5	Quality improvement of feed for cow/cattle										0.1038	0.0177
6	Balanced fertilizer application										0.2088	0.2312
7	Surface water management										7.8305	7.8305
	Reduction	**12.0818**	**15.9965**	**14.4766**	**13.637**	**16.063**	**1.877**	**6.953**	**8.096**	**12.166**	**19.352**	**19.5072**

Source: MOA

ACTIVITIES DOCUMENTATION OF GHG EMISSION REDUCTION IN AGRICULTURAL SECTOR

WATER HARVESTING: FARM POND


Ditch Dam


Farm Pond


Long Storage


Ditch Dam & Distribution Channel


Farm Pond & Distribution Channel


Long Storage

WATER SAVING TECHNOLOGI FOR HORTICULTURE using SOLAR SYSTEM

Type-3
(Pump DC;drip)

Type-2

Type-2
(AC Pump, Drip Irrigation)

Specification:

- Solar pannel 100 – 400 WA
- Solar Water pump (AC/DC)
- Micro Irrigation for 0.5 – 1.0 ha
- Smart farming: timer, fertigasi, android
- Cost: 50 – 100 juta IDR/paket
- Application: coastal land, dry land, and tidal land

Type-1
(AC Pump, Bulk Irrigation)

Organic Fertilizer Processing Unit (UPPO)

Thank You