Final Report

The World Bank Group

Technical Assistance to prepare a shelf of projects with their estimated costs for achieving climate ambition targets in Indonesia by 2030

Selection No. 1278637

THE WORLD BANK

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ACRONYMS

ABPN: State Budget (Acronym from Bahasa: Anggaran Pendapatan dan Belanja Negara)

AFOLU: Agriculture, Forestry and Other Land Use

APBD: Regional budget

ATAM: Automatic Tariff Adjustment Mechanism

BAPPENAS: Ministry of National Development Planning

BPPW: Regional Settlement Infrastructure Center

BRGM: Peatland and Mangrove Restoration Agency

BSF: Black Soldier Fly

CBT: Climate Change Budget Tagging

CH4: Methane

CMEA: Coordinating Ministry for Economic Affairs

CMMIA: Coordinating Ministry of Maritime & Investment Affairs

CO2e: Carbon dioxide equivalent

COP: Conference of the Parties

DMO: Domestic Market Obligation

DPR: Indonesia's House of Representatives

GDP: Gross Domestic Product

GHG: Green House Gases

GoI: Government of Indonesia

IDR: Indonesian Rupee

IEC: International Electrotechnical Commission

IPCC: Inter-governmental Panel on Climate Change

IPPU: Industrial Processes and Product Use

ISO: International Organization for Standardization

JAKSTRANAS: National Policy and Strategy on Management of Household Waste and Household-like Waste

KTOE: Kilotonne of Oil Equivalent

LCDI: Low Carbon Development Initiative

LFG: Landfill gas

LNG: Liquified Natural Gas

LTS-LCCR: Long-Term Strategy for Low Carbon and Climate Resilience 2050

MCF: Methane Correction Factor

MEMR: Ministry of Energy and Mineral Resources

MoA: Ministry of Agriculture

MoEF: Ministry of Environment and Forestry

MoT: Ministry of Transportation

MPWH: Ministry of Public Works and Housing

Mt: Million tons (of CO2e)

N2O: Nitrous oxide

NDC: Nationally Determined Contribution

NEK: National Energy Policy

NPAP: National Plastic Action Partnership

NRE: Non-Recurrent Engineering

PFC: Plerfluorocarbon

PLN (Persero): State Electricity Company

POME: Palm Oil Mill Effluent

PPA: Power Purchase Agreement

PPSP: Settlement Sanitation Development Acceleration Program

PSEL: Acceleration of Development of Waste Processing into Electrical Energy

PT: Project Team

R&D: Research & Development

RDF: Refused-derived fuel

RENSTRA: Ministries Strategic Plan

RKA: Budget Plan at Ministries

RKP: Central government annual work plan

RKPD: Local government work plan

RPJMN: Indonesia National Medium-Term Development Plan (Acronym from Bahasa: Rencana Pembangunan Jangka Menengah Nasional)

RPJPN: Long-term Development Plan (Acronym from Bahasa: Tentang Rencana Pembangunan Jangka Panjang Nasional Tahun)

RUEN: Presidential Regulation Number 22/2017 on the General National Energy Plan

RUKN: General Plan of National Electricity

RUPTL: Electricity and Supply Business Plan

SEA: Strategic Environmental Assessment

SOE: State-Owned Enterprise

SWDS: Solid Waste Disposal Sites

SWDS: Steam and Water Dump System

UNDCCC: United Nations Framework Convention on Climate Change

UU HPP: Law Number 7/2021 on the Harmonization of Tax Regulations

WEF: World Economic Forum

WMO: World Meteorological Organization

WWTP: Wastewater Treatment Plant

0. Executive Summary

The Republic of Indonesia has recently taken significant steps towards climate resilience and low-carbon development, and climate change mitigation and adaptation actions have become a priority for the country's authorities. Indonesia has committed to decrease by 29% the GHG emissions below business-as-usual level by 2030 from 2020, a percentage that can be increased to 41% conditional on international support to its Nationally Determined Contribution (NDC).

Further evidence of the Government of Indonesia (GoI) commitment to act on tackling climate change is the inclusion of climate change targets and associated budget in Indonesia's National Medium-Term Development Plan (RPJMN) 2020-2024. In order to achieve the NDC reduction targets, Indonesia intends to allocate Rp 3,461 trillion (US$247 billion) from its budget to climate projects for the period 2020-2030 and estimates climate finance needs between Rp 33-173 trillion (US$2.4 – 12.4 billion) by 2030. However, only Rp 3.8 trillion (US$270 million) in the RKA 2021 budget has been allocated to NDC mitigation actions, emphasizing the need for additional domestic and international sources of finance to achieve both its unconditional and conditional NDC commitments.

This Shelf of Projects and Costs of NDC Actions for Indonesia project is intended to propose detailed measures mitigating the country's emissions, providing clear and founded information to potentially impact the local budget allocations for the upcoming years. The objective of the Technical Assistance (TA) is to provide a list of projects and programs that are key to achieve climate targets identified for each climate action in the NDC, as well as the estimated financing needs for each project, and to undertake stakeholder consultations. The scope of work does not include projects and investments to strengthen resiliency or adaptation to climate change impacts.

The methodology followed by the PT to reach this objective was updated to utilize a hybrid approach, where the focus has been placed on analysis of data and other information obtained both from official public documents and from line ministries with whom the PT has interacted. Originally, more emphasis was placed on a bottom-up approach (i.e., an extensive consultation process). Due to a tight project timeframe, the PT in consultation with the WB team opted for complementing the consultations with data and other information available from official national and international sources.

Under the coordination of the TL, three sectoral experts have analyzed the relevant literature on climate projects and programs contributing to the NDC in Indonesia with the vision of extracting relevant projects. This analysis has been contrasted and further extended at the different consultation dialogues held with the most significant stakeholders, the line ministries, which have taken place throughout the duration of the TA. Similarly, two finance experts have been working on the financing needs estimations through available data at national level and, when this was not possible, at international level through corresponding national adaptations. Throughout key experts were supported by a highly qualified backstopping team, both in-country and internationally. Building on the governmental stakeholder meetings held over the course of the project, the PT is planning to conduct a final workshop to socialize and validate the Project's results with its main stakeholders after approval of this report.

The work carried out by the PT in this Technical Assistance project is summarized in three documents / products, that together make up the Final Report:

- ✓ This written Final Report, containing the main findings of the TA and further extending the information provided in the List of projects.
- ✓ A spreadsheet, containing the List of Projects with detailed information on projects and programs identified, and where information has been available including estimated financial needs.
- ✓ Annexes to the Final Report, including a full stakeholder mapping and summary of stakeholder consultations.

There is a large potential in Indonesia for green economic growth that currently remains untapped. One key pathway to closing the gap that appears to exist between the GoI budget and the NDC financing requirements, access to additional concessional and commercial sources will need to be expanded

Through the engagement with governmental stakeholders and further research, the PT have identified 268 mitigation projects across the AFOLU, energy and IPPU and waste sectors. The data available to the PT indicate that the level of climate financing envisioned in the 5-year plan is not currently mirrored in the annual budget allocation data made available to the PT. Furthermore, anecdotal evidence shows a gap may exist between budget allocation data and budget drawdown, while the financial needs and budget analysis shows the potential for a significant deepening of climate action with large co-benefits. Full details are provided in the data files accompanying this report.

A significant amount of engagement with all relevant stakeholders both governmental and those from the private and civil society sectors will be needed to realize the required mobilization and prioritization of the allocation of government budget and climate finance, whereas a detailed mapping of projects against potential sources of climate-aligned finance and investment instruments applied is needed at the sector level. These, together with cross-departmental discussions and coordination at project and levels, as well as with the opportunity to share experiences in accessing climate finance and best practice in project planning and implementation across the ASEAN region, would support opportunities for investment along the project development pathway from identification, development, primary finance through to refinancing.

Some specific recommendations are provided to support the GoI in its pursuit of climate ambition and realization of NDC / LCDI mitigation targets.

1. Introduction

Indonesia is a middle-income country, the world's fourth largest country in population terms, and the largest economy in Southeast Asia. Its diverse population of approximately 275 million people is spread across more than 17,500 islands.

Since the year 2000, high economic growth has significantly contributed to a reduction in poverty. The share of the population living in poverty has been significantly reduced from 25% in 1999, following the 'Asian financial crisis,' to 10% in 2021.

The GoI has recognized that this high growth has contributed to high levels of urban air and water pollution, deforestation and depletion of biodiversity. For that reason, the Government of Indonesia has embarked on a pathway for development in which sustainable and low carbon activities are at the core of development policy planning.

Today, as a result of the COVID-19 pandemic, Indonesia is facing a recession and an economic recovery is pursued. Sustainable low-carbon and resilient growth, then, intends to unlock economic, social and environmental benefits. In doing so, Indonesia joins international efforts under the Paris Agreement to limit dangerous climate change and its impacts by pursuing its Nationally Determined, conditional and unconditional, Contribution (NDC, see section 1.3).

1.1. Institutional framework

The Government of Indonesia guides long-term development planning through the 25-year RPJPN (National Long-Term Development Plan) and the medium-term 2020-2024 RPJMN. The RPJMN 5-year timeframe coincides with a Presidential term and thus is used to set political priorities. In response to the RPJMN and the political priorities of the President, line ministries similarly prepare the medium-term so called Ministerial Strategic Plans and sub-national governments prepare RPJMDs. Furthermore, 5-year plans are translated into annual plans including the state budget (APBN) that outlines revenue and spending targets for the financial year. The annual state budget is proposed by the cabinet and needs approval from Indonesia's House of Representatives (DPR). Each August, the President delivers a Budget Speech to Parliament where the final draft state budget is presented.

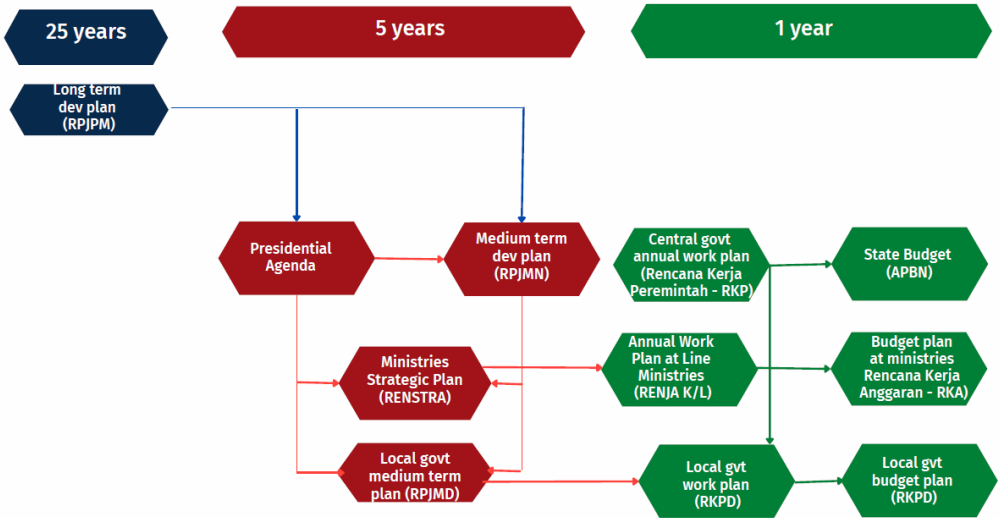

Figure 1: Long-term development planning outline. Source: PT elaboration.

The current RPJMN 2020-2024 pursues seven overarching objectives:

- Enhance economic resilience for quality growth
- Strengthen regional development to address inequality among regions
- Enhance human resource quality and competitiveness
- Build nation values and character of citizens
- Advance infrastructure to support economic development and provision of basic services
- Enhance the environment and resilience to natural disaster and climate change impacts
- Strengthen stability in politics, law, national security and defense and public service transformation.

Including Enhance the environment and resilience to natural disasters and climate change impacts as the 6th Key Development Agenda in Medium Term Development Plan (RPJMN) 2020-2024 is significant as this objective is then translated into detailed activities as part of the strategic planning by ministries and directorates.

Climate change policies and strategies are thus implemented under the RPJMN framework and are reflected in budgetary planning. However, different competencies may arise across national, regional and local levels and development and planning of climate change mitigation actions at the sector level may be subject to planning by different Ministries. Indonesia greenhouse gas (GHG) emissions are distributed across economic sectors as follows:

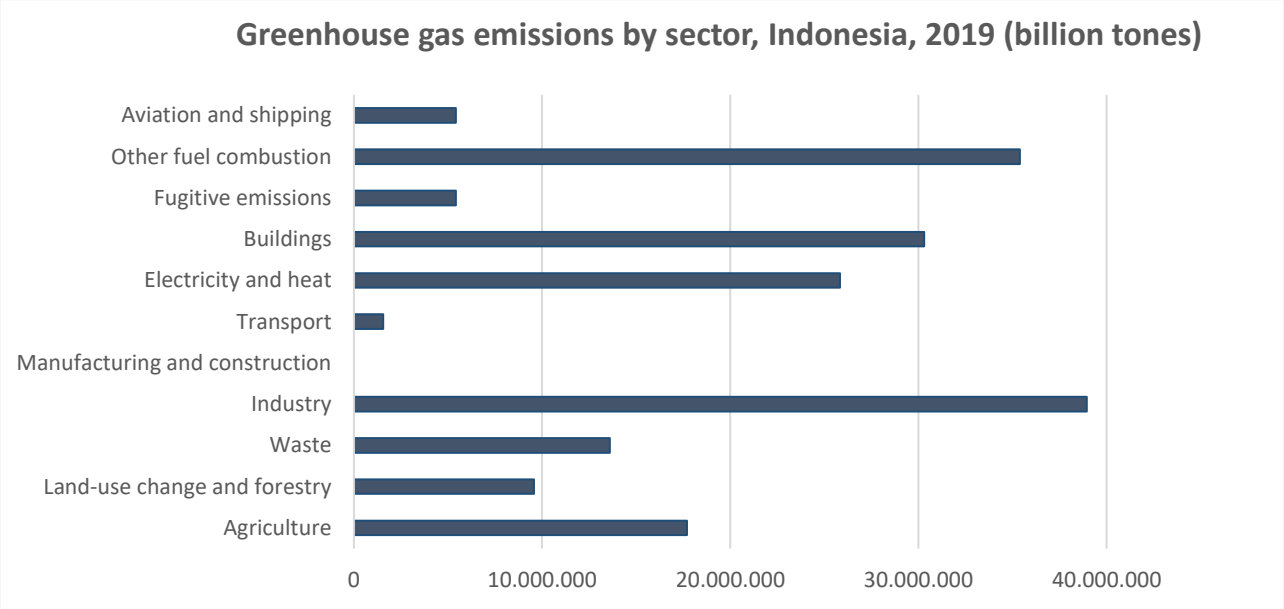

Figure 2: Greenhouse gas emission by sector in Indonesia (2019). Source: PT Elaboration.

As shown in Figure 2, the four most significant GHG emitting sectors are (1) Agriculture, Forestry and Other Land Uses (AFOLU), (2) Energy, (3) Industrial Processes and Product Use (IPPU), and (4) Waste. These four economic sectors are subject of this Technical Assistance scope and analysis.

For the four key sectors for climate mitigation action, the following key governmental stakeholders have been identified by the PT (Table 1). The stakeholder mapping and engagement methodology is described in Chapter 3:

AFOLU
1. Ministry of Environment and Forestry 2. Ministry of Agriculture

ENERGY & IPPU		
Electricity generation	**Transportation**	**Others**
1. Ministry of Energy and Mineral Resources 2. Ministry of Environment and Forestry (for reporting & verification)	1. Ministry of Transportation 2. Ministry of Industry 3. Ministry of Energy and Mineral Resources 4. Ministry of Environment Forestry (for reporting & verification)	1. Ministry of Energy and Mineral Resources 2. Ministry of Public Works and Public Housing 3. Ministry of Industry 4. Ministry of Environment and Forestry (for reporting and verification)

WASTE			
Domestic solid waste	**Domestic wastewater**	**Industrial solid waste**	**Industrial wastewater**
1. Ministry of Environment and Forestry 2. Ministry of Energy and Mineral Resources	1. Ministry of Environment and Forestry 2. Ministry of Public Works and Public Housing	1. Ministry of Environment and Forestry 2. Ministry of Energy and Mineral Resources	1. Ministry of Environment and Forestry

Table 1: Government stakeholders by sector. Source: PT elaboration

1.2. Low Carbon Development Initiative

In 2017, Indonesia's Ministry of National Development Planning (BAPPENAS) launched the Low Carbon Development Initiative (LCDI) with the aim of explicitly incorporating greenhouse gas (GHG) reduction targets, as well as preservation and restoration of natural resources, into the national policy planning and development agenda. Its stated purpose is to achieve annual GDP growth of 6% while reducing GHG emissions by up to 43% below business-as-usual GHG emissions by 2030. The LCD Initiative was subsequently integrated into the RPJMN 2020-2024, which identifies priority development policies that maintain economic growth, alleviate poverty, and help meet sector-level development targets, in addition to climate objectives, as detailed above.

1.3. Nationally Determined Contribution

Along with other Parties to the United Nations Framework Convention on Climate Change (UNFCCC) aiming to raise ambition before the 26th Conference of the Parties in Glasgow, the Republic of Indonesia submitted in July 2021 its updated National Determined Contribution (NDC) with the objective of increasing resilience and reducing the country's emissions by 2030.

Under the Paris Agreement, Indonesia has pledged to make an unconditional reduction in GHG emissions by 29% below business-as-usual levels for 2030, with a 41% conditional reduction contingent on international financial, technical and capacity building support.

The updated NDC is built around three scenarios of future emission trajectories (namely, business-as-usual (BAU), CM1 (the unconditional contribution) and CM2 (the conditional contribution):

No	Sector	GHG Emission Level 2010 (MTon CO2e)	GHG Emission Level 2030			GHG Emission Reduction			
			MTon CO_2e			MTon CO_2e		% of total BAU	
			BAU	CM1	CM2	CM1	CM2	CM1	CM2
1	Energy (incl. fugitive emissions)	453.2	1,669	1,355	1,223	314	446	**11%**	**15.5%**
2	Waste	88	296	285	256	11	40	0.38%	1.4%
3	Industry	36	70	67	66	3	3.25	0.10%	0.11%
4	Agriculture	111	120	110	116	9	4	0.32%	0.13%
5	Forestry and other land use	647	714	217	22	497	692	**17.2%**	**24.1%**
TOTAL		1,334	2,869	2,034	1,683	834	1,185	29%	41%

Table 2: Projected emission level and reduction by sectors. Source: Updated NDC Indonesia 2021

Table 3 summarizes in detail the 2021 updated NDC commitments made by the GoI:

AFOLU	**Forestry and Other Land Uses (FOLU)**
	Most of Indonesia's emissions increase between 2005 and 2010 are a result of land use change and peatland forest fires (63%), having the greatest share of emissions together with the energy sector. Thus, FOLU is the sector with the most contribution to GHG emissions in Indonesia, mainly from deforestation and forest degradation, as well as peat decomposition, including land and forest fires. Main challenges are to accurately measure the implementation mitigation actions by monitoring land use change and measure emissions from peat. In the forestry sector, Indonesia has set up an ambitious target by 2030 in peat lands restoration of 2 million ha and rehabilitation of degraded land of 12 million ha. Unconditional contribution: • Reduction of 18% emissions in 2030 from 2010 Conditional contribution: • Reduction of 24% emissions in 2030 from 2010.
	Agriculture
	GHG emissions from the agricultural sector for the period 2000-2019 were mainly from livestock and aggregated sources and terrestrial sources. Plans of improvement will have a special focus on livestock, by refining the manure management system, the calculation of CH4 and N2O, the method of calculating the harvested rice area, and the identification of data on activities that reduce GHGs from palm oil plantation, among others. Unconditional contribution: • Reduction of 0.32% emissions in 2030 from 2010 Conditional contribution:

	• Reduction of 0.13% emissions in 2030 from 2010.
ENERGY & IPPU	**Energy**
	The energy sector represents a great share of Indonesia's GHG emission mix, with about 35% increase in 2012 from 2000.The mix energy use policy and the clean energy sources directive will eventually put Indonesia in the path to decarbonization. Unconditional contribution: • Reduction of 11% emissions in 2030 from 2010 Conditional contribution: • Reduction of 14% emissions in 2030 from 2010.
	Industrial Processes and Product Use (IPPU)
	Mitigation actions in IPPC are specially carried out in cement, ammonia-urea, aluminium and nitric acid industries: Unconditional contribution: • Reduction of 0.1% emissions in 2030 from 2010 Conditional contribution: • Reduction of 0.11% emissions in 2030 from 2010.
WASTE	The Indonesian Government has committed to develop a comprehensive strategy to improve policy and institutional capacity at local level, enhance management capacity of urban waste water, reduce landfill waste by promoting the 'Reduce, Reuse, Recycle' approach, and the utilization of waste and garbage into energy production. Unconditional contribution: • Reduction of 0.4% emissions in 2030 from 2010 Conditional contribution: • Reduction of 1% emissions in 2030 from 2010.

Table 3: Indonesia's unconditional and conditional contributions per sector to GHG emission reduction, in line with its NDCs. Source: Updated Nationally Determined Contribution and Indonesia's Third Biennial Update Report

The 2019 NDC mitigation action plan remains relevant in that it documents in detail sector specific measures. These are summarized, where applicable, in the relevant chapters of this report. It is, however, noted that the GoI opted not to integrate the mitigation action plan and specify the measures in the 2021 updated NDC.

Importantly, the GoI envisions increasing climate ambition further over time. Parallel to the submission to the UNFCCC of the 2021 updated NDC, the Government submitted a Long-Term Strategy for Low Carbon and Climate Resilience 2050 (LTS-LCCR, where it extends the NDC's unconditional scenario and, therefore, is not (yet) in line with a net-zero emissions strategy.

2. Mitigation Potential Analysis

2.1. AFOLU

The achievement of the NDC and LTS' objectives heavily relies on the high mitigation potential in the forestry and land use sectors, which are expected to become a net-sink by 2030. The main mitigation measures identified in the Agriculture and FOLU sectors are:

1. Reducing emissions from (planned and unplanned) deforestation.
2. Reducing forest degradation, mainly through controlling illegal logging and increasing productivity of timber plantation.
3. Sustainable forest management (reduced impact logging RIL-C, enriched natural regeneration ENR, in Bahasa *Pengelolaan Hutan Lestari*).
4. Increasing carbon stock (rehabilitation, enrichment planting, industrial forest plantation).
5. Peatland restoration.
6. Use of low emission crops.
7. Implementation of water-efficient farming.
8. Manure management for biogas.
9. Feed supplement for cattle.

The BAU scenario represents the anticipated pathway with the highest level of emission in 2030 according to the Ministry of Environment and Forestry (MoEF), whereas the CM1 and CM2 scenarios are focused on reducing the rate of deforestation by more than a half (0.864 Mha/year) and reinforcing conservation of natural forests. Importantly, the CM1 and CM2 scenarios further count on significant improvements in peatland management, including peatland restoration and improved water management.
The Operational Plan for Indonesia's FOLU Net Sink 2030 specifies a number of areas targeted for each type of mitigation action (Figure 3). The total land area covered is detailed in Table 4.

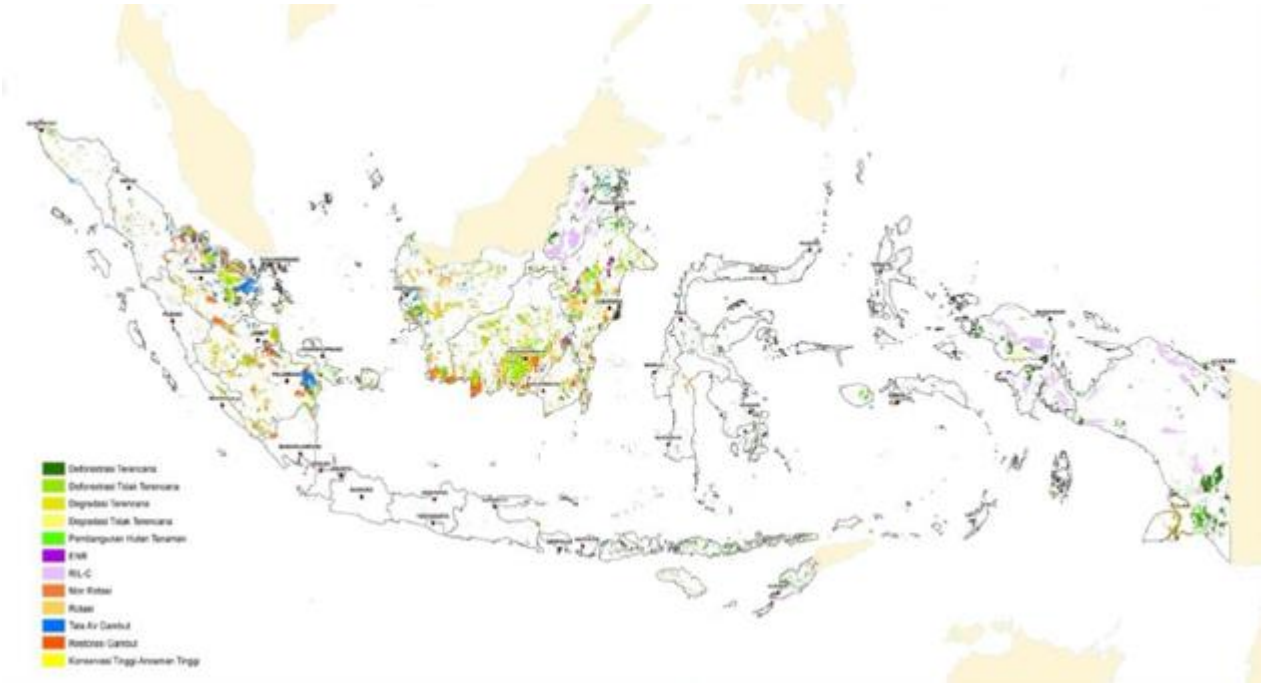

Figure 3: Areas targeted for FOLU mitigation actions. Source: Operational Plan for Indonesia's FOLU Net Sink 2030

Management Type		Total area for each mitigation action (in 000 hectare)												Area Manager
		Deforestation in mineral soil	Deforestation in peatland	Degradation in concession areas	Industrial forests plantation	ENR	RIL-C	Rehabilitation with Rotation	Rehabilitation Non-rotation	Water management	Peatland restoration	High conservation	Grand Total	
Non concession-HP	Ministry/National Govt.	656.27	285.92			8.09		205.52	180.15			11,095.03	12,430.96	DG SFM
KPHP-HPH	Private	535.68	77.64	4,398.39		654.01		504.14	1.75		0.16	5,460.25	13,092.35	
KPHP-HTI	Private	1,724.15	250.84	233.89	1,346.43	403.25	1,460.33	1,410.41	278.52	718.02	57.62	1,443.71	7,930.95	
KPHP-RE	Private	226.50	99.81	3.01		4.77	64.12	23.05	14.36		2.54	360.93	734.96	
KPHP-HPK	Private	154.34	60.66			12.01		354.33	96.11		0.30	840.15	1,517.90	
Conservation	Ministry/National Govt.	281.99	633.79			13.46			549.09		3.71		1,482.04	DG NR and ecosystem conservation
HL-Non PIAPS	Ministry/National Govt.	364.88	108.54			27.16			73.43			14,128.82	14,702.83	DG watershed and foster rehabilitation
KPHL-PIAPS	Community	58.27	13.46			9.89			21.14		17.52	1,459.03	1,579.31	DG Social forestry and parternship
KPHL-PIAPS	Community	221.32	102.99		697.90	12.42		86.29	129.82		52.10	1,750.41	3,053.25	
PEAT											1,350.74		32,663.88	DG NR and ecosystem conservation
BRGM	Ministry/National Govt.										371.52		371.52	BRGM
PEMDA-Non HGU	Local govt	3,841.9	131.15					1,827.69	80.06			1,350.74	7,231.57	Local gvt
PEMDA-HGU	Private	559.60	83.09					380.57	29.57	956.68	22.35	440.47	2,472.50	Local gvt
Grand Total		8,624.93	1,847.88	4,635.28	2,044.33	1,154,04	1,524.45	4,792.15	1,454.00	1,674.70	33,191.69	38,329.55	99,264.02	
NDC 2024		5,056.00	56.00	N/A	9,307.00	N/A	1,589.00	2,422.0	1,453.00	864.00	977.00			
NDC 2030		7,195.00	75.00	N/A	11,227.00	N/A	3,105.00	3,460.00	2,076.00	864.00	1,395.00			
Remaining kuota		3,088.00	(621.00)	N/A	6,110.00	N/A	2.669.00	725.00	1,454.00	N/A	560.00			

Table 4: Total area for FOLU mitigation action (in 1,000 ha). Source: Operational Plan for Indonesia's FOLU Net Sink 2030

2.2. Energy & Industrial Processes and Product Use

Role of the energy sector in the NDC

According to the updated NDC, *energy sector emissions* in the BAU scenario are estimated to peak at 1,669 GtCO2e in 2030. The GHG emissions reduction under the unconditional scenario (CM1) is at 314 MtCO2e or 11% below the 2030 baseline, while under the conditional scenario (CM2) GHG emissions reductions are estimated at 398 Mt CO2e (or 15.5%). The enhanced ambition announced by the GoI at COP26 will increase the unconditional contribution up to 357.8 Mt CO2e (12.5%) in 2030.

The mitigation actions of the energy sector under the unconditional NDC are grouped into 5 categories, namely (i) energy efficiency/conservation, (ii) renewable energy, (iii) clean energy, (IV) fuel switching, and (v) post-mining land rehabilitation carried out by the energy sector. At the same time, these mitigation actions will be implemented into the five sub-sectors, namely (i) Power Generation, (ii) Industry, (ii) Transport, (iv) Buildings (Households and Commercial), and (v) Others/ACM (Agriculture, Construction and Mining).

Role of the industry process and product use sector in the NDC

The industry process and product use (IPPU) sector has an unconditional target of about 3 Mt CO2e or 0.1% below the baseline of national GHG emissions in 2030, while under conditional NDC the GHG emissions reduction target is estimated at 4 Mt CO2e.

The unconditional mitigation actions for the IPPU sector are focused on just 2 sub-sectors or industries, namely (i) cement and (ii) ammonia fertilizer.

The conditional NDC mitigation actions on the other hand cover five sub-sectors, namely:

(i) cement industry (enhanced cement emission mitigations of unconditional target)
(ii) ammonia fertilizer industry (enhanced ammonia fertilizer emission mitigations of unconditional target)
(iii) iron & steel
(iv) PFC reduction in aluminum plant, and
(v) N2O reduction in nitric acid production.

The list of these mitigations actions is presented in Table 5 and 6, and Figure 4: Reduction of GHG Emission in the Energy Sector (contribution by sub-sector).

Activities	Sector of mitigation implementation and GHG Emissions Reduction Target	Activity Target in 2030 (Compared to 2010 base year)
Implementation of Energy Efficiency (EE) Measures Total reduction target in 2030 is 41.76 Mt CO2e	EE in Households by Implementing EE Appliances Standard, etc.	- EE potential 2,245 ktoe - Indirect GHG emissions reduction potential 25.87 Mt CO2e
	EE in Commercial Buildings by Implementing EE Appliances Standard and Green Building Certifications, etc.	- EE potential 165 ktoe - Indirect GHG Emissions reduction potential 1.91 Mt CO2e
	EE in Industry by Implementing new technology, equipment replacement, Energy Efficiency Appliances Standard, etc.	- EE potential: coal (3,302 ktoe), oil (586 ktoe), natural gas (1,649 ktoe), electricity (892 ktoe) - Direct GHG emissions reduction potential is 21.41 Mt CO2e - Indirect GHG Emissions reduction potential 10.28 Mt CO2e
	EE in transportation by improving public transport quality, transportation technology improvement, etc.	- EE potential: oil (6,396 ktoe) - Direct GHG emissions reduction potential 20.35 Mt CO2e
Deployment of New and Renewable Energy (NRE) Total reduction target in 2030 is 183.66 Mt CO2e	RE in industries	- Increasing use of biomass from 2010 (4,775 ktoe) and biofuel (4,792 ktoe) - Direct GHG emissions reduction potential 27.28 Mt CO2e
	RE in power generation	- RE electricity generation: Hydro power (3,933 ktoe), geothermal (3,210 ktoe), Solar & Wind (352 ktoe), biomass power (143 ktoe) - Indirect GHG emissions reduction potential 93.71 Mt CO2e
	RE in transport	- Increasing use of biofuel from 2010 (20.041 ktoe) - Direct GHG emissions reduction potential 62.66 Mt CO2e

Clean Energy technology in Power Total reduction target in 2030 is 79 Mt CO2e	Deployment of Clen Coal Technology (Super Critic & Ultra Super Critic) and more efficient power plant	- EE potential of SC is 1,777 ktoe - EE potential of USC is 5,978 ktoe - Direct GHG emissions reduction potential 39.34 Mt CO2e
	Natural Gas Power Plant with PLTGU (Combine Cycle)	- EE potential of PLTGU is 8, 985 ktoe - Direct GHG emissions reduction potential 39.66 Mt CO2e
Fuel Switching to Low GHG Emissions Total reduction target in 2030 is 9.59 Mt CO2e	Kerosene replacement with LPG	- Increasing gas supply to households compared to 2010 is 6,610 ktoe - Direct GHG emissions reduction potential 9.59 Mt CO2e
Post mining land rehabilitation (carried out by the energy sector) Total reduction target in 2030 is 5 Mt CO2e.	The reclamation activities by private mining companies to comply with government regulation on post-mining reclamation under the Strategic Plan of DG Mining and DG NRE (MEMR). 2024 Emission reduction target 4.02 Mt CO2e, 2030 target 5 Mt CO2e.	N/A

Table 5: GHG emission reduction target of each mitigation action in energy sector. Source: Estimation based on NDC road map. Source: MoEF 2016.

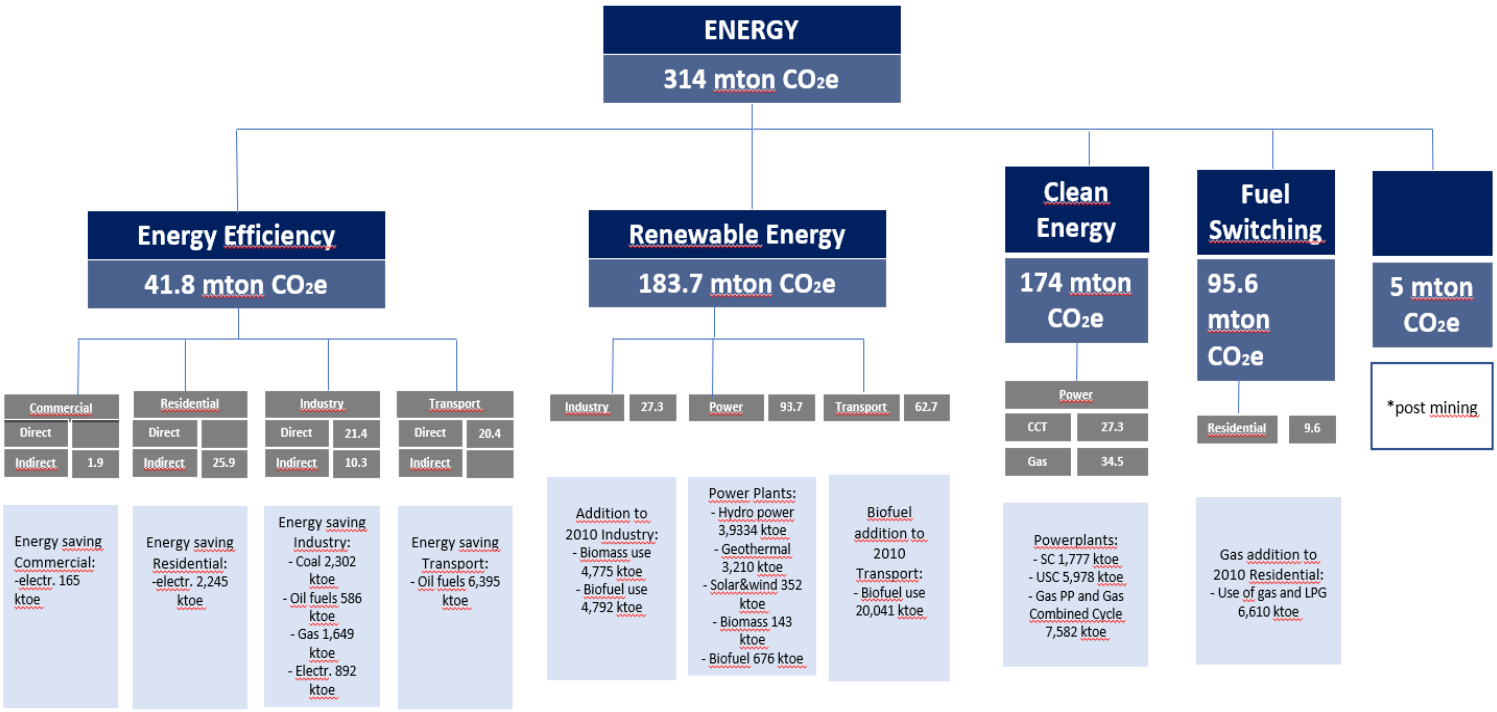

Figure 4: Reduction of GHG Emission in the Energy Sector (contribution by sub-sector)

Activities	Sector of mitigation implementation and GHG Emissions Reduction Target	Activity Target in 2030 (Compared to 2010 base year)
IPPU GHG Emissions Reduction in Industry	IPPU reduction of unconditional NDC: - CO2 reduction in cement industry - CO2 reduction in ammonia industry IPPU reduction of conditional NDC: - Increase CO2 reduction in cement industry - Increase CO2 reduction in ammonia industry - CO2 reduction in iron & steel Industry - PFC reduction in aluminum Industry - N2O reduction in Nitric Acids	CO2 emissions reduction target: - Unconditional NDC (2.75 Mt CO2e) - Conditional NDC target (4 Mt CO2e)
CEMENT INDUSTRY Implementation of Blended Cement (AFR or Additive) for the reduction of clinker to cement ratio from 83% to at least 75% Total reduction target in 2030 is 41.76 Mt CO2e	Implement Blended Cement in 40% of national cement production to reduce the ration of clinker to cement from 83% to 75% under unconditional NDC	CO2 emissions reduction target under unconditional NDC is 1.73 Mt CO2e
	Implement Blended Cement in 60% of national cement production to reduce the ration of clinker to cement from 83% to 75% under conditional NDC	CO2 emissions reduction target under conditional NDC is 1.9 Mt CO2e
	Implement Blended Cement in 50% of national cement production to reduce the ration of clinker to cement from 83% to 65% under unconditional NDC	Total CO2 emissions reduction target of unconditional NDC is 3.8 Mt CO2e
AMMONIA INDUSTRY Total reduction target in 2030 is 41.76 Mt CO2e	Implementation of EE (by improving ammonia plant, equipment, waste heat recovery, etc.)	Total CO2 emissions reduction target: - Unconditional NDC (1.03 Mt CO2e) - Conditional NDC (1.2 Mt CO2e)
IRON & STEEL INDUSTRY Total reduction target in 2030 is 41.76 Mt CO2e	The use of scarps as feed stock (10% of total production)	Total CO2 emissions reduction target of conditional NDC (0.07 Mt CO2e)
ALUMINUM INDUSTRY Total reduction target in 2030 is 41.76 Mt CO2e	Improvement technology by automatization of feeding process (developed under CDM until 2017)	Total PFC emissions reduction target of conditional NDC (0.035 Mt CO2e)
NITRIC ACIDS INDUSTRY Total reduction target in 2030 is 41.76 Mt CO2e	Implementing mitigation technology by the deployment of N_2O destruction catalysis processes	Total emissions reduction target of conditional NDC (0.054 Mt CO2e)

Table 6: IPPU GHG emission reduction target of each mitigation action in industry sector. Source: Self-elaboration based on NDC Mitigation Road Map, MoEF 2016

2.3. Waste

In the Updated NDC Indonesia 2021, the BAU Baseline Scenario and the Mitigation Scenario for the waste sector are set as follows:

- Baseline (BAU) scenario: it is the emission scenario when development does not consider climate change mitigation policies.
- Counter Measure 1 scenario (CM1): it is the emission scenario with a mitigation basis that takes into account the sectoral development targets, with an emission reduction target of 0.38% (from baseline scenario) in 2030.
- Counter Measure 2 scenario (CM2) or conditional scenario: emission scenario with more ambitious targets that takes into account the sectoral development targets, if international support is available, with an emission reduction target of 1.4% (from baseline scenario) in 2030.

The mitigation actions in the waste sector can reduce the emission levels from dominant emission sources (landfill, septic tanks, and agro-industrial WWTPs), by:

- Reducing the generation of degradable waste that is landfilled (and decomposed anaerobically) in Solid Waste Disposal Sites (SWDS).
- Reducing net emission levels by recovering methane in landfills.
- Methane avoiding in landfill due to thermal waste treatment (incinerator and/or RDF plant).

The identification of mitigation actions in the waste sector, including the Updated NDC Indonesia 2021 are:

- Landfill Gas (LFG) recovery in Solid Waste Disposal Site.
- Waste reduction through composting, reducing, reusing, and recycling (3R).
- Waste to Energy: Incinerator Power Plant and Refuse Derived Fuel (RDF) Plant.
- Domestic wastewater treatment using a septic tank equipped with sludge removal.
- Construction and operation of communal septic tanks and biodigesters, with methane recovery.
- Domestic wastewater treatment with the aerobic system.
- Industrial solid waste treatment (including WWTP sludge).
- Utilization of biogas from Palm Oil Mill Effluent (POME).

The allocation of GHG emission reduction targets for the waste sector in the Indonesia NDC Implementation Roadmap (MOEF, 2019), includes:

- LFG recovery for electricity or steam generation of 1,469 million tons of CO_2e, assuming 5,900 Household Connections (LFG for cooking) and 45 MW (LFG for electricity).
- Utilization of solid waste for compost production (= 2,606 million tons of CO_2e), as well as recycling/upcycling of paper waste (= 2.177 million tons of CO_2e, with 2,857 units of TPST, 3,018 units of TPS 3R, and 762 units of Waste Bank.
- Waste to Energy: Incinerator Power Plant and Refuse Derived Fuel (RDF) Plant, amounting to 1.911 million tons of CO_2e, with 4.6 million tons of processed waste per year.
- Sludge removal in septic tanks (= 3.000 tons of CO_2e), equivalent to the removal of 468,310 kg BOD.
- Construction (and operation) of communal septic tanks and biodigesters equipped with methane recovery facilities (= 500 tons of CO_2e), assuming the operation of 295 biodigesters with a capacity of 100 people per unit.

- Construction (and operation): (a) Centralized WWTP with aerobic system (= 84-kilo tons CO_2e), serving 2.2 million urban population, and (b) Regional WWTP with aerobic system (= 600 tons of CO_2e)
- Utilization of industrial solid waste, namely: (a) reuse of paper mill waste as raw material (= 62,300 tons of CO2e, with the processing of 6 million tons of paper waste per year, (b) composting of the pulp & paper industry (= 1,800 tons of CO2e), with the composting of 3 million tons of pulp per year, and (c) recovery of paper industry waste as fuel (= 26,600 tons of CO2e), with the recovery of 920,600 tons of paper per year.
- Utilization of biogas from; (a) POME of the palm oil industry (= 3 million tons of CO2e), from 5.7 million tons of CPO production/year, and (b) WWTP of the pulp & paper industry (= 0.01 million tons of CO2e), from the production of 165 thousand tons of paper per year.

Whereas in the Low Carbon Development Report (Bappenas, 2019), both the LCDI Moderate and High Scenarios include the following waste management and waste reduction targets to be achieved by 2045:

- Solid waste management policy that will reduce waste generation by 30%
- Solid waste management policy that will reduce emission factor by 10%
- Industrial waste management policy that will reduce the emission factor by 50%

Some of the mitigation actions taken by the government can be marked with Climate Budget Tagging (The Fiscal Policy Agency, 2020), i.e.:

- Reduce waste generation
- Increase the number of programs for waste reduction
- Improved waste management at the national level
- Waste-based fuel program (Refuse Derived Fuel)
- City-scale final solid waste management system
- Community-based waste management system
- Regional-scale waste management system
- Management of dangerous waste (B3) from the industrial sector and the application of a circular economy in industrial development.

It is worth mentioning that further studies are needed regarding the marking of budget-based GHG mitigation actions, because not all budgets in a sanitation program are directly related to emission reduction (Engineering, Procurement, Construction, and Operation). Maybe some actions can be supportive (such as comparative studies, coordination of stakeholders, official trips, uniforms, etc.), but some sanitation programs can even increase GHG emissions, for example the addition of waste services to landfills (without LFG recovery), or the construction of communal septic tanks.

Annex 7 includes a detailed analysis of the waste sector mitigation measures undertaken and the potentials identified in the 2021 updated NDC.

3. Methodology

3.1. Data Sources

3.1.1. AFOLU Sector

The main source of data for AFOLU is the updated NDC Indonesia (2021) and the Third BUR. Additional analysis was undertaken by the PT of the strategic plans at the responsible Ministry of Environment and Forestry, as well as specific Directorates within the Ministry.

Activities in the strategic plan 2020-2024 were tagged and categorized into 6 types of FOLU mitigation actions (reducing deforestation, reducing forest degradation, enriched natural regeneration ENR, reducing impact logging RIL-C, increasing carbon stock, and peat management). We further identified those activities that have a direct impact on emission reduction and those primarily designed to create a more enabling policy environment.

3.1.2. Energy & IPPU

Energy Sector

The main sources of data and information regarding the GHG emissions of the energy sector and its mitigations are NDC Indonesia (2016), updated NDC Indonesia (2021), Indonesia 3rd BUR, sectoral strategic plans of MEMR strategic plans for NDC 2017 and updated NDC 2021, Green RUPTL 2021-2030, and RPJMN & tagging results, as well as personal discussions with MEMR, MoI, and MoT. In addition to the document of government strategic plans, data related to the mitigation of GHG emissions from energy use in industries are collected from industries, SIINAS/SIM (reporting industrial data online by MoI), and the report study on the Indonesia's Market Readiness Proposal Under the Partnership for Market Readiness (PMR for Indonesia) by UNDP concerning the strategic plans of 8 industry groups in mitigating GHG emissions, and associations.

The required investment of mitigation implementations of renewable energy and clean coal power plant is estimated using a cost standard of the power plant investment (million USD/MW) as presented in Table 7 and Table 8.

RE	Win Onshore	PV	HYDRO	Biomass	Geothermal
Low	1.340	1.570	0.450	1.880	1.850
High	2.330	4.340	3.500	6.820	5.100
Average *	1.835	2.955	1.975	4.350	3.475

Table 7: GHG emission reduction target of each mitigation action in energy sector. Source: Estimation based on NDC road map. Source: MoEF 2016

Clean Coal Technology	Mill USD/MW
New Coal USC	1.26
New IGCCC	1.46

Table 8: Investment Cost of Clean Coal In Million USD/MW. Source: Estimation based on NDC road map. Source: MoEF 2016

IPPU Sector

The main sources of data and information regarding the GHG emissions of IPPU sector and its mitigations are NDC Indonesia (2016), updated NDC Indonesia (2021), Indonesia 3rd BUR, sectoral strategic plans (MoI, industries, and Associations), as well as personal discussions with MEMR, MoI, and industries. In addition to the government strategic plans, data related to the mitigation of GHG emissions from IPPU are collected from industries, SIINAS/SIM (reporting industrial data online by MoI), and the report study on the Indonesia's Market Readiness Proposal Under the Partnership for Market Readiness (PMR for Indonesia) by UNDP concerning the strategic plans of 8 (eight) industry groups in mitigating GHG emissions, and the FGD with associations and industries/companies.

3.1.3. Waste Sector

The mitigation actions (and targets) in the waste sector were obtained from the updated NDC (2021) and complemented with the climate budget tagging reports. The actions taken by the private sector were obtained from various published sources.

The transparent and comprehensive budget tagging is a welcome development. However, the practice of tagging projects as mitigation action in their entirety requires further study, as often not the entire budget in a sanitation program is directly contributing to emissions reduction (Engineering, Procurement, Construction, and Operation) and even some of them could cause the increase of GHG emissions.

The GHG emission reduction target (2030) per mitigation action is obtained from the Indonesia NDC Road Map document (MOEF, 2019), while the progress (achievement) of mitigation actions is obtained from the 2021 GHG and MPV Inventory Report (MOEF, 2022).

By comparing these two documents, we have obtained an overview of those GHG mitigation actions that have been on track, and of those mitigation actions that require acceleration. Mitigation action institutional arrangements refer to the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.73/MENLHK/SETJEN/KUM.1/12/2017.

3.2. Hybrid Approach

At the initial stage of this TA, a bottom-up approach was envisaged whereby the PT would engage all sector-relevant line ministries. The aim of such an approach is to creating a shared space where discussions on the prioritization of cross-sectoral projects, as well as Ministries' specific project pipelines for deeper financial analysis could be held. The PT's worldwide experience has shown that maintaining a close engagement and ongoing conversation with the local institutions and actors involved in the enhancement of the NDC leads to a higher degree of ownership and commitment by these actors contributing to the sustainability of the Project.

Even though the Ministry of Finance issued official letters to the relevant line ministries seeking their participation (see Stakeholder Involvement), and despite significant efforts exerted by the PT during the TA, the envisaged discussions and information sharing from governmental offices were limited and, consequently, the need to obtain complementary information and data for the assignment arose.

While a longer, deeper engagement with line ministries and other relevant stakeholders is preferred, a hybrid approach, including a top-down analysis, was proposed and agreed with the WB team in light of the tight project timeframe. This hybrid approach has allowed the PT to integrate meeting inputs into the listing and prioritization of programs extracted from official open sources. The top-down analysis has been informed by data from the following sources:

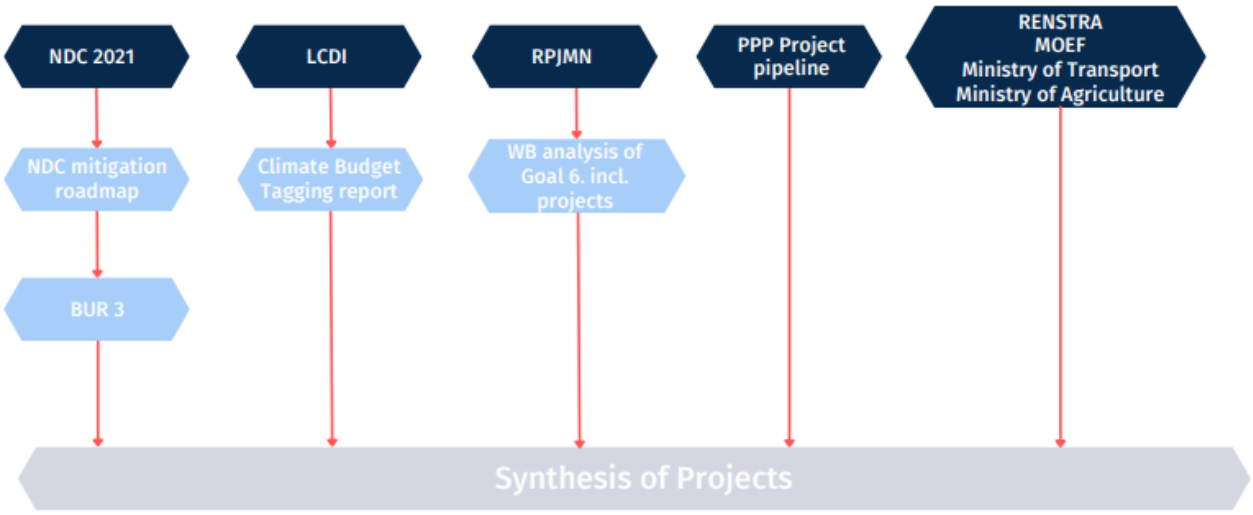

Figure 5: Outline of the data used to design the List of Project. Source: PT elaboration.

3.3. Stakeholder Mapping

The process of elaboration of the NDC shelf of projects is structured around a process of technical and analytical work together with a consultation process, which includes a series of focal group discussions and / or dialogues. To identify the stakeholders to be involved in the NDC Dialogues, desk-research, and a series of consultations with the project team members and the project partner in Indonesia have been undertaken. A synthesis of these relevant stakeholders has been presented in the Stakeholders' Map, categorized in 5 different tiers according to their level of power and influence:

- **Level 1 – Leader(s):** these stakeholders are top-level authorities and have the highest level of power and influence. They are the ones steering the process and in charge of strategic decision-making.
- **Level 2 – Partner(s):** these stakeholders are usually high-level authorities and work as core-decision makers. Decisions usually require their approval and support before they are enacted.
- **Level 3 – Influencer(s):** these stakeholders are influential on the addressed topic. Their concerns should be reflected in the decisions to be taken, because they are influential enough to affect the implementation of the decisions or have an influence on public opinion.
- **Level 4 – Feedback-giver(s):** these stakeholders are second-tier influencers. Their level of influence is lower than the stakeholders on level 3, but their involvement usually results in enhanced decisions. They are usually consulted for feedback and to ensure ownership.
- **Level 5 – Info-receiver(s):** these stakeholders are low-level influencers. They are not required to be involved in the decision-making process. However, they should be informed about the decisions taken.

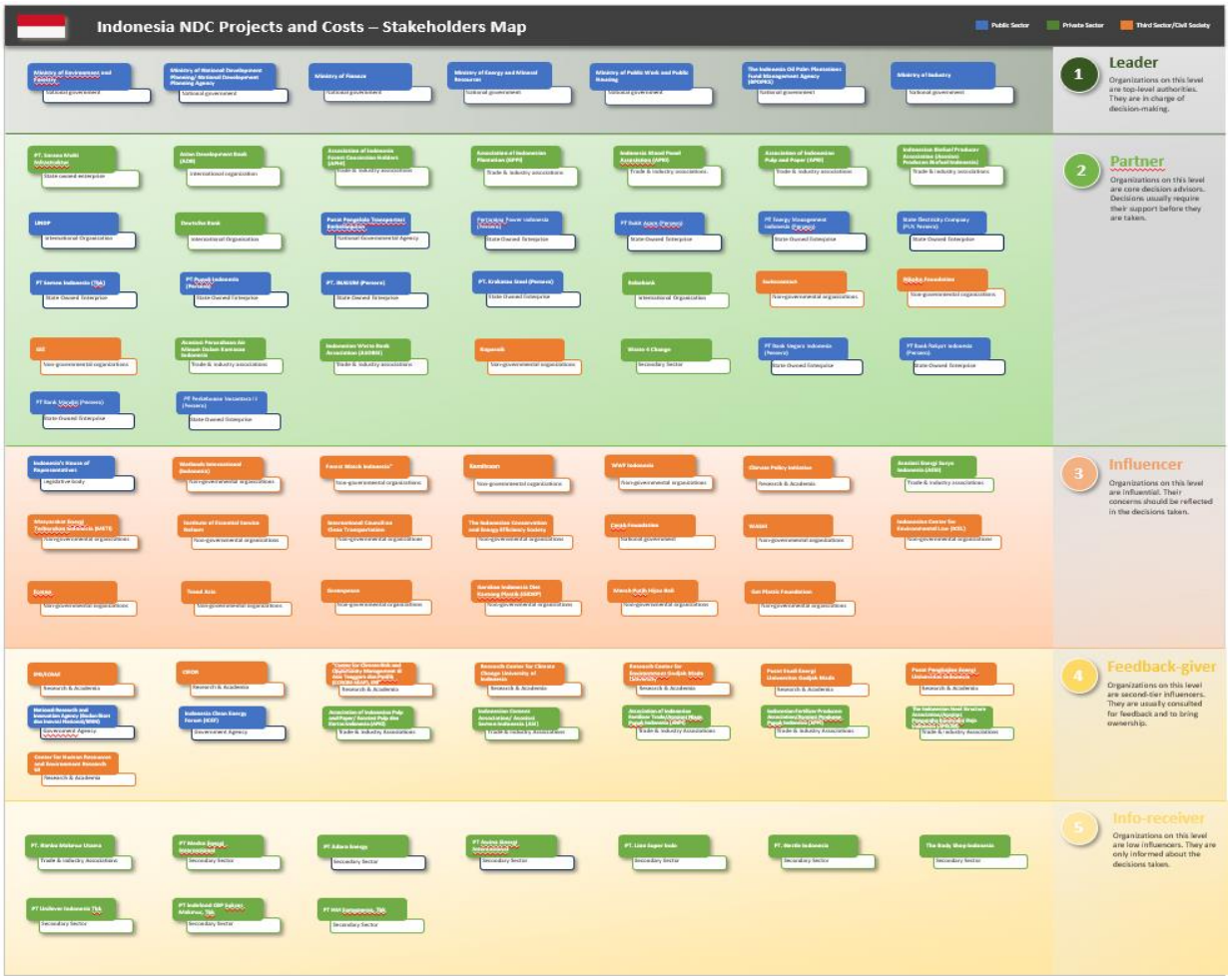

Figure 6: Stakeholder Map. Source: PT elaboration.

The Stakeholder Map and the Spreadsheet with the Stakeholder Identification can be downloaded from the following links:

- Stakeholder Map: https://docs.google.com/presentation/d/1_I-QPA_nsjC23DDGoCTEH9_qskImyQnh/edit?usp=sharing&ouid=113757822356841412557&rtpof=true&sd=true
- Stakeholder Identification Spreadsheet: https://docs.google.com/spreadsheets/d/1wI0hS9U0aP-_cUFlQnIJr9uqJdkw5XR9/edit?usp=sharing&ouid=113757822356841412557&rtpof=true&sd=true

While all the stakeholders identified exert some degree of influence on the NDC's climate actions, the PT has mainly focused on those at levels 1 and 2 as their impact is significantly higher. These are composed of line ministries and directorates whose policies and actions are more related to climate mitigation and adaptation:

Sector	Institutions and entities
AFOLU	Ministry of Agriculture (Kementan)
	Ministry of Environment & Forestry (MOEF)
Energy & Transport	Ministry of Energy & Mineral Resources (ESDM)
	Ministry of Transport (Kemenhub)
Industry	Ministry of Industry (Kemenperin)
Waste	Ministry of Public Works and Housing (PUPR)
	Ministry of Environment & Forestry (MOEF)
Others	Coordinating Ministry of Maritime & Investment Affairs
	Coordinating Ministry for Economic Affairs
	Ministry of Planning

Table 9: Most relevant governmental stakeholders (Tier 1 and 2) contacted. Source: PT elaboration.

Several meetings have been held formally and informally with identified key staff of the governmental stakeholders, aiming at presenting the Project and establishing bridges of communication to reach a higher degree of involvement. The meetings were to cover the following topics:

1) Inform the process of formulation and co-creation of the new NDC shelf of projects with the most relevant stakeholder groups in Indonesia;
2) Facilitate coordination and effectively obtain and verify the available information required for the elaboration of the NDC shelf of projects, as well as interactive discussions on how climate actions are tagged, financial instruments used, planning procedures, etc. with the objective of identifying opportunities and gaps for the country;
3) Present the initial findings and options identified by the project team; and,
4) Consult with the participants on their opinion and inputs presented.

In practice, these bilateral meetings have focused on obtaining relevant data on projects and programs contributing to Indonesia's NDCs, and to discuss about current opportunities and gaps in the budget tagging procedures. Most of these meetings have been bilateral between the stakeholder's staff and the PT. A summary of key meetings is provided in Annex 7.2.

A final, presentational workshop is scheduled to take place. The purpose being to present the Project's results and recommendations to a wider range of stakeholders, pursuing awareness raising and obtaining feedback on the results.

The Figure below depicts the consultation approach.

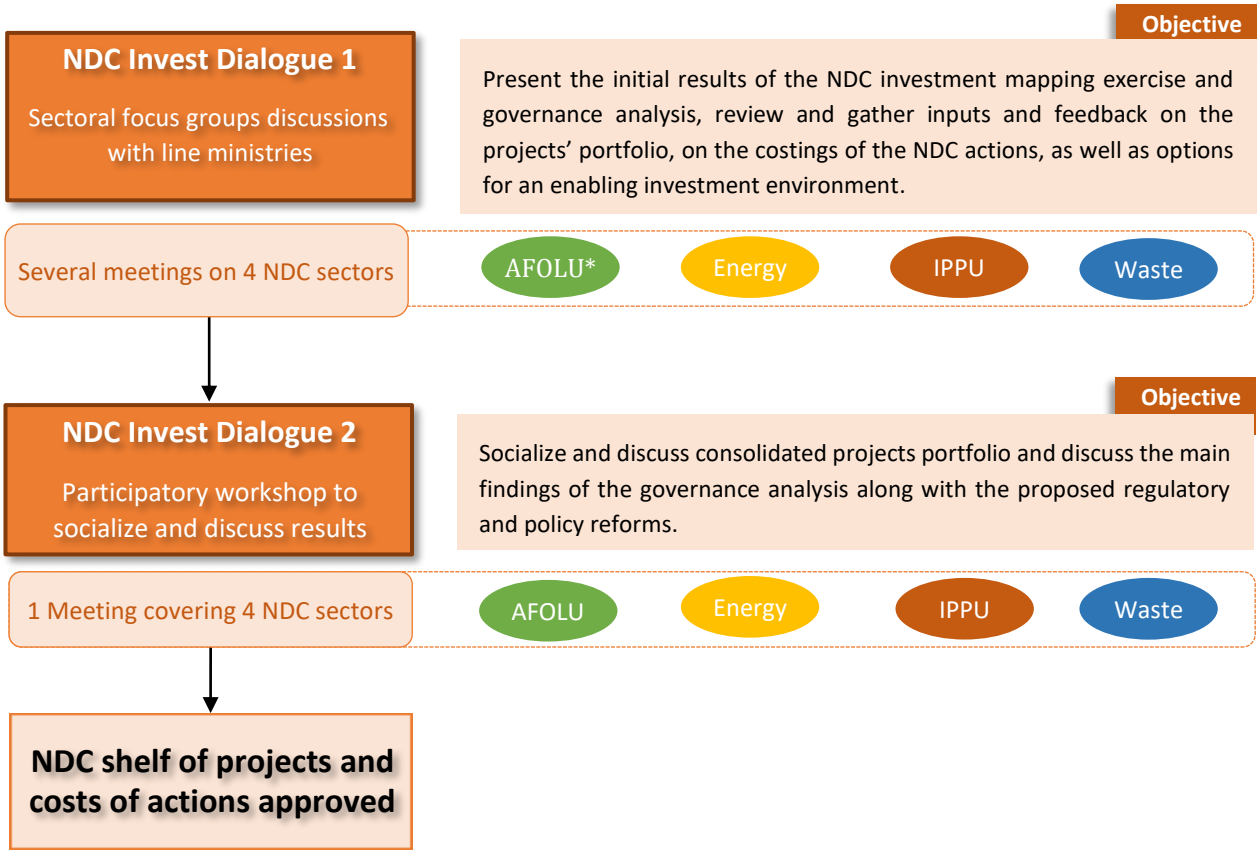

Figure 7: Consultation Process. Source: PT elaboration.

4. Key NDC Sectors

Based on several documents, including the NDC, the Third Biennial Update Report, the Strategic Plan of MoEF, the Climate Budget Tagging and the National Medium-Term Development Plan for 2020-2024, all relevant projects supporting NDC mitigation actions in Indonesia have been assessed from the financial standpoint. The information was collated in a database designed by the PT using Excel, highlighting the project name, sector, financial needs, climate mitigation and adaptation cost, return and remarks.

The financial assessment identifies and prioritizes projects according to the NDC unconditional and conditional targets. It also provides new technological developments and climate finance sources identified with a potential interest in terms of both mitigation and adaptation. Many projects are categorized by sector and sub-sector, with an annual cost estimation. The assessment of the financing needs, gaps and opportunities by sector enables also to better understand the state of progress of the NDC-related projects, given the different development stages identified.

This section should be read alongside the List of projects provided in the Excel spreadsheets. The *Projects List* file includes all the projects that have been identified through our research. The first worksheet tab provides an overview of all projects identified, across sectors, whereas the following worksheet tabs include the projects by sector: AFOLU. Energy and IPPU, and Waste.

The PT has been able to estimate the financing needs of most projects related to the AFOLU and Energy and IPPU sectors. Due to the decentralized nature of project financing in the waste sector, and a lack of data made available by governmental stakeholders, it has not been possible to assess waste sector financing needs. To mitigate this, an alternative approach was developed intended to complement the Projects List. The "*Complementary Projects List*" prepared by the PT lists relevant projects for each sector and their financial needs. It uses a fundamentally different approach to the *Projects List* which is based on official government data. For that reason, the data are not compatible. It does include an assessment of waste sector financing needs.

Nevertheless, by comparing both outcomes a deeper understanding is achieved. As a next step, this project inventory may usefully be expanded with climate benefits information, currently unavailable, and additional departmental data sets.

4.1. Brief analysis of policy, regulatory and institutional arrangements related to the financial needs

The updated NDC and the Long-Term Strategy for Low Carbon and Climate Resilience 2050 (LTS-LCCR 2050) present Indonesia's sustainable vision beyond the Paris Agreement targets, with a balance between emissions reduction and economic development. The long-term strategy also outlines Indonesia's goal to reach peak national GHG emissions by 2030, with a net sink in the forestry and land use sectors, and to progress further towards net-zero emissions by 2060 or sooner. Similarly, it aims to reduce the country's potential GDP loss by 3.45% due to climate change in 2050 by enhancing resilience in four basic socio-economic development needs: food, water, energy, and environmental health.

According to statements by the Minister of Finance, Sri Mulyani, including recently during the third G20 Finance Ministers and Central Bank Governors meeting, under the G20 Presidency of Indonesia, Indonesia needs more than USD 300 billion in climate finance to reach the 2030 NDC target.

Around 4.1% of the State budget is expected to be mobilized for emissions reduction efforts. Between 2018 and 2020, a total of circa 102.6 trillion IDR (8.78 billion USD) was set aside for climate projects in the national budget. However, according to independent analysis this amount covered approximately one third of the projected mitigation project costs and was thus insufficient to meet the unconditional NDC commitment.

To guide and support mitigation project development and investment, different regulations, laws and policies exist, such as the Law 7/2021 introducing the carbon tax to finance the NDC. However, implementation of Law 7/2021 appears to have been delayed from its original April 2022 start date. This may reflect an ongoing debate among policy makers and experts about the pros and cons of a carbon price signal. Some analysts posit that a carbon tax affects the affordability of electricity, putting the GoI goal of ensuring universal energy access by 2030 at risk. The potential increase in electricity prices could also adversely affect households from the lowest income groups, many of which are considered energy poor. As electricity costs account for 80% of production costs in some industries, the increasing cost of electricity due to the carbon tax would lead to a price increase for consumers, make products less competitive, and possibly disrupt exports. Others point to the need to provide stronger incentives for investment in renewable energy and reducing the cost to the taxpayer of subsides to fossil power generation and consumption. Further arguing that the current minimum rate of IDR30,000 per ton CO2e (USD2.02), the tax rate is too low to trigger behavioral change. Without corrective measures, a carbon tax could inflate fossil fuel subsidies, as the GoI may increase subsidies for some producers or consumers to offset the increased cost of fossil power generation, to prevent a significant effect on electricity affordability without adding substantial revenue, ultimately putting more pressure on the state budget.

In our assessment, in the absence of an effective carbon market, emitters are likely to absorb a low tax rather than obtain carbon credits. The carbon tax as currently implemented may not lead to a significant reduction in GHG emissions, and hence its contribution to the NDC unconditional target may remain limited. At the current rate the tax is unlikely to trigger behavioral change.

Meanwhile, the GoI continues to impose a Domestic Market Obligation (DMO) for domestic coal producers that require them to set aside 25% of their production for power generation at subsidized prices, which guarantees sales of coal to power plants and further demotivates coal producers to reduce production or find greener alternatives for power generation. The continuation of fossil fuel subsidies, including the coal for power generation subsidy, will also reduce the likelihood of behavioral change.

The Ministry of Finance is currently drafting various technical regulations for implementing the carbon tax. Those technical regulations will cover tariffs and the basis for imposition, methods for calculating, collecting, paying or depositing, and reporting, as well as a carbon tax roadmap. Meanwhile, other technical regulations, such as the Emission Upper Limit for the Coal Based Power generation sub-sector and procedures for implementing the Carbon Economic Value in power plants will be determined by the Ministry of Energy and Mineral Resources.

In order for climate control instruments to run optimally, the GOI is also preparing various derivative regulations from the Presidential Regulation 98/2021, including those related to the implementation of

carbon economic values (NEK) and the NDC at the Ministry of Environment and Forestry (KLHK) with a Carbon Economic Value Steering Committee at the coordinating Ministry for Maritime Affairs and Investment. The imposition of the carbon tax is to be carried out in stages by taking into account the priorities in achieving the NDC target, the development of the carbon market, sector readiness, and Indonesia's economic condition.

Other regulations are indirectly important to consider when assessing the financial needs of the NDC.

Table 10 below presents a comprehensive overview of relevant regulations, laws and policies.

Regulation	Summary of the regulation
Related to NDC, Climate Change, and its Financing	
Law Number 6/1994 on the Ratification of the United Nations Framework Convention on Climate Change (UNDCCC)	Indonesia agreed to and signed an agreement with the United Nations Framework Convention on Climate Change during the Earth Summit in Rio de Janeiro Brazil from June 3 to June 14, 1992. Its purpose is to mitigate the increasing concentration of greenhouse gases in the atmosphere. The Government of Indonesia has responded positively to the commitments of developed countries to provide financial and technological assistance as stipulated in the United Nations Framework Convention on Climate Change. In an effort to prevent the continuation of climate change that is detrimental to the environment and human life, the international community through the United Nations has agreed to pursue the reduction of greenhouse gases that were projected in 1990.
Law Number 17/2004 on the Ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC)	The Kyoto Protocol regulates the reduction of GHG emissions resulting from human activities so as to stabilize GHG concentrations in the atmosphere and not endanger the Earth's climate system. The Kyoto Protocol establishes rules regarding the procedures, targets, mechanisms, emission reduction mechanisms, institutions, as well as compliance and dispute resolution procedures. Ideas and programs to reduce GHG emissions internationally have been developed since 1979. The program gave rise to an idea in the form of an international treaty, namely the Convention on Climate Change, which was adopted on May 14, 1992, and entered into force on March 21, 1994. By ratifying the Kyoto Protocol, Indonesia has adopted the Protocol to be elaborated in the framework of the national law, then, be elaborated in the regulatory and institutional framework; therefore, it can: a. Affirming commitments to the Convention on Climate Change based on the general principle but differentiated responsibilities principle b. Implementing sustainable development, especially to maintain the concentration of GHGs in the atmosphere so as not to endanger or maintain the stability of earth's climate; c. Opening up new investment opportunities from industrialized countries to Indonesia through MPB; d. Encouraging cooperation with industrialized countries through MPB to improve and strengthen capacity, legal, institutional, and technology transfer for GHG emission reduction;

	e. Accelerating the development of industry and transportation with low emission levels through the utilization of clean and efficient technology and renewable energies; f. Increasing the ability of forests and land use to absorb GHG
Law Number 31/2009 on Meteorology, Climatology and Geophysics	The national and international strategic environment demands the implementation of meteorology, climatology, and geophysics in accordance with the development of science and technology, regional autonomy, and accountability of state administrators while prioritizing public safety and security in the national interest. The development of science and technology that affects the implementation of meteorology, climatology and geophysics globally needs to be anticipated and responded to through international cooperation.
Law Number 32/2009 on Environmental Protection and Management	The objectives of environmental protection and management efforts are listed in Article 3 of Law Number 32 of 2009, namely: a. Protect the territory of the Republic of Indonesia from pollution and or environmental damage. b. Ensure safety, health and human life. c. Ensure the continuity of life of living things and the preservation of ecosystems. d. Maintain the preservation of environmental functions. e. Achieve harmony and environmental balance. f. Ensure the fulfilment and protection of the right to the environment as part of human rights, for the present and future generations. g. Control the wise use of natural resources. h. Realize sustainable development
Law Number 16/2016 on the Ratification of the Paris Agreement	Due to rising temperatures is an increasingly serious threat to humanity and the planet, it requires more effective cooperation between countries. To control the continuation of climate change, the Government of Indonesia together with members of the international community through the COP-21, on December 12, 2015, have adopted the Paris Agreement to the United Nations Framework Convention on Climate Change which was followed up with the signing of the agreement on April 22, 2016, in New York, United States of America.
Law Number 7/2021 on the Harmonization of Tax Regulations	On October 7, 2021, the GoI passed the law named UU HPP, to revise several existing tax laws and introduce a new carbon tax. This is the first time Indonesia imposed any taxation on carbon emissions. Carbon taxes are imposed in order to control greenhouse gas emissions to support Indonesia's NDC achievement. The carbon tax follows a cap and tax scheme, which imposes a tax for carbon emissions beyond a stipulated cap. The GoI is set to pilot the tax in the coal-fired power generation sector beginning in April 2022. In its ambitious aspiration to reduce CO_2 emissions, the GoI plans to establish both a carbon trading market system and to expand the carbon tax to other sectors beyond coal-fired power generation in 2025. By Law, the carbon tax rate is set to be higher than or at market price, with a minimum rate of IDR 30 (US$ 0.002) per kilogram of CO_{2e}, or US$ 2.13 per ton of CO_{2e} emission above the stipulated cap. CO_{2e} is a representation of greenhouse gas emissions that includes CO_2, nitrous oxide (N_2O) and methane (CH_4) compounds. This revenue from carbon taxes can be allocated for climate

	change mitigation efforts.
Presidential Regulation Number 98/2021 on Implementation of the Carbon Economic Value for the Achievement of the NDC Target and GHG Emission Mitigation	This Presidential Regulation aims to regulate the reduction of GHG Emissions, enhancement of Climate Resilience, and Carbon Economic Value in the context of achieving the NDC target, referring to the GHG Emission Baseline in 2030 of 2,869 million tons of CO2e as well as the Climate Resilience Baseline and Target. It states that Indonesia's effort to meet its commitment to reduce carbon dioxide (CO2) emissions by 29% (834 million tons of CO2e) on its own or 41% (1,185 million tons of CO2e) with international support by 2030. The reduction of GHG Emissions is mainly supported by controlling GHG Emissions in the forestry sector to become carbon storage/strengthening in 2030 with a carbon net sink approach from Indonesia Forest and Other Land Use Net Sinks 2030.
Presidential Regulation Number 77/2018 on Environmental Fund Management	Environmental fund management is carried out through activities such as, fundraising; fund fertilization; and disbursement of funds. The fund-raising instruments includes: Pollution Management Fund and/or Environmental Damage and Environmental Recovery; and Trust Fund/Conservation Assistance. It comes from government budgets (APBN/APBD) collected from environmental taxes and levies; while for the trust fund/conservation assistance comes from grants and donations. The fund fertilization is carried out through: banking instruments; capital market instruments; and or other financial instruments in accordance with the laws and regulations. The distribution of environmental funds is carried out in accordance with the agreement in the contract through the following mechanisms: carbon trading; loan; subsidy; grant; and/or other mechanisms in accordance with the provisions of the legislation. To carry out the management of environmental funds, a non-echelon organizational unit is formed that carries out the function of managing environmental funds using the pattern of financial management of public service agencies. The non-echelon organizational unit is formed by the Minister of Finance. Non-echelon organizational units may appoint and assign a Custodian Bank as a trustee.
Government Regulation Number 46/2016 on Procedures for Conducting Strategic Environmental Studies	The Republic of Indonesia is now entering a new phase in the implementation of Environmental Management after the enactment of Law No. 32/2009 concerning the Protection and Management of the Environment. This law mandates several instruments of prevention of pollution and/ or damage to the environment, one of which is the Strategic Environmental Assessment (SEA). The potential environmental impacts and/ or risks that may be resulted by a Policy, Plan, and/or Program, before the enactment can be anticipated through the SEA. The Policy, Plan, and/or Program that have impact and/or damaging risk to the environment in accordance with Law No. 32/2009 concerning the Environmental Protection and Management includes Policy, Plan, and/or Program that could potentially resulting in impact and/or risk including the increasing climate change, increasing damages, deterioration or extinction of biodiversity, increasing the intensity of floods, landslides, drought and/or forest and land fire, reducing the quality and abundance of natural resources, increasing changes in the use and/ or conversion of forest areas, especially in areas where the conditions are classified as critical, increasing the number of poor people or endangerment/threat sustainability subsistence of group of

	society and/or increasing the risks to human health and safety. This Government Regulation includes the major points of regulation including the implementation of Strategic Environmental Assessment (SEA), involvement of community and stakeholders, coaching/ guidance, monitoring and evaluation, and financing.
Related to the Energy sector	
Law Number 30/2007 on Energy	This law has a focus on to: ● Improve energy accessibility for underprivileged people and people in remote areas. Thus, priority is given to underdeveloped areas, remote areas, and villages that use local energy sources, particularly renewable sources. ● Establish a National Energy Council which will later formulate national energy policies and determine responses to the energy crisis. ● Encourage central and local governments to increase the supply of new and renewable energy. ● Make sure that business entities/individuals that provide energy from new and renewable sources can obtain facilities and/or incentives from the central or local government.
Law Number 30/2009 on Electricity	● Electricity development in Indonesia aims to secure sufficient electricity supply of good quality and affordable for the welfare of the community towards sustainable development. ● SOEs have the priority for electrification of unserved regions, if they cannot take up this task, then private/regional government companies can do so. If private companies/local governments do not pursue electrification of unserved areas, the central government should assign a state-owned enterprise to serve those areas. ● Electricity business activities are carried out based on permits issued by the central and regional governments. Licensing authorities also approve tariffs with the approval of the relevant legislature. The central government grants permits to electricity providers who 1) have business areas that cross provincial borders, 2) are state-owned companies, or 3) sell electricity to companies licensed by the central government.
Government Regulation Number 79/2014 on National Energy Policy (KEN)	The target for increasing renewable energy in the national energy mix for 2025 is 23% and for 2050 is at least 31%.
Presidential Regulation Number 22/2017 on the General National Energy Plan (RUEN)	RUEN is a government policy on an energy management plan which constitutes the application and implementation of energy policy across sectors to achieve the targets of the National Energy Policy (KEN). RUEN serves as a reference document for the development of: ● National and local government planning documents ● General Plan of National Electricity (RUKN) and Electricity and Supply Business Plan (RUPTL) ● National state budget (APBN) and regional budget (APBD) The RUEN mandates a reduction in energy intensity by 1 per cent annually during the period of 2015-2025 and reductions in the final energy consumption by 17% and 39% by 2025 and 2050 respectively.
Presidential Regulation Number 48/2011 jo. Presidential Regulation No. 4/2010 concerning the Assignment of	Implementation of accelerated development of power plants that use renewable energy, coal, and gas is carried out through Government assignment to a State Electricity Company, hereinafter referred to as PT PLN (Persero) and through cooperation between PT PLN (Persero) and private power developers

the State Electricity Company to Accelerate the Development of Power Plants Using Renewable Energy, Coal, and Gas	with a power purchase scheme. Power plants that use renewable energy, coal, and gas as referred to must use environmentally friendly technology following the provisions of laws and regulations. PT PLN (Persero) submits a periodic report every 3 (three) months regarding the implementation of the power plant and related transmission to the Minister of Energy and Mineral Resources and the Minister of State-Owned Enterprises.
Presidential Regulation Number 8/2011 on Basic Electricity Tariffs Provided by PLN	Rates are adjusted differently for each fare class. Some classes, including the smallest household consumers, did not increase, while others increased substantially.
Minister of Energy and Mineral Resources Regulation Number 33/2014 concerning Service Quality Levels and Costs Associated with the Distribution of Electricity by the State Electricity Company (PT PLN)	PT PLN is obliged to fulfil and improve the level of quality of electric power service and also announce the amount of quality level of electric power service and its realization in each service unit and places that are easily known to consumers for each quarter.
Ministry of SOE Decree SK-252/MBU/07/2020 concerning the Establishment of an Acceleration Team for the Development and Utilization of Solar Energy in SOEs to achieve the 2025 energy mix target	There are 2 schemes: (i) a system that can save APII's electricity consumption; (ii) LEN will rent their rooftop for solar power installation. Through this collaboration, it is expected to know how much renewable energy needs to be installed and what the optimal use is. Then, the executor of the construction is a joint venture formed by LEN Industry, Pertamina, and PLN.
MEMR Regulation Number 50/2017 on The Utilization of Renewable Energy Sources for the Provision of Electricity	In order to provide a sustainable supply of electricity, PT PLN (Persero) is obliged to purchase electricity from power plants that utilize renewable energy sources. Utilization of Renewable Energy Source for electricity supply shall refer to National Energy Policy and National Electricity General Plan. In the process of selection, PT PLN (Persero) prioritizes PPL that use local content following the provisions of laws and regulations. The local content used in the power plant utilizing Renewable Energy Sources must fulfil: a. Indonesian national standards in the field of electricity; b. International standards; or c. Standards of other countries that do not conflict with the International Organization for Standardization (ISO) or International Electrotechnical Commission (IEC) standards.
MEMR Regulation Number 38/2016 on Acceleration of Electricity Supply in Undeveloped Rural Areas, Remote Areas, Border Areas, and Small Islands with Residents through the Application of Small-Scale Power Supply	To fulfil the electricity in remote areas, the Government through the Ministry of Energy and Mineral Resources has targeted electricity provided for 2,500 villages by the end of 2019. To achieve these targets, the Minister of Energy and Mineral Resources Regulation No. 38/2016 on Accelerating the Rural Electrification in Developing yet Isolated, Border and Small Island inhabited Through Implementation of Electricity Supply Business Small Scale. Through this regulation, Regional-Owned Enterprises (enterprises), privates, and cooperatives can manage a business area, which is not yet covered. This acceleration program of rural electrification is also proposed to the massiveness of the renewable energy utilization as the power sources.

MEMR Regulation Number 49/2018, jo. MEMR Regulation Number 13/2019, jo. MEMR Regulation Number 16/2019, jo. MEMR Regulation Number 26/2021 on The Use of Rooftop Solar Power Generation Systems by PLN Customers	The Government of Indonesia is encouraging the development of rooftop PV projects as its global commitment to reduce greenhouse gas emissions. GoI also opens the possibility for trading carbon credits generated from solar PV systems. Anticipating the removal of the discount on exported energy, the extension of the setoff period, and the introduction of quicker licensing processes will generate significant interest among customers seeking to develop rooftop solar PV projects. Against this context, it remains to be seen how the Government will deal with private developers seeking to provide electricity generation capacity for customers through "corporate PPA" schemes.
Related to the Agriculture sector	
Minister of Agriculture Regulation Number 39/PERMENTAN/HM.130/8/2018 on Early Warning System and Management of the Impact of Climate Change on the Agricultural Sector	Early warning is a key factor in disaster risk reduction, including disasters caused by climate change. In this regulation, an early warning system is defined as a series of systems designed to provide information on the impact of climate change in the agricultural sector to the public. WMO (2015) states that early warning systems are expected to have the characteristics of impact based forecasting and risk based warning, meaning that the predictions produced are expected to provide an overview of the resulting impact, in addition, the early warning system can also provide information about the amount of risk posed if no adaptation measures are taken. A qualified early warning system needs to be built using a reliable and adequate climate information system. Meanwhile, the climate information system is a design of how the flow of information from the results of observations, analyses, and how the flow of information from the results of observation, analysis, data processing and storage in the form of a database that is accessible by users. Further development of the existing system is to make it on a national scale. For the benefit of the Agricultural Sector, data is needed not only at the national level but also at the global level. Also, data from various countries at a global level, so that it can anticipate seasonal regularity patterns in other regions to determine the provision of adequate national food stock.
Related to the FOLU sector	
Minister of Environment and Forestry Regulation Number 33/2016 on Guidelines for Preparation of Climate Change Adaptation Actions	Climate change could be directly or indirectly caused by activities of humans that cause changes in the composition of the atmosphere globally and also in the form of changes in natural climate variability that are observed over comparable periods. Stages of preparing climate change adaptation actions as intended are carried out, among others through: a. identification of target coverage areas and/or sectors; b. and the problem of climate change impacts; c. preparation of climate vulnerability and risk assessment; d. preparation of climate change adaptation action options; e. prioritization of climate change adaptation actions; f. integrating climate change adaptation actions into development policies, plans, and/or programs;

	g. policies, plans, and/or development programs.
Minister of Environment and Forestry Regulation Number 71/2017 on the Implementation of the National Registry System for Climate Change Control	SRN PPI is system management and provision of web-based data and information on actions and resources of climate change adaptation and mitigation in Indonesia. Climate Change Adaptation is an effort made to improve the ability to adapt to climate change, including climate variability and extreme events so that the potential damage due to climate change is reduced, opportunities caused by climate change can be utilized, and the consequences arising from climate change can be overcome. The implementation aims to: a. data collection of actions and resources for adaptation and mitigation of climate change; b. government recognition of the contribution of various parties to climate change control efforts which consists of adaptation, mitigation, funding, technology, and capacity building; c. provision of data and information to the public about actions and resources and their achievements; and d. avoiding double counting of adaptation and mitigation actions and resources as part of managing the principles of clarity, transparency and understanding (CTU).
Minister of Environment and Forestry Regulation Number 72/2017 on Guidelines for Implementation, Measurement, Reporting, and Verification of Actions and Resources for Controlling Climate Change	Climate Change Mitigation Action is carried out through stages of activity: measurement; reporting; and verification. Measurement of Climate Change Mitigation Action in this guideline is aimed at determining the level and status of GHG emission from a business and/or activity in the condition before and after performing Climate Change Mitigation Actions with the following procedures: (i) Planning, (ii) Implementation, (iii) Evaluation along with constraints and barriers.
Minister of Environment and Forestry Regulation Number P.7/MENLHK/SETJEN/KUM.1/2/ 2018 on Guidelines for the Study of Vulnerability, Risk, and Impact of Climate Change	This regulation provides guidelines for the Government, local Governments, and communities for: - Determining the scope of analysis, selection of methods, indicators, and data sources in the preparation of Climate Change Vulnerability, Risk and Impact Studies; or - Determining the criteria for verification of the results of the Vulnerability, Risk and Climate Change Impact Assessment. The determination of the scope of analysis based on the purpose of utilizing the study results for decision-making purposes: a. utilization of macro-level analysis for national interests; b. utilization of mid-level analysis for the benefit of provincial regions; c. utilization of micro-level analysis for the benefit of districts/cities; and d. utilization of site-level analysis for the benefit of sub-districts and villages.
Minister of Environment and Forestry Regulation Number 84 of 2016 on the Climate Village Program.	Climate Village Program hereinafter referred to as ProKlim is a national scope program that is managed by the Ministry of Environment and Forestry in order to increase the involvement of community and other stakeholders to strengthen adaptation capacity to the impacts of climate change and reduce greenhouse gas emissions as well as recognise climate change adaptation and mitigation efforts that have been carried out that can improve welfare at the local level in accordance with regional conditions.

	It is an effort to increase the capacity of various parties to support the establishment and implementation of ProKlim in order to improve the adaptation and mitigation of climate change at the local level. It is conducted by the government, local government and ProKlim supporters.
Minister of Environment and Forestry Decree Number 679 of 2017 on Monitoring the Implementation of Nationally Determined Contributions (NDC)	This regulation inaugurates NDC Implementation Monitoring, Steering Committee, and Technical Team for NDC monitoring. Steering Committee and Technical Team consist of representatives from relevant ministries/institutions and experts. In the decree, the Chairperson of the Steering Committee is mandated to establish a Secretariat that will assist in the operational monitoring and reporting of NDC implementation carried out by Ministries/Institutions at the national level, with a time frame of 2017-2019 (pre-2020) and 2020-2030 (post-2020). As a follow-up to the decree, in November 2018 KLHK published the book Mechanism of NDC Implementation Monitoring which provides further information on the flow of monitoring and reporting of NDC mitigation and adaptation actions carried out by Ministries/Institutions at the national level. Monitoring of the implementation of NDC mitigation and adaptation actions in each Ministry/Institution is expected to be coordinated by the working unit/group in each respective Ministry/Institution. Meanwhile, NDC implementation refers to the MRV mechanism that has been developed, using the information system through the National Registry System for Climate Change Control (SRN-PPI), which will cover both climate change mitigation and adaptation activities. For climate change mitigation activities, monitoring will be conducted on: a. Important influential activities (enabling conditions) that include aspects of policies and institutions, funding for mitigation actions, technology development, research and development (R&D), capacity building and public awareness, and law enforcement and compliance; and b. Activities that can directly reduce GHG emissions in each of the 5 sector categories (forestry, energy, waste, agriculture, and IPPU).
Related to the Waste sector	
Law Number 18/2008 on Waste Management	Developing countries are experiencing the same problem where the amount of waste is increasing due to material consumption led by economic growth, especially in Indonesia, the level of waste is increasing very quickly also due to industrial development. This regulation shows a roadmap for optimizing the utilization of local plastic waste as raw material for the recycling industry, targeting to: a. Reduce the need for plastic scrap as raw material from imports b. Support circular economy mechanism in local communities (Waste Bank scheme). c. Develop a Task Force for the Supervision of Non-Hazardous Waste Import, including handling illegal traffic. This task force is coordinated by the Ministry of Trade whose members come from several related agencies such as the Coordinating Ministry for Maritime and Investment Affairs, MoEF, Ministry of Industry, Ministry of Foreign Affairs, and Customs. d. Oversee national surveyors in providing guidelines to conduct verification in the country of origin of waste prior to shipment.

Presidential Regulation Number 35/2018 on the Acceleration of the Development of Waste Processing Installations into Environmentally Friendly Technology based Power	Waste management aims to improve public health and environmental quality, significantly reduce the volume of waste for the sake of cleanliness and beauty of the city and to turn waste into a resource. In waste management, it is proposed to accelerate the construction of waste-to-energy processing installations based on environmentally friendly technology. Required funding for the acceleration of the construction of Waste-based Power Generation is sourced from the regional revenue and expenditure budget. This could be supported by the state revenue and expenditure budget or other sources in accordance with statutory regulations.

Table 10: Regulatory and institutional arrangement. Source: PT elaboration

4.2. Agriculture and Forestry

Despite being one of the priorities in the GoI development agenda, climate change mitigation activities are generally deemed under-resourced. Table 11 and Table 12 detail the annual budget allocation for each type of mitigation action. The PT has made the following observations:

- ✓ Current policies and programs in the AFOLU sectors are predominantly oriented towards reduction of deforestation and forest degradation. There are at least two important categories of mitigation in the FOLU sector that lack funds: enhancing SFM and peatland restoration.
- ✓ The budget analysis of the NDC and LTS-LCCR was prepared before the Covid-19 pandemic struck. Since, a major reallocation of budget has occurred in order to manage the pandemic and subsequent recovery efforts.
- ✓ In assessing project costs and budgets, we observed that the standard costs of activities, set by DG Regulation, vary across MOEF Directorates. Some have updated costs, whereas others have not. This needs re-alignment.
- ✓ According to the Bank Indonesia, the rate of inflation for July 2019 was 3.32%, increasing to 4.94% in July 2022. The inflation will need to be reflected in the detailed climate action budgeting post-2022.
- ✓ In 2020 Indonesia's government passed the Omnibus Law with the objective of creating more jobs and raising foreign and domestic investments by reducing regulatory requirements for businesses. Some regulations concerning forest use permits have since been updated. For example, Regulation No. 6/2007 about forest planning has been revoked and replaced by Regulation No. 23/2021. This is expected to influence the total area targeted under the NDC.
- ✓ Through the Presidential Regulation No.77/2018, the GoI established an Agency for Environmental Funds Management (Badan Pengelola Dana Lingkungan Hidup - BPDLH) which is expected to mobilize funding resources from domestic as well as international sources.
- ✓ Finally, in addition to the national state budget (APBN) and local government budgets, a potential source of funds may be revenue from carbon trading and/or a carbon tax. Since the adoption of Presidential Regulation No. 98/2021, relevant ministries are preparing derivative regulations for the operationalization of both trading and taxation, which is tentatively scheduled to come into force for all sectors in 2024.

Responsible Unit	Budget (million Rupiah)					
	2020	2021	2022	2023	2024	Total
DG Climate Change	182893	218.000	254.000	290.000	326.000	1.270.893
DG Forest planning and environmental management	3.822	11.611	13.129	13.773	13.180	55.514
DG Natural Resources and Ecosystem Conservation	2.738.015	3.220.278	3.511.043	3.826.448	4.120.892	17.416.676
DG Social Forestry and Environmental Partnership	61	151.200	182.300	142.200	124.100	660.400
DG Sustainable Production Forest Management	9.328	8.336	9.170	10.087	11.095	48.016
DG Watershed and Protected Forest	4.795.000	5.103.000	5.369.000	5.611.000	5.904.000	26.782.000
Directorate General of Pollution and Environmental Damage Control	332.546	500.000	650.000	850.000	-	2.332.546
Grand Total	**8.122.204**	**9.212.425**	**9.988.641**	**10.743.508**	**10.499.267**	**48.566.044**

Table 11: Annual budget allocation for activities in RENSTRA with direct impacts on emission reduction. Source: PT elaboration based on RENSTRA.

Responsible Unit	Budget Allocated (million Rupiah)					
	2020	2021	2022	2023	2024	Total
DG Climate Change	130.380	161.900	184.150	194.250	209.000	879.680
DG Forest planning and environmental management	457.396	566.033	586.887	587.949	619.990	2.818.256
DG Law Enforcement	295.771	577.970	703.270	870.970	1.022.570	3.470.553
DG Natural Resources and Ecosystem Conservation	82.500	98.760	92.520	93.780	95.040	462.600
DG Social Forestry and Environmental Partnership	438	655	710	728	769	3.300
DG Sustainable Production Forest Management	101.547	104.699	94.901	98.759	102.941	502.848
DG Watershed and Protected Forest	72.500	76.360	80.220	84.080	87.940	401.100
DG Watershed and Protected Forest, DG Climate Change, and DG Forest planning and environmental management	270	377	395	415	436	1.893
Directorate General of Pollution and Environmental Damage Control	683.463	1.065.000	1.309.600	1.575.000	1.749.200	6.382.263
Grand Total	**1.824.266**	**2.651.755**	**3.052.654**	**3.505.933**	**3.887.886**	**14.922.493**

Table 12: Annual budget allocation for activities in RENSTRA which support or create enabling condition for emission reduction. Source: PT elaboration based on RENSTRA.

4.2.1. Financial Analysis

Even if agriculture is not as economically important as before, it is still vital to the overall health of the Indonesian economy. Viewed from the amount of land under production, the main food crops are rice, corn, cassava, soybeans, and peanuts. Additionally, Indonesia is among the top producers and exporters of tree crops such as rubber, copra, palm oil, coffee, cocoa, and spices (Ministry of Agriculture, 2001).

The agricultural sector is negatively impacted by climate change, especially small farms, which are particularly vulnerable to climate-related calamities including floods and droughts, as well as insect assaults that might result in output failure. Resources, agricultural infrastructure, agricultural production methods, food security and independence issues, as well as the welfare of farmers and the society at large, are just a few of the many ways that climate change is having an influence on the agricultural sector. An adaptation action program in the food crops and horticulture sectors as the major focus in order to boost productivity and preserve national food security is one of the common tactics and policies for combating climate change impacts on agriculture.

To address the challenges of adapting to the effects of climate change and ensuring food security and economic prosperity in Indonesia's agricultural sector, many stakeholders have been engaged at international, national and local level. The Ministry of Agriculture has been in charge of defining an action plan with its Draft Plan for 2024. The Asian Development Bank and the World Bank have also addressed the issue of sustainability and adaptation of the agricultural sector in Indonesia, and are therefore participating in the financing process. Taking into account the multilateral agreement reached at COP21 in Paris, the country has also updated its NDC, reflecting the political will to reduce emissions and fight against climate change.

For the full implementation of the 63 projects, a total of USD1.86 billion has to be allocated to the agricultural sector. Among this amount, USD20 million will be dedicated to mitigation projects and USD1.85 billion to adaptation.

These funds will be dedicated to enhance several aspects of the agricultural sector in Indonesia such as agricultural policies, natural resources management, biologic processes, land use management, research and development, etc. Some projects can be highlighted as they were the most expansive: implementation of a water efficient system in the paddy field, feed supplement for cattle, management of food plant seed supply system, seed and seedling provision, improvement of livestock production and strengthening the agricultural education system.

Based on the following references and cost components, we present below the operational expenditure for specific mitigation actions in ranges (min - max), with costs varying across regions:

- ✓ Standard cost for each unit of activity at DG Watershed and Forest Rehabilitation 2022
- ✓ Standard cost for each unit of activity at DG Natural Resources and Ecosystem Conservation 2021
- ✓ Standard cost for each unit of activity at DG Watershed and Protected Forest 2018

Rehabilitation cost components:

- ✓ Development of annual plans (a number of rehabilitation projects have sepcific preparation costs). *Penyusunan rencana tahunan (bebeberapa kegiatan RHL memiliki standar biaya penyusunan/ prencanaannya sendiri)*
- ✓ Development of activity planning. *Penyusunan rencana kegiatan*.
- ✓ Planting. *Penanaman*.
- ✓ Maintenance. *Pemeliharaan*.
- ✓ Monitoring and evaluation

Costs vary for each different region as follows:

Region	Provinces
I (lowest)	Banten, Jawa Barat, Jawa Tengah, DI Yogyakarta, dan Jawa Timur
II	Sumatera Utara, Sumatera Barat, Sumatera Selatan, Jambi, Lampung, Bengkulu, Riau, Bali, dan Nusa Tenggara Barat
III	Sumatera Utara, Sumatera Barat, Sumatera Selatan, Jambi, Lampung, Bengkulu, Riau, Bali, dan Nusa Tenggara Barat
IV	Aceh, Kalimantan Timur, dan Kalimantan Utara
V (highest)	Kepulauan Riau, Nusa Tenggara Timur, Maluku, Maluku Utara, Papua, Papua Barat, Kepulauan Bangka Belitung, dan DKI Jakarta

Table 13: Costs allocation among regions. Source: PT elaboration.

A detailed list of operational expenditure in ranges (min - max based on the regions) for the different sub-sectors is presented in Annex 3. In total, cost for each mitigation action will typically increase more than 100% with adjustment to latest regulations on cost per unit activity above.

See Table 14 below for an illustration of costs based on latest unit costs (*Harga Satuan Pokok Kegiatan* - HSPK) 2022 at DG Watershed and Forest Rehabilitation.

	NDC Rehabilitation target with rotation (ha)	Min unit cost based on HSPK 2022 (Million Rp)	Max unit cost based on HSPK 2022 (Million Rp)	Total cost based on HSPK 2022 (Million Rp)	Unit cost in NDC Roadmap (Million Rp)	Total cost based on NDC roadmap (Million Rp)	Gap	% Gap
NDC 2024	2.422	9,56	30,34	73.471	6,63	16.058	(57.414)	357,5
NDC 2030	3.460	9,56	30,34	104.959	6,63	22.940	(82.019)	357,5
Remaining quota	725	9,56	30,34	21.993	6,63	4.807	(17.186)	

	NDC Rehabilitation target non-rotation (ha)	Min unit cost based on HSPK 2022 (Million Rp)	Max unit cost based on HSPK 2022 (Million Rp)	Total cost based on HSPK 2022 (Million Rp)	Unit cost in NDC Roadmap (Million Rp)	Total cost based on NDC roadmap (Million Rp)	Gap	% Gap
NDC 2024	1.453	16,96	28,89	41.983	3,71	5.391	(36.593)	678,8
NDC 2030	2.076	16,96	28,89	59.985	3,71	7.702	(52.283)	
Remaining quota	1.454	16,96	28,89	42.012	3,71	5.394	(36.618)	

Table 14: Operational expenditures based on latest unit costs. Source: PT elaboration.

4.2.2. Gaps and Opportunities

A challenge for the forestry and agricultural sector is that most financing goes to the large commercial plantations instead of ordinary farmers and smallholders with limited bankability but significant mitigation capacities. Around 90% of them do not have formal title to their land and an absence of strong farmer groups

prevent them from enhancing credit access and marketing production. However, the liquidity and physical accessibility of the banking system are less of a concern in the Indonesian landscape (World Bank, 2021).

Another identified gap is the knowledge and capacity of the actors in the value chain and the financial institutions. On one hand, smallholders do not necessarily have a financial and business education to engage with banks and struggle to mitigate risks. On the other hand, financial institutions do not provide the right products to the agricultural value chain actors and do not understand the risks faced by smallholders (DFAT, 2015).

4.3. Energy and IPPU

The energy sector is expected to significantly contribute to the emissions reduction target, according to the updated NDC. It accounts for 15.5 percent, or 446 Mt CO2e. Concretely, the country commits to increasing the proportion of renewable energy sources in its energy mix to 23% by 2025 and 31% by 2030. Additionally, Indonesia wants to cut the amount of coal and oil in its energy mix by 25% and 30%, respectively, by 2030.

Indonesia has a lot of renewable energy resources available. In addition to 40% of the world's geothermal reserves, the country is endowed with enormous hydropower potential, including micro / mini hydropower, as well as solar, biomass, and wind energy potential. Diversification, environmental sustainability, and the best possible use of local energy resources are all stated as objectives in the GOI's overall plan for the country's energy sector. However, visions for a cleaner future will need to incorporate proactive measures like boosting renewable energy sources, or implementing emission-mitigation technologies. As detailed above, imposing a carbon tax appears for now to be rather challenging.

Role of the energy and IPPU sector in NDC

The energy sector is a major contributor to GHG emissions and, not surprisingly, plays an important role in achieving the NDC emission reduction target in 2030, as well as the 2060 Net Zero Emissions target. The emissions mitigation requires substantial investment, which not only concerns costs associated with the development of energy infrastructure for power plants, electricity grid, renewable energy, production processes technology, retrofitting of facilities or process units for energy efficiency, construction of gas networks, but also the costs for supervision, developing of regulations, policies (incentives or disincentives), and other enabling activities that support the implementation of the mitigation measures.

To deliver on the NDC commitment, the GoI has made budget allocations for mitigation measures through RPJMN (national), RPJMD (sub-national), and direct investment (BUMN, BUMD). In addition to the government, the private sector also has relevant role in achieving the GHG emissions reduction target.

Although its contribution is not as high, the IPPU sector also has an important role to play in achieving NDC emission reduction targets, both for 2030, as well as 2060. While most of the mitigation investments in the IPPU sector are financed by the private sector, the GOI budget contribution is still significant. GoI support is required for program development introducing mitigation measures, supervision, monitoring, data records for mitigation reporting systems, etc. In our assessment, however, the current budget allocation would need to be increased in order to carry out the required activities.

The impacts of climate change on the energy sector infrastructure

The energy sector is susceptible to a wide range of predicted climate change consequences on its infrastructure, including more frequent and severe weather events, warmer air and water, altered patterns

of rainfall and river discharge, and sea level rise. For example, sub-sectors such as fuel mining and production, fuel delivery to power plants, electricity production, transmission through high-voltage networks, and low-voltage distribution to consumers, might all be impacted by climate change.

Effects on the power generation sub-sector might have significant social and economic knock-on effects with rising energy prices and power use. Water is key to electricity generation, both for hydropower generation and for use in gas and biomass power plants.

Observers have commented on under-investment in the transportation sector, which might hinder the extraction and movement of energy resources across the archipelago.

Due to anticipated impacts of climate change, since the power grid is already overloaded, impacts like extreme weather events and sea level rise might jeopardize the availability of service to millions of users. The increasing share of variable renewables (esp. small hydro, solar and wind) in the energy mix might affect grid reliability if not well managed. Addressing climate change resilience in the energy sector could significantly improve energy security. At present, climate change adaptation is not incorporated into the country's energy infrastructure planning.

4.3.1. Financial Analysis

The primary body responsible governing the Indonesian energy sector is the MEMR. Other government ministries and agencies involved in the sector include the MOF, BAPPENAS, the Ministry of State-Owned Enterprises (MSOE), and the MOEF.

In 2014-2015, the incoming Widodo administration embarked on a series of subsidy reforms. Only the poorest households should continue to receive support, all others will pay electricity at the market price. This resulted in a reform of electricity subsidy by amendment of Law 30/2009. It obliges the GoI to subsidize electricity supply only to poor households and remote areas. The Ministerial Regulation No. 31/2014 introduced tariffs to match the cost of supply, and importantly, reintroduced the automatic tariff adjustment mechanism (ATAM), which is applied monthly for the relevant consumer classes. The consumer electricity subsidies are thus being phased out gradually.

The financial health of power sector companies is a source of concern to the GoI. Business needs to raise fund to satisfy investment requirements for power production, transmission, and distribution. The largest power sector company, PLN, has ongoing engagement with the government on issues of budgeting, capital spending plans and investment choices. The government also plays a coordinating role in the supply of primary energy resources for power generation (coal, gas and oil). Additionally, through governmental guarantees, the conversion of certain debt into equity, debt restructuring, subsidies to bridge gaps between revenue and expenditure and other methods, the GoI supports PLN in financing capital investments. Realistically speaking, moving forward and unless a significant policy shift is made, the growing demand for electricity will be likely only be met if investments are made by the GoI or state-owned entities. To put this in perspective, PLN predicted a financial shortfall for the period 2015 - 2019 of Rp 392 trillion, or US$30.2 billion. More recently, PLN obtained some external funding from the State budget (APBN) and received government-backed loans (SLA/direct lending/commercial), but this will not be sufficient.

The investment requirements of both renewable energy and coal power plant technologies is presented here using a cost standard of the power plant investment (million USD/MW) (Table 15 and Table 16).

	Onshore wind	PV	Hydro	Biomass	Geothermal
Low	1.340	1.570	0.450	1.880	1.850
High	2.330	4.340	3.500	6.820	5.100
Average *	1.835	2.955	1.975	4.350	3.475

Table 15: Investment costs for new RE technology options in million USD/MW.
Source: Estimation based on NDC Mitigation Road Map, MoEF 2016

Coal technology investment costs	million USD/MW
new Ultra-Super Critical (USC) coal	1.26
new Integrated Gasification Combined Cycle (IGCC) coal	1.46

Table 16: Investment costs for new coal technology options in million USD/MW.
Source: Estimation based on NDC Mitigation Road Map, MoEF 2016

The investment costs for mitigating GHG emissions in the energy sector will reach around IDR 3.500 trillion (USD243.9 billion) with the following details:

- NRE generation: IDR 1.688 trillion
- Non-electric RE: IDR 84 trillion
- Low carbon coal power plant technology: IDR 1.619 trillion
- City gas network and the replacement of kerosene to LPG conversion: IDR 17 trillion
- Energy conservation activities: IDR 92 trillion.

There is a lack of investment cost data for mitigation options in industry. The only information available to the PT pertains to a target budget until 2030 for mitigation programs in the cement industry.

No.	Mitigation Programs	Investment Cost (USD)	Remarks
1	Installation of inverter/variable speed drive	73,505,607	the capacity of the motor to be fitted with variable speed drive is 340 MW
2	Waste Heat Recovery Power Plant	573,274,591	Power plant capacity 291 MW
3	Decreasing of clinker to cement ratio up to 75%	19,583,381	1% decrease of the ratio will reduce 7.4 kg CO2e reduction/ton cementitious
4	Fossil fuel substitution with 5% of RDF/AF TSR	41,985,044	The use of RDF for coal substitution will reduce GHG emissions 1.56 Mt CO2e
5	Installation of High Momentum Burner	20,727,660	Some of the burners have already been installed
6	Calciner Improvement	28,778,320	-

Table 17: Mitigation budget for reducing GHG emissions from energy use in cement industry. Source: MEMR, 2021

4.3.2. Gaps and Opportunities

The financial weaknesses of the energy sector

Investments for oil exploration, and for power production, transportation, conversion, and distribution are insufficient, and often not fully efficient. The lack of funding is the main weakness, but not the only one. Limitations in the policy, the planning, and the implementation arrangements between subsectors, within governmental agencies, and between central and local governments are also impinging investments in the sector. Additionally, the financial weaknesses of many SOEs restrict the amount of capital to be invested. This is a result of improper planning and pricing decisions as well as an inefficient regulatory framework that discourages private financing. Chronic underinvestment makes energy supply expensive and unstable, and energy access is subpar compared to other countries in the region, and mainly directed to the country's economic development areas. At a macro level, the need to import LNG and petroleum products threatens the national budget and exposes the State, the industry, and consumers to the turbulence of global fuel markets.

Despite having a lot of promise, almost all energy subsectors do have weaknesses. Oil was the main source of income and economic growth for many years, but in recent years, falling local production and an increasing demand have turned the country into a net importer. Despite having high domestic energy resources demand, Indonesia is still a net exporter of gas. However, that may change in the near future due to a combination of high export obligations, low domestic prices, an uncertain regulatory environment that deters the private sector, and the high infrastructure costs associated with connecting production to consumption.

The coal deposits in Indonesia support a thriving export business and, in PLN's plans, will eventually support domestic power generation, albeit this will also depend on timely investments in infrastructure for mining and transportation. Continued dependence on fossil fuels is anticipated to become the main cause of Indonesia's growing GHG emissions, in large part from increased coal output.

Attempts to increase the use of renewable energy, especially geothermal energy, are hindered by implementation difficulties, a lack of capacity, environmental concerns, lengthy regulatory procedures, and a history of low energy prices. Every major economic sector presently operates at 10–35% below its capacity for energy saving as a result of low energy prices mixed with a lack of regulations enforcing energy conservation. Nearly 35 million people, or roughly 16% of the populace of the country, remain without access to energy.

Finally, the IPPU sector is said to be less important than the energy sector. Still, it holds an important place in the NDC of Indonesia.

Mitigation actions, that can be adopted in the following industries: cement, fertilizers, steel, nitric acid and aluminum. The aim is for instance to use more efficient smelter technology (energy source and raw materials), and use scrap as a raw material substitute, as well as operating N2O emissions reduction.

The opportunity of involving the private sector

The private sector is expected to play an ever-increasing role in the energy sector. Electricity Law 30/2009, ended PLN's monopolistic status in electricity production, transmission, and distribution, and a legal framework was established for the private sector to participate in the further development of the sector. However, private investment has fallen far short of projections. Independent Power Producers are constrained by erratic fuel availability, especially coal and gas. They also face occasional difficulties accessing

the grid. A further market access barrier has been ambiguity in the tariff regimes for geothermal, hydroelectric, and renewable energy facilities. The latter issue is currently being clarified by the government.

There seems to be widespread agreement that to enable Indonesia to move beyond (energy) politics as usual, a commitment and real synergy between the public and private sectors is needed. The reality is tough: The slow progress in the adoption of renewable energy technology is partly due to a lack of awareness among end users (residential, commercial, and industrial) and/or because existing regulations do not match expectations / realities. Unfortunately, potential and opportunity alone are not sufficient for a full energy transition.

There is only one Public-Private Partnership (PPP) on-going, namely the "Bintang Bano Mini Hydro Power Plant" with expected investment needs of USD113.9 million. Otherwise, it appears that low-carbon energy projects have yet to receive the support needed to encourage cooperation between the government and private sector.

Beyond energy, PPP projects are typically toll roads and transportation projects. We note that some public urban transportation projects, could be categorized as climate mitigation projects in as much as they encourage a modal shift (for freight) or reduce private vehicle use in favor of environmentally-friendly public transportation. The financial needs of the PPP projects in the urban transportation sector amount USD1,134.80 million of investment as detailed below:

- Makassar Parepare Railway (USD 69.07 million)
- Bandung Metropolitan Urban Railway (USD 810.38 million)
- Poris Plawad TOD Terminal (USD 181.98 million)
- Betan-Subing Type-A Bus Terminal (USD 16.72 million)
- Purabaya Type-A Bus Terminal (USD 24.39 million)
- Kalimantan Type-A Bus Terminal (USD 32.26 million)

4.4. Waste

The implementation of both a domestic solid waste and a wastewater management plan is a joint responsibility of the central government, the provincial governments, and city/local governments. Starting in 2009, cities / local authorities developed Settlement Sanitation Development Acceleration Programs ("PPSP") for the improvement of solid waste and waste water management. The central government through the Regional Settlement Infrastructure Center (BPPW) of the Ministry of PUPR assists in the provision of domestic waste and wastewater infrastructure, based on the sanitation program prepared by the city or regency.

The provincial governments also help with the provision of sanitation facilities. City / local governments, apart from providing infrastructure, are also supervisors and operators in the management of domestic waste and wastewater. However, few city / regency governments have become operators in the management of domestic wastewater. The majority of wastewater treatment is done offsite through individual septic tanks.

For the waste to energy program, in addition to the Ministry of Environment and Forestry (MOEF) and Ministry of Public Works and Housing (MPWH), this involves the Ministry of Energy and Mineral Resources (MEMR), through the Directorate General of Renewable Energy and Energy Conservation (DG EBTKE). As for industrial waste, apart from MOEF, it involves the Ministry of Industry and related private companies. The following table below summarizes the roles of different stakeholders.

Source Of Emissions	Mitigation Actions In Updated NDC (2021)	Subsector (Stakeholder)		Role
Municipal Solid Waste (MSW)	• Landfill Gas (LFG) Recovery at Solid Waste Disposal Site. • Waste Reduction through Composting and Reduce, Reuse, Recycle. • Waste to Energy: Incinerator Power Plant and Refuse Derived Fuel (RDF) Plant.	MOEF	Directorate of Waste Management	• Planning, provision of facilities and infrastructure, monitoring. • Operation by local company/government.
		MPHW	Directorate of Environmental and Residential Sanitation Development.	
		MEMR	Directorate General of Renewable Energy and Energy Conservation	
Domestic Wastewater	• Domestic wastewater treatment using a septic tank equipped with sludge recovery. • Construction of communal septic tanks and biodigesters, with methane recovery. • Domestic wastewater treatment with the aerobic system.	MOEF	Directorate of Water Pollution Control	• Research, planning, provision of facilities and infrastructure, monitoring. • Operation by local government/company/ community.
		MPHW	• Directorate of Environmental and Residential Sanitation Development • Housing and Settlement Research and Development Center	
Industrial solid waste	Industrial solid waste treatment: • Reuse of paper mill waste • Pulp & paper industry composting • Paper mill waste recovery as fuel	MOEF	Directorate of Toxic Hazardous Materials Management	• Research, monitoring. • Planning, Engineering, Construction, and Operational by private companies.
		MOI	• Center for the Study of Green Industry and the Environment. • Data and Information Center.	
Industrial wastewater	• Utilization of biogas from Palm Oil Mill Effluent	MEMR	Directorate General of Renewable Energy and Energy Conservation	• Research, monitoring. • Planning, Engineering, Construction, and Operational by private companies.
		MOEF	• Directorate General for Environmental Pollution and Degradation Control.	

			• Directorate of Hazardous Waste Management Performance Assessment	
		MOI	• Center for the Study of Green Industry and the Environment. • Data and Information Center.	

Table 18: Role of the sector in NDC in the waste sector at the national level. Institutions are adjusted to the GHG Inventory Institutional Arrangement in the Regulation of the MOEF (Regulation of the MOEF Number P.73/MENLHK/SETJEN/KUM.1/12/2017). Source: Self-elaborated.

4.4.1. Financial Analysis

Globally, tens of millions of tons of plastic waste are not managed properly every year, millions of tons end up in the sea and have a negative impact on marine biodiversity. For Indonesia, as an archipelago, it is important to keep the marine health stable as the population and economy depend and rely on the marine resources.

The National Plastic Action Partnership (NPAP) which establishes recommendations for actions to achieve national targets in the waste sector requires a total capital investment of $18 billion between 2017 and 2040 to address the status quo and have more efficient waste management. The breakdown is as follows: $5.1 billion between 2017 and 2025, and $13.3 billion between 2025 and 2040. The different actors (Government, private sector and non-governmental actors) need to coordinate in order to formulate an effective waste management policy. In addition, an annual investment of an additional $1 billion is needed to achieve a solid waste management system by 2040.

In order to achieve these financing goals, especially for waste collection and recycling infrastructure, Indonesia needs national and international funding. Cleans Oceans is already investing US$2 billion in the sector, and PT SMI has invested over US$3 billion in waste infrastructure. However, it is the locals who participate the most in the effort to finance waste management through the fee, even though it represents less than 1% of local government revenues (NPAP, 2021). Solid waste management is often the largest budget item (20% of the municipal budget) for many local governments in low-income countries like Indonesia. However, local governments in Southeast Asia are often underfunded due to: i) a lack of funding from the central government; or ii) a lack of revenue for these activities from local people.

As a result, local funding is insufficient to cover all expenses, and lack of investment in the sector leads to inefficient management and high operating costs (Green Investment Group, 2020). However, even when the local government is allocating operational financing to waste management systems that would be considered sufficient by international standards, the waste sector is still struggling due to poor infrastructures and technical capacity. Additionally, the private sector is keen to collaborate with public institutions to address operational difficulties, but there are considerable obstacles preventing the initiative's expansion due to a lack of confidence in public governance, operational finance, and managerial competence. Hence, the private capital inflows for investment in the waste sector is not currently available.

The allocated funds for waste management in 2021 were between 1-4%, and waste fees collected from users are mostly for the transportation of waste from the source to temporary storages, although for its treatment.

In 2020, the MoEF adopted the National Policy and Strategy on Management of Household Waste and Household-like Waste (JAKSTRANAS) in order to provides recommendations to accelerate the reduction of plastic pollution.

Furthermore, Indonesia intends to construct central landfills in the Java regions (Malang, Jambi, Jombang, Sidoarjo and Pekalongan) with a $100 million loan from the German Government.

Currently, five PPP projects have been identified in the waste sector, with a total budget of USD 639.80 million. They are:

(i) Nambo Regional Waste Management (USD 44.40 million);
(ii) Legok Nangka Regional Waste Processing Facility (USD 279.87 million);
(iii) Piyungan Waste Management (USD 123.55 million);
(iv) South Tangerang Waste to Energy (USD 122.90 million); and
(v) Sumatera Hazardous Waste Treatment Facilities (USD 69.08 million).

Investors are often hesitant to invest in the waste sector, especially through a PPP scheme, due to the challenge in agreeing a profitable tipping fee agreement with the relevant Government Contracting Agency and the company behind the Special Purpose Vehicle.

4.4.2. Gaps and Mitigation Opportunities

The following section provides a detailed analysis of the technical opportunities for different waste management measures.

4.3.2.1. Landfill Gas (LFG) Recovery at Solid Waste Disposal Site

In landfills (SWDS), the level of CH4 emissions is influenced by the volume of solid waste buried in SWDS, waste composition, dry matter content, and SWDS conditions. The methane recovered fraction is the input data that reflects the mitigation action of methane recovery. Utilization of LFG for electricity may only be appropriate for landfills serving metropolitan municipal waste. There is more potential than currently realized for landfills that serve large, medium, and small cities, for thermal (cooking) purposes, which can be distributed to settlements around the landfill. In the 2021 GHG and MPV Inventory Report, the achievement of reducing GHG emissions from waste to energy actions is 19,436 tons of CO_2e (MoEF, 2022).

4.3.2.2. Waste reduction through composting, reducing, reusing, and recycling (3R)

This mitigation action is in line with national policies related to domestic waste management (30% reduction in domestic waste). The mitigation target is set as methane avoidance from the decomposition of biodegradable waste (organic & paper) in the TPA landfill, regardless of project emissions. The 2021 GHG and MPV Inventory Report (MOEF, 2022) states that the achievement of reducing GHG emissions from the composting action is 558 of 420 tons CO_2e and from the reduced/reused/recycled of paper waste by 82,712 tons of CO_2e.

Further studies are needed regarding the emission reduction from this type of activity, which is not only methane avoidance in landfills, but also from:

- ✓ Comparison of emission levels from recycled materials (eg compost), compared to new materials (eg urea).
- ✓ Reducing emissions from waste transportation from the source and/or transfer station ("TPS") to SWDS ("TPA") plus landfilling operations, compared to emissions from composting and 3R activities.

Composting and 3R (degradable waste) activities not only reduce the generation of degradable waste landfilled in SWDS but also reduce the consumption of fossil fuels in transportation and landfill operations. This change in consumption may be captured in the energy sector inventory, but cannot be claimed as an achievement of waste sector mitigation actions from composting or 3R activities. On the other hand, emissions arising from composting activities or 3Rs (due to the consumption of diesel or grid electricity for operations) will also not be caught.

4.3.2.3. Waste to Energy: Incinerator Power Plant and Refuse Derived Fuel Plant

The Presidential Regulation No. 35 of 2018 concerning the Acceleration of Development of Waste Processing into Electrical Energy ("PSEL") Based on Environmentally Friendly Technology, mentions the acceleration of PSEL development in 12 cities, namely: DKI Jakarta Province, Tangerang City, South Tangerang City, Bekasi City, Bandung City, Semarang City, Surakarta City, Surabaya City, Makassar City, Denpasar City, Palembang City, and Manado City. This waste to energy activity is divided into two sub-activities:

- Waste incineration is accompanied by the use of incineration heat for electricity generation.
- Processing of waste into fuel (RDF) for co-firing in industrial/power plant boilers.

From this action, emission reductions are obtained from (a) avoiding methane from landfilling activities and (b) a certain amount of energy from fossil fuels which can be substituted by heat from incineration to produce electricity. Because almost all Indonesian landfills are Un-Managed Deep (or Semi Aerobic not well managed) landfills, which have a high Methane Correction Factor (MCF), and most power plants still use fossil fuels (coal and natural gas), the action waste to energy has the potential to significantly reduce emissions. Referring to the 2021 GHG and MPV Inventory Report, the achievement of reducing GHG emissions from waste to energy actions is 10,301 tons of CO2e (MoEF, 2022).

However, this waste to energy program has several weaknesses, specifically:

- Potential to reduce waste economy circular activities.
- Requires strict control, starting from the collection, transfer station, transportation, and operations in incinerators.
- High capital (CAPEX) and operational (OPEX) costs.
- Requires specific human resources.
- Requires a large input of waste, and is only suitable for metropolitan cities.

The RDF Plant may be more suitable to be built in Indonesia because the waste input can be adjusted to the capacity of the plant. Thus, the waste circular economy can still be accommodated, and the RDF Plant can only process waste with low selling value. Emission reductions from RDF result from the substitution of fossil fuels (coal) with fluffy RDF (known as “bahan bakar jumputan padat”). Due to the high cost of services, the central government provides funding support for the State Revenue and Expenditure Budget for Waste Management in the Local Government (Regulation of the Minister of Finance of the Republic of Indonesia Number 26/PMK.07/2021, in the form of a Waste Management Service Fee Assistance Fund.

In addition to utilizing waste to energy, thermal waste processing is also carried out with incinerators (without a power plant), in several locations in Indonesia. Further studies are needed to determine whether this incineration process can be categorized as a mitigation action, with baseline emissions from landfilling and open burning of waste, and project emissions in the form of electricity and fossil fuels used during the incineration process.

4.3.2.4. DOMESTIC WASTEWATER TREATMENT USING A SEPTIC TANK EQUIPPED WITH SLUDGE RECOVERY

Some city / regency governments have issued Regional Regulations on Domestic Wastewater Management. These regulate Scheduled Fecal Sludge Services (known as "Layanan Lumpur Tinja Terjadwal, LLTT"), where desludging must be carried out periodically, no later than every 3 years (according to Regulation of the Minister of Public Works and Public Housing Number 04 /PRT/M/2017 concerning Implementation of Domestic Wastewater Management System). However, due to the non-optimal operation, the high idle capacity of the Fecal Sludge Treatment Plant (IPLT), and leaks in the individual septic tanks (individual septic tanks that are not impermeable), the sludge removal action in domestic wastewater is not optimal. In the 2021 GHG and MPV Inventory Report (MoEF, 2022), the GHG emissions reduction from the (fecal) sludge removal is 2,778 tons of CO_2e.

4.3.2.5. CONSTRUCTION OF COMMUNAL SEPTIC TANKS AND BIODIGESTERS WITH METHANE RECOVERY

Reducing emissions from methane capture and the utilization in communal septic tanks (and biodigesters), apart from avoiding methane also reduces the need for grid electricity.

This mitigation action faces challenges related to the diversity of characteristics of wastewater, which causes methane generation to be sub-optimal. In addition, leakage usually occurs, especially in concrete plants. In the 2021 GHG and MPV Inventory Report, the achievement of reducing GHG emissions from this action is only 42 tons of CO2e (MoEF, 2022).

4.3.2.6. DOMESTIC WASTEWATER TREATMENT WITH THE AEROBIC SYSTEM

Emission reductions can be achieved through the transfer of the treatment system from an anaerobic septic system to an aerobic WWTP (Centralized WWTP and/or Communal WWTP). Further studies are needed, to filter data on house connections that apply aerobic treatment systems in Urban WWTPs and Communal WWTPs. However, aerobic urban WWTPs are suitable for urban areas with large effluent discharges and small WWTP area requirements.

In the 2021 GHG and MPV Inventory Report, the achievement of reducing GHG emissions from the Centralized WWTP (with an aerobic system) is 71,160 tons of CO_2e, plus the Communal WWTP of 56,367 tons of CO_2e (MOEF, 2022). However, high capital and operational costs are an obstacle to the expansion of the aerobic system in domestic wastewater WWTPs.

4.3.2.7. INDUSTRIAL SOLID WASTE TREATMENT (INCLUDING WWTP SLUDGE)

Paper recycling and recovery of paper mill waste as fuel, can not only reduce GHG emissions from methane avoiding (if the waste is landfilled and decomposed anaerobically), but also minimize the amount of energy and wood products otherwise used for the production of the new paper. This mitigation measure therefore has co-benefits beyond the waste sector.

Likewise, the sludge produced from industrial WWTPs, where it is used as a compost material, issues lower emissions compared to the sludge treatment at the sludge treatment plant. This action is also related to emissions that can be avoided from the synthetic fertilizer production process or landfilled.

The 2021 GHG and MPV Inventory Report (MoEF, 2022) verifies the emission reduction from this activity by 98,527 tons of CO_2e. The treatment of this sludge requires good technical knowledge of nutrition and may attract insects that can potentially damage trees. As a note, the reported mitigation actions only cover mitigation in the pulp and paper industry WWTPs.

4.3.2.8. Utilization of biogas from Palm Oil Mill Effluent (POME)

In contrast to industrial WWTPs in urban areas that use aerobic systems, agro-industrial WWTPs that are (often) located in remote areas use a series of biological ponds to treat their wastewater and produce high methane (in anaerobic ponds). With high levels of methane emission in anaerobic WWTPs (including biodigesters and biological ponds), there is potential to utilize methane as an energy source (for electricity and/or heat production). Based on the 2021 GHG and MPV Inventory Report (MOEF, 2022), there is an emission reduction of 460,169 tons of CO_2e.

For the record, a more intense study is needed regarding the use of methane in agro-industry, not only from POME but also from other agro-industrial wastewater such as tapioca. This mitigation action has a high potential and enjoys regulatory support.

4.3.2.9. Construction of Semi Aerobic Landfill (not included in NDC Indonesia)

Solid waste disposal site is one of the largest emission sources in the waste sector, besides domestic and industrial wastewater. Most of the domestic waste will be transported to the SWDS, which is carried out by the landfilling method. The majority of landfills in Indonesia are built with a semi-aerobic landfill model, where leachate distribution pipes are connected to vertical gas vents and permeable intermediate cover soil. Thus, oxygen can circulate within the landfill cells, and not all waste decomposes anaerobically. IPCC Refinement (2019) sets MCF = 0.5 – 0.7 for semi-aerobic landfills, compared to MCF = 1.0 for anaerobic landfills, where all degradable waste decomposes anaerobically. The Construction and operation/maintenance of a semi-aerobic landfill is one of the mitigation actions that have been carried out with the baseline being an open dumping solid waste disposal site which has an MCF = 0.8. Most landfills in Indonesia have a depth of more than 5 meters, and, under baseline conditions, are categorized as Un-managed Deep SWDS (with MCF = 0.8)

Based on the 2021 GHG and MPV Inventory Report (MoEF, 2022), the emission reduction from eight types of mitigation actions in the Updated NDC Indonesia is 1,359,647 tons of CO_2e. With baseline/BAU (2020) emissions of 145.71 million tons of CO_2e, the achievement of reducing emissions in the waste sector is around 1%. This reduction value has exceeded the CM1 reduction target (with own efforts) in Updated NDC Indonesia (= 0.38%), but is still below the CM2 target with international assistance, which is 1.4%. This implies an opportunity for intensification and/or extensification of mitigation actions in the waste sector.

In conclusion, Table 19 shows a recapitulation of emission reduction potentials based on the 2021 GHG and MPV Inventory Report (MoEF, 2022) compared to the 2030 emission reduction target based on the NDC Implementation Roadmap (MoEF, 2019).
From this comparison, it can be seen that actions that require acceleration, include: Landfill Gas Recovery, reduce-reuse-recycle (3R) of paper waste, waste to energy (Incinerator Power Plant, Biodigester Power Plant, & RDF Plant), and utilization of biogas from POME in the palm oil industry. However, there are several challenges in extending each mitigation action as presented in the Table**.** These eight mitigation actions are divided into two groups, namely:

- ✓ Mitigation actions that require high CAPEX and OPEX, and need specific technology and human resources, such as waste to energy.
- ✓ Mitigation actions that do not require high CAPEX and OPEX, and use locally available technology and human resources, such as composting and 3R.

Mitigation Actions	2030 emission reduction target based on NDC Implementation Roadmap (MOEF, 2019)	Emission reduction Based on the 2021 GHG and MPV Inventory Report (MOEF, 2022)	Strengths	Challenges
Landfill Gas (LFG) Recovery at Solid Waste Disposal Site	1.47 million tons of CO_2e (CM1 & CM2)	19,436 tons of CO_2e	• The majority of final waste processing in Indonesia uses the landfilling method, of which more than 50% is organic waste. • Community groups around landfills can become LFG managers. • Support from waste to energy regulations	• With a semi-aerobic construction, LFG generation is not high, and is only suitable for thermal purposes. • Low waste management budget, making it difficult to maintain gas pipelines and wells.
Waste reduction through composting, reducing, reusing, and recycling (3R)	Composting = 2.61 million tons of CO_2e (CM1 & CM2) 3R of paper waste = 2.18 million tons of CO_2e (CM1 & CM2)	Composting = 558,420 tons of CO_2e 3R of paper waste = 82,712 tons of CO_2e	• The circular economy of waste has been running in society. • 3R is the cheapest option in waste management. • Regulatory and institutional support related to waste reduction.	• People are not used to sorting and processing waste. • Low waste management budget, making it difficult to maintain 3R infrastructure. • Product marketing support that has not been optimal.
Waste to Energy: Incinerator Power Plant and Refuse Derived Fuel Plant	1.91 million tons of CO_2e (CM1 & CM2)	10,301 tons of CO_2e	• Significant emission reductions from methane avoidance in landfills • Regulatory support related to the acceleration of waste to energy projects. • RDF Plant can be a coal co-firing for industrial and power plant boilers.	• Imported technology. • Requires large waste input, only suitable for metropolitan cities • Has the potential to disrupt waste circular economy activities • High CAPEX and OPEX • Strict environmental control is required.
Domestic wastewater treatment using a septic tank equipped with sludge recovery	3,000 tons of CO_2e (CM1 & CM2)	2,778 tons of CO_2e	• There are regulations regarding Scheduled Sludge Services • Institutional support from the Ministry of Public Works & Public Housing	• The septic tank is not impermeable. • Idle capacity at the Faecal Sludge Treatment Plant.
Construction of communal septic tanks and biodigesters, with methane recovery	500 tons of CO_2e (CM1 & CM2)	42 tons of CO_2e	Technology is not high and can be met by local suppliers.	• Strict control is needed regarding leakage • Characteristics of wastewater are not homogeneous.
Domestic wastewater treatment with the aerobic system	Centralized WWTP = 600 tons of CO2e (CM1 & CM2) Modular/Communal WWTP = 84,000 tons of CO_2e (CM1 & CM2)	Centralized WWTP = 71,160 tons of CO_2e Modular WWTP = 56,367 tons of CO_2e	The aerobic system is suitable for urban WWTPs that have high wastewater discharges, with a small area requirement and minimal odor.	• Expensive operation/maintenance. • Some equipment is imported.

Mitigation Actions	2030 emission reduction target based on NDC Implementation Roadmap (MOEF, 2019)	Emission reduction Based on the 2021 GHG and MPV Inventory Report (MOEF, 2022)	Strengths	Challenges
Industrial solid waste treatment (including WWTP sludge)	Reuse of paper mill waste = 62,300 tons of CO_2e (CM1 & CM2) Pulp & paper industry composting = 1,800 tons of CO_2e (CM1 & CM2) Paper mill waste recovery as fuel = 26,600 tons of CO_2e (CM1 & CM2)	98,257 tons of CO_2e	Suitable for use as organic fertilizer (compost) in agro-industries that have plantation areas.	• Nutrients are reduced if the application is late • Can attract certain insects that have the potential to damage trees.
Utilization of biogas from Palm Oil Mill Effluent	3.01 million tons of CO2e (CM1) 18.01 million tons of CO2e (CM2)	460,169 tons of CO_2e	Support from government and associations: tax incentives for renewable energy, GHG emission reductions, and purchase of renewable energy by PLN.	• Lack of information about methane capture. • Lack of Company HR to be allocated to projects • Fermentation process is mostly done in batches, not continuous (not optimal). • There are palm oil mills that have excess energy, have used shells and fibers as boiler fuel, and generate electricity.
	Total	**1,359,647 tons of CO_2e**		

Table 19: Recapitulation of mitigation actions in the waste sector. Source: PT's elaboration from GHG and MPV Inventory Report (MoEF, 2022) compared to the 2030 emission reduction target based on the NDC Implementation Roadmap (MoEF, 2019)

5. Reflections and recommendations

There is a large potential in Indonesia for green economic growth that currently remains untapped. In its most recent Article 4 Consultation with the government, the IMF positively commented on the government's mitigation ambition. They encouraged the authorities to undertake further reforms, including measures on carbon pricing and the emission trading system, and fostering a green financial market.

One key pathway to closing the gap that appears to exist between the GoI budget and the NDC financing requirements, access to additional concessional and commercial sources will need to be expanded. Indonesia has made extensive progress in creating enablers for the transformation of its economy.

At the same time, OECD data show that while the volume of private finance for climate action is increasing over time and accelerated in recent years, it still accounts for only 7% of all private finance mobilized. Of all private finance flowing to LDCs, only 37% targeted climate action, amounting to $1.6 billion (on average in 2018-2019). There is thus significant competition for scarce financial resources among developing countries.

The Ministry of Finance has developed a Green Bond and Green Sukuk Framework. A successful issuance in 2018, the first from Asia, yielded USD1.25 billion at a coupon rate of 3.75% for 5-year maturity. Yet, barriers to access and mobilization of climate-aligned private finance appear to persist.[1] [2] Municipal green bonds are one example of an instrument with a large unexplored potential.

There are a number of cross-sectoral issues relating to attracting more private sector investment. A recent ADB review of best practices in five infrastructure sectors highlighted the importance of competition, transparent tendering, and effective regulation. However, the long-term track record of PPP infrastructure projects remains mixed and only few infrastructure projects are climate-aligned. Hence, the recent launch of the Asian Development Bank / Green Climate Fund-sponsored USD 3.7 billion ASEAN Catalytic Green Finance Facility is a significant development.[3]

A detailed mapping of projects against potential sources of climate-aligned finance and investment instruments applied is needed at the sector level. This would support opportunities for investment along the project development pathway from identification, development, primary finance through to refinancing.[4]

The recent introduction of a carbon price is a welcome development. Our analysis, however, shows that the current low price is not having a material impact on project economics. Hence an early evaluation of the experience is advised, in order to inform adjustments that better align the mechanism with the green development priorities of the Presidency.

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[1] Progress in improving the enabling environment (barriers and enablers) is tracked across five categories: i) Policy and regulatory; ii) Finance and economics; iii) Technology and markets; iv) Information and capacity; and v) Social, cultural, and behavioral.

[2] CBI (2019), for example, lists the following barriers to development of the bond market: Currency hedging cost; Currency hedging perceived complexity; Low volume and market liquidity; Low credit ratings; Policy & Regulations; Insufficient bankability of green projects; and Limited local market awareness.

[3] See the Climate Bonds Initiative report with ADB (2022) Green Infrastructure Investment Opportunities. INDONESIA: Green Recovery.

[4] International climate fund sources include: Multilateral institutions, Bilateral development partners, Foreign Direct Investment, Commercial banks, Institutional investors (e.g., pension funds), Private equity and venture capital, Impact funds, and NGOs and philanthropic organizations.

The data available to the PT indicate that the level of climate financing envisioned in the 5-year plan is not currently mirrored in the annual budget allocation data made available to the PT. Furthermore, anecdotal evidence shows a gap may exist between budget allocation data and budget drawdown. Whereas the existence of a small utilization gap is not unusual (in fact it may be prudent fiscal management by departments in times of economic crisis) a large gap puts at risks the achievement of the 5-year plan objectives and international commitments made.

Analyzing the Gap in Climate Mitigation Finance

In order to achieve the NDC reduction targets, Indonesia intends to allocate IDR 3,461.31 trillion (USD 241.21 billion) annually to achieve its CO_2 emission reduction target, of which 29% is on its own and 41% with international support, up to 2030 and as according to the NDC Target for the Paris Agreement. That budget allocation is detailed as below:

1. Forestry and Land Use (FOLU) Sector: IDR 77.82 trillion;
2. Industrial Process and Product Use (IPPU) Sector: IDR 40.77 trillion;
3. Waste Sector: IDR 30.34 trillion;
4. Agricultural Sector: IDR 5.18 trillion;
5. Energy and Transportation Sector: IDR 3,307.2 trillion.

There remains a clear gap between the detailed list of projects' costs being prepared by the PT compared to the NDC ultimate target in 2030. Detailed projects' financial needs identified by the PT were mainly estimated for the period 2020-2024, based on the datasets available. In the case of the energy sector the average annual financial needs were estimated up to 2030.

The analysis of detailed projects' financial needs prepared by the PT 'covered' only 33.55% of the NDC target, with large differences across sectors. While the lack of data for the period 2025-2030 may be a significant reason explaining this gap, other factors come into play, such as the lack of data from subnational government entities and the lack of data from the private sector financed projects. These two sources would collectively contribute significantly to closing the (large) gaps in the Agriculture and the IPPU sectors, both traditionally dominated by private investment and by subnational agencies (especially agriculture).

In the absence of the above-mentioned data, we are presently unable to estimate the 'real' budget gap between the List of Projects and the NDC Targets. We do believe further data collection and analysis could be provided if more time/resources were allocated.

Sector	Total Financial Needs (Billion IDR)		Gap (Billion IDR)	Project Percentage
	Based on Climate Mitigation Project	Based on NDC Emission Target up to 2030		
Agriculture	IDR 257,86	IDR 5.180,00	IDR 4.922,14	4,98%
FOLU	IDR 16.323,50	IDR 77.820,00	IDR 61.496,50	20,98%
IPPU	IDR 879,00	IDR 40.770,00	IDR 39.891,00	2,16%
Waste	IDR 20.920,15	IDR 30.340,00	IDR 9.419,85	68,95%
Energy	IDR 1.103.157,81	IDR 3.307.200,00	IDR2.184.139,61	33,96%
Transportatio	IDR 19.902,58			
TOTAL	**IDR 1.161.440,90**	**IDR 3.461.310,00**	**IDR2.299.869,10**	**33,55%**

Table 20: Financing Gaps. Source: PT elaboration.

Full details are provided in the data files accompanying this report.

These *further recommendations* may support the GoI in its pursuit of climate ambition and realization of NDC / LCDI mitigation targets.

As a first step, cross-departmental discussions and coordination both at the project level and at the level of programs may aid the mobilization of international (blended) investment, both concessional and commercial.

A significant amount of engagement with all relevant stakeholders both governmental and those from the private and civil society sectors will be required to realize the required mobilization and prioritization of the allocation of government budget and climate finance.

Sharing of experiences in accessing climate finance and best practice in project planning and implementation across the ASEAN region, including at the sub-national level, could be an efficient way to build capacity in attracting investment, from both concessional and blended finance sources.

AFOLU

Specifical to the AFOLU sector, the PT recommend that the following policies and regulations need to be further pursued:

1. There is a need for reinforcement of Government Regulation No.46/2016 on strategic environmental assessment.
2. Ensure the ecosystem service index (within or outside concession) acts as the basis for planning of Forest Management Units (FMU).
3. Strengthening of incentives for concession holders to convert forested areas into protected forest.
4. Regulations to ban logging in some forests with social forestry permits, instead allowing non-timber forest products business and environmental service.
5. Prioritization of programs for strengthening and accelerating development in high risk FMUs.
6. Reinforcement of MoEF regulation No.71/2017 and Law No.18/2013 about logging in primary natural forests to avoid degradation (especially for HTI and HPH permit holders) and Presidential Instruction No.4/2005 on illegal logging.
7. Related to Sustainable Forest Management (SFM), it is necessary to develop a set of key indicators to guide each concessional holder in adjusting management towards meeting the standard.
8. Forest with less than 70% cover need reassessment and be targeted for non-exploitative activities or ecosystem restoration. Non-concessional logging (by KPHP) should follow Reduced Impact Logging (RIL) in those areas with >70% forest cover and Enriched Natural Regeneration in those areas with <70% forest cover.
9. Reinforce MoEF Regulation No. 83/2016 on non-rotational rehabilitation in social forestry areas (PIAPS). The incentives and implementation guide are detailed in MoEF regulation No. 39/2016.
10. Prioritization in rehabilitation is ordinarily based on assessment of the critical level of damage. However, rehabilitation should also consider social capital in the area. Forests areas with high social capital and willingness for cooperation from local government, community and youth leaders, university, and NGOs should be prioritized.
11. Stimulate innovation in policies regulating industrial forestry. E.g., plantation of IUPHHK-HT on abandoned land with total area of 2x land clearing, log over area (LOA) > 20 m3/hectare should practice intensive or multi-system silviculture.

Energy and IPPU

12. The central and local governments may establish, design, and conduct socialization related to technology and the benefits of NRE as well as affordable financing schemes through various public information channels.
13. The central and local governments need to ensure the implementation of government-owned building obligations to use NRE systems. For example, in the solar based power sector, it requires installations of Rooftop PV system at a minimum of 30% of the government building's rooftop area and a minimum of 25% on the rooftop of luxury homes following the General National Energy Plan (RUEN) as stipulated in Presidential Regulation No.22/2017. This target has not yet been achieved.
14. The central and local governments can increase public interest in NRE through the provision of incentives such as the allocation of the Sustainable Energy Fund (SEF) grants, reduction of Land and Building Tax for green buildings or other tax reductions under the authority of the central and local governments.
15. The GOI, especially the Ministry of Energy and Mineral Resources, could harmonize, coordinate and synchronize policies that support the adoption of NRE systems; including the ease of installation and provision of net-metering services as well as ensuring that regulations and policies are perfectly implemented (for example in the implementation of a 1:1 fair electricity credit according to the Minister of Energy and Mineral Resources Regulation No.26/2021).
16. The GOI, especially the Ministry of Energy and Mineral Resources, should initiate the development of a specific module/manual/toolkit related to the development of NRE along with examples of best practice applications in the field to be applied directly. In making this toolkit, the government can also work together with donor agencies to then be socialized through public channels.
17. The Ministry of Energy and Mineral Resources should encourage the development of the domestic NRE industry and enforce quality and service standards.
18. The GOI, in particular the Ministry of National Development Planning/BAPPENAS as the government in charge for cross-sectoral development innovation policies, should establish a consortium/forum/information hub to bridge stakeholders and increase the active role of private sector involvement in advancing and mainstreaming the adoption of NRE businesses and assisting Small Medium Enterprises of Energy.
19. The Ministry of Industry could consider relaxing the local content policy for NRE business players by providing financing support or opening a special market for projects with local content requirements.
20. The Monetary Service Authority (OJK) should issue more attractive green financing instruments and monitor their implementation in the field. This recommendation could be applied to climate mitigation projects to all sectors.
21. Financial Institutions, banks, MFIs, Cooperatives, and LPDB could increase financial flows for priorities for sustainable development, NRE, and climate mitigation programs. They could support Green Financing by implementing financing schemes and incentives/loan interest rates that are lower than conventional loans/credit in general.
22. Business actors should have a larger role in the NDC financing ad implementation. Private investors an MSMEs ensure quality products and services at affordable prices to create economies of scale (maximizing NRE technology which is characterized by a decrease in production costs per unit along with an increase in production volume) rather than pursuing profits through high margins.
23. Business actors could utilize Corporate Social Responsibility (CSR) funds in the development of a green economy, for example by installing NRE systems for public facilities which can also serve as a model for local residents regarding the benefits of NRE.

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7. Annexes

7.1. Waste Sector: Detailed analysis

7.1.1 Landfill Gas (LFG) Recovery at Solid Waste Disposal Site

Indonesia's NDC targets 10% methane recovery in 2030. Based on the 2021 GHG Inventory and Monitoring, Reporting, Verification report (MOEF, 2022), the achievement of GHG emission reductions from LFG Recovery is 19,436 tons of CO_2e (verified). Massive efforts are, therefore, still needed to achieve the 2030 NDC target, both from the aspects of planning, operation, and monitoring, including data archiving systems.
Since most of the final waste processing in Indonesia uses landfilling, LFG Recovery is a high potential mitigation action in the solid waste sector. Emission reduction is obtained from (a) methane destruction and (b) replacement of fossil energy for electricity and/or thermal.
Waste to energy activities through methane recovery was piloted by several CDM projects in the early 2000s. These projects are constrained by the current low carbon price.

The majority of landfills in Indonesia are designed as semi-aerobic landfills (with a relatively low methane correction factor compared to anaerobic landfills), so LFG Recovery for electricity is only suitable for landfills with large waste generation (in metropolitan cities). Figure 4 and Table 5 show LFG Recovery activities in several cities in Indonesia, where almost all landfills have extracted LFG for cooking fuel. The exception being the use of LFG for electricity (with a gas engine) at the Bantar Gebang Landfill (DKI Jakarta), Benowo Landfill (Surabaya City), and Jatibarang Landfill (Semarang City).

Location of activity	Technology	Notes
Bantar Gebang Landfill, DKI Jakarta Province	LFG Power Plant	Capacity 1,8 MW
Benowo Landfill, Surabaya City	LFG Power Plant	Capacity 1,65 MW
Jatibarang Landfill, Semarang City	LFG Power Plant	Capacity 0,8 MW
Supit Urang Landfill, Malang City	LFG for cooking	300 household connections
Banyuroto Landfill, Kulon Progo Regency	LFG for cooking	For internal consumption of the landfill
Winongo Landfill, Madiun City	LFG for cooking	200 household connections
Seboro Landfill, Probolinggo Regency	LFG for cooking	
Srabah Landfill, Trenggalek Regency	LFG for cooking	
Manggar Landfill, Balikpapan City	LFG for cooking	20 household connections

Annex Table 1: Several LFG Recovery activities at Landfills in Indonesia. Source: PT elaboration.

7.1.2 Waste Reduction through Composting and Reduce, Reuse, Recycle

Presidential Regulation of the Republic of Indonesia Number 97 of 2017 concerning National Waste Management Policies and Strategies is a reference used for waste reduction in Indonesia. This national policy (known as “Jakstranas”) targets a 30% reduction in waste, through Reduce, Reuse, and Recycle (3R) by 2025. Restriction and 3R of (degradable) reduce methane emissions in landfills due to anaerobic degradation of degradable waste and reduced GHG emissions due to open burning of waste (containing fossil carbon).

Reduction of waste landfilled at SWDS can occur at various stages of waste management, through storage, collection, temporary storage, transportation, and final processing. Based on data from the National Waste

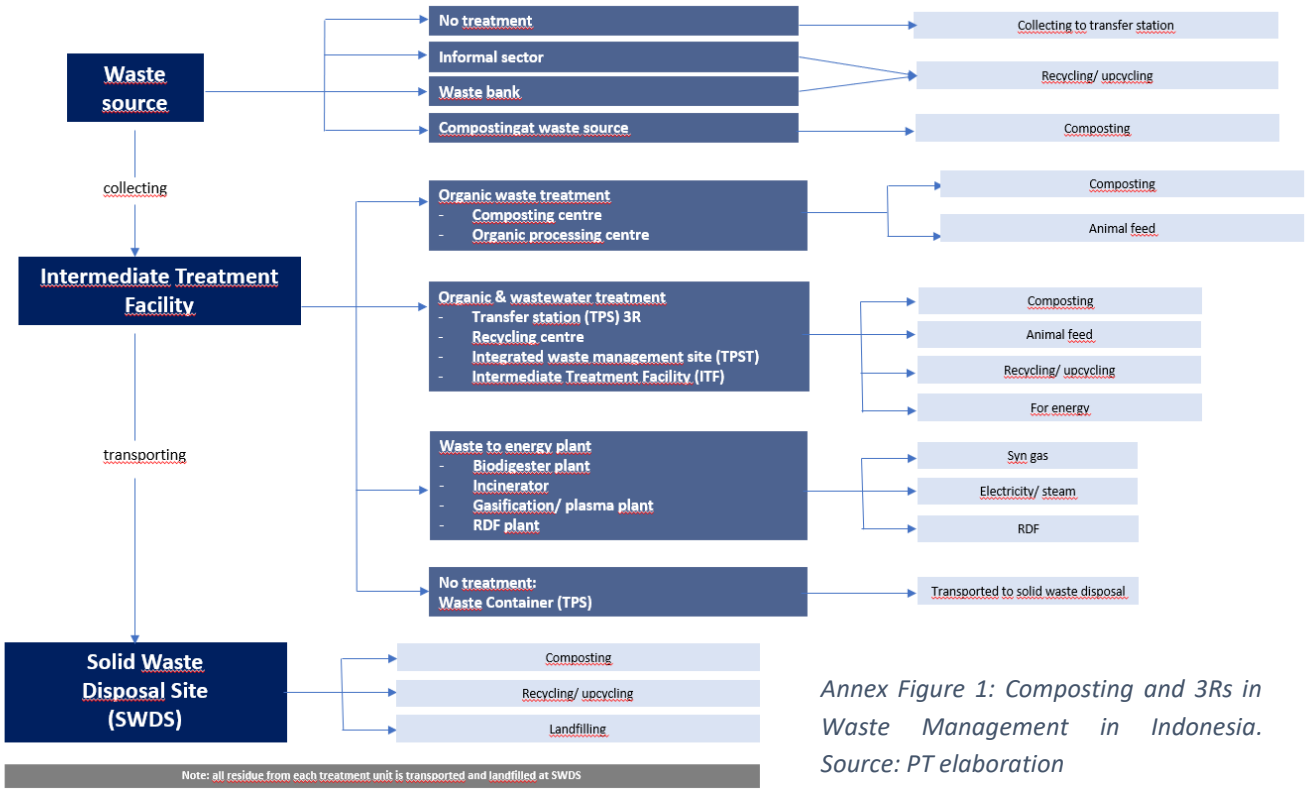
Management Information System (https://sipsn.menlhk.go.id/sipsn/#, viewed August 03, 2022), from the estimated waste generation in Indonesia of 28,871,946.24 tons of waste, there is a waste reduction of 15.37% (= 4,438,884.31 tons of waste). The percentage of composting organic waste and recycling/upcycling of degradable (inorganic) waste is unknown, from the total reduced waste, so further studies are needed regarding these variables, to calculate the reduction from avoided methane emissions at Solid Waste Disposal Sites.

Processing of organic waste by composting, and recycling/upcycling of inorganic waste, can be done at:

- Sources of waste (household markets/offices/schools), through household-scale composting activities and Waste Banks. The informal sector (waste business actors) also plays a role in recycling/upcycling activities.
- Transfer station (Intermediate transfer facility), through composting activities in the Main Waste Bank, Composting Centre, Organic Processing Center, Transfer Station ("TPS 3R"), Recycle Center, and Integrated Waste Disposal Site ("TPST")

Most of the composting is done using the windrow composting model (which has a low Emission Factor) and is a mitigation action that has been running in Indonesia (methane emissions are avoided from dumping waste at a solid waste disposal site). Apart from being used as compost, food waste is often processed into animal feed. In areas that have pig farms (only in some areas in Indonesia such as Palangkaraya, Kupang, etc.), vegetable/food waste from the market is directly purchased by the farmers. Meanwhile, in many other areas, food waste is used as feed for Black Soldier Fly (BSF), and maggot (produced) is used as animal feed. Several Integrated Waste Disposal Sites or Transfer Stations (TPS 3R) are integrated with poultry farms.

Apart from domestic waste, composting is also carried out to treat industrial solid waste, for example composting solid waste from the pulp & paper industry and the palm oil industry (Empty Fruit Bunch). Waste digestion has not been widely carried out in Indonesia, and may develop related to the waste to energy program in Indonesia.



Annex Figure 1: Composting and 3Rs in Waste Management in Indonesia. Source: PT elaboration

Restrictions on the use of plastic and guidance to producers also contribute to waste reduction (assuming some plastic waste is burned openly). The informal sector (waste collectors) also contributes to the reduction of waste generation in Indonesia. In addition to involving the informal sector (waste collectors), there are recycling and upcycling activities carried out directly by the community through the Waste Bank (Figure 3), or directly managed by the Local Government at Main Waste Bank, Recycling Centre, Intermediate Transfer Facility, and Integrated Waste Management site. Composting and Recycling Center facilities were also built by the government at the Solid Waste Disposal Site.

7.1.3 Waste to Energy: Incinerator Power Plant and Refuse Derived Fuel (RDF) Plant

Presidential Regulation No. 35 of 2018 concerning Acceleration of Construction of Waste Processing Installations into Electrical Energy Based on Environmentally Friendly Technology, making waste to energy activities increase. This regulation states that the acceleration of the construction of Waste Power Plants can be carried out by Regional Governments: DKI Jakarta Province, Tangerang City, South Tangerang City, Bekasi City, Bandung City, Semarang City, Surakarta City, Surabaya City, Makassar City, Denpasar City, Palembang City, and Manado City. **¡Error! No se encuentra el origen de la referencia.** provides examples of waste to e nergy projects.

Project Location	Technology	Notes
TPA Bantar Gebang, DKI Jakarta	Incinerator with Power Plant	Completed Construction. Capacity 100 tons per day.
TPA Bantar Gebang, DKI Jakarta	RDF Plant	in the construction phase, with a capacity of 1000 tons per day for fresh waste, and 1000 tons per day for landfilled waste.
Jatiuwung, Tangerang City	RDF Plant and Incinerator Plant.	In planning stage
TPA Benowo, Kota Surabaya	Gasification Power Plant	In operation, with a capacity of 9 MW.
TPA Putri Cempo, Kota Solo	Gasification Power Plant	Not yet operating, with a capacity of 8 MW.
TPA Karya Jaya, Kota Palembang	Incinerator with Power Plant	In the planning stage, with a capacity of 1000 tons of waste per day.
RDF Jeruk Legi Kabupaten Cilacap	RDF Plant	In operation, with a capacity of 140 tons of waste per day.

Annex Table 2: Several activities of Waste Processing into Electrical Energy in Indonesia. Source: PT elaboration

In the agro-industry, the gasification process is carried out to generate electricity from industrial solid waste, for example at the Siantan Biomass Power Plant (PLTBm) in the Siantan district. The Siantan PLTBm supplies 10 MW of electricity to the equatorial interconnection system. The Siantan PLTBm uses gasification technology with fuel from oil palm shells, wood, rice husks, corn cobs, bagasse, sawdust, and other agricultural wastes. In addition to energy (boiler fuel, bioethanol), agro-industrial waste is also processed into compost, mushroom cultivation, etc.

Domestic wastewater treatment using a septic tank with sludge recovery

Domestic wastewater treatment and disposal is a concurrent affair of the Central Government, Provincial Government, and City/Regency Government. The Central Government through the Regional Settlement Infrastructure Center (BPPW) of the Ministry of PUPR assists in the provision of domestic wastewater infrastructure, based on the City Sanitation Strategy and Sanitation Program Memorandum prepared by the City/Regency. The Provincial Government (through the Department of Housing and Settlement Areas) also

assists in providing these sanitation facilities. City/Regency Governments, apart from providing infrastructure (through the Public Housing & Settlement Service and/or Public Works Office), are also supervisors (through the Health Office and the Environment Agency) and operators in the management of domestic wastewater. However, not so many City/Regency governments have become operators in domestic wastewater management (because the majority of treatment is carried out on-site through individual septic tanks). City/Regency Governments often only provide and manage Faecal Sludge Treatment Plant ("IPLT") to accommodate sludge removal activities in septic tanks.

Domestic wastewater treatment in Indonesia is generally carried out using the onsite method (with a septic tank). In some urban slum areas, septic tanks are made for several houses, known as Communal Septic Tanks (which are made with an anaerobic baffled reactor system), often combined with shared toilets. Mitigation actions that have been carried out in the septic tank, only related to sludge removal, are known as the "Pengerukan Lumpur Tinja Secara Berkala". Next, the sewage sludge is taken to the Faecal Sludge Treatment Plant (IPLT).

7.1.6 Construction of communal septic tanks and biodigesters with CH4 recovery

The Community-Based Sanitation Program (SANIMAS) with the manufacture of MCK Plus (MCK-Biogas) started in the mid-2000s (**Figure 7**). MCK Plus is a communal facility for washing, bathing, and toileting, equipped with a septic tank connected to a gas holder. However, the difficulty of generating biogas due to the various characteristics of liquid waste, as well as the vulnerability of septic tanks, pipelines, and gas holders to leakage make this action difficult to apply and maintain. This action may be more suitable for small industrial wastewater.

7.1.7 Domestic wastewater treatment with the aerobic system

Several cities (Bandung, Medan, Jogjakarta, Bali) already have Centralized WWTP (equipped with methane flares), although they do not serve the entire city area. And, several other cities are building Centralized WWTPs (Pekanbaru, Palembang, Makassar). Several other cities have WWTP on a Regional Scale (Cirebon, Banjarmasin).

In several cities, which already have centralized WWTP, the City Government has formed regional companies that manage wastewater, such as in DKI Jakarta Province and Banjarmasin City. Several other cities mandated Regional Drinking Water Companies ("PDAM") to manage wastewater, such as Bandung City, Cirebon City, and Medan City. Others, such as the WWTP Sewon Jogjakarta and WWTP Suwung Bali are managed by the Provincial Public Works Department.

7.1.8 Industrial solid waste treatment (including WWTP sludge)

Paper waste that can be recycled from paper mills is in the form of a Mill Broke. Mill Broke is waste that paper mills produce during the paper-making process, and can be reused to make recycled paper. In addition, paper waste can be used as fuel.

In addition to industrial solid waste, sludge from wastewater treatment contains residual organic matter from the pulp and paper manufacturing process, which can be processed through a composting process with the final result in the form of organic fertilizer.

7.1.9 Utilization of biogas from Palm Oil Mill Effluent (POME)

Wastewater treatment must be carried out by the industry so that the wastewater effluent complies with the Regulation of the State Minister of the Environment Number 03 of 2010 concerning Wastewater Quality Standards for Industrial Estates. The Waste Water Treatment Plant (WWTP) facilities and infrastructure are provided by the industry and supervised (both at the planning, construction, and operation stages) by the MoEF.

Industrial WWTP in urban areas uses an aerobic system, and produces little methane, but has emissions (direct and indirect) from energy consumption. Meanwhile, industries located in remote areas, especially agro-industry (e.g., Palm Oil Plant and Tapioca Plant), process liquid waste into a series of biological ponds (some of which are anaerobic ponds) and produce high methane. In some agro-industrial WWTPs, methane is captured in anaerobic ponds to be used as energy (electricity). In several other locations, tanks/CSTRs were made to treat liquid waste into electricity. In general, the investment cost of a tank/CSTR system is more expensive than a closed pond.

Finally, some examples of methane capture projects (at WWTP agro-industry) for energy:

- Biogas Power Plant (PLTBg) Sungai Terlung, Cengkong Abang Village, Bangka Regency, with a capacity of 2 Mega Watt (MW). This PLTBg uses POME, with methane capture technology, as its primary energy source.
- Asian Agri Group's Biogas Plant (5 units in North Sumatra, 3 units in Riau, and 2 units in Jambi)
- M.P. Evans Group’s Biogas Plant (at Kerasaan, Kota Bangun, Bangka)
- Biogas Plant in tapioca factories in Lampung Province

7.2. Annex: Minutes of meeting with line ministries

Head of Sustainable Transportation Center – Ministry of Transport		
Participants:	-Hari Purnomo (WB) -Marwanto Heru (MoT) -Dina Kartika (MoT) -Puti Handayani (MoT) -Danawiryya Silaksanti (MoT) -Dodhy Wibowo (MoT) -Kiwinta Diaussie Boer (MoT) -Mutiara Khatulistiwa (MoT)	-Hans Verolme (Team Leader, OCA Global) -Alexandre Borde (International Finance Expert) -Hartono Kurniawan (Local Finance Expert) -Retno Gumilang Dewi (National Energy and Industry Expert) -Mr. Bernat Pallejà (Backstopping, OCA Global) -Kiki Kartikasari (Backstopping, CER Indonesia)
Main topics of discussion:	After a brief presentation of the Team, the TL Hans Verolme has presented the Project's Workplan, Consultation Plan and the Stakeholders' Map. This has been followed by a discussion on the following topics: - The majority of the mitigation actions are funded from the state budget, not from specific funds sources. - Those activities are earmarked and reported in the Annual Climate Budget Tagging. Therefore, the budget and implementation are reviewed regularly. - The implementation is reported to Bappenas, MoEF, and to MEMR. - MoT climate related activities are under the coordination of the MEMR (incl. for Net Zero Emissions program). - At this point, Hari Purnomo has asked if there is any planning beyond the annual budget tagging and the MoT has responded by saying that some activities are not specifically labelled as climate change in the medium-term plans. For instance, in RENSTRA, the activities are treated as regular activities from the programme at MoT. - Retno Gumilang Dewi has requested if the MoT is using any international support for mitigation activities, and MoT has clarified that they are not aware of them, as this kind of fundings are blended in the state budget. MoT is only aware of green/sukuk bonds marked projects as they are reported regularly. - The PPTB is only a coordinator and further discussions with the planning bureau and sub-sectors might be useful.	
Commitments	1. The Team will request for: (i) Climate Budget Tagging; (ii) RENSTRA; (iii) Other projects that are funded by non-state budget (to get details of activities). 2. The Team will identify any NDC projects or other plans at MoT that are not listed anywhere in the planning documents.	

	Fiscal Policy Agency – Ministry of Finance	
Participants:	-Hari Purnomo (Task Team Leader, WB) -Andhyta Firselly Utami (Afu) (Environmental Economist, WB) -Joko Tri Haryanto (Ministry of Finance, BKF1) -Irwan Dharmawan (Ministry of Finance, PKPPIM2) -Gerry Pramudya (BKF) -Merryn Ester Augina (BKM) -Dewa Ekayana (BKF)	-Faradina Salsabil (BKF) -M. Zainul Abidin (BKF)Paradhika Galih (BKF) -Zenitha Astra Paramitha (BKF) -Kiki Safitri, Naely and Tiofan S (MoF) -Hans Verolme (Team Leader, OCA Global) -Hartono Kurniawan (National Finance Expert) -Rizaldi Boer (National AFOLU Expert) -Bernat Pallejà (Backstopping, OCA Global) -Maria Galí (Backstopping, OCA Global) -Kiki Kartikasari (Backstopping, CER Indonesia)
Main topics of discussion:	The TA Team Leader Mr. Hans Verolme presented the specific objectives for the project, as well as some limitations the team is currently encountering: Hans Verolme (TL) and Bernat Pallejà (OCA Global Project Manager) visited Indonesia on 17-22 June. They met with the WB task team and the local consultants. It proved challenging to hold meetings with the line ministries identified by the WB as priority partners for the exercise. It became clear that line ministries need information on the project scope and guidance from the WB and BKF (as the counterpart for this TA project), including a request to collaborate with the Project Team (PT). In order to secure the line ministries' active collaboration, it would be useful for BFK to signal on behalf of the Government of Indonesia its support for this specific WB TA project. It is noted that Ministries might not feel strong co-ownership of the NDC Implementation Roadmap, which has a 2030 focus. Instead, they look towards the Low Carbon Development Initiative, with a net-zero by 2060 focus. The question is how more near-term GHG reduction projects can enter the year-to-year planning cycles and budgets. On the question of providing localized costing of projects in line with the proposed bottom-up approach to the project, pak Joko comments on the fact that while some data has already been gathered this is by no means simple. Up to now, the PT has made significant progress in preparing a globally significant mitigation potentials report for Indonesia based on international research. This will be merged with detailed bottom-up results obtained by the national consultants. At this point, MoF's assistance is necessary to ensure the collaboration of the line ministries in facilitating available information and participating in the PT's consultation process.	
Commitments	1. The PT will provide the list of specific line ministries to be contacted and a letter template with the information that would be needed from them, by tomorrow close of business.	

	2. MoF commits to contact line ministries (from the list provided) once the letter template is made available to them. 3. MoF will also organize an internal meeting with DG Treasury and Budget to ask for any related information they may have.

	Inland water and mangrove rehabilitation – Ministry of Environment and Forestry	
Participants:	- Ibu Inge Retnowati (KLHK) - Bapak Giri (KLHK) - Prof. Rizaldi Boer (CER)	- Kiwinta Diaussie (CER) - Kiki Kartikasari (CER)
Main topics of discussion:	Following a brief presentation of the Project, the discussion was focused on: - Current status of regulations related to the implementation of Carbon Economic Values and Nationally Determined Contributions. With a close coordination with the Directorate of GHG Inventory they conduct monitoring and registry to specifically measure contribution of mangrove rehabilitation to NDC/NET FOLU SINK. The draft of ministerial regulation on NEK is under development, it is tentatively indicated that each sub-sector should develop NEK roadmap to enable participation in NEK scheme/domestic carbon trading. - The current achievement of the climate-related projects, adaptation and mitigation. The number of projects being successfully implemented and the reasons why the targets were not being achieved. The main planning is done through the Development of Peta Mangrove Nasional (One Map Mangrove) 2021 and the Roadmap for Mangrove Rehabilitation 2021-2030 which is recently signed by the MOEF. - The number of climate-related projects that are currently under development and its impact. Under the Roadmap of Mangrove Rehabilitation, there is a regular planning for 600,000 ha rehabilitation until 2024. However, there is no specific calculation yet on the contribution to emission reduction. - The climate finance scheme. The State budget has been the regular financing tool, with private sector accounting only for 30%. - The possibility of new financing schemes being developed in the near future and how alternative financing schemes (outside Government budget) can be mobilized. The Technical framework of a joint program with the private sector is currently under development. In addition to the planting/rehabilitation, the technical framework will also outline potential economic activities in the area, so it can further contribute to socio-economic development, e.g silvo-fisheries (milkfish/crab farming in the mangrove).	
Commitments	The following documents were agreed to be provided: 1. Mangrove rehabilitation budgeting (coordination meeting with Ministry of Maritime and Investment Feb 2021) 2. Targeted area for regular planning + CSR 3. Post pandemic mangrove rehabilitation planning	

	4. MoEF regulation No. 02/2020 on incentive, coaching, and control of mangrove rehabilitation programs 5. Presidential regulation No. 120/2020 on establishment of BRGM 6. DG PDASHL regulation No. P8/PDASHL/SET/KUM.1/2017 on standardized cost for mangrove rehabilitation 7. Minister of Maritime and Investment Decree No.88/2022 on mangrove working group 8. Blue carbon concept - joint workshop with KKP 9. Draft of mangrove roadmap 2021 - 2030 10. Need assessment of field facilitators - for follow up via Ibu Ayu at BRGM 11. Standardized costs for maintenance and monitoring - for follow up via KKP 12. Criteria and indicators for access and utilization of BPDLH (climate related) funds esp. REDD+ safeguards

	Directorate of Ecosystem Restoration and Management – Ministry of Environment and Forestry	
Participants:	- Bapak Kukuh Santoso (BPPE KLHK) - Bapak Danang Anggoro (BPPE KLHK) - Ibu Widyaningsih Ratna (BPPE KLHK) - Prof. Rizaldi Boer (CER)	- Kiki Kartikasari (CER) - Mawardah Hanifiyani (CER) - Fakhri Muhammad (CER) - Rafli Zenta (CER)
Main topics of discussion:	Following a brief presentation of the Project, the discussion was focused on: - Current status of regulations related to the implementation of Carbon Economic Values, Nationally Determined Contributions, and supports to climate mitigation and adaptation in wider context. Activities at this directorate that contribute to the achievement of NDC target are mainly on ecosystem restoration (regulated via MoEF Regulation No. 48/2014). The draft of ministerial regulation on NEK is still under development, but it will have to indicate that ecosystem restoration is mandatory in new lease mechanisms and permits for companies. - The current achievement of the climate-related projects, adaptation and mitigation. The number of projects being successfully implemented and the reasons why the targets were not being achieved. The target of biodiversity conservation area inventory and verification in non-conservation area in RENSTRA 2020-2024 is 43 million ha, but by 2021 it was only completed for 15 million ha. Thus, it is highlighted that they do not always have sufficient funds to meet the targets. - The number of climate-related projects that are currently under development and its impact. They are currently developing (i) Habitat Typology (GCF funding via BPDLH) and (ii) Synchronization of geospatial data for ecosystem restoration whose final product, a map, is scheduled to be launched by the end of this year. On the other hand, the priority Project for the 2023 budget is the FPVI in North Sumatra.	

	- The climate finance scheme. The State budget remains as a dominant source of funding, although it often does not meet the minimum costs. Grants would be the second tool, followed by funds from companies who have a lease agreement on forest areas. - The possibility of new financing schemes being developed in the near future and how alternative financing schemes (outside Government budget) can be mobilized. - How is the private sector involved and what is done to attract its interest. The Synchronized data/ecosystem map should play an important role in encouraging new initiatives with a higher degree of involvement of private companies.
Commitments	The following documents were agreed to be provided: 1. Standard costs for environmental rehabilitation 2021 2. MoEF Regulation No. 48/2014

	Directorate of Planning, Monitoring and Management of Watershed – Ministry of Environment and Forestry
Main topics of discussion:	The discussion was started by introducing the Project and how it can contribute to the revision of NDC roadmap. Then, the following topics were covered: - Current status of regulations related to the implementation of Carbon Economic Values and Nationally Determined Contributions. - The current achievement of the climate-related projects, adaptation and mitigation. The number of projects being successfully implemented and the reasons why the targets were not being achieved. - The number of climate-related projects that are currently under development and its impact. - The climate finance scheme. A part from grants, which scheme/instrument is the most used for their climate-related projects. - The possibility of new financing schemes being developed in the near future and how alternative financing schemes (outside Government budget) can be mobilized. - The priority of activities and standard cost per unit of activity within their directorate.

	Sub-directorate of Climate Change Mitigation Planning, Policy and Tools – Ministry of Environment and Forestry
Main topics of discussion:	The discussion was started by introducing the Project and how it can contribute to the revision of NDC roadmap. Then, the following topics were covered: - Current status of regulations related to the implementation of Carbon Economic Values and Nationally Determined Contributions. - The current achievement of the climate-related projects, adaptation and mitigation. The number of projects being successfully implemented and the reasons why the targets were not being achieved.

	- The number of climate-related projects that are currently under development and its impact. - The climate finance scheme. A part from grants, which scheme/instrument is the most used for their climate-related projects. - The possibility of new financing schemes being developed in the near future and how alternative financing schemes (outside Government budget) can be mobilized. - The priority of activities and standard cost per unit of activity within their directorate.

	Directorate of Energy Conservation – Ministry of Energy and Mineral Resources
Main topics of discussion:	The discussion was started by introducing the Project and how it can contribute to the revision of NDC roadmap. Then, the following topics were covered: - Current status of regulations related to the implementation of Carbon Economic Values and Nationally Determined Contributions. - The current achievement of the climate-related projects, adaptation and mitigation. The number of projects being successfully implemented and the reasons why the targets were not being achieved. - The number of climate-related projects that are currently under development and its impact. - The climate finance scheme. A part from grants, which scheme/instrument is the most used for their climate-related projects. - The possibility of new financing schemes being developed in the near future and how alternative financing schemes (outside Government budget) can be mobilized. - The priority of activities and standard cost per unit of activity within their directorate.

Annex Table 3: Meetings' summary. Source: PT elaboration

7.3. Operational expenditure for the different subsectors in AFOLU

Reforestation 1 (1100 trees/ha)		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	404000	458000
Planting	13498000	16373000
Maintenance y-1	3866000	5215000
Maintenance y-2	3080000	3748800
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**23.489.000,00**	**28.894.300,00**

Reforestation 2 (625 trees/ha)		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	404000	458000
Planting	8509000	10442000
Maintenance y-1	3063000	3690000
Maintenance y-2	2345000	2829000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**16.962.000,00**	**20.518.500,00**

Peat forest and land		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	369000	444000
Planting	15258000	
Maintenance y-1	4933000	
Maintenance y-2	2777000	
		1223000
MONEV P-0	1098000	
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**25.978.000,00**	**30.788.500,00**

Peat fire		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	404000	458000
Planting	24885000	29684000
Maintenance y-1	4478000	5945000
Maintenance y-2	3019000	3525000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**35.427.000,00**	**42.711.500,00**

Agroforestry 1 (400 trees/ha)		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	404000	458000
Planting	7473000	9193000
Maintenance y-1	2458000	3012000
Maintenance y-2	1958000	2345000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**14.934.000,00**	**18.107.500,00**

Agroforestry 2 (200 trees/ha)		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	404000	458000
Planting	4041000	5031000
Maintenance y-1	1294000	1839000
Maintenance y-2	1177000	1414000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**9.557.000,00**	**11.841.500,00**

Community forest 1 (625 trees/ha)		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	253000	289000
Planting	15566000	18657000
Maintenance y-1	4157000	4992000
Maintenance y-2	3018000	3587000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**25.382.000,00**	**30.335.500,00**

Community forest 2 (400 trees/ha)		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	253000	289000
Planting	10526000	12644000
Maintenance y-1	3075000	2555000
Maintenance y-2	2005000	2385000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**18.247.000,00**	**20.683.500,00**

Mangrove 1: Intensive planting 3300 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	17988000	25194000
Maintenance y-1	3670000	5058000
Maintenance y-2	1900000	2504000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**26.638.000,00**	**36.416.500,00**

Mangrove 2: Intensive planting 10000 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	41356000	57418000
Maintenance y-1	7625000	10385000
Maintenance y-2	3777000	5067000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**55.838.000,00**	**76.530.500,00**

Mangrove 3: Spaced clump 5000 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	19496000	27238000
Maintenance y-1	4265000	5905000
Maintenance y-2	2197000	2927000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**28.599.000,00**	**39.169.500,00**

Mangrove 4: Spaced clump 10000 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	36746000	49888000
Maintenance y-1	7515000	10255000
Maintenance y-2	3522000	4752000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**50.863.000,00**	**68.555.500,00**

Mangrove 5: Enrichment 1000 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	9076000	13058000
Maintenance y-1	2240000	3140000
Maintenance y-2	1185000	1545000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**15.581.000,00**	**21.403.500,00**

Mangrove 6: Enrichment 3000 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	16356000	23058000
Maintenance y-1	3465000	4785000
Maintenance y-2	1797000	2367000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**24.698.000,00**	**33.870.500,00**

Mangrove 7: Silvofishery 800 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	8216000	11842000
Maintenance y-1	1960000	2728000
Maintenance y-2	945000	1189000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**14.201.000,00**	**19.419.500,00**

Mangrove 8: Silvofishery 1600 trees/ha		
Activity	**Budget (Rupiah)**	
	Min	**Max**
Design	439000	561000
Planting	11451000	16241000
Maintenance y-1	2335000	3291000
Maintenance y-2	1232000	1570000
MONEV P-0	1098000	1223000
MONEV P-1	793000	938000
MONEV P-2	750000	938500
Total	**18.098.000,00**	**24.762.500,00**

Annex table 4: Operational expenditure for the different subsectors in AFOLU. Source: PT elaboration.