

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



Biomass Director

CEFIA FLAGSHIP, Januari 14th 2026

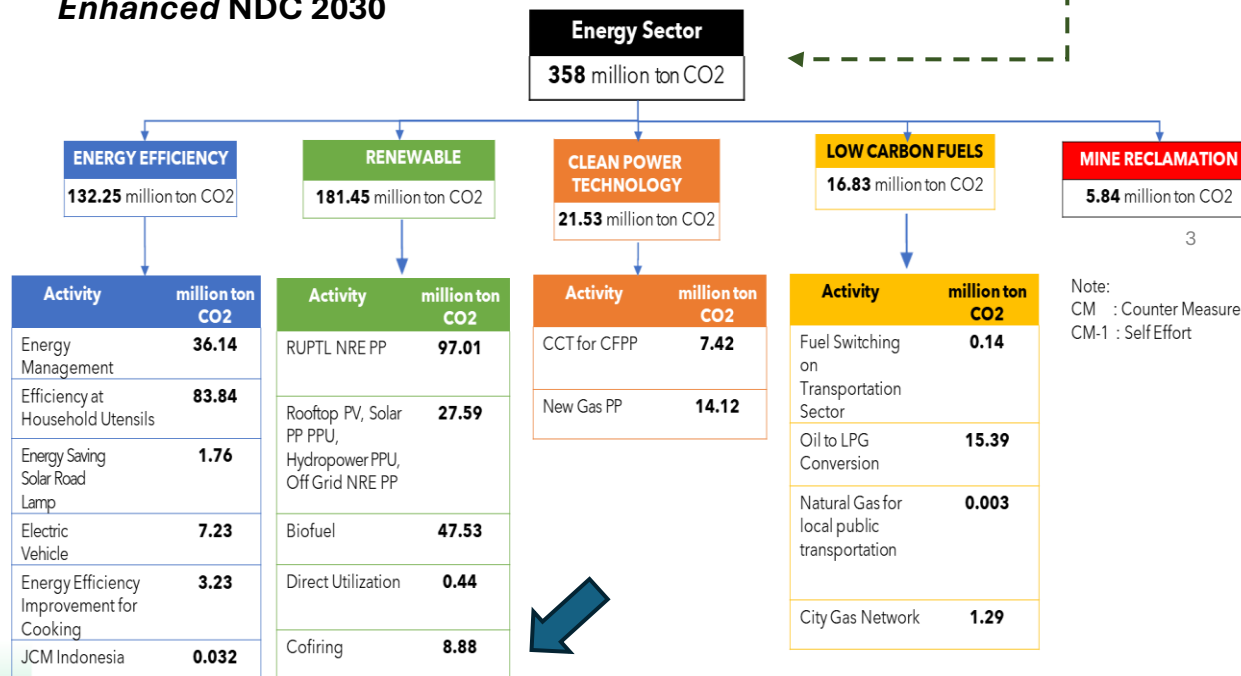
Outline

- 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	453.2	1,669	1,311	1,223	358	446
2.	Waste	88	296	256	253	40	45.3
3.	IPPU	36	70	63	61	7	9
4.	Agriculture	111	120	110	108	10	12
5.	FOLU	647	714	217	-15	500	729
	TOTAL	1,334	2,869	1,953	1,632	915	1,240

Enhanced NDC 2030



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.

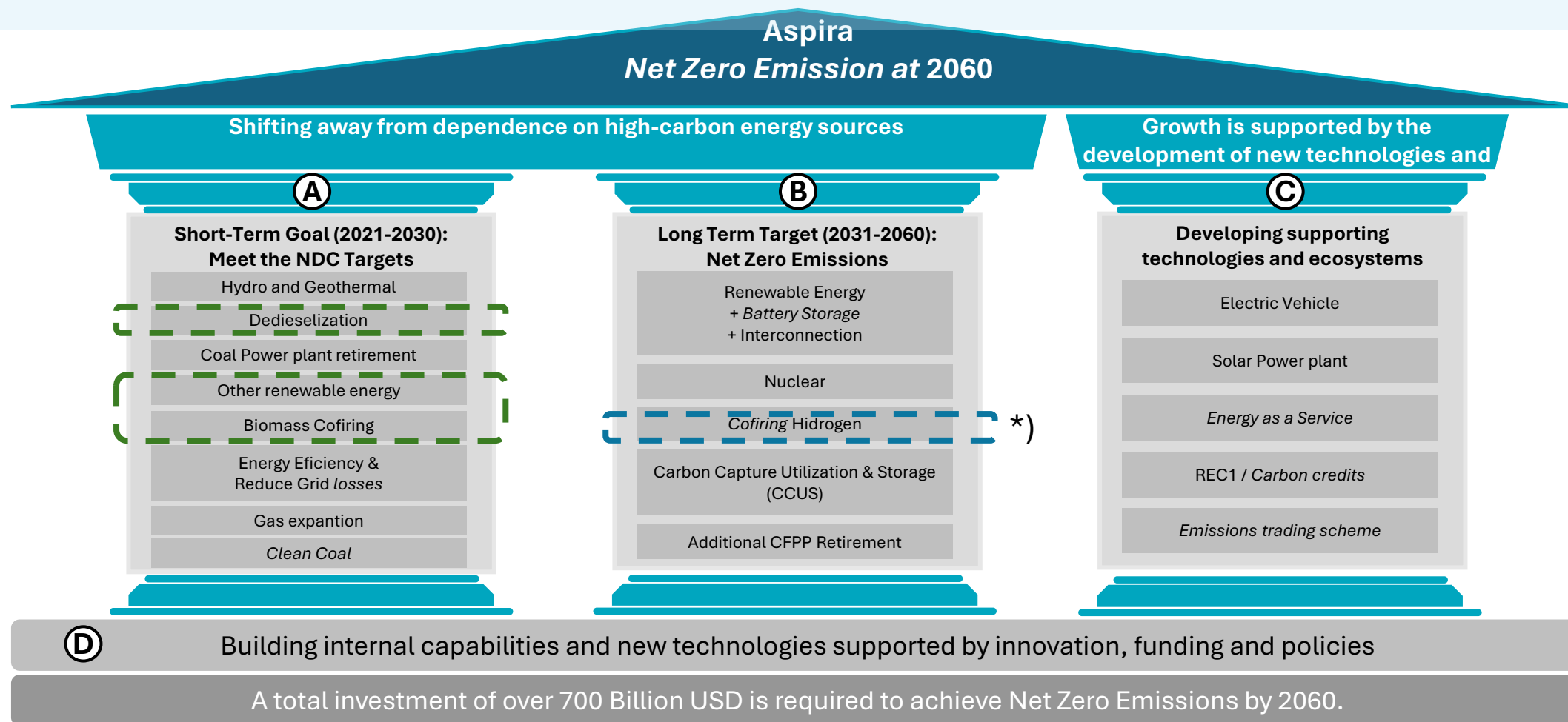
Annex 1 Enhanced Nationally Determined Contribution (NDC) Republic of Indonesia MITIGATION

Assumptions used for projected BAU and emission reduction (unconditional/CM1 and conditional/CM2 reduction) for all sector categories (Energy, Waste, IPPU, Agriculture, and FOLU)

SECTOR: ENERGY				
No	Mitigation Actions	2030		
		BaU	CM1	CM2
1	Renewable Energy (RE)			
	- Additional RE in Power according to RUPTL	no additional RE PP since 2010	Installed RE 20,923 MW	Similar actions with CM1 but with further enhanced/ expanded utilisation of RE
	- Solar rooftop, PV *Wilus and Hydro *Wilus, Off grid RE	no solar roof top program	Installed RE 15,483 MW	
	- Biofuel	400,000 KL FAME in B-40	18 million KL FAME in B-40	
	- 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.

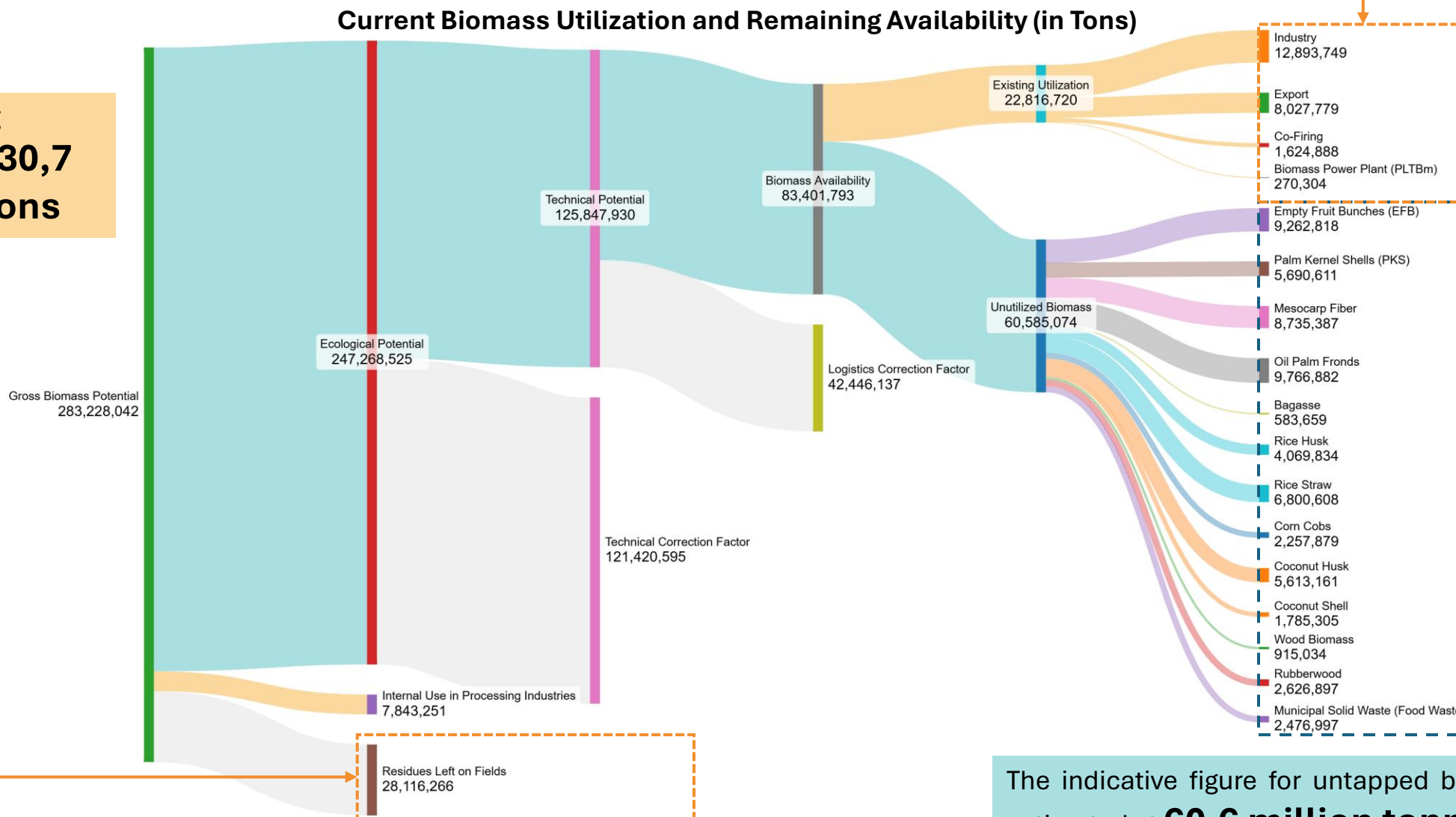
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Availability of Biomass Energy Resources

Total existing
utilization is **30,7
million tons**

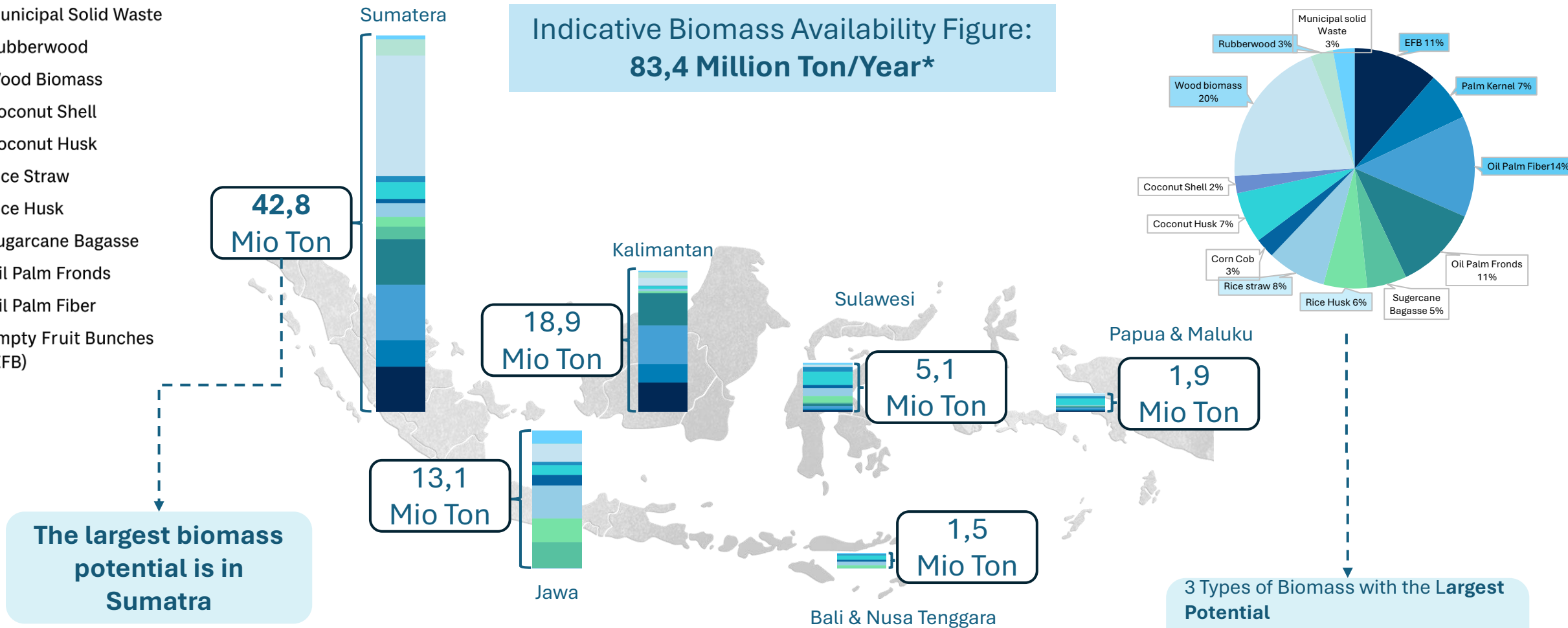


The indicative figure for untapped biomass potential is estimated at **60.6 million tonnes***

































This figure is still indicative because it does not take into account several 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.

- 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)

Indicative Biomass Availability Figure:
83,4 Million Ton/Year*



*) 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.

By-Product Pertukangan/Kehutanan	By-Product Pertanian	By-Product Perkebunan	Hasil Olahan Municipal Solid Waste	Produk Biomassa	Penanaman dan Replanting
 sawdust Serbuk Gergaji  Limbah Plywood, partikel kayu  Wood waste Limbah Kayu  Wood Chip Serpihan Kayu  Wood grain Serbuk Kayu	 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	 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	 MSW BBJP/SRF  MSW Bubur Sampah  Biochar Pyrolysis	 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	 Limbah Replanting Perkebunan dan Kehutanan (karet, akasia, sengon, dll) <p>Tanaman multifungsi di lahan kering/ tumpangtari/bekas tambang :</p>  Kaliandra Merah  Gmelina  Gamal  Indigofera

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

Bahan Bakar Biomassa (Co-Firing PLTU)

Sumber : PLN EPI



Basis Serpih

Tipe Boiler Circulating Fluidized Bed & Stocker

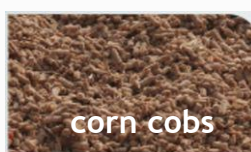
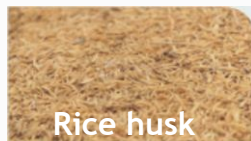
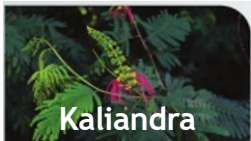
- Particle Size 6-32 mm
- TM < 25%
- GCV: 3487 kkal/kg
- Klorin: 0.04%
- Kalium: 15%
- Natrium: 5%
- Sulfur: 0.5%



Basis Serbuk

Tipe Boiler Pulverised Coal

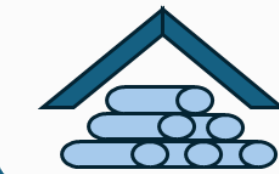
- Particle Size <2,5 mm
- TM < 35%
- GCV: 3009 kkal/kg
- Klorin: 0.04%
- Kalium: 15%
- Natrium: 5%
- Sulfur: 0.5%



Planted Source



Waste Source



Stockpile Bahan Baku
Raw Material
Stocpile

-Production Facility
-Biomass Product
-Stockpile

-Production Facility
-Biomass Product
-Mixing
-Stockpile



FOB

Transport to Power
Plant

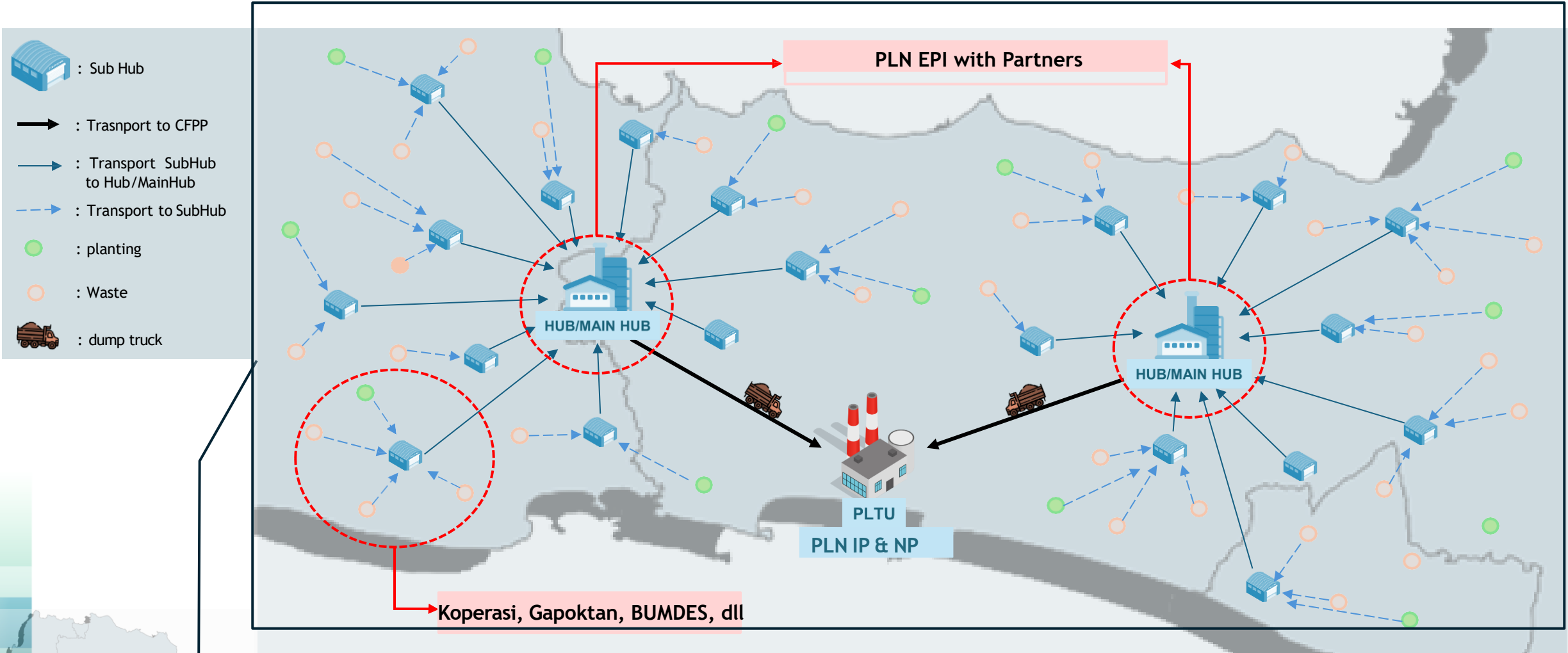


FOB

SUB HUB: Serves as a raw material collection point

HUB: Serves as a biomass production facility, stockpiling, and quality control facility for ready-to-use biomass before it is sent to the PLTU

MAIN HUB: Serves as a biomass production facility, mixing facility, stockpiling, and quality control facility for ready-to-use biomass before it is sent to the PLTU



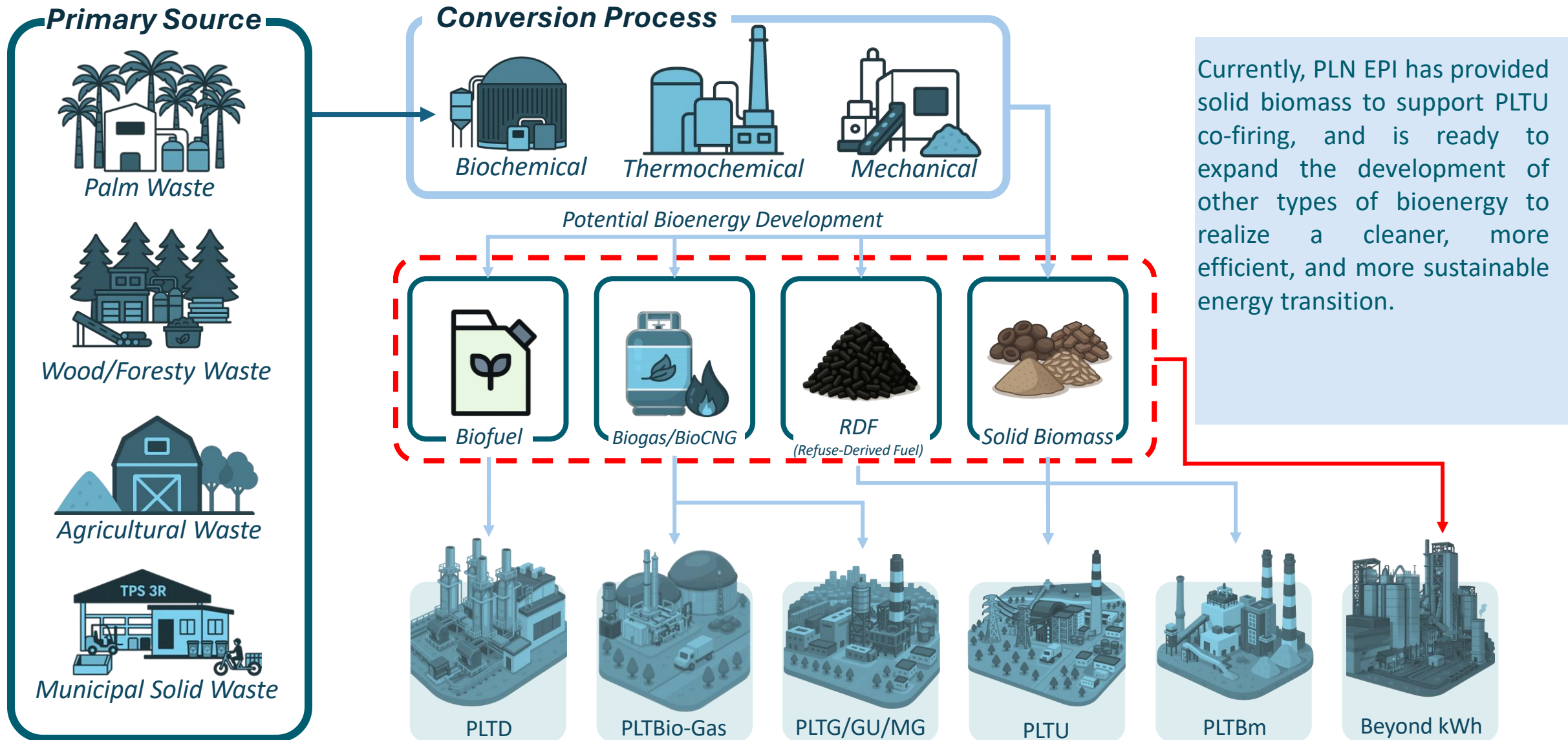
Java Island

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

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Implementation of the Biomass Co-firing Program

PLN EPI Establish

	2020	2021	2022	2023	2024	2025
	5 PLTU	27 PLTU	36 PLTU	43 PLTU	47 PLTU	49 PLTU
	10.756 Ton CO2e/year	312.433 Ton CO2e/year	647.534 Ton CO2e/Tahun	1,052Mio Ton CO2e/year	1,870Mio Ton CO2e/year	2,460Mio Ton CO2e
	9.728 Ton/Year	282.581 Ton/Year	585.663 Ton/Year	1,006Mio Ton/Year	1,624Mio Ton/Year	2,353Mio Ton/Year
	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

Target 2025:

 3 Million Ton
 3,316 Million Ton CO2e

Biomass Price = 85% CIF Coal

Biomass Price = 100% CIF Coal

Biomass Price =
120% FOB Coal + Transport

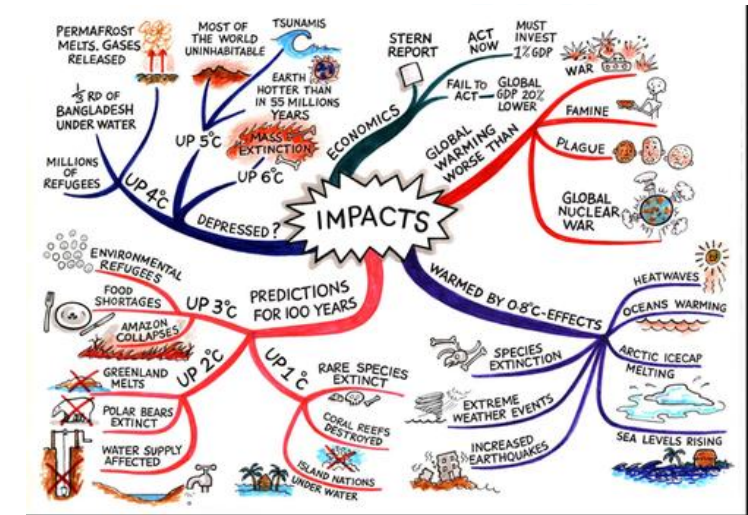
Bioenergy & New Energy Business Development Roadmap

	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%

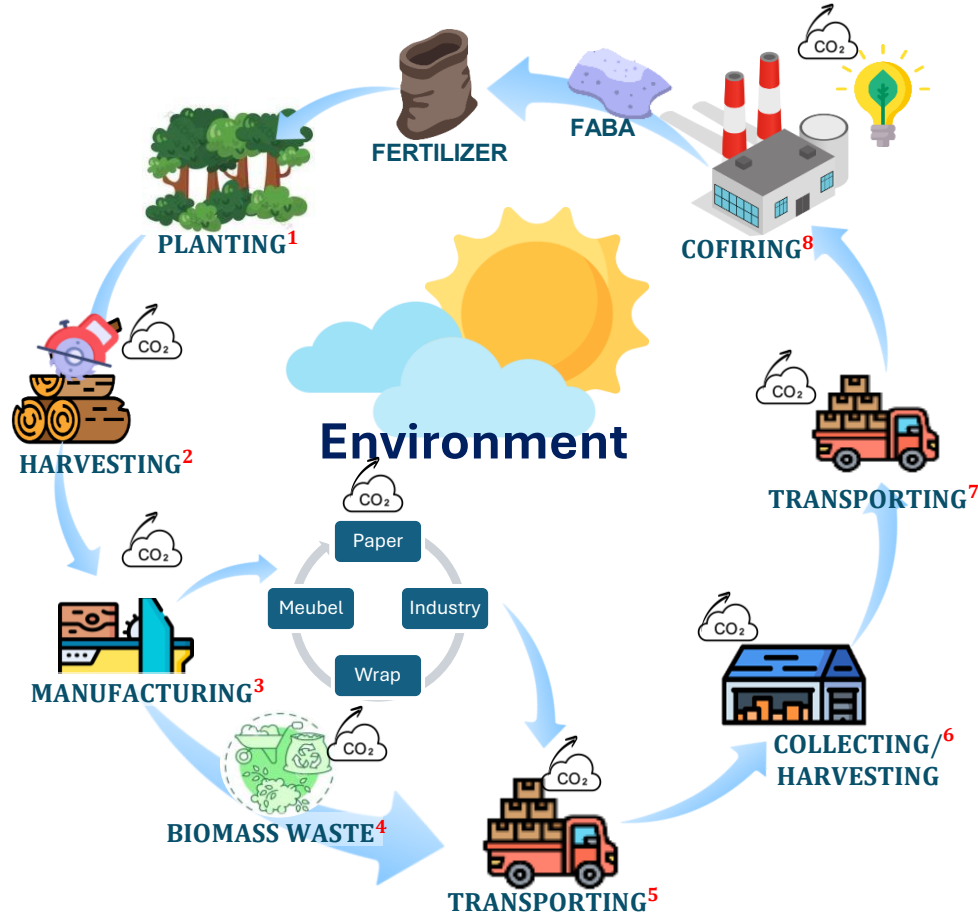
4 Hub Biomassa (COD: Ciamis, Tasikmalaya); (On Progress: Suralaya, Lebak)	<ul style="list-style-type: none"> • 3 Main Hub Biomassa Blora, Tanjungkaras, P.Pisau • 2 Hub Biomassa Suralaya, Lebak 	<ul style="list-style-type: none"> • 2 Main Hub Biomassa Cilegon, Rembang • 3 Hub Biomassa Pati, Kalbar, Lampung 	<ul style="list-style-type: none"> • 2 Main Hub Biomassa Balikpapan, Konawe • 4 Hub Biomassa Jombang, Wonosobo, Palembang, Aceh-Tamiang 	<ul style="list-style-type: none"> • 4 Main Hub Biomassa Lombok, Padang, Barru, Kupang • 2 Hub Biomassa Bengkulu, Jambi 	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • Pra-FS Bioenergy • Market Research Indonesia & Global 	<ul style="list-style-type: none"> • Biogas Partnership • Waste Management Partnership • FS & Legal Bioenergy Plant 	1 st Biogas Plant EPC 1 st RDF Plant EPC	<ul style="list-style-type: none"> • 1st COD Biogas Plant • 2nd Biogas Plant EPC <ul style="list-style-type: none"> • 1st COD RDF Plant • 2nd RDF Plant EPC 	<ul style="list-style-type: none"> • 2nd COD Biogas Plant • 3rd Biogas Plant EPC <ul style="list-style-type: none"> • 2nd COD RDF Plant • 3rd RDF Plant EPC 	3 rd COD Biogas Plant 3 rd 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



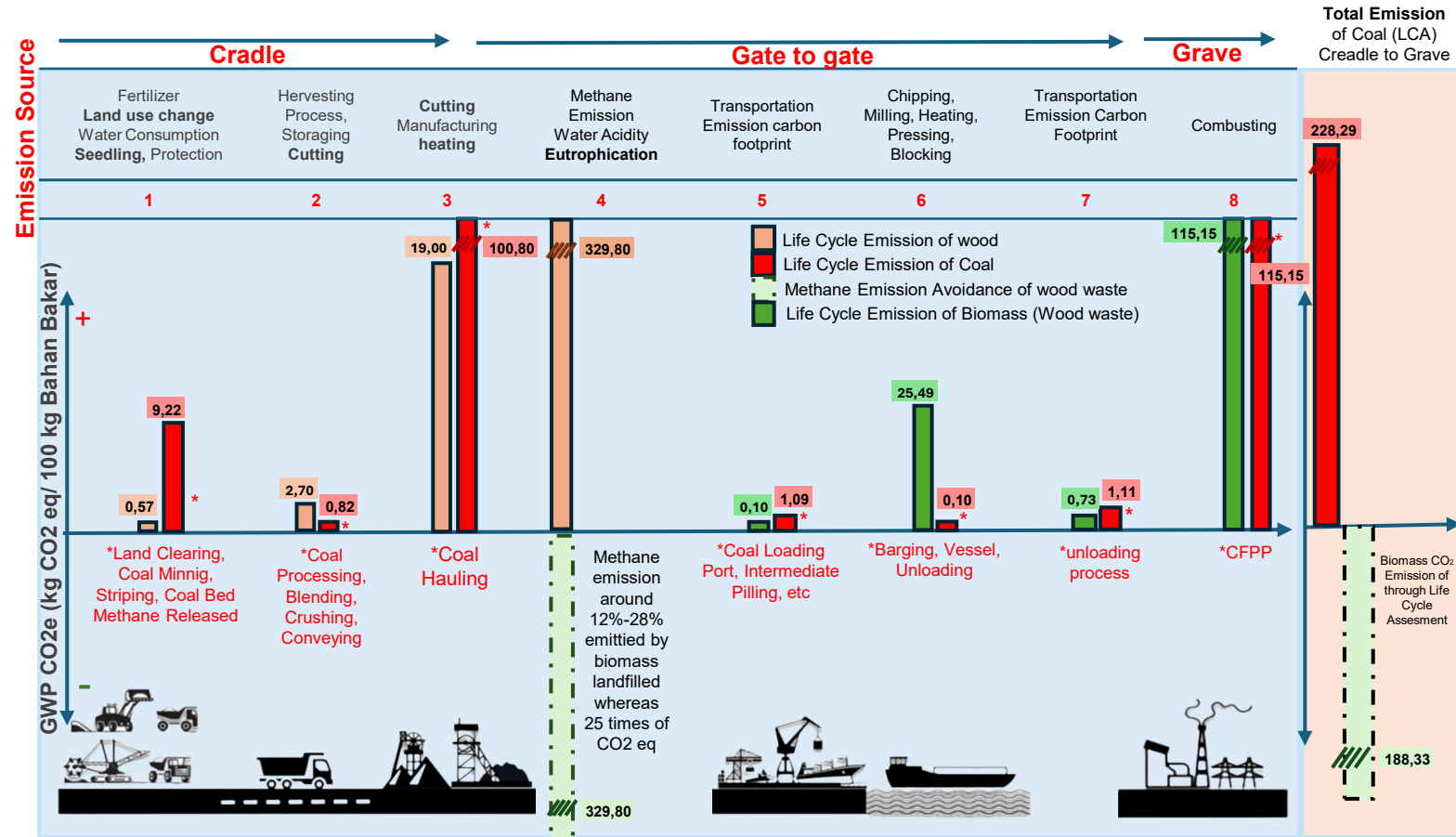
Terima Kasih



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.



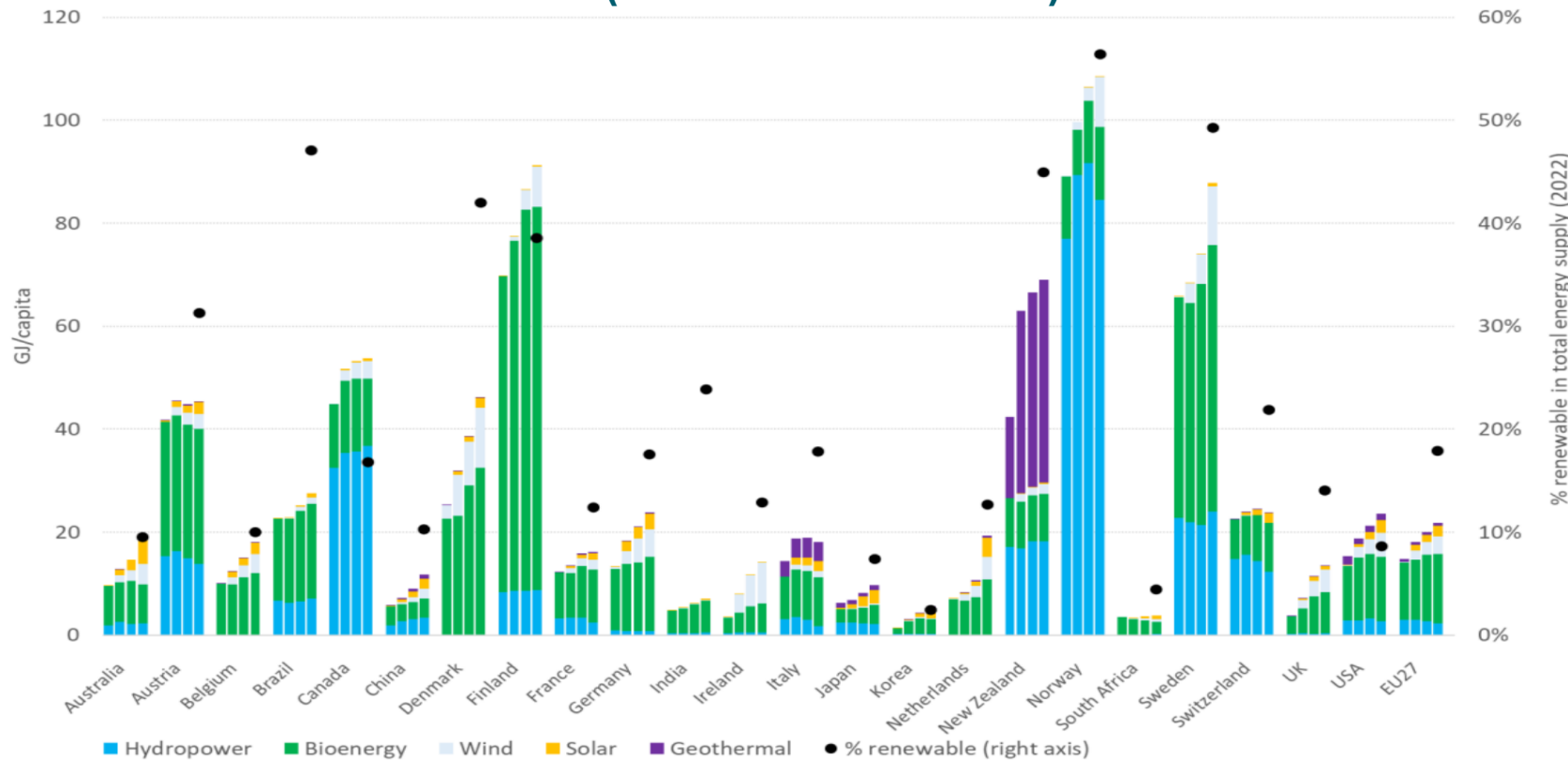
Glosarium:

- **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)**



Sumber: IEA Bioenergy Report 2024

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

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.