FIRST NATIONALLY DETERMINED CONTRIBUTION

REPUBLIC OF INDONESIA

November 2016

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1. NATIONAL CONTEXT

Indonesia is a nascent yet stable democracy and the fourth most populous country in the world. Despite continuous, multi-decade economic growth, approximately 11% of Indonesia's population is living below the poverty line. To lift people out of poverty, the Government of Indonesia (GOI) is promoting economic development projected to average at least 5% per year in order to reduce the poverty rate to below 4% by 2025, as mandated by the Indonesian Constitution, inter alia, that "every person shall have the right to enjoy a good and healthy environment." As climate change becomes a reality, Indonesia continues to seek a balance between its current and future development and poverty reduction priorities.

In 2010 the Government of Indonesia pledged to reduce emissions by 26% (41% with international support) against the business as usual scenario by 2020. The current administration, under President Joko Widodo, has determined priority actions within the national *Nawa Cita* (Nine Priority Agendas) framework, which includes protecting Indonesia's citizens, encouraging rural and regional development, improving the quality of life, and improving productivity and global competitiveness. These core missions are consistent with the national commitment towards a low carbon and climate change-resilient development path, in which climate change adaptation and mitigation constitute an integrated and cross-cutting priority of the National Medium-Term Development Plan. The following priorities for enhanced actions in 2015-2019 will be fully integrated into Indonesia's National Medium-Term Development Plan in 2020.

Given its pivotal geographic position in the global ocean conveyor belt (thermohaline circulation), the largest archipelagic country and its extensive tropical rainforests with high biodiversity, high carbon stock values and energy and mineral resources, Indonesia is recognized its role to play in combatting global climate change. Nevertheless, Indonesia is vulnerable to natural disaster that will likely be exacerbated by climate change, especially in low-lying areas throughout the archipelago. Therefore Indonesia views comprehensive land and ocean-based climate change adaptation and mitigation efforts as a critical strategic consideration in achieving climate resilience in food, water and energy.

Indonesia's Nationally Determined Contribution (NDC) outlines the country's transition to a low carbon and climate resilience future. The NDC describes the enhanced actions and the

necessary enabling environment during the 2015-2019 period that will lay the foundation for more ambitious goals beyond 2020, contributing to the concerted effort to prevent 2^0C increase in global average temperature and to pursue efforts to limit the temperature increase to 1.5^oC above pre-industrial levels. For 2020 and beyond, Indonesia envisions achieving archipelagic climate resilience as a result of comprehensive adaptation and mitigation programmes and disaster risk reduction strategies. Indonesia has set ambitious goals for sustainability related to production and consumption of food, water, and energy. These goals will be achieved by supporting empowerment and capacity building, improved provision of basic services in health and education, technological innovation, and sustainable natural resource management, in compliance with principles of good governance.

2. MITIGATION

According to Indonesia's Second National Communication of 2010, national greenhouse gas (GHG) emissions were estimated to be 1.8 GtCO$_2$e in 2005. This represents an increase of 0.4 GtCO$_2$e compared to 2000. Most emissions (63%) are the result of land use change and peat and forest fires, with combustion of fossil fuels contributing approximately 19% of total emissions. Based on Indonesia's First Biennial Update Report (BUR) submitted to UNFCCC in January 2016, national greenhouse gas (GHG) emissions was 1.453 GtCO2e in 2012 which represent an increase of 0,452 GtCO2e from year 2000. The main contributing sectors were LUCF including peat fires (47.8%) and energy (34,9%).

Since Indonesia voluntarily pledged to reduce emissions by 26% on its own efforts, and up to 41% with international support, against the business as usual scenario by 2020, Indonesia has promulgated relevant legal and policy instruments, including the national action plan on GHG emissions reduction as stipulated in Presidential Regulation (PERPRES) No. 61/2011 and GHG inventory through Presidential Regulation (PERPRES) No. 71/2011.

Post 2020, Indonesia envisions a progression beyond its existing commitment to emission reductions. Based on the country's most recent emissions level assessment, Indonesia has set unconditional reduction target of 29% and conditional reduction target up to 41 % of the business as usual scenario by 2030.

Indonesia has taken significant steps to reduce emissions in land use sector by instituting a moratorium on the clearing of primary forests and by prohibiting conversion of its remaining forests by reducing deforestation and forest degradation, restoring ecosystem functions, as well as sustainable forest management which include social forestry through active participation of the private sector, small and medium enterprises, civil society organizations, local communities and the most vulnerable groups, especially adat communities (Indonesia: *Masyarakat Hukum Adat*, internationally known as Indigenous People), and women – in both

the planning and implementation stages. A landscape-scale and ecosystem management approach, emphasizing the role of sub-national jurisdictions, is seen as critical to ensure greater and more enduring benefits from these initiatives.

REDD+ will be an important component of the NDC target from land use sector. Forest Reference Emission Level (FREL) for REDD+ was submitted to the UNFCCC Secretariat in December 2015, covering deforestation and forest degradation and peat decomposition. The FREL was set at 0.568 GtCO2e yr-[1] (AGB), using reference period of 1990 – 2012 and will be used as the benchmark against actual emission starting from 2013 to 2020. These figures should be used as benchmark for evaluating REDD+ performance during the implementation period (up to 2020). Indonesia will adjust the FREL for post-2020 or earlier when necessary.

In energy sector, Indonesia has embarked on a mixed energy use policy. Indonesia has also established the development of clean energy sources as a national policy directive. Collectively, these policies will eventually put Indonesia on the path to de-carbonization. Government Regulation No. 79/2014 on National Energy Policy, set out the ambition to transform, by 2025 and 2050, the primary energy supply mix with shares as follows:

a) new and renewable energy at least 23% in 2025 and at least 31% in 2050;
b) oil should be less than 25% in 2025 and less than 20% in 2050;
c) coal should be minimum 30% in 2025 and minimum 25% in 2050; and
d) gas should be minimum 22% in 2025 and minimum 24% in 2050.

For the waste management sector, the GOI is committed to develop a comprehensive strategy to improve policy and institutional capacity at the 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. The GOI is committed to further reduce emissions from the waste management sector by 2020 and beyond, through comprehensive and coherent policy development, institutional strengthening, improved financial and funding mechanisms, technology innovation, and social-cultural approaches.

3. ADAPTATION

Climate change presents significant risks for Indonesia's natural resources that will, in turn, impact the production and distribution of food, water, and energy. Therefore, the GOI considers climate mitigation and adaptation efforts as an integrated concept that is essential for building resilience in safeguarding food, water and energy resources. The GOI has made significant efforts towards developing and implementing a National Action Plan on Climate

Change Adaptation (RAN-API) which provides a framework for adaptation initiatives that has been mainstreamed into the National Development Plan.

The GOI will implement enhanced actions to study and map regional vulnerabilities as the basis of adaptation information system, and to strengthen institutional capacity and promulgation of climate change sensitive policies and regulations by 2020. The medium-term goal of Indonesia's climate change adaptation strategy is to reduce risks on all development sectors (agriculture, water, energy security, forestry, maritime and fisheries, health, public service, infrastructure, and urban system) by 2030 through local capacity strengthening, improved knowledge management, convergent policy on climate change adaptation and disaster risks reduction, and application of adaptive technology.

Pre 2020 policies' and actions will facilitate smooth transition towards implementation of nationally determined contribution under the Paris Agreement post 2020. The following pre 2020 policies and actions will lay a strong foundation for adaptation actions from 2020 onwards :

1) Pre-condition:
   - Development of nation wide climate vulnerability index data Information System, built on the existing system known as *SIDIK* (Vulnerability Index Data Information System) which allows public access to the information in the system website (http://ditjenppi.menlhk. go.id)
   - Ministerial Regulation No. P.33/2016 on Guideline for development of National Adaptation Plan (NAP). The regulation allows sub national government to formulate their own Sub National Adaptation Plan (Sub NAP)
   - Enhance existing National Action Plan on Climate Change Adaptation that has been formulated in 2014.

2) Environment and social economic area:

   - Law No. 37/2014 on Soil and water conservation, which leads to Sustainable agriculture and land use. The Law guided stakeholders in conserving lands and increasing productivity towards conservation agricultural approach.
   - Government Regulation No. 37/2012 on Watershed Management, which leads to enhanced watershed carrying capacity. The regulation provides guideline to identify and address watersheds which need to be protected, restored, and rehabilitated.
   - Community Based Forest Management will enhance community income and at the same time reduce pressure on primary forest which leads to deforestation and forest degradation.
   - Enhance role of PROKLIM (joint adaptation and mitigation/JAM) as a bottom up approach in climate resilience programme at the village level. Furthermore, the enhanced PROKLIM will enable to account for its contribution to the achievement of emission reduction both pre and post 2020.

4. STRATEGIC APPROACH

Indonesia requires a comprehensive and thorough plan to effectively implement sustainable production and consumption patterns, benefiting from the diversity of traditional wisdom of her indigenous institutions. Broader constituency building is also deemed critical through effective engagement of all stakeholders including faith based networks as well as the existing interfaith movement.

The strategic approach of Indonesia's NDC is predicated on the following foundational principles:

- Employing a landscape approach: Recognizing that climate change adaptation and mitigation efforts are inherently multi-sectoral in nature, Indonesia takes an integrated, landscape-scale approach covering terrestrial, coastal and marine ecosystems.
- Highlighting existing best practices: Recognizing significant strides in multi-stakeholder efforts in combating climate change, Indonesia intends to scale up the diversity of traditional wisdom as well as innovative climate change mitigation and adaptation efforts by the government, private sector, and communities.
- Mainstreaming climate agenda into development planning: Recognizing the needs to integrate climate change into development and spatial planning and the budgeting process, Indonesia will include key climate change indicators in formulating its development programme's targets.
- Promoting climate resilience in food, water and energy: Recognizing the importance of fulfilling the needs of a growing young population for food, water and energy, Indonesia will improve its management of natural resources to enhance climate resilience by protecting and restoring key terrestrial, coastal and marine ecosystems.

Indonesia's commitment to a low carbon future outlines enhanced actions and puts in place the necessary enabling environment for the 2015-2019 period that will lay the foundation for more ambitious goals beyond 2020. This would provide opportunities for building coherent actions at the national level, with particular emphasis on research, resource mobilization through partnerships, and international cooperation. The Indonesian Environmental Protection and Management Law of 2009 secures the legal framework to support 2015-2019 strategies and actions, which would serve as enabling conditions for long-term policy of 2020 and beyond. However, to achieve long-term policy goals, a comprehensive legal harmonization of all relevant matters related to climate change is seen as critical to meet the daunting challenges of climate change mitigation and adaptation.

National Development Planning Agency reported that for the period of 2007 to 2014 Indonesia had spent a total of about USD 17.48 billion for climate change adaptation,

mitigation and supporting activities. Indonesia will continue to provide funding for the implementation of climate change actions and plans, including allocating a total of USD 55.01 billion for the period of 2015 to 2019. Indonesia will continue to set aside significant national funding for the implementation of mitigation and adaptation actions for the period of 2020-2030.

In line with the Paris Agreement, Indonesia respects, promotes and considers its obligation on human rights, the right to health, the right of adat communities (Indonesia: Masyarakat Hukum Adat and internationally known as indigenous people), local communities, migrants, children, persons with different abilities, and people in vulnerable situations, and the right to development, as well as gender equality, empowerment of women and intergenerational equity. Engagement of non-party stakeholders, including local government, private sectors, civil societies will continuously be enhanced.

5. PLANNING PROCESS

The Government of Indonesia has demonstrated its strong commitment to institutional development by establishing the Directorate General of Climate Change, under the Ministry of Environment and Forestry. Established by Presidential Regulation No. 16 of 2015, the Directorate General serves as the National Focal Point for the United Nations Framework Convention on Climate Change to effectively facilitate ongoing relevant programmes and processes being implemented by variety of government sectors and stakeholders. Since climate change has local to national and international dimensions, coordination and synergy will continuously be enhanced between the Ministry of Environment and Forestry and National Development Planning Agency (BAPPENAS) and Ministry of Finance in the context of climate change, national development and finance, and with Ministry of Foreign Affairs in the context of climate change and international negotiation.

In the preparation of the NDC, the GOI has conducted consultations with various stakeholders representing Ministries and other government institutions, academia, scientists, private sector, and civil society organizations; these consultations have included workshops and consultations organized at both the national and provincial levels, as well as bilateral meetings with key sectors.

The preparation of the NDC has taken into account the Post-2015 Sustainable Development Goals (SDGs) particularly on taking urgent action to combat climate change and its impacts, promoting food security and sustainable agriculture, achieving gender equality, ensuring the availability and sustainable management of water, access to affordable, reliable, and renewable energy for all, sustained, inclusive and sustainable economic growth, resilient infrastructure, sustainable consumption and production patterns, conservation and

sustainable use of the oceans, seas and marine resources, and protecting, restoring and promoting sustainable use of terrestrial ecosystems, sustainably managing forests, combating desertification, and halting and reversing land degradation and biodiversity loss.

6. INFORMATION TO FACILITATE CLARITY, TRANSPARENCY AND UNDERSTANDING

Reduction Level

(a) Unconditional Reduction

Indonesia has voluntarily committed to reduce unconditionally 26% of its greenhouse gases against the business as usual scenario by the year 2020.

The above commitment is a necessary prerequisite for embarking on a more ambitious commitment to further reductions by 2030 by outlining an emission reduction plan using an evidence-based and inclusive approach. The commitment will be implemented through effective land use and spatial planning, sustainable forest management which include social forestry programme, restoring functions of degraded ecosystems including wetland ecosystems, improved agriculture and fisheries' productivity, energy conservation and the promotion of clean and renewable energy sources, and improved waste management.

Indonesia has committed to reduce unconditionally 29% of its greenhouse gasses emissions against the business as usual scenario by the year of 2030. The BAU scenario is projected approximately 2,869 GtCO2e in 2030 which is up-dated from the BAU scenario on the INDC due to current condition on energy policy development in particular in coal fired power plant.

(b) Conditional Reduction

Indonesia could increase its contribution up to 41% reduction of emissions by 2030, subject to availability of international support for finance, technology transfer and development and capacity building.

Type

Emission reduction relative to Business As Usual (BAU) baseline.

Coverage	Nationwide with a landscape and ecosystem management approaches in both adaptation and mitigation efforts by building and strengthening sub-national jurisdictional capacity.
Scope	Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N2O)
Baseline	BAU scenarios of emission projection started in 2010.
Fair and Ambitious	Indonesia GDP growth rate has slowed down between 2010-2015, from 6.2-6.5% per annum to only 4.0% (first quarter 2015). Indonesia's population has increased at an average rate of 1.49% during the period of 2000-2010, posing challenges for Indonesia in fulfilling energy demand, ensuring food security, and fulfilling livelihood needs. At the same time, poverty alleviation remains a challenge for Indonesia, with 10.96% of the population living in poverty in 2014, and the unemployment rate at 5.9%.
	Despite challenges which common to other developing countries, Indonesia is committed to transition its current development pathway towards low carbon and climate resilience in a phased-approach. The pathway towards de-carbonization of the economy will be fully integrated into Indonesia's National Medium-Term Development Plan for the period 2020-2024.
	Indonesia also considers to work on finding the peaking time of national GHGs emissions necessary to meet the national sustainable development objectives while contributing to the global efforts to fight against the dangerous impacts of climate change.

Key Assumption on Mitigation	
Metric Applied	Global Warming Potential (GWP) on a 100 year timescale in accordance with the IPCC's 4th Assessment Report.
Methodology for Estimating Emissions	Model for estimating emission:
	▪ Dashboard AFOLU for land-based sector;
	▪ ExSS (*Extended Snap Shot*) using GAMS (*General*

Algebraic Modeling System) and CGE (Dynamic CGE) for energy sector;

- Mitigation Action Road Map for Cement Industry (Ministry of Industry) for IPPU sector;

- *First Order Decay*-FOD (IPCC-2006) and existing regulation for waste sector

Baseline, Assumption Used for Projection and Policy Scenario 2020-2030

BAU Baseline Scenario and Mitigation Scenario

- BAU Scenario: emission scenario when the development path does not consider the mitigation policies.

- Counter Measure 1 Scenario (CM1): emission scenario with mitigation scenario and considers sectoral development target.

- Counter Measure 2 Scenario (CM2) or conditional scenario: emission scenario with more ambitious mitigation scenario and considers sectoral development target when international support is available.

Coverage of Emission Reduction

With the baseline and assumption used for projection and policy scenario 2020-2030, the projected BAU and emission reduction for both unconditional (CM1) and conditional (CM2) reduction are as in the Table 1 with more elaborated assumptions for each sector can be seen in the Annex.

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

No	Sector	GHG Emission Level 2010* MTon CO$_2$e	GHG Emission Level 2030 (MTon CO$_2$e)			GHG Emission Reduction				Annual Average Growth BAU (2010-2030)	Average Growth 2000-2012*
						(MTon CO$_2$e)		% of Total BaU			
			BaU	CM1	CM2	CM1	CM2	CM1	CM2		
1	Energy*	453.2	1,669	1,355	1,271	314	398	11%	14%	6.7%	4.50%
2	Waste	88	296	285	270	11	26	0.38%	1%	6.3%	4.00%
3	IPPU	36	69.6	66.85	66.35	2.75	3.25	0.10%	0.11%	3.4%	0.10%
4	Agriculture	110.5	119.66	110.39	115.86	9	4	0.32%	0.13%	0.4%	1.30%
5	Forestry**	647	714	217	64	497	650	17.2%	23%	0.5%	2.70%
	TOTAL	**1,334**	**2,869**	**2,034**	**1,787**	**834**	**1,081**	**29%**	**38%**	**3.9%**	**3.20%**

* Including fugitive   **Including peat fire

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

7. TRANSPARENCY FRAMEWORK

As part of the implementation of Article 13 of the Paris Agreement, Indonesia applies an Integrated National Transparency framework, through : (a) National Registry System (NRS) for mitigation, adaptation and means of implementation both from national and international sources; (b) National GHGs Inventory System (SIGN-SMART); (c) MRV system for mitigation including REDD+, and (d) Safeguards Information System for REDD+ (SIS-REDD+); and (e) Information Systems on vulnerability (SIDIK) and joint adaptation and mitigation at the Village level (PROKLIM).

Indonesia commits to periodically communicate its greenhouse gases emissions from various sectors, including the status of emission reduction efforts and results to the Secretariat of UNFCCC. Indonesia is currently preparing the Third National Communication Report (TNC), to be submitted by 2017. Indonesia will also meet its obligation to prepare the Biennial Update Report (BUR). The first BUR has been submitted in early 2016.

8. INTERNATIONAL SUPPORTS

International support from developed country parties on finance, technology development and transfer, and capacity building is required to increase ambition in reducing GHGs emission, including in the preparation of NDC implementation (pre 2020) in all sector categories and the implementation of REDD+ under Article 5 of the Paris Agreement.

Article 5 of the Paris Agreement sends clear political signal on the recognition of the roles of forest and REDD+. Existing COP decisions has provided sufficient guidance to implement and support REDD+ implementation. Furthermore, considering significant progress of REDD+ readiness and transition at the national and sub national level in the country, Indonesia's REDD+ should be ready for result-based payment. As policy approaches and positive incentives, REDD+ should be able to support the achievement of Indonesia's emission reduction target in forestry sector.

Furthermore, Indonesia welcome bilateral, regional and international cooperation in the NDC implementation as recognized under Article 6 of the Paris Agreement, that facilitate and expedite technology development and transfer, payment for performance, technical cooperation, and access to financial resources to support Indonesia's climate mitigation and adaptation efforts towards a climate resilient future.

9. INDONESIA LOW CARBON AND CLIMATE RESILIENCE STRATEGY

Introduction

The Government of Indonesia considers climate mitigation and adaptation efforts as an integrated concept that is essential for building resilience in safeguarding food, water and energy resources. Indonesia also views its development pathway towards low carbon and climate resilience is consistent with its commitment to contribute to the global effort for achieving Sustainable Development Goals (SDGs).   These global agendas will be contextualized given Indonesia's unique archipelagic geography, and its position within the global ocean conveyor belt (thermohaline circulation) and its extensive tropical rainforests, with their high biodiversity and high carbon stock value. Indonesia is also a nascent yet stable democracy and the fourth most populous country in the world, with the largest generation of young people and the most working-age people in its history.

Indonesia's Vulnerability to Climate Change

As an archipelagic country with extensive low-lying and small island areas, Indonesia is highly vulnerable to the adverse impacts of climate change. Indonesia has already experienced extreme climate events such as floods and drought, and is anticipating long-term impacts from sea level rise. As the Indonesian population grows, climate change-induced natural disasters will affect a greater number of people and their assets, making it difficult for them to escape poverty.

Climate change is believed to increase the risk for hydro-meteorological disasters, which make up to 80% of disaster occurrences in Indonesia. The poorest and most marginalized populations tend to live in high-risk areas that are prone to flooding, landslides, sea level rise, and water shortages during drought.

As the country with the second longest coastline in the world, Indonesia faces a high risk of coastal inundation and sea level rise that may affect up to 42 million people living in low laying coastal zones. Most of these areas have experienced rapid urbanization, reaching 50% in 2010.

The vulnerability of Indonesia's coastal zone is also affected by the rate of deforestation and forest degradation. The loss of forest ecosystems leads to the loss of critical environmental services, provision of water catchment areas, prevention of erosion and floods.

In order for Indonesia to reduce its vulnerability to climate change, it must strengthen its climate resilience by integrating its adaptation and mitigation efforts in development planning and implementation.

Enabling conditions for climate resilience

Indonesia's pathway toward low carbon and climate resilience must be developed by building a strong foundation based on the following enabling conditions:

- Certainty in spatial planning and land use
- Land tenure security
- Food security
- Water security
- Renewable energy

Economic resilience

Climate change presents significant risks for Indonesia's natural resources that will in turn affect the production and distribution of food, water and energy. As the population grows, there will be increasing pressures on Indonesia's already limited resources. As a response, Indonesia plans to transform to low carbon economy and build resilience into its food, water and energy systems through the following enhanced actions:

- Sustainable agriculture and plantations
- Integrated watershed management
- Reduction of deforestation and forest degradation
- Land conservation
- Utilization of degraded land for renewable energy
- Improved energy efficiency and consumption patterns

Social and Livelihood Resilience

Climate change impacts the day-to-day lives of all Indonesians, but most severely Indonesia's most vulnerable populations. Climate change-induced natural disasters will impact a greater number of people living below the poverty line, preventing asset accumulation. Rising food, water and energy prices, which often follow drought, floods, and other disasters, will drive the poor further into poverty. Socio-economic disparity will potentially contribute to political instability in regions most affected by climate change. To prevent further disparity, Indonesia plans to build social resilience through the following actions:

- Enhancement of adaptive capacity by developing early warning systems, broad-based public awareness campaigns, and public health programmes;
- Development of community capacity and participation in local planning processes, to secure access to key natural resources;
- Ramping up disaster preparedness programmes for natural disaster risk reduction;

- Identification of highly vulnerable areas in local spatial and land use planning efforts.
- Improvement of human settlements, provision of basic services, and climate resilient infrastructure development.
- Conflict prevention and resolution.

Ecosystem and Landscape Resilience

As an archipelagic country with high biodiversity, Indonesia's highly diverse ecosystems and landscapes provide various environmental services such as watershed protection, carbon sequestration and conservation, and disaster risk reduction.   In order to build climate resilience, Indonesia must protect and sustain these environmental services by taking an integrated, landscape-based approach in managing its terrestrial, coastal and marine ecosystems.   The following are enhanced actions to support ecosystem and landscape resilience:

- Ecosystem conservation and restoration
- Social forestry
- Coastal zone protection
- Integrated watershed management
- Climate resilient cities.

10. REVIEW AND ADJUSTMENT

The NDC reflects the most recent data and information, analysis, and scenario for possible future, by the Government of Indonesia. As a developing country, Indonesia will likely experience dynamic changes due to national and global economic changes. In this regards, the NDC will be reviewed and adjusted, as necessary, taking into account national circumstances, capacity and capability, and the provision under the Paris Agreement.

Annex
First Nationally Determined Contribution (NDC)
Republic of Indonesia
Assumptions used for projected BAU and emission reduction
(unconditional/CM1 and conditional/ CM2 reduction)
for all sector categories (Energy, Waste, IPPU, Agriculture, and Forestry)

S E C T O R : E N E R G Y			
	BAU	**Mitigation Scenario 1 (CM 1)**	**Mitigation Scenario (CM 2)**
1. Efficiency in final energy consumption. 2. Implementation of clean coal technology in power plant.	In-efficiency in final energy consumption. 0%	75%	100%
3. Renewable energy in electricity production.	Coal power plant	19,6% (*Committed* 7,4 GW based on RUPTL)	Electricity production of 132,74 TWh
4. Implementation of biofuel in transportation sector (Mandatory B30).	0%	90%	100%
5. Additional gas distribution lines.	0%	100%	100%
6. Additional compressed-natural gas fuel station (SPBG).	0%	100%	100%

S E C T O R :   A F O L U

A. Deforestation rate

- Deforestation rate under BAU scenario for 2013-2020 is in line with the FREL for REDD+, which is about 0.920 Mha/year, and consist of planned and unplanned deforestation. The rate for planned deforestation was calculated under existing development scenario.
- For both CM1 and CM2 scenarios, it is assumed that the rate of unplanned deforestation is low and the total of planned and unplanned deforestation would not exceed 0.450 Mha.
- Rate of deforestation for BAU 2021-2030 assumed to be 0.820 Mha/year, with scenario of CM1 and CM2 comes into 0.325 Mha, respectively.

	BAU	CM1	CM2	Note
Total (000 ha)	2013-'20: 920 2020-'30: 820 2030-'50: result from model	2013-'20: 450 2020-'30: 325 2030-'50: result from model	2013-'20: 450 2020-'30: 325 2030-'50: result from model	It is assumed that unplanned deforestation would not occur post 2030. Meaning the rate of deforestation completely comes from planned deforestation (model).
1. Unplanned Deforestation	2013-'20: 500 2020-'30: 409 2030-'50: 0	2013-'20: 175 2020-'30: 92 2030-'50: 0	2013-'20: 175 2021-'30: 66 2030-'50: 0	
2. Planned Deforestation (from the model)	2011-'50: result from model	2011-'50: result from model	2011-'50: result from model	

B. Assumption for wood production:
1. Some literatures recorded that the rate of wood extraction from sustainable natural forest ranges from 20 to 35 m^3ha. This work take an assumption of 50 m^3/ha for wood extraction in 2010 (the difference between literature and assumption taken is from illegal logging. Illegal logging was assumed zero in 2050, and rate of wood extraction would reach $30m^3$ (rate of sustainable extraction).
2. Target for wood production from natural forest under CM1 and CM2 scenarios follow National Forestry Planning (*Rencana Kehutanan Tingkat Nasional*/RKTN) (MoF, 2011), while the BAU is higher, using data from the Association for Indonesian Forest Concessionaire (APHI).
3. The rate for establishing forest estate (plantation) under BAU follows the historical data, with the percentage of feasible areas for planting is about 63% (Assumption from APHI, 2007)
4. It is assumed that all forests cleared would leave zero waste, and all woods from these areas would be useable.
5. Utilization of wood from oil palm and rubber trees at the end of its cycle is at medium rate or about a half of total.

C. Assumption for growth rate:
1. Growth rate of plants in ton C/ha/year for natural forest was calculated based on the growth in m^3/ha/year with conversion factor of :
   a. Biomass Expansion Factor (BEF): 1.4 (Ruhiyat, 1990)
   b. Wood density for natural forest: 0.7 t/m^3
2. The rate of Industrial Plantation (HTI) in ton C/ha/year was calculated based on data of measurable wood production volume in m^3/ha, with BAU, CM1 and CM 2 in 2010 about 120 and has been increased respectively to 140, 160 and 200 m^3/ha in 2050 with the role of technology intervention. The escalation is in every 10 year and correction factors:
   a. BEF: 1.4 (IPCC Default)
   b. Wood density for HTI: 0.4 t/m^3
3. 6 years rotation.

D. CM2 calculation used a very ambitious targets (38%), and some adjustment to the above assumption (CM1) are as follows:
1. Peat restoration achieves 90% survival rate and the area of peat restoration reaches 2 Mha by 2030
2. Land rehabilitation achieves 90% survival rate and almost all unproductive lands have to be rehabilitated (about 12 Mha in total), so that up to 2030 the rate of plantation would be 800 thousand ha/year (the baseline under historical data is about 270 thousand ha).

S E C T O R : A G R I C U L T U R E			
	BAU	**CM1**	**CM2**
1. The use of low-emission crops.	No mitigation actions.	In total, the use of land for low emission crops is up to 926,000 hectares in 2030*.	In total, the use of land for low emission crops is up to 908,000 hectares in 2030*.
2. Implementation of water-efficient concept in water management.	No mitigation actions.	Implementation of water efficiency is up to 820,000 hectares in 2030*.	Implementation of water efficiency is up to 820,000 hectares in 2030*.
3. Manure management for biogas.	No mitigation actions.	Up to 0.06% of the total cattle in 2030**.	Up to 0.06% of the total cattle in 2030**.
4. Feed supplement for cattle.	No mitigation actions.	Up to 2.5% of the cattle population in 2030**.	Up to 2.5% of the cattle population in 2030**.

Note: * the use of best available technology will increase cattle productivity and lead to the decrease of land use change to agricultural purposes.

** increase of cattle population and current biogas operationalization (with the assumption that government's subsidy will continue taking into consideration its high cost of investment).

A. The index for paddy increases from 2.11 into 2.5 (for Java island) and from 1.7 up to 2.0 (for outside of Java island). It is assumed that all paddy fields out of Java island has already completed with irrigation system like in Java island, and all irrigation system in Java island is working optimally (existing condition: only 60-70% of irrigation system in Java are working optimally).

B. Assumption used for crop index : for seasonal crop, the cropping Intensity or crop index is a ratio between the area of harvesting and the area of crop planted. So that the IP is 2 when the areas were planted twice a year. For annual crop, the crop index refers to crop fraction that harvestable (under productive ages).

C. Assumption used for population/GDP and livestock: all projection scenarios for GDP employ the same livestock population. Target settled for self-supporting meat is difficult to reach, and even the needs for meat would not be easily attainable. The livestock population growth follows historical data, which is lower than the rate of the meat demands.

SUB-SECTOR: SOLID WASTE

	BAU	CM1	CM2
1. Enhancement of LFG recovery from 2010 to 2030.	No mitigation actions.	LFG recovery reduces CH_4 from 0.65% to 10%.	LFG recovery reduces CH_4 from 0.65% to 10%.
2. Enhancement of the percentage of waste utilization by composting and 3R (paper).	No mitigation actions.	22% in 2020, 30% in 2030*.	22% in 2020, 30% in 2030*.
3. Enhancement of the percent-age of PLTSa/RDF (*Refuse Derived Fuel*) implementation, compare to total waste. Note: PLTSa = Pembangkit Listrik Tenaga Sampah	No mitigation actions.	- Up to 3% in 2020 and increase up to 5% in 2030**. - PLTSa implementation in 7 cities.	- Up to 3% in 2020 and increase up to 5% in 2030**. - PLTSa implementation in 12 cities (additional)***.

Notes: *   refer to national target on solid waste management 2015-2025.
         ** considered government plan in developing PLTSa (Pembangkit Listrik Tenaga Sampah) in 7 cities and current trend on waste utilization by RDF in industries.
         *** considered size of the cities, their mitigation potentials in RDF implementation, and population growth rate.

SUB-SECTOR: DOMESTIC LIQUID WASTE

	BAU	CM1	CM2
Management of domestic liquid waste.	No mitigation actions.	- sludge recovery in septic tank/latrine management. - *LFG recovery* communal septic tank and biodigester management. - Operationalization of aerobic septic tank. Note: A quantitative target to be defined by the Min. of Public Work and the Min. of Health.	- sludge recovery in septic tank/latrine management. - *LFG recovery* communal septic tank and biodigester management. - Operationalization of aerobic septic tank. Note: A quantitative target to be defined by the Min. of Public Work and the Min. of Health.

SUB-SECTOR: INDUSTRIAL LIQUID WASTE

	BAU	CM1	CM2
Management of industrial liquid waste.	No mitigation actions.	Pulp and paper industry implement the waste water treatment sludge management, and utilization of methane. Waste water treatment (palm oil mill effluent or POME) in palm oil industry: implement methane capture & utilization. Note: A quantitative target to be defined by the Min. of Industry and the Min. of Environment and Forestry.	Pulp and paper industry implement the waste water treatment sludge management and utilization of methane. Waste water treatment (palm oil mill effluent or POME) in palm oil industry: implement methane capture & utilization. Note: A quantitative target to be defined by the Min. of Industry and the Min. of Environment and Forestry.

S E C T O R : I P P U			
	BAU	**CM1**	**CM2**
Industrial processing and product use in major large scale industries.	No mitigation actions.	Cement industry implements "clinker to cement ratio" (blended cement) from 80% in 2010 to 75% in 2030.	Cement industry implements "clinker to cement ratio" (blended cement) from 80% in 2010 to 75% in 2030.
		Enhancing efficiency by feedstock utilization and CO_2 recovery in Primary Reformer in petrochemical industry (in particular ammonia production).	Enhancing efficiency by feedstock utilization and CO_2 recovery in Primary Reformer in petrochemical industry (in particular ammonia production).
		Other actions: - Steel industry implements: CO_2 recovery, improvement process in smelter and scrap utilization. - Remains of claim PFCs from CDM-activities (aluminum smelter). Note: A quantitative target to be defined by the Min. of Industry.	Other actions: - Steel industry implements: CO_2 recovery, improvement process in smelter and scrap utilization. - Remains of claim PFCs from CDM-activities (aluminum smelter). Note: A quantitative target to be defined by the Min. of Industry.

R E F F E R E N C E S

ENERGY SECTOR
- o National Energy Policy (KEN) 2014,
- o Electricity Supply Business Plan (RUPTL) 2016-2025,
- o National Energy Plan (RUEN) 2016.

AFOLU SECTOR
- o RKTN (*Rencana Kehutanan Tingkat Nasional* 2011-2030/National Forestry Plan 2011-2030),
- o *Industri Minyak Sawit Indonesia Menuju 100 Tahun NKRI*/Indonesian Oil Palm Industry toward 100 year (GAPKI),
- o The Roadmap of Indonesia's Forest Business Association (APHI) 2050,
- o Strategic Plan for Plantation/estate crops (including scenario for livestock),
- o Introduction Study on RPJMN 2015-2019 (BAPPENAS, 2013)

WASTE SECTOR
- o Act No. 18 year 2008 regarding Solid Waste Management,
- o Government Regulation No. 81 year 2012 regarding Management of Domestic Solid Waste.

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