

Transforming Biomass into Bioenergy: Experience of Biomass Utilization Activities and Issue to be Adressed

Biomass Director

CEFIA FLAGSHIP, Januari 14th 2026



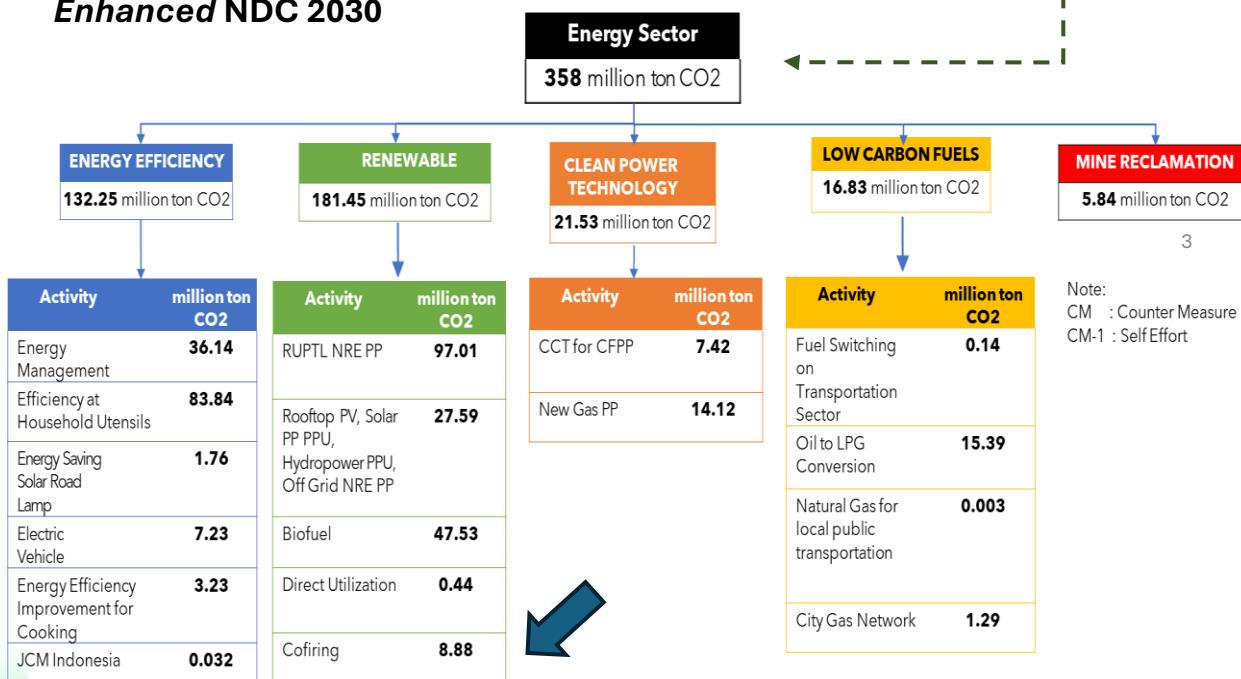
Outline

- The Urgency of Bioenergy Utilization and Its Key Role in Reducing Greenhouse Gas Emissions
- Potential and Availability of Biomass – Bioenergy
- Bioenergy Business Development, Achievement and Roadmap on PT PLN EPI



No	Sector	2010 GHG Emission (Million Ton CO ₂ e)	GHG Emission in 2030			Emission Reduction	
			BaU	CM1	CM2	CM1	CM2
1. Energy	Energy	453.2	1,669	1,311	1,223	358	446
2. Waste	Waste	88	296	256	253	40	45.3
3. IPPU	IPPU	36	70	63	61	7	9
4. Agriculture	Agriculture	111	120	110	108	10	12
5. FOLU	FOLU	647	714	217	-15	500	729
TOTAL		1,334	2,869	1,953	1,632	915	1,240

Enhanced NDC 2030



#EnergyofLife

Source : EBTKE, KESDM

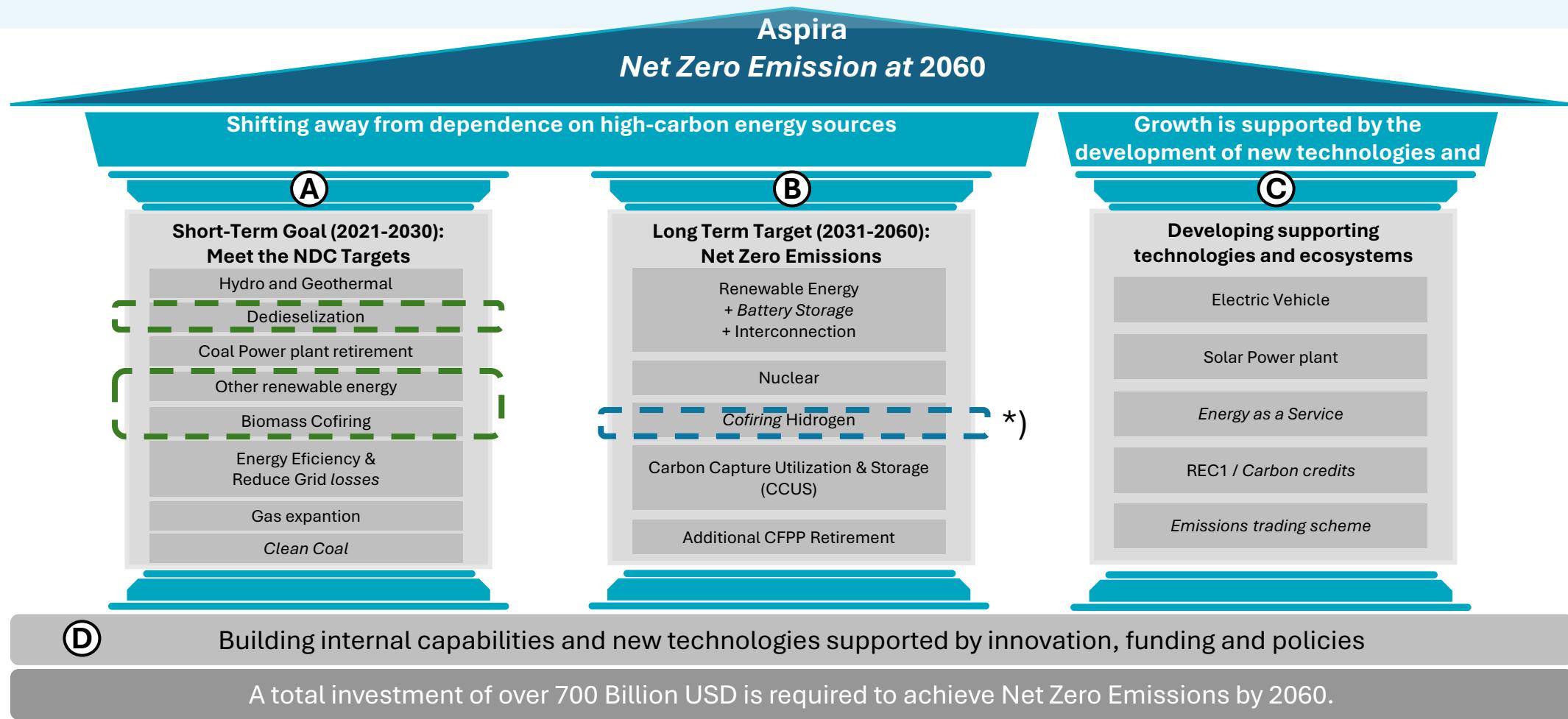
The government has set a 2030 eNDC target for the energy sector, with co-firing—the partial replacement of coal with biomass in coal-fired power plants—as one of the GHG emission reduction programs. The national target is to utilize 9 million tons of biomass by 2030.

Annex 1
Enhanced Nationally Determined Contribution (NDC)
Republic of Indonesia
MITIGATION
Assumptions used for projected BAU and emission reduction (unconditional/CM1 and conditional/CM2 reduction) for all sector categories (Energy, Waste, IPPU, Agriculture, and FOLU)

No.	Mitigation Actions	SECTOR: ENERGY		
		2030		
		BaU	CM1	CM2
1	Renewable Energy (RE) - Additional RE in Power according to RUPTL - Solar rooftop, PV *Wilus and Hydro *Wilus, Off grid RE - Biofuel	no additional RE PP since 2010 no solar roof top program 400,000 KL FAME in B-10 - Biofuel	Installed RE 20,923 MW Installed RE 15,483 MW 18 million KL FAME in B-10	Similar actions with CM1 but with further enhanced/ expanded utilisation of RE
	Cofiring	no-cofiring program	Biomass utilisation 9 Mton	
	Direct Utilisation of Biomass and Biogas for off-grid power generation	no-direct utilisation program	333,776 BOE	

Sumber : Enhancednationally Determined Contribution (ENDC) Republic of Indonesia (2022)

Bioenergy is a pillar of the decarbonization stage at PLN Group, becoming an energy transition program to reduce the use of some fossil fuels at PLN Group Power Plants.



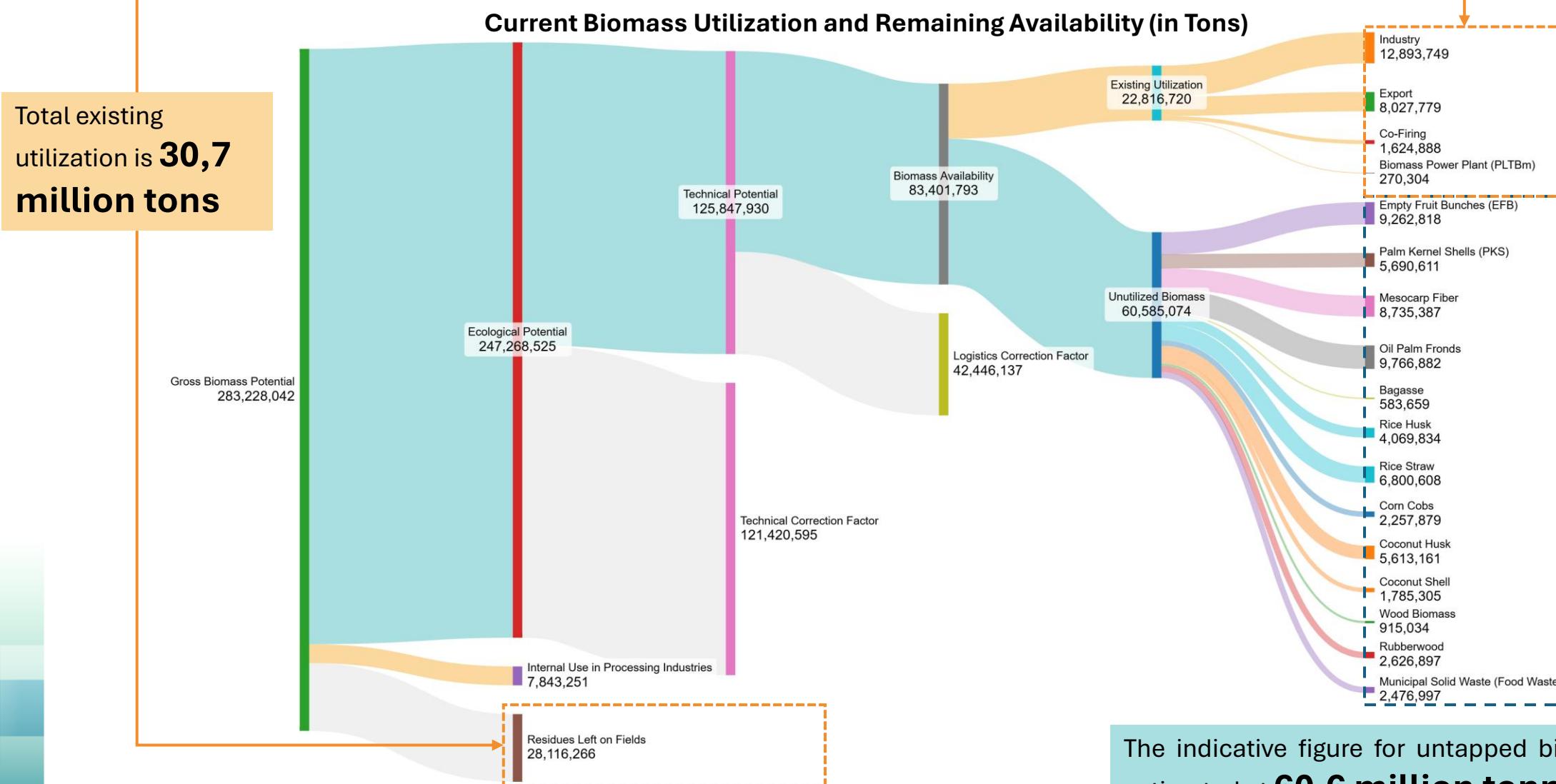
*) **hydrogen**, is categorized as a new energy source and has not yet entered the commercialization phase until 2030. The roadmap includes studies and support for pilot projects involving renewable energy-based power sources, including bioenergy.

Outline

- The Urgency of Bioenergy Utilization and Its Key Role in Reducing Greenhouse Gas Emissions
- Potential and Availability of Biomass – Bioenergy
- Bioenergy Business Development, Achievement and Roadmap on PT PLN EPI

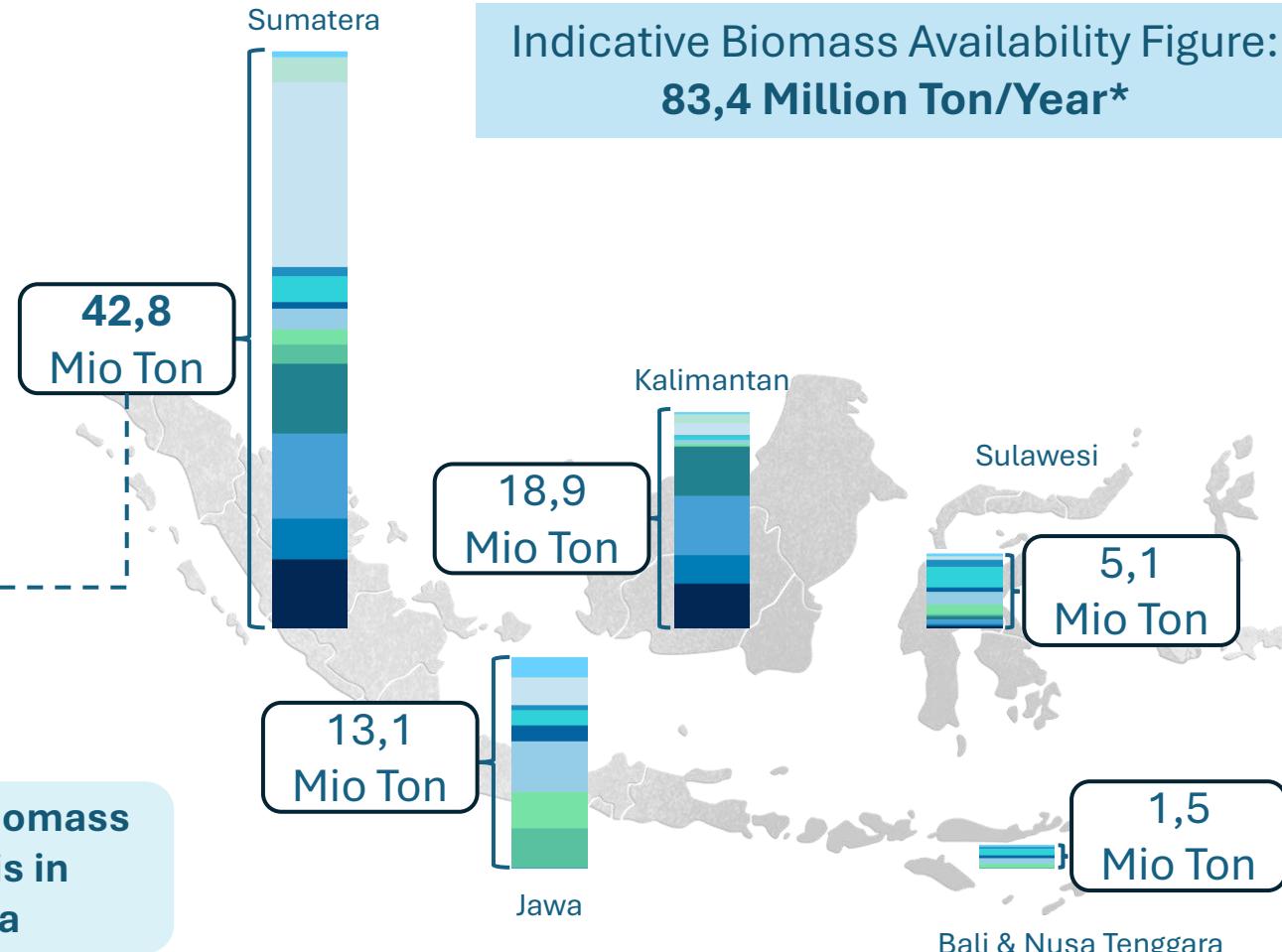


Availability of Biomass Energy Resources



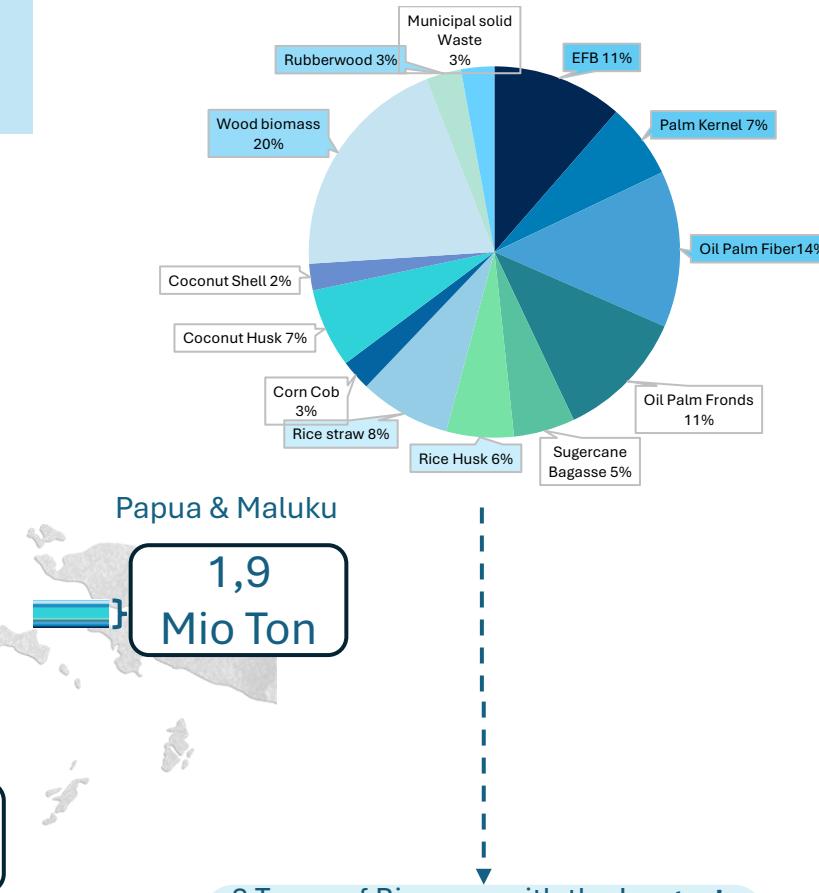
The indicative figure for untapped biomass potential is estimated at **60.6 million tonnes***

- █ Municipal Solid Waste
- █ Rubberwood
- █ Wood Biomass
- █ Coconut Shell
- █ Coconut Husk
- █ Rice Straw
- █ Rice Husk
- █ Sugarcane Bagasse
- █ Oil Palm Fronds
- █ Oil Palm Fiber
- █ Empty Fruit Bunches (EFB)



*) This figure is still indicative because it does not take into account a number of important factors, such as technical aspects, economics, accessibility, and the formation of a supply chain ecosystem on the midstream side that is not yet fully integrated end-to-end.

#EnergyofLife



3 Types of Biomass with the Largest Potential

- Palm Oil Biomass
- Wood Biomass
- Rice Husk Biomass

By-Product Pertukangan/Kehutanan

-  sawdust
-  Limbah Plywood, partikel kayu
-  Wood waste Limbah Kayu
-  Wood Chip Serpihan Kayu
-  Wood grain Serbuk Kayu

By-Product Pertanian

-  Rice Husk Sekam Padi
-  Bagasse Bagasse Tebu
-  Corn Cob Bonggol Jagung
-  Aren Waste Limbah Aren
-  Sagoo Waste Limbah Sagu
-  Sagoo Bark Kulit Sagu
-  cassava stem Batang Singkong

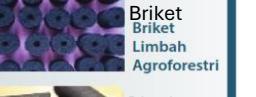
By-Product Perkebunan

-  Palm Kernel Cangkang Sawit
-  Walnut Shell Cangkang Kenari
-  Walnut Shell Cangkang Pala
-  Nutmeg Shell Limbah Replanting karet
-  Nutmeg Shell Limbah Batang Sawit
-  EFB Tandan Kosong Kelapa Sawit

Hasil Olahan Municipal Solid Waste

-  MSW BBJP/SRF
-  MSW
-  Bubur Sampah
-  Biochar Pyrolysis

Produk Biomassa

-  Woodpellet
-  Rice Husk Pellet Pellet Sekam Padi
-  Rice straw Pellet Pellet Jerami
-  EFB Pellet Pellet Tandan Kosong
-  Agrowaste Briket Briket Limbah Agroforestri
-  Black Briket Arang Biobriket

Penanaman dan Replanting

-  Limbah Replanting Perkebunan dan Kehutanan (karet, akasia, sengon, dll)
- 
 -  Kaliandra Merah
 -  Gmelina
 -  Gamal
 -  Indigofera

Pengumpulan, Pengelolaan , Proses Pengolahan Sederhana s/d Tinggi, Transportasi dan Logistik

Bahan Bakar Biomassa (Co-Firing PLTU)



Sumber : PLN EPI

Tipe Boiler Circulating Fluidized Bed & Stocker

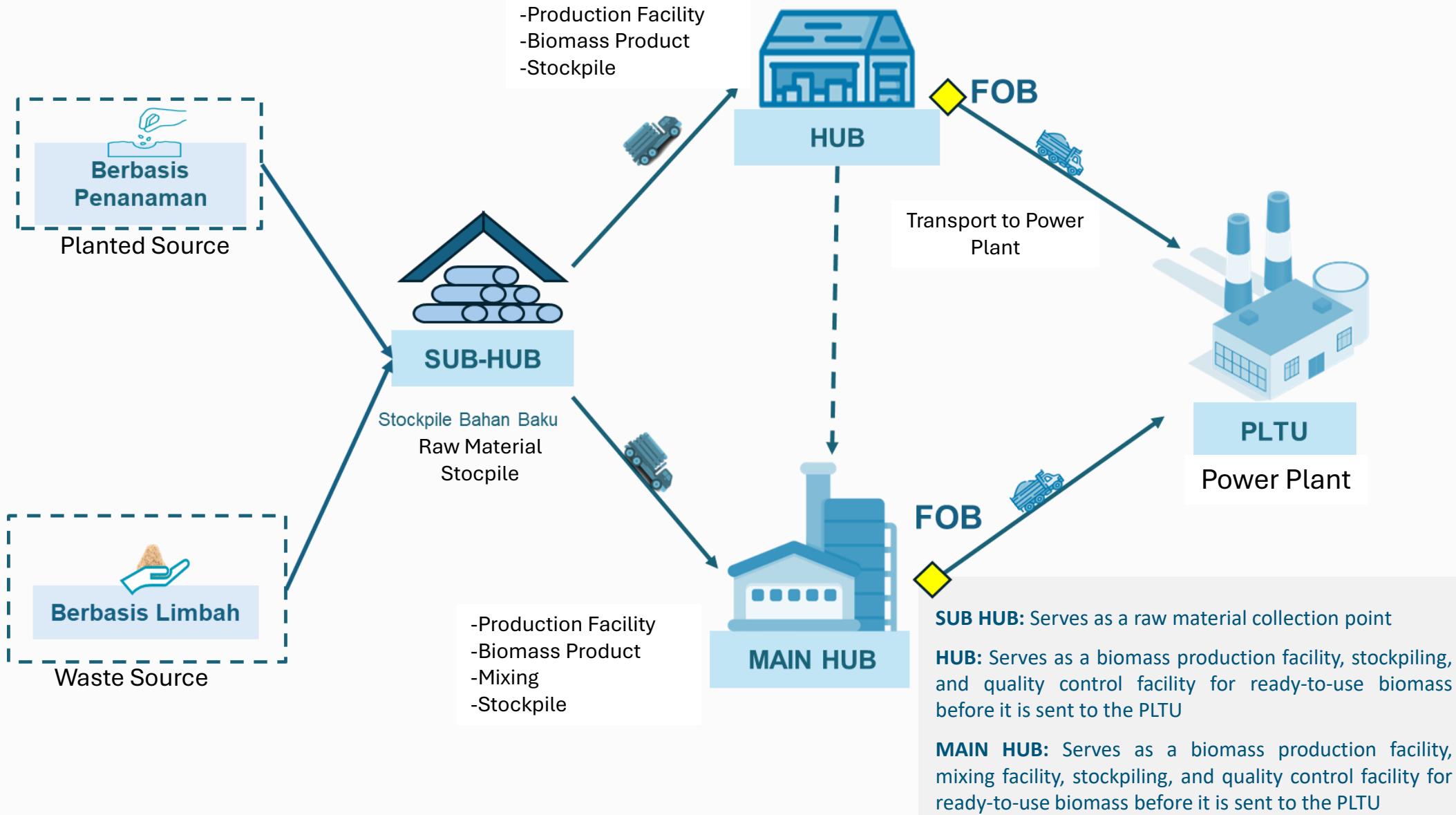
- Particle Size 6-32 mm
- TM < 25%
- GCV: 3487 kkal/kg
- Klorin: 0.04%
- Kalium: 15%
- Natrium: 5%
- Sulfur: 0.5%

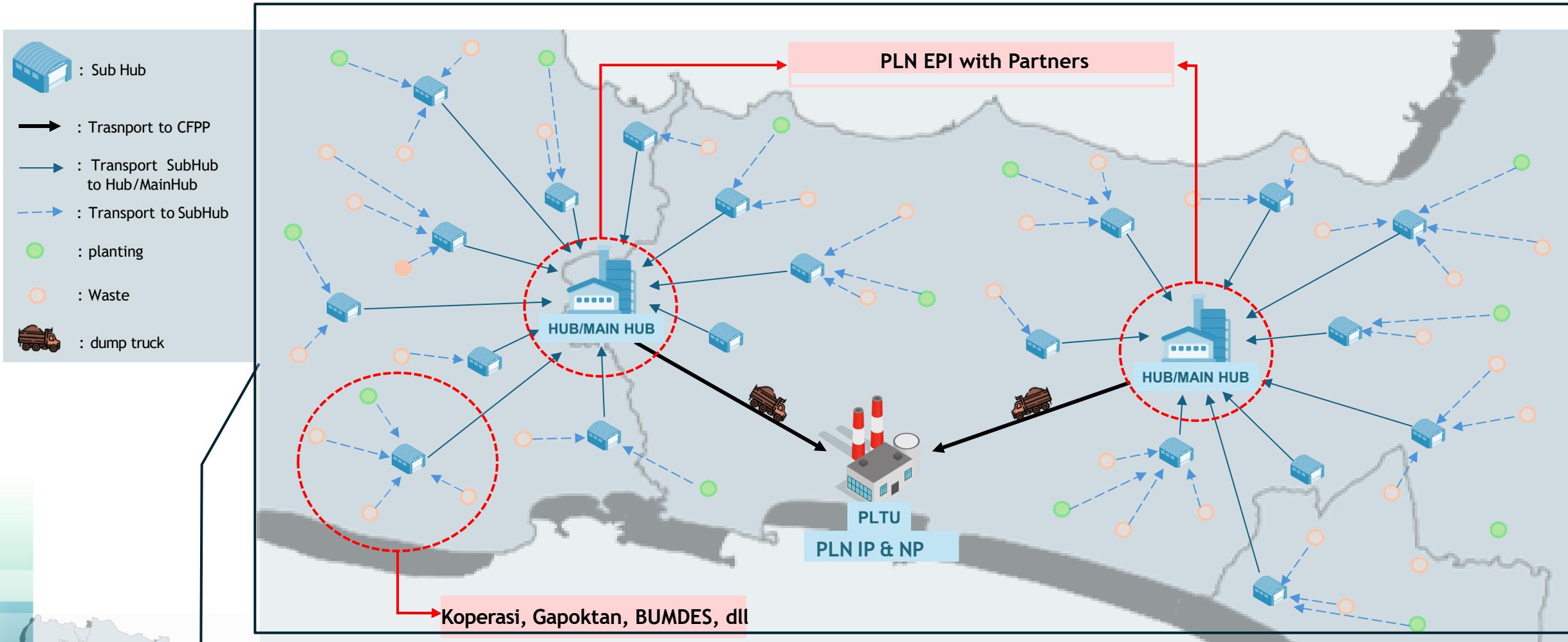


Basis Serbuk

Tipe Boiler Pulverised Coal

- Particle Size <2,5 mm
- TM < 35%
- GCV: 3009 kkal/kg
- Klorin: 0.04%
- Kalium: 15%
- Natrium: 5%
- Sulfur: 0.5%





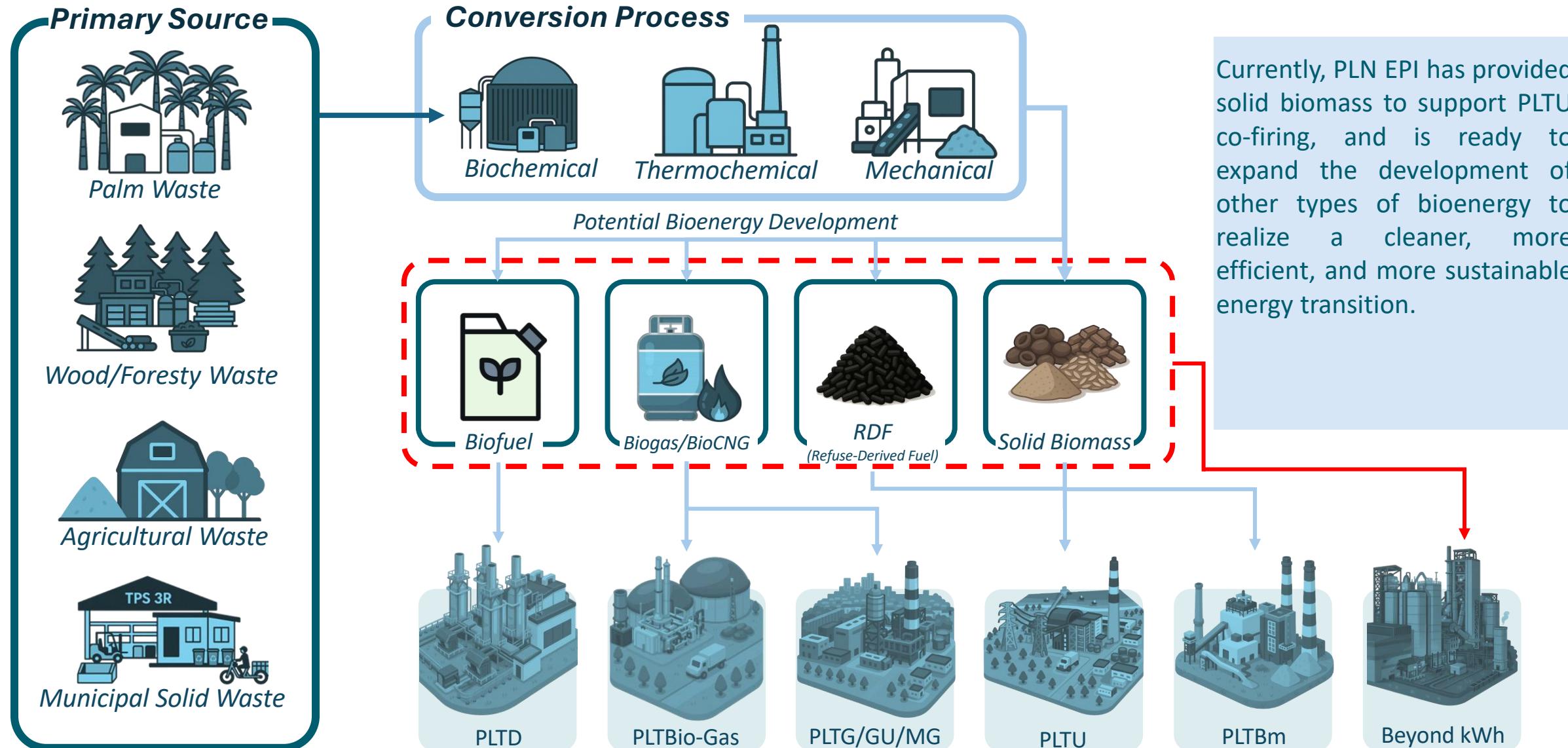
SUB HUB : As a raw material collection point
HUB : As a biomass production facility, as a stockpile and QC for ready-to-use biomass before being sent to the PLTU
MAIN-HUB : As a place for biomass production facilities, mixing facilities, stockpiles and QC of ready-to-use biomass before being sent to the PLTU

Outline

- The Urgency of Bioenergy Utilization and Its Key Role in Reducing Greenhouse Gas Emissions
- Potential and Availability of Biomass – Bioenergy
- Bioenergy Business Development, Achievement and Roadmap of PT PLN EPI



Scope of Bioenergy Development

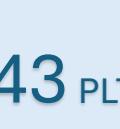


Implementation of the Biomass Co-firing Program


2020
5 PLTU


2021
27 PLTU


2022
36 PLTU


2023
43 PLTU


2024
47 PLTU


2025
49 PLTU


PLN EPI Establish

Target 2025:

3 Million Ton

3,316 Million Ton CO2e

3 Million Ton

3,316 Million Ton CO2e
Biomass Price = 85% CIF Coal
Biomass Price = 100% CIF Coal
**Biomass Price =
120% FOB Coal + Transport**
3
Types of Biomass
4
Types of Biomass
6
Types of Biomass
6
Types of Biomass
13
Types of Biomass
16
Types of Biomass
2.520
kCal/Kg
2.520
kCal/Kg
2.800
kCal/Kg
3.008
kCal/Kg
3.093
kCal/Kg
3.121
kCal/Kg

Bioenergy & New Energy Business Development Roadmap

	2025	2026	2027	2028	2029	2030
Biomass	3 Million Tons	3,7 Million Tons	4,5 Million Tons	7,2 Million Tons	8,3 Million Tons	10 Million Tons
Waste Management			3,3 Thousand Tons	6,6 Thousand Tons	9,9 Thousand Tons	13,2 Thousand Tons
Biogas				120 BBTU (4 BBTUD)	1.348 BBTU (7,8 BBTUD)	2.957 BBTU (15,6 BBTUD)
De-dieselization	0,3 MW	1,2 MW	2,7 MW		7,2 MW	16,2 MW
Green Hydrogen/Ammonia	Ammonia Supply Study Hydrogen Blending Study	Ammonia Utilization Test <3% Blending Hydrogen <5%		Amonia pilot Evaluation Hydrogen Pilot Test <5%	AmoniaSupply integration Blending Hydrogen <10%	Co-firing Amonia >3-5% Hydrogen Pilot test <10%
4 Hub Biomassa (COD: Ciamis, Tasikmalaya); (On Progress: Suralaya, Lebak)	• 3 Main Hub Biomassa Blora, Tanjungkaras, P.Pisau • 2 Hub Biomassa Suralaya, Lebak	• 2 Main Hub Biomassa Cilegon, Rembang • 3 Hub Biomassa Pati, Kalbar, Lampung	• 2 Main Hub Biomassa Balikpapan, Konawe • 4 Hub Biomassa Jombang, Wonosobo, Palembang, Aceh-Tamiang	• 4 Main Hub Biomassa Lombok, Padang, Barru, Kupang • 2 Hub Biomassa Bengkulu, Jambi	• 2 Main Hub Biomassa Riau, Sumut • 5 Hub Biomassa Sulbar, Sulut, Halmahera, Jayapura, Berau	
Beyond kWh Biomassa	8.000 ton/year	50.000 ton/year	326.000 ton/year	376.000 ton/year	609.000 ton/year	1.459.000 ton/year
• Pra-FS Bioenergy • Market Research Indonesia & Global	• Biogas Partnership • Waste Management Partnership • FS & Legal Bioenergy Plant	1st Biogas Plant EPC	• 1st COD Biogas Plant • 2nd Biogas Plant EPC	• 1st COD RDF Plant • 2nd RDF Plant EPC	• 2nd COD Biogas Plant • 3rd Biogas Plant EPC	3rd COD Biogas Plant
		1st RDF Plant EPC		• 1st COD RDF Plant • 2nd RDF Plant EPC	• 2nd COD RDF Plant • 3rd RDF Plant EPC	3rd COD RDF Plant
	1st bioenergy supply to Dedieselization Power Plant	4th bioenergy supply to Dedieselization Power Plant	9th bioenergy supply to Dedieselization Power Plant	24th bioenergy supply to Dedieselization Power Plant	54th bioenergy supply to Dedieselization Power Plant	

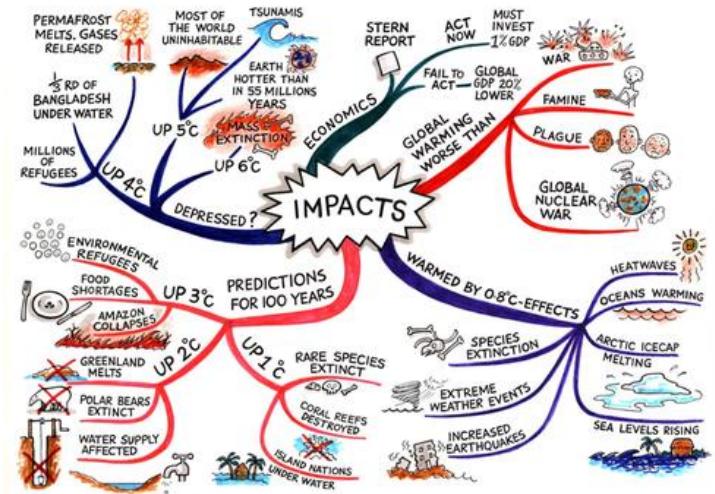
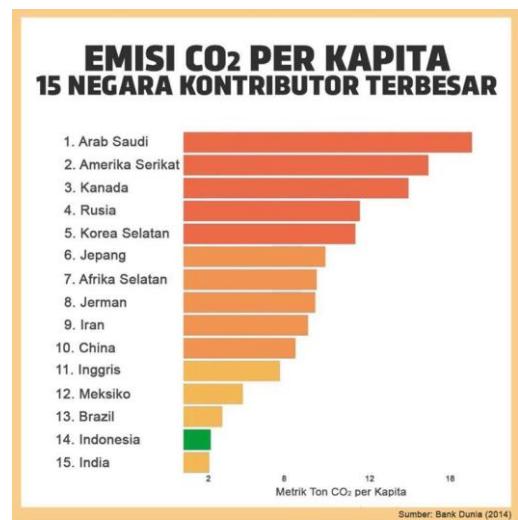
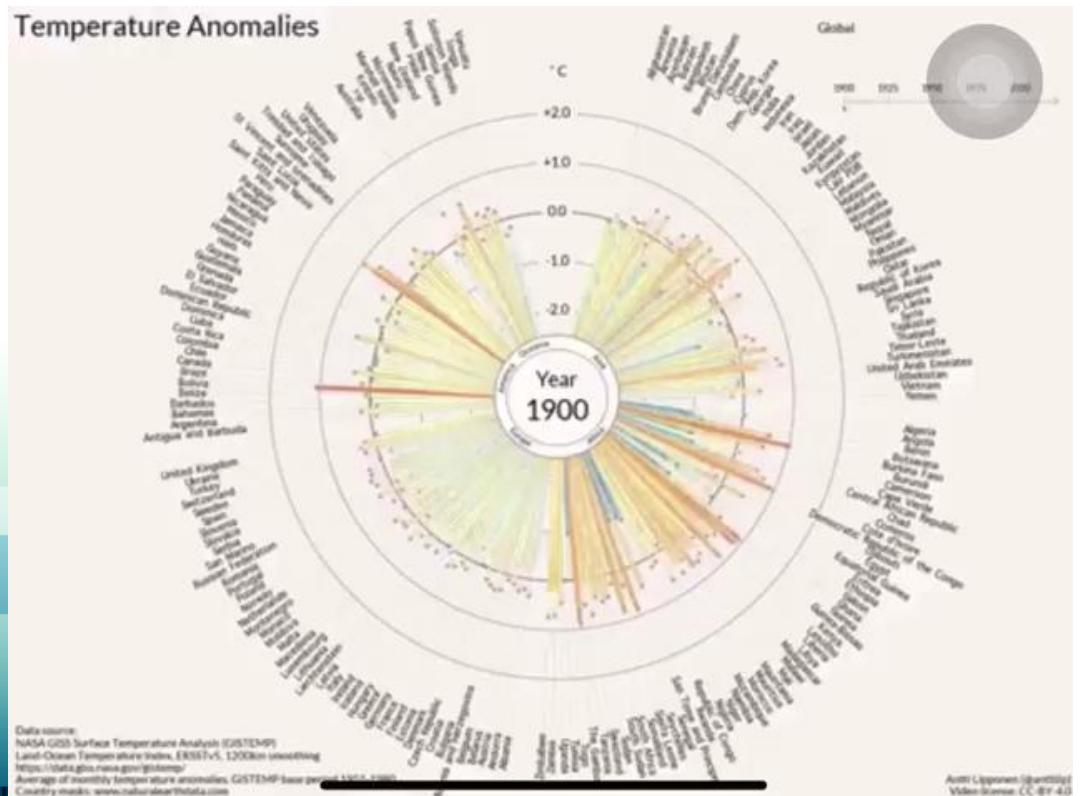


Terima Kasih

#EnergyofLife

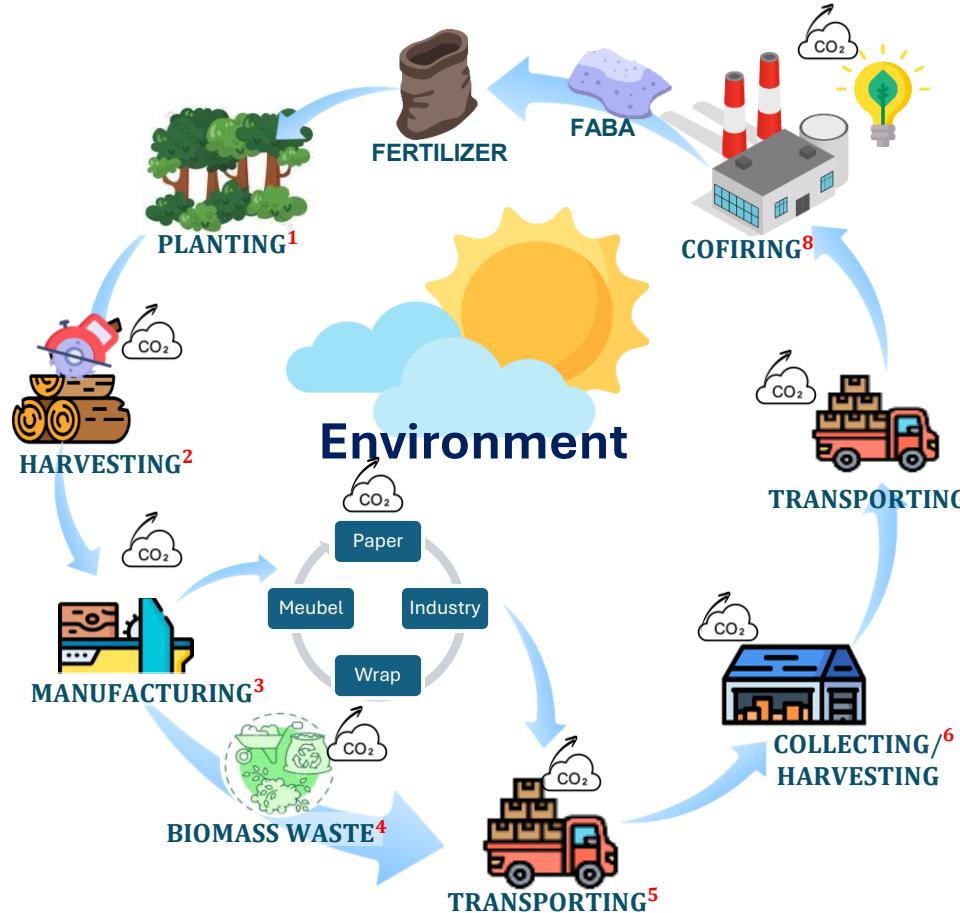
www.plnepi.co.id

Indonesia in the Middle of Climate Change, Carbon Emission, Waste Crisis, and Forest Fire

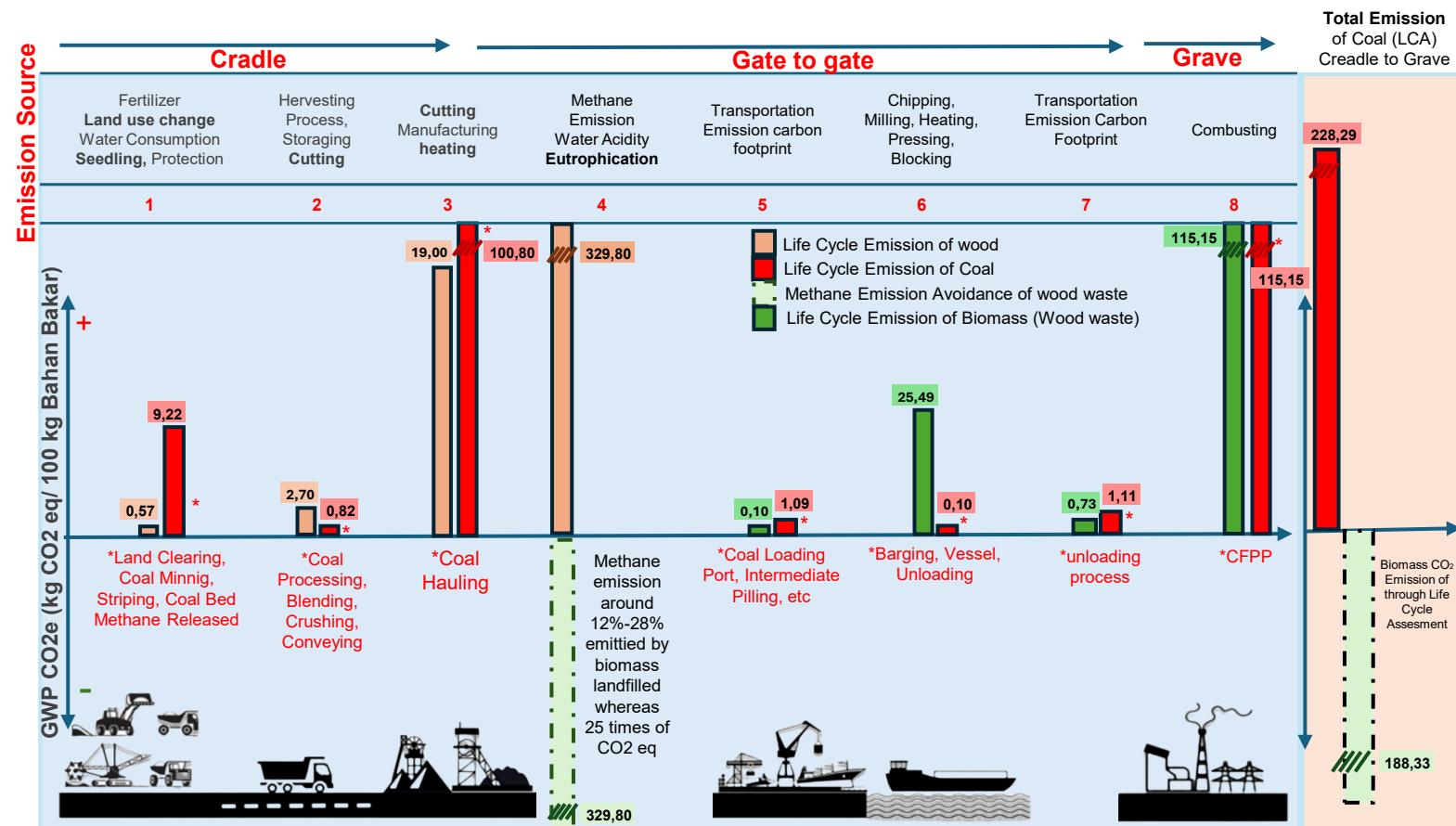


BOOM SNIPS

Supply Chain System



The LCA study uses the gate to grave concept, starting from the utilization of biomass waste as fuel for the PLTU cofiring program, where there is avoidance in the release of greenhouse gases (GHG) from the waste decomposition process.



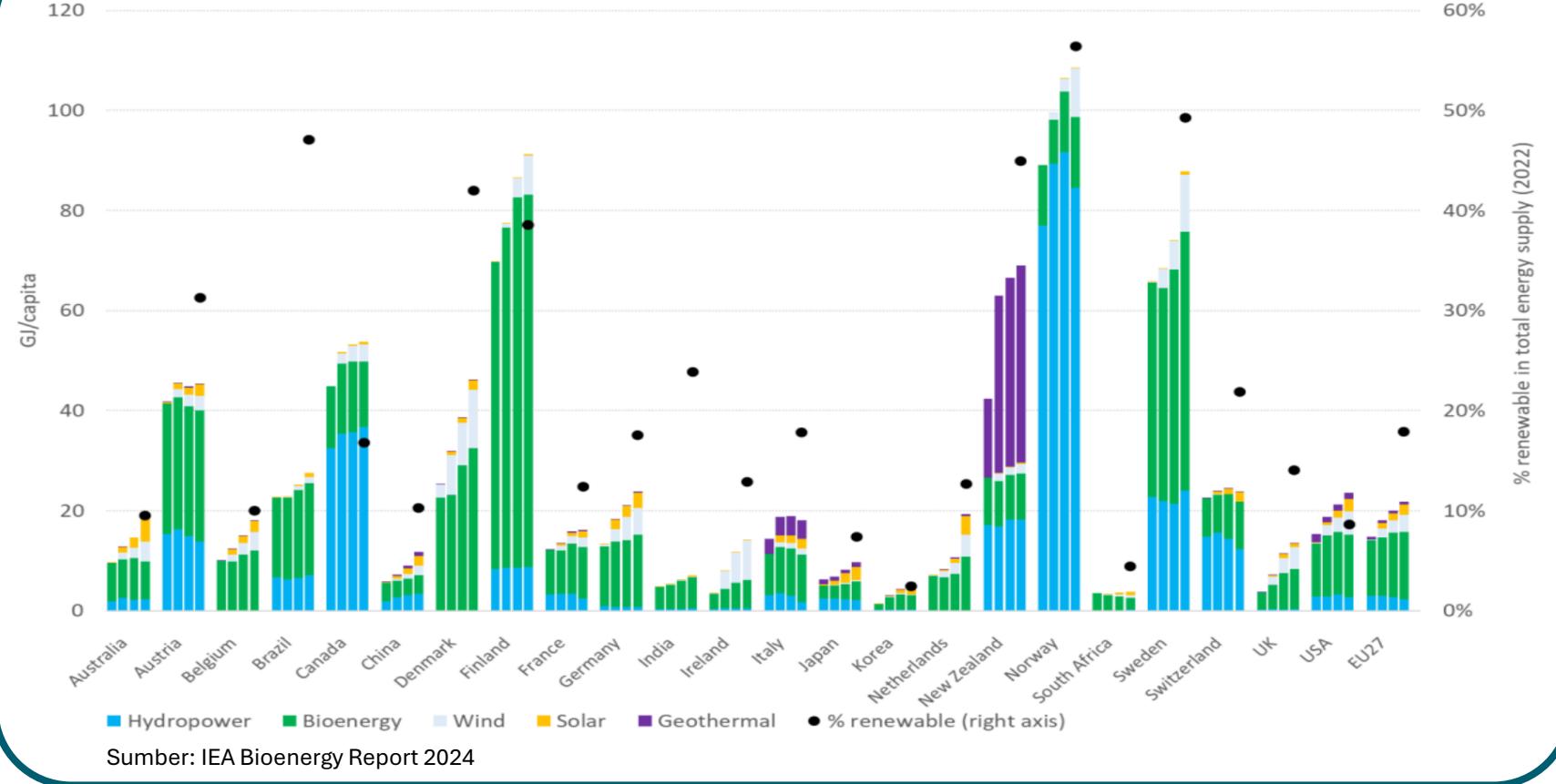
Glosarium:

- **Life Cycle Analysis (LCA)** : Metode untuk mengukur dampak lingkungan dari suatu produk atau proses
- **Global Warming Potential (GWP)** : Satuan untuk mengukur dampak GRK terhadap pemanasan

Sumber:

Mann, M.K. dan Spath, P. L. 2001. A Life Cycle Assessment Of Biomass Cofiring In A Coal-fired Power Plant. *Clean Prod Processes*. Vol. 3:81-91. DOI 10.1007/S100980100109

Total Energy Supply per Capita – Renewables (2010-2014-2018-2022)



Bioenergy is growing rapidly in several countries, with **Finland, Sweden, and Austria leading the way**, with bioenergy utilization exceeding 50% of renewable energy supply. Meanwhile, in Indonesia, bioenergy utilization has only reached approximately 5% of the total potential.

0,35
Giga Joule/Capita/Year
Indonesia Bioenergy Utilization

6,50
Giga Joule /Capita/year
Indonesia Bioenergy Potential

Source: report of Kinerja Direktorat
Jenderal EBTKE 2024