PROPER 13 PROPER EMAS TAHUN 2023

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PLN Indonesia Power

IMPLEMENTATION OF BIOMASS COFIRING TELUK SIRIH CFB POWER PLANT

PT PLN INDONESIA POWER
POWER GENERATION BUSINESS UNIT
TELUK SIRIH

UBP TIR PRIDES
P Production Scale Up
R Reliability Improvement
I Intense Culture & Synergy
D Deliver Green Energy
E Efficiency Focus
S Safety (Zero Accident) & Clean Power Plant

www.plnindonesiapower.co.id

SPEAKERS

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Assistant Manager of Coal & Ash Handling

Bachelor of Mechanical Engineering

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Engineering Senior Officer

Bachelor of Electrical Engineering

BUMN UNTUK INDONESIA

GENERAL OVERVIEW
UBP TELUK SIRIH

PLN Indonesia Power

PLTU TELUK SIRIH

Plant Capacity	: 2 X 112 MW
Nett Capacity	: 2 X 87.5 MW
Fuel	: Low Range Coal
Boiler Company	: Wuxi Huaguang Boiler
Tipe Boiler	: CFB
Turbin & Generator	: Nanjang Turbine Generator

PLTG TELUK SIRIH

Plant Capacity	: 21 MW
Nett Capacity	: 16.5 MW
Fuel	: High Speed Diesel
Turbin	: Alsthom Atlantique
Generator	: Alsthom Atlantique

PT PLN Indonesia Power Unit Bisnis Pembangkitan (UBP) Teluk Sirih is located in Dusun Teluk Sirih, Kelurahan Kabung Tengah, Kecamatan Bungus Teluk Kabung, Padang City, West Sumatra Province. It is approximately 33 km south of the Padang City government center, and not far from the Mandeh Tourism area which is nicknamed the Raja Ampat of Sumatra.

PLTU Teluk Sirih contributes greatly to maintaining the resilience of electrical energy in Sumatra (4% of the total Load of Sumatra Island, and contributes 1/3 of the electricity needs in West Sumatra) with sales of electricity generated in 2024 reaching 975,763 MWh with coal consumption of 831,000 tons. The coal used is Low Rank Coal (LRC) with a calorific value of 4,200-4,300 kcal/kg which comes from Sumatra.

Teluk Sirih PLTU with a capacity of 224 MW (2 x 112 MW) using main equipment from Chinese manufacturers (Nanjing Turbine Generator Co., Ltd. and Wuxi Huaguang Boiler Company) began commercial operations in July 2014 (Unit 1) and August 2014 (Unit 2).

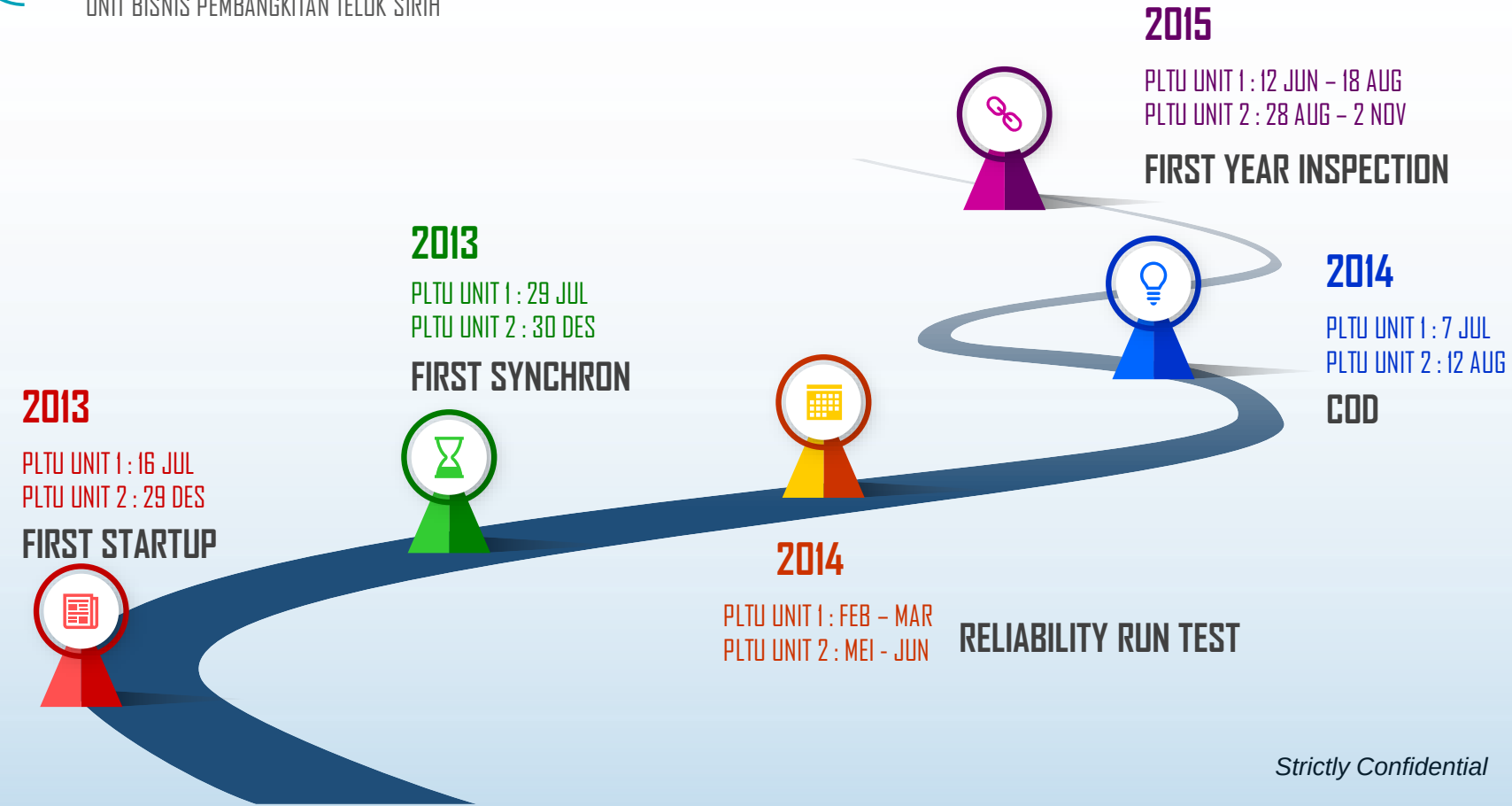
Address :

Jl. Lintas Sumatera Padang-Painan KM. 25 Kec. Bungus Teluk Kabung, Kel. Teluk Kabung Tengah, Kota Padang, Sumatera Barat
(PLTU: -1.076833, 100.372389)
(PLTG: -1.078780, 100.372723)

MILESTONE PROJECT

UNIT BISNIS PEMBANGKITAN TELUK SIRIH

PLN Indonesia Power



MAIN EQUIPMENT SPECIFICATION (PLTU)

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BOILER

Manufacture	: Wuxi Huanguang Boiler Corp., Ltd
Type	: Circulating Fluidized Bed (CFB)
Feed Water Temp.	: 234 °C
Outlet Pressure	: 9.81 MPa
Superheater Outlet	: 540 °C

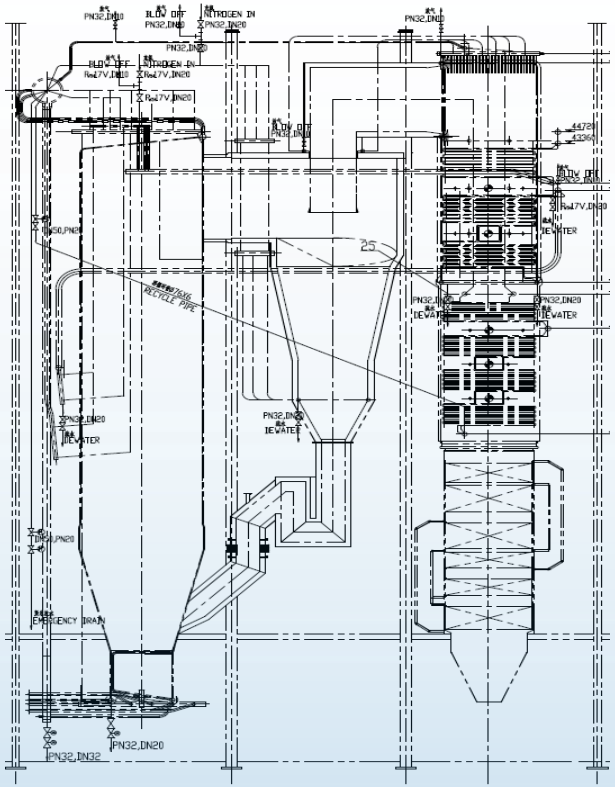
TURBINE

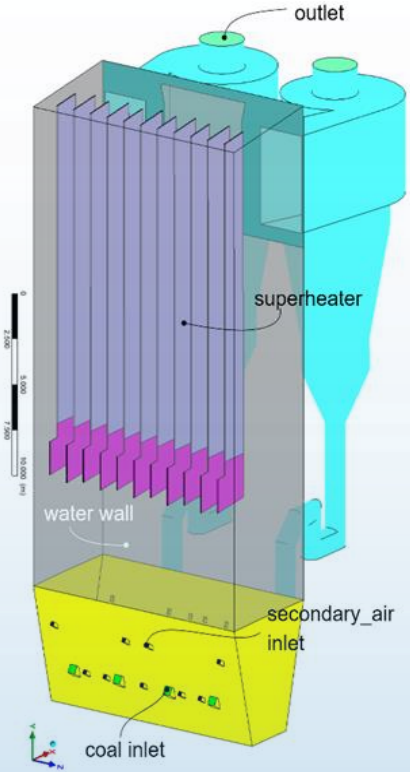
Manufacture	: Nanjing Steam Turbine Works Co. Ltd.
Type	: High pressure, doube cylinder, double exhaust condensing
Main Steam Pres.	: 8.83 MPa
Main Steam Temp.	: 535 °C

GENERATOR

Manufacture	: Nanjing Turbine & Electric Machinery (Group) Co., Ltd.
Type	: QFJ 112-2, 13.8 kV
Capacity	: 112000 kW
Voltage/Current	: 1380 V / 5512.6 A
Power Factor	: 0.85
Cooling Type	: Air

CIRCULATING FLUIDIZED BED (CFB) BOILER



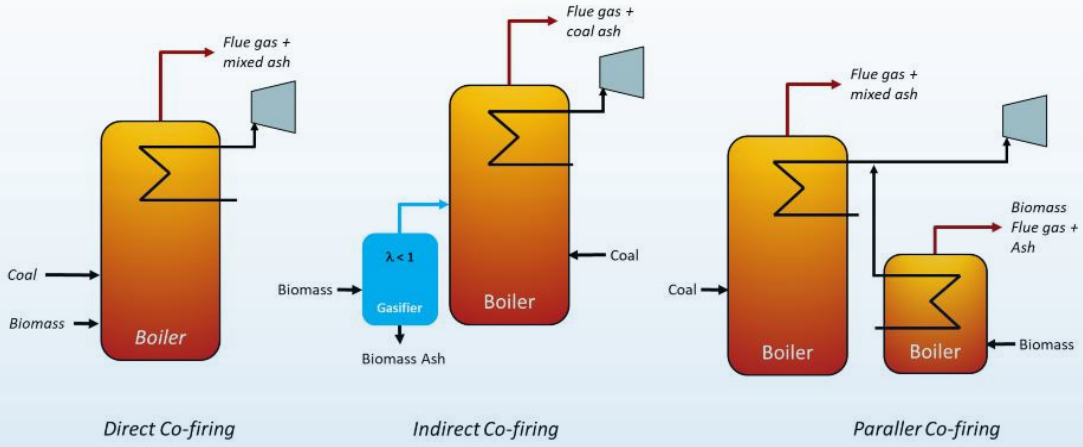


Boiler Manufacture Company	**: Wuxi Huaguang Boiler**
Model	**: UG-434/9.81-M**
Boiler Capacity	: 434 t/h
Boiler Fuel Consumption (coal)	: 78.26 t/h (1 unit)
Plant Heat Rate	: 2.162,03 kKal/kWh
Capacity Factor	: 79,9 (7000H/Years)
Nominal Steam Temperature	: 540 ºC
Nominal Steam Pressure	: 9,8 Mpa
Elevating of the Furnace Ceiling	: 43440 mm
Elevating of the Central Line of Drum	: 47200 mm
Elevating of the Highest Point of Boiler	: 53300 mm
Elevating of the Boiler Operation Level	: 9000 mm
Furnace Volume Thermal Load	: 92 KW/m3
Furnace Outlet Flue Gas	: 890 ºC
Daily Coal Consumption	: 1878,2 t
Annual Coal Consumption	: 54,78 10^4t
Rated Stem Temperature	: 540ºC
Feedwater temperature	: 234ºC
Calculated Boiler Heat Efficiency	: 92.26%
Hot Primary Air Temperature	: 215ºC
Hot Secondary Air Temperature	: 215ºC
Ratio of Primary and Secondary Air	: 60 : 40

BIOMASS COFIRING DESCRIPTION

Cofiring refers to the process of simultaneously burning two or more types of fuel together in a power plant or boiler, typically a combination of fossil fuels (such as coal) and renewable or alternative fuels (like biomass, waste, or other organic materials).

Biomass Cofiring Method (Gil & Rubiera, 2019)



Direct Co-firing

The most common cofiring method and cheap

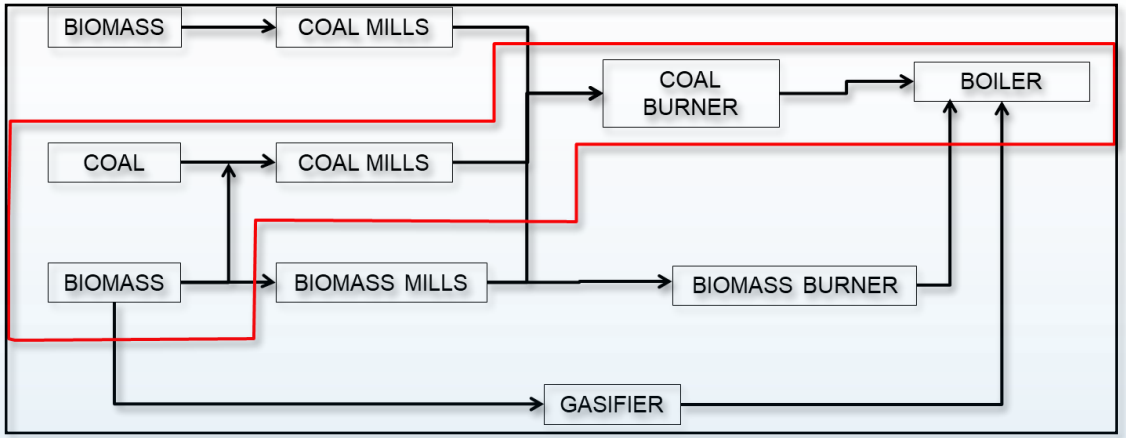
Indirect Co-firing

The biomass is gasified first

Paraller Co-firing

The biomass is burned separately

BIOMASS COFIRING DESIGN



No	Parameter Uji	Satuan, min./maks.	Kualitas			Metode Uji
			Premium	Standar	Utilitas	
1	Ukuran Partikel					
	- CFB	mm, min.	<16	<16	<16	Lihat pasal 6
	- Stoker	mm	6 s.d. 32	6 s.d. 32	6 s.d. 32	
2	Kadar abu [a]	% berat, maks.	2	3,5	4,5	SNI 06-3730
3	Kadar air [a]	% berat, maks.	15	25	35	SNI 01-1506
4	Kadar zat mudah menguap [a]	% berat, maks	74	74	74	SNI 06-3730
5	Kadar karbon tetap [a]	% berat, min.	17	14	12	SNI 06-3730
6	Nilai kalor bruto (GCV) [a]	MJ/kg, min.	17,3	14,6	12,6	SNI 01-6235
		kkal/kg, min.	4.132	3.487	3.009	
7	Kadar Klorin [b]	% berat, maks.	0,02	0,03	0,04	SNI 8951
8	Kadar Kalium [c] (sebagai K_2O)	% berat, maks.	5	10	15	SNI 8951
9	Kadar Natrium [c] (sebagai Na_2O)	% berat, maks.	2,5	3,5	5	SNI 8951
10	Kadar Sulfur Total [b]	% berat, maks.	0,3	0,4	0,5	SNI 8951
11	*Ash Fusion Temperatur: IDT (at Reducing Atmosphere)*	°C, min.	1.200	1.180	1.150	SNI 8951

Keterangan:
[a] : *as received*
[b] : Kadar klorin/sulfur total: dalam kondisi *dry basis*
[c] : Persen dari abu

Woodchip specification standard

BIOMASS SPECIFICATION

PLN Indonesia Power

Woodchip

Gross Calorific Value : 3,009 – 3,487 (kcal/kg)

Total Moisture : ≤ 25%

Size : 2,6 – 16 mm

Source : Replanting plants (rubber wood, durian, rambutan, mahoni, etc)

Raw material source : Dharmasraya, Sijunjung, Pariaman, Lubuk Basung, Painan (West Sumatera Province)

Sawdust

Gross Calorific Value : 3,009 (kcal/kg)

Total Moisture : ≤ 45%

Size : ≤ 2,5 mm

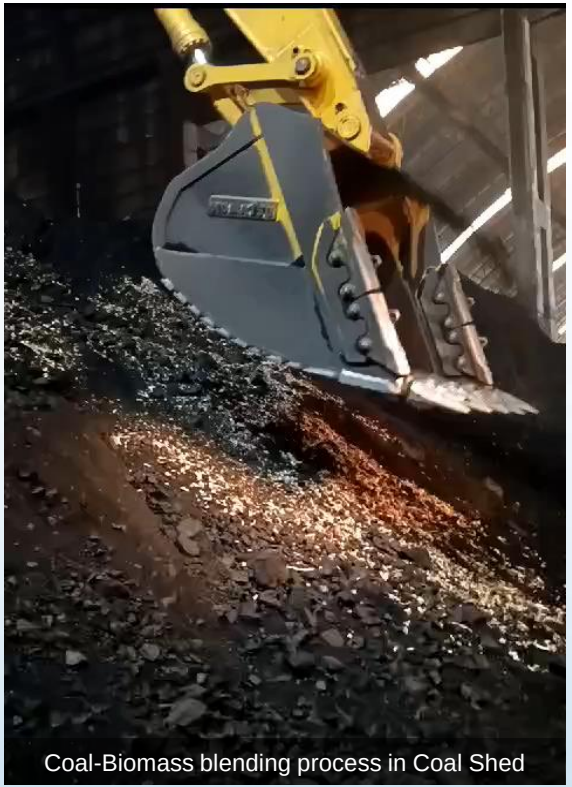
Source : Sawmill waste

Raw material source : Dharmasraya, Sijunjung, Pariaman, Lubuk Basung, Painan (West Sumatera Province)

BIOMASS HANDLING

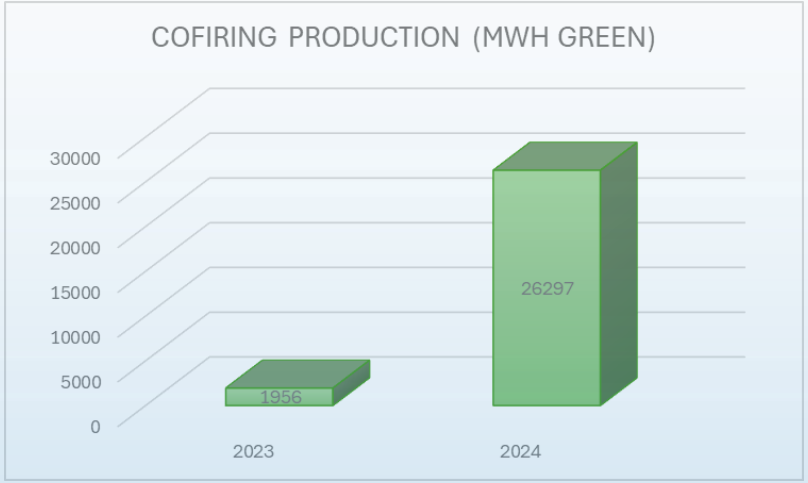
- Biomass transported using trucks undergoes a quick test before entering the PLTU, if it meets the acceptance criteria then it is continued with weighing in the PLTU.
- Then unloading is carried out in the stockpile using an excavator.
- The blending process is carried out using heavy equipment (excavator) with a conventional mixing method, namely based on the tonnage composition between biomass and coal which is carried out in the coal yard/stockpile.
- The mixing proportion is **3-5%** biomass and **95-97%** coal.

Biomass unloading process in Stockpile


Coal-Biomass blending process in Coal Shed

MILESTONE & ACHIEVEMENT

The biomass cofiring program at Teluk Sirih PLTU went live on **October 17, 2023**, where the total in **2023** managed to produce **1,956** MWh green. Currently, it has entered the cofiring up-ratio stage with an average daily percentage realization of **3%** and total biomass absorption in **2024** of **28,968** tons of biomass and managed to produce **26,297** MWh green.



*2023 : October 17th until December 31st

NEXT IMPLEMENTATION

PLN Indonesia Power

Common Biomass diversification

PLN Indonesia Power — KAN LP-1331-IDN

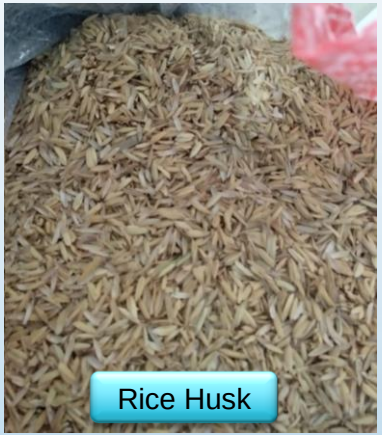
REPORT OF ANALYSIS

No. : UPKTIR.PT.0043.24

NAME OF SAMPLE / BARGE	:	ANALISA SEKAM
KIND OF SAMPLE	:	~~Consignment~~/Others Internal
REFERENCE NUMBER	:	PT.0043.24
DATE OF RECEIVED	:	14-Oct-24
ANALYSIS DATE	:	16-Oct-24
REPORTED TO	:	Coal & Ash handling, "Bahan bakar" PT. PLN (Persero) Unit Induk Pembangkitan Sumatera Bagian Selatan Unit Pelaksana Pembangkitan Teluk Sirih Jl. Lintas Sumatera Padang - Painan Km. 25 Teluk Kabung Tengah, Bungus, Teluk Kabung, Kota Padang - 25241

GENERAL CONDITION OF SAMPI : As far as visible, sample packing by independent is good.

PARAMETER	UNIT	RESULT				METHODS
		AR	ADB	DB	DAF	
Total Moisture	%	10.57	-	-	-	ASTM D3302/D3302M-2017*
Moisture in the analysis sample	%	-	8.51	-	-	ASTM D7582-2015
Ash Content	%	20.69	21.17	23.14	-	ASTM D7582-2015
Volatile Matter	%	55.46	56.74	62.01	80.68	ASTM D7582-2015
Fixed Carbon	%	13.28	13.59	14.85	19.32	ASTM D7582-2015
Gross Calorific Value	Cal/g	3254	3328	3638	4733	ASTM D5865/D5865M-19
Total Sulfur	%	0.27	0.28	0.31	0.40	ASTM D4239-18e1 Method A



Rice Husk

PLN Indonesia Power — KAN LP-1331-IDN

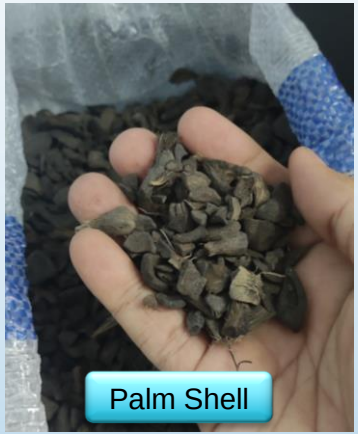
REPORT OF ANALYSIS

No. : UPKTIR.PT.0039.24

NAME OF SAMPLE / BARGE	:	ANALISA CANGKANG KA LOCAL TELUK SIRIH
KIND OF SAMPLE	:	~~Consignment~~/Others Internal
REFERENCE NUMBER	:	PT.0039.24
DATE OF RECEIVED	:	10-Oct-24
ANALYSIS DATE	:	11-Oct-24
REPORTED TO	:	Coal & Ash handling, "Bahan bakar" PT. PLN (Persero) Unit Induk Pembangkitan Sumatera Bagian Selatan Unit Pelaksana Pembangkitan Teluk Sirih Jl. Lintas Sumatera Padang - Painan Km. 25 Teluk Kabung Tengah, Bungus, Teluk Kabung, Kota Padang - 25241

GENERAL CONDITION OF SAMPI : As far as visible, sample packing by independent is good.

PARAMETER	UNIT	RESULT				METHODS
		AR	ADB	DB	DAF	
Total Moisture	%	8.96	-	-	-	ASTM D3302/D3302M-2017*
Moisture in the analysis sample	%	-	7.29	-	-	ASTM D7582-2015
Ash Content	%	2.66	2.71	2.92	-	ASTM D7582-2015
Volatile Matter	%	69.82	71.11	76.69	79.00	ASTM D7582-2015
Fixed Carbon	%	18.56	18.90	20.39	21.00	ASTM D7582-2015
Gross Calorific Value	Cal/g	4563	4647	5012	5163	ASTM D5865/D5865M-19
Total Sulfur	%	0.29	0.30	0.32	0.33	ASTM D4239-18e1 Method A



Palm Shell

PLN Indonesia Power — KAN LP-1331-IDN

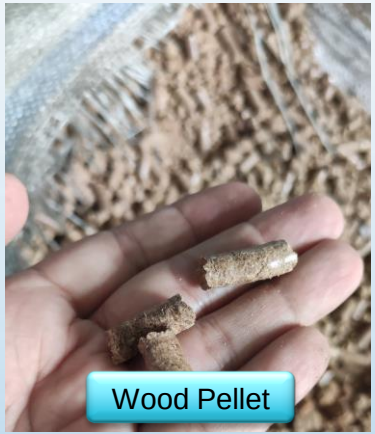
REPORT OF ANALYSIS

No. : UPKTIR.PT.0049.24

NAME OF SAMPLE / BARGE	:	ANALISA SAMPEL WOOD PELET SIJUNJUNG
KIND OF SAMPLE	:	~~Consignment~~/Others Internal
REFERENCE NUMBER	:	PT.0049.24
DATE OF RECEIVED	:	28-Nov-24
ANALYSIS DATE	:	03-Dec-24
REPORTED TO	:	Coal & Ash handling, "Bahan bakar" PT. PLN (Persero) Unit Induk Pembangkitan Sumatera Bagian Selatan Unit Pelaksana Pembangkitan Teluk Sirih Jl. Lintas Sumatera Padang - Painan Km. 25 Teluk Kabung Tengah, Bungus, Teluk Kabung, Kota Padang - 25241

GENERAL CONDITION OF SAMP : As far as visible, sample packing by independent is good.

PARAMETER	UNIT	RESULT				METHODS
		AR	ADB	DB	DAF	
Total Moisture	%	13.72	-	-	-	ASTM D3302/D3302M-2017*
Moisture in the analysis sample	%	-	10.04	-	-	ASTM D7582-2015
Ash Content	%	1.61	1.68	1.86	-	ASTM D7582-2015
Volatile Matter	%	70.64	73.66	81.87	83.42	ASTM D7582-2015
Fixed Carbon	%	14.04	14.64	16.27	16.58	ASTM D7582-2015
Gross Calorific Value	Cal/g	4021	4193	4661	4749	ASTM D5865/D5865M-19
Total Sulfur	%	-	-	-	-	ASTM D4239-18e1 Method A



Wood Pellet

PLN Indonesia Power — KAN LP-1331-IDN

REPORT OF ANALYSIS

No. : UPKTIR.PT.0048.24

NAME OF SAMPLE / BARGE	:	ANALISA SAMPEL WOOD PELET KELAPA
KIND OF SAMPLE	:	~~Consignment~~/Others Internal
REFERENCE NUMBER	:	PT.0048.24
DATE OF RECEIVED	:	13-Nov-24
ANALYSIS DATE	:	15-Nov-24
REPORTED TO	:	Coal & Ash handling, "Bahan bakar" PT. PLN (Persero) Unit Induk Pembangkitan Sumatera Bagian Selatan Unit Pelaksana Pembangkitan Teluk Sirih Jl. Lintas Sumatera Padang - Painan Km. 25 Teluk Kabung Tengah, Bungus, Teluk Kabung, Kota Padang - 25241

GENERAL CONDITION OF SAMP : As far as visible, sample packing by independent is good.

PARAMETER	UNIT	RESULT				METHODS
		AR	ADB	DB	DAF	
Total Moisture	%	9.28	-	-	-	ASTM D3302/D3302M-2017*
Moisture in the analysis sample	%	-	6.30	-	-	ASTM D7582-2015
Ash Content	%	1.03	1.06	1.13	-	ASTM D7582-2015
Volatile Matter	%	71.54	73.90	78.86	79.76	ASTM D7582-2015
Fixed Carbon	%	18.15	18.75	20.01	20.24	ASTM D7582-2015
Gross Calorific Value	Cal/g	4269	4410	4706	4760	ASTM D5865/D5865M-19
Total Sulfur	%	0.30	0.31	0.33	0.33	ASTM D4239-18e1 Method A

Coconut Shell Pellet

NEXT IMPLEMENTATION

PLN Indonesia Power

Potential Biomass as Environment Solution

Collection of wood waste and coconut shells

Waste is shredded using a shredding machine

Coconut shell & beach woodchip waste

The result of shredded waste that becomes woodchips

CLIENT : PT. PLN INDONESIA POWER
UNIT BISNIS PEMBANGKITAN TELUK SIRIH
Jl. Lintas Padang-Painan KM 25, Teluk Kabung Tengah, Bungus Teluk Kabung, Padang – Sumatera Barat

SUBJECT : TEMPURUNG PANTAI

TESTED FOR : Preparation Sample, Total Moisture, Proximate Analysis, Total Sulfur, Gross Calorific Value

DESCRIPTION OF SAMPLE : 1 (One) Sample received on March 15th, 2024
Packing : 1 (one) sealed plastic bag.
Weight/Volume : ± 0.771 Kg

DATED OF ANALYSED : March 17th, 2024

Result :

PARAMETERS		RESULTS AR	ADB	DB	DAFB	METHODS
- Total Moisture,	%	13.29	-	-	-	ASTM D3302/D3302M – 17
PROXIMATE ANALYSIS :						
- Inherent Moisture,	%	-	9.58	-	-	ASTM D3173/D3173M – 17a
- Ash Content,	%	1.46	1.52	1.68	-	ASTM D 3174 – 12 (2018 e1)
- Volatile Matter,	%	68.09	71.00	78.52	79.87	ASTM D 3175 – 20
- Fixed Carbon,	%	17.16	17.90	19.80	20.13	ASTM D 3172 – 13 (2021) e1
Total Sulphur,	%	0.50	0.52	0.58	0.58	ASTM D 4239 – 18e1 *method* A
Gross Calorific Value,	K Cal/kg	4184	4363	4825	4908	ASTM D 5865/D5865M - 19

The calorific value of beach shells is: 4184 kCal/kg

REPORT OF ANALYSIS

CLIENT : PT. PLN INDONESIA POWER
UNIT BISNIS PEMBANGKITAN TELUK SIRIH
Jl. Lintas Padang-Painan KM 25, Teluk Kabung Tengah, Bungus Teluk Kabung, Padang – Sumatera Barat

SUBJECT : KAYU SAMPAH PANTAI

TESTED FOR : Preparation Sample, Total Moisture, Proximate Analysis, Total Sulfur, Gross Calorific Value

DESCRIPTION OF SAMPLE : 1 (One) Sample received on March 15th, 2024
Packing : 1 (one) sealed plastic bag.
Weight/Volume : ± 0.537 Kg

DATED OF ANALYSED : March 17th, 2024

Result :

PARAMETERS		RESULTS AR	ADB	DB	DAFB	METHODS
- Total Moisture,	%	15.41	-	-	-	ASTM D3302/D3302M – 17
PROXIMATE ANALYSIS :						
- Inherent Moisture,	%	-	12.04	-	-	ASTM D3173/D3173M – 17a
- Ash Content,	%	4.60	4.78	5.43	-	ASTM D 3174 – 12 (2018 e1)
- Volatile Matter,	%	63.14	65.66	74.65	78.94	ASTM D 3175 – 20
- Fixed Carbon,	%	16.85	17.52	19.92	21.06	ASTM D 3172 – 13 (2021) e1
Total Sulphur,	%	0.34	0.35	0.40	0.42	ASTM D 4239 – 18e1 *method* A
Gross Calorific Value,	K Cal/kg	3714	3862	4391	4643	ASTM D 5865/D5865M - 19

The calorific value of beach wood waste is: 3714 kCal/kg

NEXT IMPLEMENTATION

Potential Biomass as Environment Solution

BANK INDONESIA
BANK SENTRAL REPUBLIK INDONESIA

PLN Indonesia Power

BERITA ACARA KESEPAHAMAN

ANTARA

DEPARTEMEN PENGELOLAAN UANG

BANK INDONESIA

DAN

PT. PLN INDONESIA POWER

TENTANG

PEMANFAATAN LIMBAH RACIK UANG RUPIAH

Paper money waste

RDF

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ADDITIONAL INFORMATION

PENGOLAHAN SAMPAH MENJADI MAGGOT

- **Kapasitas sampah** yang bisa ditampung di bak pengumpul sebanyak **1 ton**
- **Pengolahan sampah** hingga menjadi maggot dilakukan selama **1 minggu** dan menghasilkan **maggot sebanyak ±150 kg** dimanfaatkan sebagai **pakan ikan dan ternak**
- Selain menghasilkan maggot, sampah yang diolah menghasilkan **pupuk cari organik** yang digunakan pada tanaman

Bak pengolah sampah dengan BSF menjadi maggot

Maggot yang dihasilkan

Pemberian pakan ikan dari maggot

Pupuk cair organic dari pengolahan sampah

Maggot atau **larva dari lalat Black Soldier Fly (BSF)** dapat digunakan untuk mengurai sampah organik. Maggot dapat mengurai sampah organik dengan cara mengonsumsinya dan mengubahnya menjadi kompos.

Berikut beberapa manfaat maggot dalam pengelolaan sampah organik:

Mengurangi sampah organik: Maggot dapat mengurai sampah organik hingga 5 kg dalam 24 jam.

Tidak berbau: Maggot mengurai bahan organik tanpa menimbulkan bau.

Menjadi pakan ternak: Maggot dapat dijadikan pakan untuk unggas, ikan, dan hewan peliharaan lainnya.

Sumber pupuk organik: Pupa maggot dapat digunakan sebagai pupuk organik untuk meningkatkan kesuburan tanah.

Untuk membudidayakan maggot, Anda dapat:

Menyiapkan media organik yang lembab dan kaya akan bahan organik sebagai tempat bertelur lalat BSF dewasa.

Setelah telur menetas menjadi larva, beri pakan maggot berupa sampah organik.

Setelah maggot mencapai ukuran optimal, panen untuk dijadikan pakan ternak atau pupa untuk dijual sebagai pupuk organik.

Beberapa faktor yang mempengaruhi kesuksesan budidaya maggot, di antaranya: Kondisi lingkungan budidaya maggot, Kandungan nutrisi bahan, Umur indukan.