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LAMPIRAN

Lampiran A. Data Operasi Pembangkit Periode Bulan Juli 2021

PT PLN (PERSERO) UNIT INDUK WILAYAH MALUKU DAN MALUKU UTARA
UNIT PELAKSANA PEMBANGKITAN MALUKU
PLTMG 30 MW TERNATE

HASIL PENGAMBILAN DATA OPERASI MESIN WARTSILA TYPE 20 V34DF DI PLTMG TERNATE 30 MW
PERIODE JULI 2021

TGL	K W H YANG DIBANGKITKAN					PEMAKAIAN SENDIRI MESIN			PEMAKAIAN BAHAN BAKAR (LITER), Flow Meter					JAM KERJA MESIN (JAM)				TOTAL (JAM)
	MESIN #1	MESIN #2	MESIN #3	MESIN #4	JUMLAH	BLOK 1	BLOK2	JUMLAH	MESIN #1	MESIN #2	MESIN #3	MESIN #4	JUMLAH	MESIN #1	MESIN #2	MESIN #3	MESIN #4	
1	0	113,672	168,736	168,528	450,936	0	4,446	4,446	0	27,710	40,752	40,906	109,368	0	16	24	24	64
2	93,056	21,760	160,864	161,424	437,104	0	4,443	4,443	22,492	5,332	39,110	39,348	106,282	14	4	24	24	66
3	28,320	121,944	162,128	161,976	474,368	0	4,184	4,184	6,976	29,694	39,348	39,402	115,420	6	18	24	24	72
4	33,792	178,032	178,072	177,832	567,728	0	4,791	4,791	8,168	43,146	42,870	42,938	137,122	4	24	24	24	76
5	36,672	153,472	164,024	163,816	517,984	0	4,246	4,246	8,762	37,190	39,722	39,676	125,350	6	22	24	24	76
6	161,472	17,672	162,616	162,416	504,176	0	4,343	4,343	38,726	4,340	39,376	39,440	121,882	23	3	24	24	74
7	168,288	40,848	157,800	167,728	534,664	0	4,540	4,540	40,410	9,846	38,178	40,624	129,058	24	5	23	24	76
8	161,216	178,432	39,016	181,096	559,760	0	4,631	4,631	38,522	43,092	9,426	43,730	134,770	21	24	6	24	75
9	106,096	143,856	161,584	161,464	573,000	0	4,545	4,545	25,384	35,156	39,120	39,310	138,970	15	23	24	24	86
10	181,056	43,760	168,208	168,024	561,048	0	4,790	4,790	43,144	10,584	40,716	40,840	135,284	24	6	24	24	78
11	121,056	105,888	174,744	174,528	576,216	0	4,591	4,591	28,932	25,592	42,094	42,170	138,788	17	13	24	24	78
12	109,440	179,856	171,120	135,920	596,336	0	4,534	4,534	26,172	43,404	41,246	33,018	143,840	14	24	23	19	80
13	170,560	184,160	38,904	194,592	588,216	0	4,948	4,948	40,662	44,454	9,338	46,870	141,324	23	24	5	24	76
14	41,024	177,440	161,280	173,120	552,864	0	4,444	4,444	9,950	42,948	38,880	41,904	133,682	6	24	23	24	77
15	20,032	155,872	163,928	159,112	498,944	0	4,443	4,443	4,832	37,918	39,668	38,804	121,222	3	23	24	24	74
16	108,976	63,408	174,080	179,176	525,640	0	4,442	4,442	26,340	15,800	42,118	43,506	127,764	14	9	24	24	71
17	37,936	132,128	165,856	165,696	501,616	0	4,563	4,563	9,124	32,266	40,074	40,206	121,670	5	20	24	24	73
18	63,840	115,312	166,392	166,184	511,728	0	4,970	4,970	15,414	28,064	40,388	40,438	124,304	10	16	24	24	74
19	6,256	173,648	168,168	167,952	516,024	0	4,667	4,667	1,548	42,144	40,682	40,756	125,130	1	24	24	24	73
20	95,424	56,688	167,240	167,080	486,432	0	4,581	4,581	22,934	13,820	40,546	40,622	117,922	13	9	24	24	70
21	181,680	33,712	155,336	173,648	544,376	0	4,854	4,854	43,514	8,367	37,846	42,160	131,887	24	5	22	24	75
22	171,984	109,888	81,880	169,376	533,128	0	4,743	4,743	41,186	27,016	19,738	41,249	129,189	24	18	11	24	77
23	181,680	40,096	166,872	173,304	561,952	1,865	3,287	5,152	43,864	9,794	40,582	42,216	136,456	24	5	24	24	77
24	177,296	176,912	32,128	182,656	568,992	5,190	0	5,190	42,704	43,100	7,922	44,452	138,178	24	24	4	24	76
25	162,224	161,808	37,088	157,616	518,736	4,992	0	4,992	39,112	39,486	8,946	38,412	125,956	24	24	5	23	76
26	163,888	168,992	162,128	31,120	526,128	4,842	0	4,842	39,620	41,222	39,300	7,704	127,846	24	24	23	5	76
27	174,256	173,856	85,584	109,544	543,240	5,139	0	5,139	42,018	42,504	20,796	26,768	132,086	24	24	12	15	75
28	173,472	173,072	182,880	24,264	553,688	4,705	0	4,705	41,752	42,230	44,302	6,022	134,306	24	24	24	4	76
29	169,872	169,472	85,008	121,080	545,432	4,844	0	4,844	41,014	41,458	20,682	29,574	132,728	24	24	12	17	77
30	167,808	167,392	127,984	71,968	535,152	4,758	0	4,758	40,540	41,022	31,168	17,554	130,284	24	24	18	9	75
31	167,360	166,944	22,480	158,264	515,048	4,884	0	4,884	40,470	40,900	5,484	38,790	125,644	24	24	3	23	74
JUMLAH	3,636,032	3,899,992	4,214,128	4,730,504	**16,480,656**	41,219	104,027	145,246	874,286	949,599	1,020,418	1,149,409	**3,993,712**	507	551	598	667	2323

Diketahui Oleh.
Ul PLTD Kayu Merah

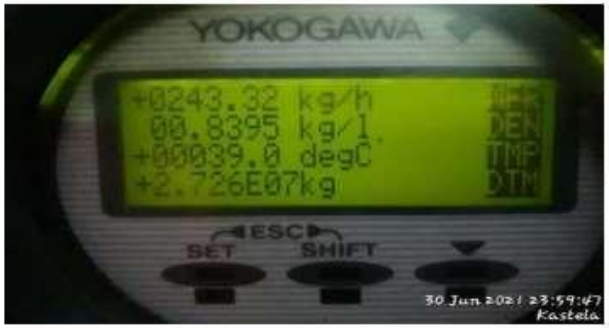
Firman Haqiqi
SPV II Ops

Kastela, 1 Agustus 2021
Peneliti,

Deni Adi Saputra
NIM. 07241621090

Lampiran B. Pengambilan Data Flowmeter Bahan Bakar 30 Juni dan 31 Juli 2021

PT PLN (PERSERO) UNIT INDUK WIL. M2U UNIT PELAKSANA PEMBANGKITAN MALUKU PLTMG 30 MW TERNATE	Pengambilan Data Flow Meter (Pemakaian Bahan Bakar) Engine 30 Juni dan 31 Juli 2021

	30 Juni 2021 (Jam 24;00)	31 Juli 2021 (Jam 24;00)
Engine # 1		
Engine # 2		

Engine # 3		
Engine # 4		

Diketahui Oleh,
ULPLTD Kayu Merah

Firman Haqiqi Mh.
SPV II Ops

Kastela, 1 Agustus 2021
Peneliti,

Deni Adi Saputra
NIM. 07241621090

Lampiran C. Laporan Analisa Bahan Bakar (B30)

VPS **Fuel Analysis Report**
PT. WARTSILA INDONESIA

Report date
19-Jul-2021

PLTMG MPP TERNATE (INDONESIA)

Product B30

Operational
Please refer to the comments on FAME and FTIR Analysis

Sample Number	SNG21F027119
Sent From	Indonesia
Date Sent	14-Jul-2021
Arrived at Lab	17-Jul-2021
Product Type	BIO
Sampling Point	BEFORE SEPARATOR
Sampling Date	01-Jul-2021
Sampling Method	Not Stated
Seal Data	4209128 (VPS, Intact)

Test Results

	Unit	Test Results	Test Method
Density @ 15°C	kg/m3	854.1	ISO 12185
Viscosity @ 40°C	mm2/s	3.704	ASTM D7042
Water	%V/V	0.03	ASTM D6304-C
Micro Carbon Residue 10%	%m/m	0.11	ISO 10370
Sulfur	%m/m	0.076	ISO 8754
Ash	%m/m	< 0.010	LP2605
Vanadium	mg/kg	< 1	LP1105
Sodium	mg/kg	< 1	LP1105
Aluminium	mg/kg	< 1	LP1105
Silicon	mg/kg	< 1	LP1105
Iron	mg/kg	< 1	LP1105
Nickel	mg/kg	< 1	LP1105
Calcium	mg/kg	< 1	LP1105
Magnesium	mg/kg	< 1	LP1105
Zinc	mg/kg	< 1	LP1105
Phosphorus	mg/kg	< 1	LP1105
Potassium	mg/kg	2	LP1105
Pour Point	degC	6	ISO 3016
Flash Point	degC	58.0	ISO 2719-A
Visual Appearance	-	Pass	LP 1902
Net Specific Energy[1]	MJ/kg	42.67	ISO 8217
Aluminium + Silicon	mg/kg	< 2	
Calculated Cetane Index[1]	-	53.1	ISO 4264
Temp.@ 10% recovery	degC	235	ISO 3405
Temp.@ 50% recovery	degC	310	ISO 3405
Temp.@ 90% recovery	degC	349	ISO 3405
Acid Number	mg KOH/g	0.18	ASTM D664
FAME content	%V/V	**31.12**	ASTM D7371
FTIR Screening	-	**See comment**	LP 2403

[1] Calculated value

Operational Advice

FAME	FAME may influence the cold flow properties and the affinity to water and thereby increasing the risk of microbial growth. Long term storage issues and material deposition on exposed surfaces may also be affected. In order to minimize the risk, it is important that the fuel is kept free from water, that any free water is removed from the tank bottoms and that tank drains and all filters in use are checked daily. When the fuel is stored for a prolonged period of time, e.g. more than 4-6 months, it is recommended to frequently monitor the fuel quality in the storage tanks.
FTIR Analysis	FTIR screening indicates the presence of unidentified compounds. GCMS on Vacuum Distillate analysis would be required to possibly determine the type of compounds. Meanwhile it is recommended to monitor engine operations closely.

Lampiran D. Laporan Analisa Bahan Bakar Diesel Oil

VPS **Fuel Analysis Report**
PT. WARTSILA INDONESIA

Report date
24-Feb-2018

TERNATE PLTMG 30 MW

== Final Report ==
NCV results included

Operational
Please refer to the comments on FAME

Sample Number	SNG1807126
Sent From	Jakarta
Date Sent	19-Feb-2018
Arrived at Lab	20-Feb-2018
Product Type	MGO
Sampling Date	09-Jan-2018
Seal Data	0240557 (VPS, Intact)

Test Results

	Unit	Test Results	Test Method
Density @ 15°C	kg/m3	846.1	ISO 12185
Viscosity @ 40°C	mm2/s	3.767	ASTM D7042
Water	%V/V	< 0.01	ASTM D6304-C
Micro Carbon Residue 10%	%m/m	< 0.10	ISO 10370
Sulfur	%m/m	0.13	ISO 8754
Ash	%m/m	< 0.010	LP 1001
Vanadium	mg/kg	< 1	IP 501
Sodium	mg/kg	< 1	IP 501
Aluminium	mg/kg	< 1	IP 501
Silicon	mg/kg	< 1	IP 501
Iron	mg/kg	< 1	IP 501
Nickel	mg/kg	< 1	IP 501
Calcium	mg/kg	1	IP 501
Magnesium	mg/kg	< 1	LP 1101
Zinc	mg/kg	< 1	IP 501
Phosphorus	mg/kg	< 1	IP 501
Potassium	mg/kg	< 1	LP 1101
Pour Point	degC	15	ISO 3016
Flash Point	degC	54.0	ISO 2719-A
Visual Appearance	-	Pass	LP 1902
Net Heat of Combustion[1]	MJ/kg	42.72	ASTM D240
Aluminium + Silicon	mg/kg	< 2	
Calculated Cetane Index[1]	-	53.9	ISO 4264
Temp @ 10% recovery	degC	229	ISO 3405
Temp @ 50% recovery	degC	294	ISO 3405
Temp @ 90% recovery	degC	375	ISO 3405
Acid Number	mg KOH/g	0.23	LP 2003
FAME content	%V/V	**0.25**	EN 14078
FTIR Screening	-	Pass	LP 2403
Gross Heat Combustion	MJ/kg	45.54	ASTM D240
Hydrogen	%m/m	13.3	ASTM D5291

[1] Calculated value

Operational Advice

FAME	Result shows presence of a small concentration of FAME. It is important that any free water is removed from tank bottoms, tank drains and all filters in use.

Note

SAMPLE BOTTLE MARKED AS MPP 1 FINISH 19.00 - WIF

Lampiran E. Laporan Uji Unjuk Kerja PLTMG Ternate Blok 2 (Awal Operasi)

KAN
LEMBAGA AKREDITASI NASIONAL
LEMBAGA INSPEKSI
LI-026-IDN

LAPORAN INSPEKSI TEKNIK

NO. :UJK PL/0009/172/2018/17.4001.002.60/MPPTERNATEBLOK2

INSPEKSI UJI UNJUK KERJA PLTMG MPP TERNATE BLOK 2

PT PLN (PERSERO) PUSAT SERTIFIKASI ◇LMK◇
Jl. Laboratorium Duren Tiga, Jakarta Selatan 12760, Telp. : (021) 7900034 (Hunting) Facsimile : (021) 798 2034, 794 3450
Home page : www.pln-jaser.co.id Email : niaga@pln-jaser.co.id - skt@pln-jaser.co.id - psm@pln-jaser.co.id
◇LMK◇ *Faster, Better & Competitive*

PT PLN (PERSERO) PUSAT SERTIFIKASI	LAPORAN INSPEKSI TEKNIK *TECHNICAL INSPECTION REPORT*	KAN Komite Akreditasi Nasional LEMBAGA INSPEKSI LI-026-IDN

No. / *Number*	UJK PL/0009/172/2018/17.4001.002.60/MPPTERNATEBLOK2	
Tanggal / *Date*	16 April 2018	
Peminta Jasa / *Client*	PT. PLN (Persero) Unit Induk Pembangunan Maluku	
Alamat / *Address*	Keluarahan Kastela, Kecamatan Pulau Ternate, Kota Ternate, Maluku Utara	
Keterangan / *Refference*		Dikeluarkan oleh / *Issued by*
No. Surat / *Letter Number*	0083/KON.01/UIPMALUKU/2017	**a.n. GENERAL MANAGER** PLT. Manajer Sistem Pembangkit
Tanggal / *Date*	04 April 2017	
Perihal / *Subject*	Penawaran Harga *Commissioning Test*	PARLINDUNGAN SIHOMBING

Judul / *Title*	No. KMP/WBS/IO *Number of* KMP/WBS/IO
INSPEKSI UJI UNJUK KERJA PLTMG MPP TERNATE BLOK 2	I.8601.17.16.4001.002.60

Ringkasan / *Summary*

Berdasarkan surat tersebut di atas, PT PLN (Persero) Pusat Sertifikasi – Bidang Pembangkit telah melaksanakan inspeksi uji unjuk kerja terhadap instalasi tenaga listrik Pusat Listrik Tenaga Mesin Gas (PLTMG) MPP Ternate Blok 2 dengan hasil perhitungan uji unjuk kerja **terlampir**

5. Pelaksanaan Pekerjaan

5.1. Tempat : PLTMG MPP Ternate 30 MW

5.2. Tanggal : 10 Februari 2018 & 2 Maret 2018

5.3. Pelaksana :

- Tim Inspeksi
  PT PLN (Persero) Pusat Sertifikasi : Panggulu Rigit W., Shahid Ardi, Ahmad Faizun.
- Tim Penguji
  Consortium PT. PP – Wartsila : Alfin Masykur, Akbar Rusdi, Andhika Fitrianto Rahmad Kusuma, Mikko Suhonen, Mikko Spannari.
- Disaksikan
  PT PLN UIP Maluku : Yohannes C.M, Nasaruddin.

6. Hasil Pekerjaan

Perhitungan dilakukan sesuai dengan *Performance Test Procedure mobile power plant & fixed type gas engine power plant package VII PLTMG MPP Ternate*

6.1. Hasil pekerjaan inspeksi uji unjuk kerja disajikan dalam tabel perhitungan pada lampiran IV.

6.2. Uji unjuk kerja dilakukan pada beban 50%, 75% dan 100%.

6.3. Hasil perhitungan Performanace Test Blok 2 adalah sebagai berikut :

No	Description	Unit	Result		
			50%	75%	100%
1.	Gross Output Corrected Unit 3	kW	5,019.00	7,530.00	9,725.00
2.	Gross Output Corrected Unit 4	kW	5,013.00	7,555.00	9,700.00
3.	Net Output Corrected Unit 3	kW	4,901.17	7,400.17	9,591.17
4.	Net Output Corrected Unit 4	kW	4,891.48	7,420.48	9,550.47
5.	Net Block (2) Output Corrected	kW	9,792.65	14,820.65	19,141.65
6.	Net Block (2) Heat Rate Corrected	kJ/kWh	8,865.78	8,749.39	8,463.98
7.	Net Plant Power Output Corrected	kW	19,609.18	29,627.18	38,310.18
8.	Auxiliary Power Unit 3	kW	32.00	44.00	48.00
9.	Auxiliary Power Unit 4	kW	34.00	47.00	62.00
10.	Total Common Auxilliary Power	kW	54.38	54.38	54.38
11.	Losses Main Transformers Block 2	kW	103.967	103.967	103.967
12.	Losses UAT Block 2	kW	20.272	20.272	20.272

Diperiksa,
Deputi Manajer
Sistem Pembangkit Tenaga Listrik

Hendar Prisnadianta

Penulis,

Inspektor

Panggulu Rigit W.

Lampiran F. Laporan Uji Unjuk Kerja PLTMG Ternate Blok 1 (Awal Operasi)

KAN
LEMBAGA AKREDITASI NASIONAL
LEMBAGA INSPEKSI
LI-026-IDN

LAPORAN INSPEKSI TEKNIK

NO. :UJK PL/0008/172/2018/17.4001.002.60/MPPTERNATEBLOK1

INSPEKSI UJI UNJUK KERJA PLTMG MPP TERNATE BLOK 1

PT PLN (PERSERO) PUSAT SERTIFIKASI ◇LMK◇
Jl. Laboratorium Duren Tiga, Jakarta Selatan 12760, Telp. : (021) 7900034 (Hunting) Facsimile : (021) 798 2034, 794 3450
Home page : www.pln-jaser.co.id Email : niaga@pln-jaser.co.id - skt@pln-jaser.co.id - psm@pln-jaser.co.id

◇LMK◇ *Faster, Better & Competitive*

PT PLN (PERSERO) PUSAT SERTIFIKASI	LAPORAN INSPEKSI TEKNIK *TECHNICAL INSPECTION REPORT*	KAN Komite Akreditasi Nasional LEMBAGA INSPEKSI LI-026-IDN

No. / *Number*	UJK PL/0008/172/2018/17.4001.002.60/MPPTERNATEBLOK1	
Tanggal / *Date*	16 April 2018	
Peminta Jasa / *Client*	PT. PLN (Persero) Unit Induk Pembangunan Maluku	
Alamat / *Address*	Keluarahan Kastela, Kecamatan Pulau Ternate, Kota Ternate, Maluku Utara	
Keterangan / *Refference*		Dikeluarkan oleh / *Issued by*
No. Surat / *Letter Number*	0083/KON.01/UIPMALUKU/2017	**a.n. GENERAL MANAGER** PLT. Manajer Sistem Pembangkit
Tanggal / *Date*	04 April 2017	
Perihal / *Subject*	Penawaran Harga *Commissioning Test*	PARLINDUNGAN SIHOMBING

Judul / *Title*	No. KMP/WBS/IO *Number of* KMP/WBS/IO
INSPEKSI UJI UNJUK KERJA PLTMG MPP TERNATE BLOK 1	I.8601.17.16.4001.002.60

Ringkasan / *Summary*

Berdasarkan surat tersebut di atas, PT PLN (Persero) Pusat Sertifikasi – Bidang Pembangkit telah melaksanakan inspeksi uji unjuk kerja terhadap instalasi tenaga listrik Pusat Listrik Tenaga Mesin Gas (PLTMG) MPP Ternate Blok 1 dengan hasil perhitungan uji unjuk kerja **terlampir**

5. Pelaksanaan Pekerjaan

5.1. Tempat : PLTMG MPP Ternate 30 MW

5.2. Tanggal : 9 - 10 Februari 2018

5.3. Pelaksana :

- Tim Inspeksi
  PT PLN (Persero) Pusat Sertifikasi : Panggulu Rigit W., Shahid Ardi, Ahmad Faizun.
- Tim Penguji
  Consortium PT. PP – Wartsila : Alfin Masykur, Akbar Rusdi, Andhika Fitrianto Rahmad Kusuma, Mikko Suhonen, Mikko Spannari.
- Disaksikan
  PT PLN UIP Maluku : Yohannes C.M, Nasaruddin.

6. Hasil Pekerjaan

Perhitungan dilakukan sesuai dengan *Performance Test Procedure mobile power plant & fixe type gas engine power plant package VII PLTMG MPP Ternate*

6.1. Hasil pekerjaan inspeksi uji unjuk kerja disajikan dalam tabel perhitungan pada lampiran IV.

6.2. Uji unjuk kerja dilakukan pada beban 50%, 75% dan 100%.

6.3. Hasil perhitungan Performance Test Blok 1 adalah sebagai berikut :

No	Description	Unit	Result		
			50%	75%	100%
1.	Gross Output Corrected Unit 1	kW	5,034.00	7,540.00	9,727.00
2.	Gross Output Corrected Unit 2	kW	5,017.00	7,521.00	9,706.00
3.	Net Output Corrected Unit 1	kW	4,916.01	7,413.01	9,603.01
4.	Net Output Corrected Unit 2	kW	4,900.52	7,393.52	9,565.52
5.	Net Block (1) Output Corrected	kW	9,816.53	14,806.53	19,168.53
6.	Net Block (1) Heat Rate Corrected	kJ/kWh	8,923.36	8,591.29	8,379.46
7.	Net Plant Power Output Corrected	kW	19,609.18	29,627.18	38,310.18
8.	Auxiliary Power Unit 1	kW	33.00	42.00	39.00
9.	Auxiliary Power Unit 2	kW	31.00	42.00	55.00
10.	Total Common Auxilliary Power	kW	54.348	54.348	54.384
11.	Losses Main Transformers Block 1	kW	102.243	102.243	102.243
12.	Losses UAT Block 1	kW	20.462	20.462	20.462

Diperiksa,
Deputi Manajer
Sistem Pembangkit Tenaga Listrik

Hendar Prisnadianta

Penulis,

Inspektor

Panggulu Rigit W.