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# The Acceleration of Decarbonization for Mitigation of the GHG Emissions in Indonesia

Economy-wide Long-term Overview with Cross-sector Features and Transition Pathways



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- 1. Indonesia NDC and NZE 2060
- 2. AFOLU Sector
- 3. Energy Sector: Socio-Economic Development, Energy Projection and the Associated GHG Emissions, and Challenges for Energy Transitions
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# **Paris Agreement Mandate** the First NDC, Updated NDC, LTS-LCCR 2050 Indonesia NZE is 2060 or Sooners



### Indonesia LTS LCCR & NZE

# **LTS LCCR 2050**

#### (Long Term Strategy for Low Carbon and Climate Resilience)



3,000



#### LCCP: Peaking 5 sector 2,500 NZE 2060 with net sink FOLU in 2030 2,000 Mton CO2 1,500 1,000 500 2040 2040 20501 2050 2050 2 0 2 0 2030 2010 2020 2 03 0 2010 2020 2 03 0 2040 2010 (500)CPOS TRNS LCCP Agriculture FOLU IPPU Waste ——Net emiss. Energ

#### Sumber: LTS LCCR Indonesia, KLHK (2021)

- **CPOS** (Current Policy)
- **TRNS** (Transition)
- LCCP (Low Carbon Scenario Compatible with Paris Agreement Target)

| Sector        | 2010  | 2020  | 2030  | 2040  | 2050  | 2060 |
|---------------|-------|-------|-------|-------|-------|------|
| Energy        | 453   | 638   | 1030  | 960   | 572 🧃 | 129  |
| IPPU          | 35    | 55    | 62    | 55    | 50    | ~45- |
| Agriculture   | 84    | 88    | 94    | 98    | 102   | 101  |
| FOLU          | 470   | 98    | -140  | -246  | -304  | -362 |
| Waste         | 89    | 139   | 198   | 170   | 120   | 87   |
| Net Emissions | 1,131 | 1,018 | 1,244 | 1,037 | 540   | 0    |

2060



# 2. AFOLU Sector

# Emission Pathway toward NZE

- In NZE-2060 scenario:
  - Agriculture: 101 million tCO<sub>2</sub>e
  - FOLU: -362 million tCO<sub>2</sub>e
  - AFOLU: -261 million tCO<sub>2</sub>e
- In Policy scenario:
  - Agriculture: 108 million tCO<sub>2</sub>e
  - FOLU: -139 million tCO<sub>2</sub>
  - AFOLU: 31 million tCO<sub>2</sub>
- Key Activities
  - Accelerating peat restoration & enforcing improved peat water management practices in concessions
  - Enhancing forest regeneration through enrichment planting in concessions
  - Minimizing/Stopping deforestation
  - Accelerating mangrove restoration
  - Accelerating establishment of timber plantation and land rehabilitation
- Key Policies:
  - Forest Multi-bussines (>30 Mha), Social Forestry (12 M ha)
  - Carbon pricing (carbon tax, RBP, carbon trading - emission trading and offset emission





BUSSINESS FOREST MULTI

#### RIMARY FOREST

- Forest Ecosystem services
- NTFP- as part of utilization of forest ecosystem
- Utilization of forest in line with the ecosystem characteristics Ecotourism
- Selective Cutting following Annual Workplan (RKT)

#### ECONDARY FOREST (LoA - lighly degraded)

- Forest Ecosystem services
- NTFP- as part of utilization of forest ecosystem
- Utilization of forest in line with the ecosystem characteristics
- Ecotourism
- Selective Cutting following Annual Workplan (RKT)

#### ECONDARY FOREST (LoA - medium degraded)

- Forest Ecosystem services
- NTFP- as part of utilization of forest ecosystem
- Utilization of forest area
- Ecotourism
- Intensive Silviculture (SILIN)

# SECONDARY FOREST (LoA - heavily degraded)

- Forest Ecosystem services
- NTFP- as part of utilization of forest ecosystem

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- Utilization of forest area
- Ecotourism
- Agroforestry
- Clear cutting and replanting (THPB)

GENERAL GUIDANCE OF FOREST MULTI BUSSINESS

- NON-FOREST ED LAND IN FOREST AREA
- Forest restoration
- NTFP
- Agroforestry
- Ecotourism
- Clear cutting and replanting (THPB)

#### TIMBER PLANTATION

- NTFP
- Clear cutting and replanting (THPB)
- Agroforestry
- Ecotourism
- Other ecosystem services

#### NON-FOREST ECOSYSTEM IN FOREST AREA

- NTFP
- TFP in line with ecosystem characteristics
- Ecotourism
- Other ecosystem services

#### POST MINING

- Restoration of forest ecosystem
- NTFP, Ecotourism
- Agroforestry
- Clear cutting and replanting (THPB)



# **3. Energy Sector:**

Socio-Economic Development, Energy Projection & the Associated GHG Emissions, and Challenges for Energy Transitions

#### GDP (Gross Output) Structure, High Scenario





# **ECONOMY - WIDE**

Economic development is expected to increase with average growth of 5.2% (low scenario) & 6.0% (high scenario), which relies on manufacture. Tertiary industry currently relies on tourism (12%) and the rest on households consumtion, in the future it will relies on services in office area, real estate, tourism

Pandemic recovery would require economic growth of 4.5%-5.5% (2022-2025) and 6.5%-7.5% (2026-2040) and then escape from 'middle income trap' become developed country in 2045. Beyond 2045, the GDP growth slightly declining to 4.2% in 2060.

High economic development requires high energy, resulted to high emissions, particularly if it relies to manufactur (intensive energy) industry. However, choises of energy system affect to GHG emissions level.

In 2060, final energy demand is targeted to exceed world average in 2020 (1.45 toe/cap) and electricity would reach 5000 kWh/cap that is the same level with developed country (7000-8000 kWh/cap) in 2020. More efficient energy technology trajectory has been considered.

# Energy Consumption and the Associated GHG Emissions

### LCCP Scenario"high energy for high economic growth"





GHG by Sector (High Scenario)









## POWER SECTOR

#### Power Capacity in 2060, GW

| Type of Power Generation                 | Lo   | W    | Hi  | gh   |
|--|------|------|-----|------|
| Coal (incl. coal co-firing) w/CCS        | 61   | 11%  | 70  | 11%  |
| Biomasa (incl. biomasa co-firing) w/ CCS | 19   | 4%   | 27  | 4%   |
| Solar                                    | 270  | 50%  | 329 | 50%  |
| Wind                                     | 18   | 3%   | 22  | 3%   |
| Hydro                                    | 58   | 11%  | 70  | 11%  |
| Geothermal                               | 22   | 4%   | 23  | 3%   |
| Nuclear                                  | 45   | 8%   | 54  | 8%   |
| Other RE (Green Amonia/H2, Green         | 22 4 |      | 12  |      |
| Methanol, Ocean Energy, etc)             | 52   | 6%   | 43  | 7%   |
| Natural gas w/ CCS                       | 16   | 3%   | 20  | 3%   |
|  | 541  | 100% | 658 | 100% |

#### Share of NRE in 2060 85,8% (Low) & 86,4% (High)

Source: Draft academic paper for Indonesia National Energy Policy (ITB, 2023)









Source: Draft academic paper for Indonesia National Energy Policy (ITB, 2023)

#### **Acceleration of Decarbonization in Power Sector**



- Acceleration of decarbonization of power system by phasing out some of coal power plants earlier gardualy will move peak emissions level in power sector from 2035 to 2030 and in turn it will move the peak of national energy level also from 2035 to 2030.
- The proposed phase down coal power plants in total is about 6.1 GW,
- In low scenario coal power generation will decrease from 64.1 GW to become 58 GW, which will be replaced by new & renewable energy (implementing blue ammonia/H2 and speed up the implementation of Hydro, Geothermal, Biomasa, Soalr, and other RE)



### Biomass co-firing by retrofiting existing coal power plants







| % Biomass (energy    | GHG Emissions | Intensity   | GHG Reduction | n % Biomass (energy | GHG Emissions | Intensity   | GHG Reduction |
|----------------------|---------------|-------------|---------------|---------------------|---------------|-------------|---------------|
| Unit)                | Ton CO2e/vear | Ton CO2/MWh | Ton CO2e/MWh  | Unit)               | Ton CO2e/year | Ton CO2/MWh | Ton CO2e/MWh  |
| 0% (100% coal)       | 3.189.879     | 1,30        |               | 0% (100% coal)      | 3.189.879     | 1,30        |               |
| 5% rice husk pellet  | 2.992.893     | 1,22        | 0,080         | 5% wood pellet      | 3.048.510     | 1,24        | 0,058         |
| 25% rice husk pellet | 2.251.392     | 0,92        | 0,383         | 25% wood pellet     | 2.486.943     | 1,01        | 0,287         |
| 50% rice husk pellet | 1.417.383     | 0,58        | 0,723         | 50% wood pellet     | 1.793.664     | 0,73        | 0,569         |

### Explore posibility to co-produce H2 and power in ammonia combustion



# Effect of Grid Emission Intensity





CCS = carbon capture and storage.

RE = Renewable Energy

Source: International Energy Agency (IEA), 2021. Ammonia Technology Roadmap CC BY-NC 3.0 IGO. <u>https://www.statista.com/statistics/1303574/indonesia-emissions-intensity-from-electricity-generation/</u>



- Shifting the global economy into NRE is a key in mitigating climate change, while improving quality of life.
- National energy systems must transition first, and then fast changes.
- **Energy** sector faces an uncertain situation in deciding a transition that requires a jump into much larger use of NRE, as Indonesia is basically a 'fossil based' one, while it is demanded to contribute to global mitigation
- Implementation of decarbonization to achieve low carbon economy will face many challenges, i.e.
  - need to develop local capacity in NRE technologies such geothermal, solar PV, wind power, bioenergy (biofuels and other biomass base) and new energy (i.e. ammonia/H2 in green or blue)
  - reduce coal use significantly, which will affect negatively to coal industry (related to stranded assets).
  - negative impact could also be lessen by keep using coal (for the rest of coal power) with high efficiency and CCS/CCUS, biomass co-firing and CCS (BECCS) as negative carbon technology, and ammonia/H2 cofiring
- Recommendation to develop policies to promote the followings:
  - Exploration of the potential of emission reduction from various mitigation actions.
  - Identification of, and then focus on, the most effective, efficient and promising actions.
  - Development of pathways and strategy of pathways to achieve low carbon economy



# Thank you

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