LAMPIRAN

Lampiran 1. Simulasi PVsys

PVSYST
PHOTOVOLTAIC SOFTWARE

Version 7.3.4

PVsyst - Simulation report

Standalone system

Project: SNB AOI-2 Standalone

Variant: 40% LOADS FOR PV

Standalone system with batteries

System power: 1110 Wp

Satuan Pemukiman Dua Kaliorang - Indonesia

Main results

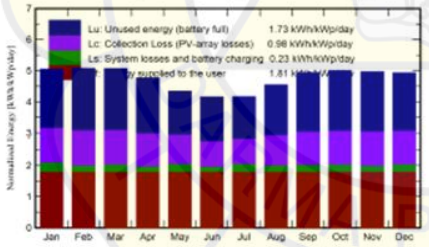
System Production

Useful energy from solar	733.65 kWh/year	Perf. Ratio PR	38.12 %
Available solar energy	1488.52 kWh/year	Solar Fraction SF	100.00 %
Excess (unused)	700.49 kWh/year		

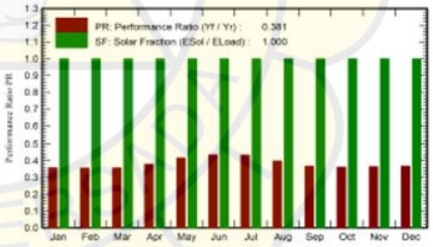
Loss of Load

Time Fraction	0.0 %	**Battery aging (State of Wear)**	
Missing Energy	0.00 kWh/year	Cycles SOW	91.5 %
		Static SOW	92.8 %

Normalized productions (per installed kWp)



Performance Ratio PR

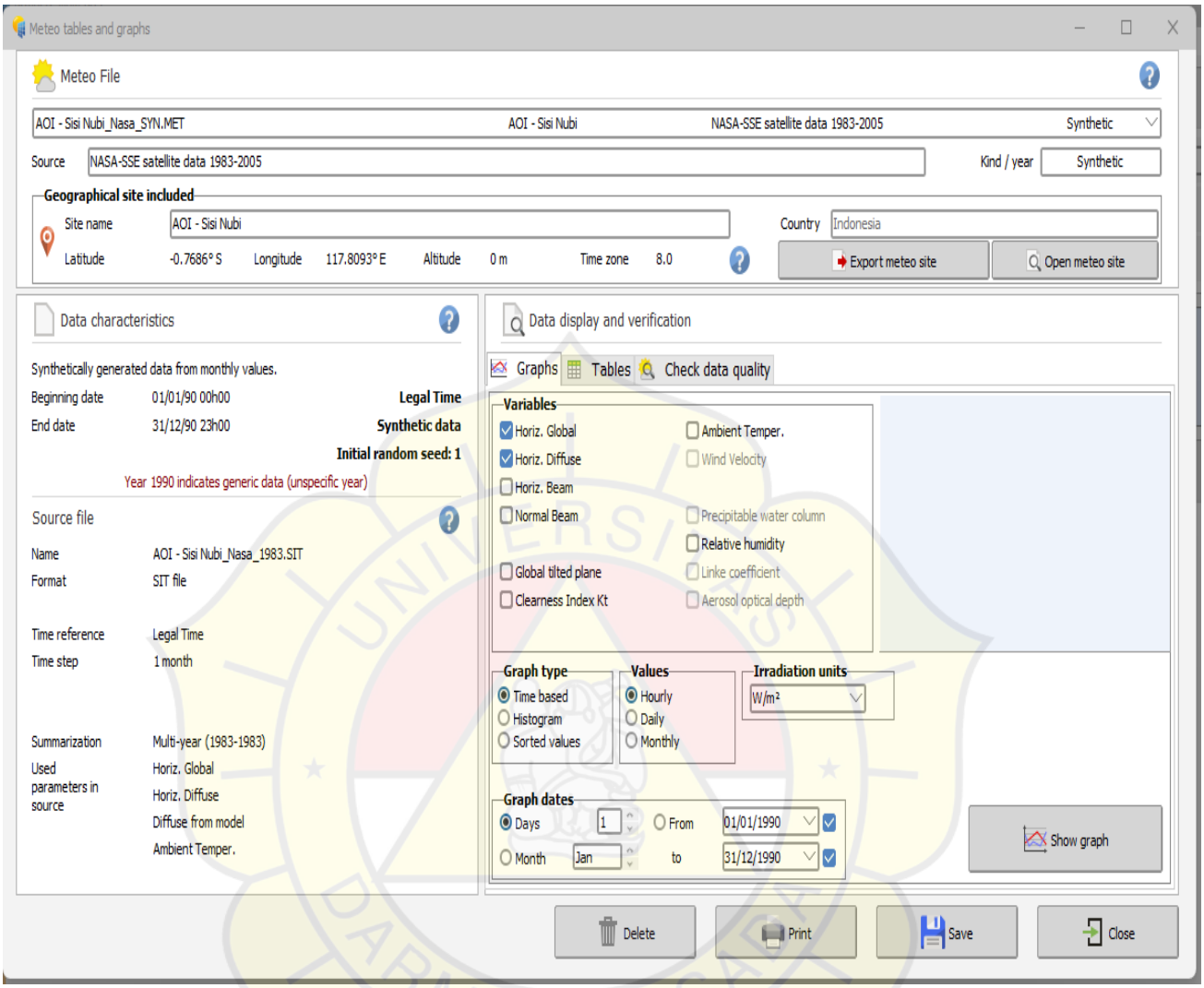


Balances and main results

	GlobHor kWh/m²	GlobEff kWh/m²	E_Avail kWh	EUnused kWh	E_Miss kWh	E_User kWh	E_Load kWh	SolFrac ratio
January	147.6	152.4	133.8	64.09	0.000	62.31	62.31	1.000
February	137.5	138.7	121.3	61.49	0.000	56.28	56.28	1.000
March	156.9	153.2	135.0	67.55	0.000	62.31	62.31	1.000
April	148.5	138.9	121.8	58.80	0.000	60.30	60.30	1.000
May	144.2	129.9	115.2	47.52	0.000	62.31	62.31	1.000
June	135.6	120.3	107.9	45.45	0.000	60.30	60.30	1.000
July	139.5	124.3	112.5	44.39	0.000	62.31	62.31	1.000
August	148.2	136.8	121.6	55.29	0.000	62.31	62.31	1.000
September	150.0	144.0	127.4	62.68	0.000	60.30	60.30	1.000
October	151.3	151.3	133.3	65.90	0.000	62.31	62.31	1.000
November	141.6	145.3	127.4	63.74	0.000	60.30	60.30	1.000
December	143.2	149.1	131.2	63.58	0.000	62.31	62.31	1.000
Year	1743.9	1684.2	1488.5	700.49	0.000	733.65	733.65	1.000

Legends

GlobHor	Global horizontal irradiation	E_User	Energy supplied to the user
GlobEff	Effective Global, corr. for IAM and shadings	E_Load	Energy need of the user (Load)
E_Avail	Available Solar Energy	SolFrac	Solar fraction (EUsed / ELoad)
EUnused	Unused energy (battery full)		
E_Miss	Missing energy		


Meteo tables and graphs
Meteo File
AOI - Sisi Nubi_Nasa_SYN.MET
AOI - Sisi Nubi
NASA-SSE satellite data 1983-2005
Synthetic
Source
NASA-SSE satellite data 1983-2005
Kind / year
Synthetic
Geographical site included
Site name
AOI - Sisi Nubi
Country
Indonesia
Latitude
-0.7686° S
Longitude
117.8093° E
Altitude
0 m
Time zone
8.0
Export meteo site
Open meteo site
Data characteristics
Synthetically generated data from monthly values.
Beginning date
01/01/90 00h00
Legal Time
End date
31/12/90 23h00
Synthetic data
Initial random seed: 1
Year 1990 indicates generic data (unspecific year)
Source file
Name
AOI - Sisi Nubi_Nasa_1983.SIT
Format
SIT file
Time reference
Legal Time
Time step
1 month
Summarization
Multi-year (1983-1983)
Used parameters in source
Horiz. Global
Horiz. Diffuse
Diffuse from model
Ambient Temper.
Data display and verification
Graphs
Tables
Check data quality
Variables
Horiz. Global
Horiz. Diffuse
Horiz. Beam
Normal Beam
Global tilted plane
Clearness Index Kt
Ambient Temper.
Wind Velocity
Precipitable water column
Relative humidity
Linke coefficient
Aerosol optical depth
Graph type
Time based
Histogram
Sorted values
Values
Hourly
Daily
Monthly
Irradiation units
W/m²
Graph dates
Days
1
From
01/01/1990
Month
Jan
to
31/12/1990
Show graph
Delete
Print
Save
Close

Lampiran 2. Datasheet Panel Surya

Pharos Marine Automatic Power

BROCHURE

Solar Panel

Zone 1 & 2

OVERVIEW

Pharos Marine Automatic Power offers a versatile and rugged range of solar electrical power generators for individual or multiple installations, suitable for a wide range of client projects in demanding gas & dust hazard environments.

The Photovoltaic Module is highly resistant to water, abrasion, hail impact and other severe weather conditions, making it suitable for use in any climate. Our dedicated team can custom design and manufacture a portable or permanent certified Zone 1 solar powered system, with battery back-up to provide required autonomy for a multitude of applications in hazardous areas.

Current applications for this reliable and economical energy source include remote marine navigation and aviation warning systems, communications & wifi, site traffic management, pipeline / valve leak detection and fluid / vapour flow monitoring, security applications and offshore HPU UPS systems.

CERTIFICATIONS

ATEX certificate number: ExVeritas 15ATEX0051X
IECEx certificate number: IECEx EXV 15.0001X
Coding: Ex II 2 G Ex e mb II C T6 Gb -40°C ≤ Tamb ≤ +55°C
Ingress Protection: IP-66

MECHANICAL SPECIFICATIONS

Connector	MC4 Compatible
Diode	Shottky bypass diodes; 3nos
Frame	Anodised aluminium alloy; twin wall profile
Locking	Corner Key Type
Glass	ARC; low iron; tempered; high light tramsmission; 3.2mm

Furnished with universal GRP Junction Box

Part Number	Length (mm)	Width (mm)	Thickness (mm)	Weight (kg)
SPEX37-12	515	470	35	4
SPEX60-12	558	667	35	7
SPEX130-12	1157	677	35	10
SPEX175-12	1487	667	35	11
SPEX235-24	1353	987	40	20
SPEX350-24	1968	987	40	23

ELECTRICAL SPECIFICATIONS

Part Number	Nominal Volt	Rated Power (W)	Open Citcut Voltage (Voc)	Max Power Voltage (Vmp)	Max Current (Imp)	Short Circut Current (Isc)	Efficiency (%)
SPEX37-12	12	37	24.12	20.63	1.83	1.92	15.3
SPEX60-12	12	60	23.98	20.45	2.97	3.13	16.3
SPEX130-12	12	130	23.98	20.45	6.59	6.96	17.2
SPEX175-12	12	175	23.98	20.45	8.63	9.11	17.5
SPEX235-24	24	235	31.97	27.26	8.63	9.11	17.5
SPEX350-24	24	350	47.95	40.90	8.63	9.11	18.2

General Details:
Output Tolerance (%): +-5

Warranty:
0-10 Years for 90% rated power, 10-25 years for 80% rated power

Lampiran 3. Datasheet Thermoelectric Generator

MODEL 1120

The Model 1120 Thermoelectric Generator is Class I, Div 2 or Class I, Div 1 hazardous area rated. With no moving parts it is a reliable, low maintenance source of DC electrical power for any application where regular utilities are unavailable or unreliable.

KEY FEATURES:

- Automatic Spark Ignition (SI)
- Automatic Fuel Shut-Off (SO)
- Fuel Filter
- Low Voltage Alarm Contacts (VSR)
- Volt & Amp Meter
- Reverse Current Protection
- Flame Arrestor
- CSA Certification (Class I, Div 2 Group D, Temp T3

OPTIONAL FEATURES:

- FM Certification (Class I, Div 1, Temp T3)
- 316 SS Regulator & Fuel Valve
- Cathodic Protection Interface Panel
- Pole Mount or Bench Stand
- Intake Air Filter

SPECIFICATIONS

POWER SPECIFICATIONS

POWER RATING AT 20°C (68°F)

110 Watts @ 6.7 Volts
100 Watts @ 24 Volts
100 Watts @ 12 Volts

ELECTRICAL

OUTPUT ADJUSTMENT RANGE

6.7 Volts	Up to 11 Volts
12 Volts	12–18 Volts
24 Volts	24–30 Volts
48 Volts	48–60 Volts

Output: Terminal block which accepts up to 00 AWG wire. Opening for two 3/4" NPT ports in base of electronics enclosure.

FUEL REQUIREMENTS

NATURAL GAS

8.8m³/day (311 Sft³/day)
1000 BTU/Sft³ (37.7 MJ/Sm³) gas
max 115 mg/Sm³ (~170 ppmw) H_2S
max 120 mg/Sm³ H_2O
max 1% free O_2

PROPANE

11.4 L/day (3.0 US gal./day)

NATURAL GAS/PROPANE

Max. Supply Pressure: 172 kPa (25 psi)
Min. Supply Pressure NG: 69 kPa (10 psi)
Min. Supply Pressure LPG: 103 kPa (15 psi)
Fuel Connection: 1/4" Male NPT

ENVIRONMENTAL

AMBIENT OPERATING TEMPERATURE

Max. +40°C (104°F)
Min. -20°C (-4°F)

OPERATING CONDITIONS

Unsheltered operation certified for use in hazardous areas.

Please contact GPT for operating conditions below -20°C or above +40°C.

CONSTRUCTION

MATERIALS

Cabinet:	316 Stainless Steel (SS)
Cooling Type:	Natural Convection
Fuel System:	Aluminum & Stainless Steel

NOTES

Specifications shown are for standard 1120 configurations. Global Power Technologies (GPT) also offers customized products and systems to accommodate custom voltages, fuel supply systems and operating temperatures.

Specification data stated in this document is subject to change without notice. To verify these specifications are current, please contact your GPT sales representative.

GLOBAL power technologies

Global Power Technologies
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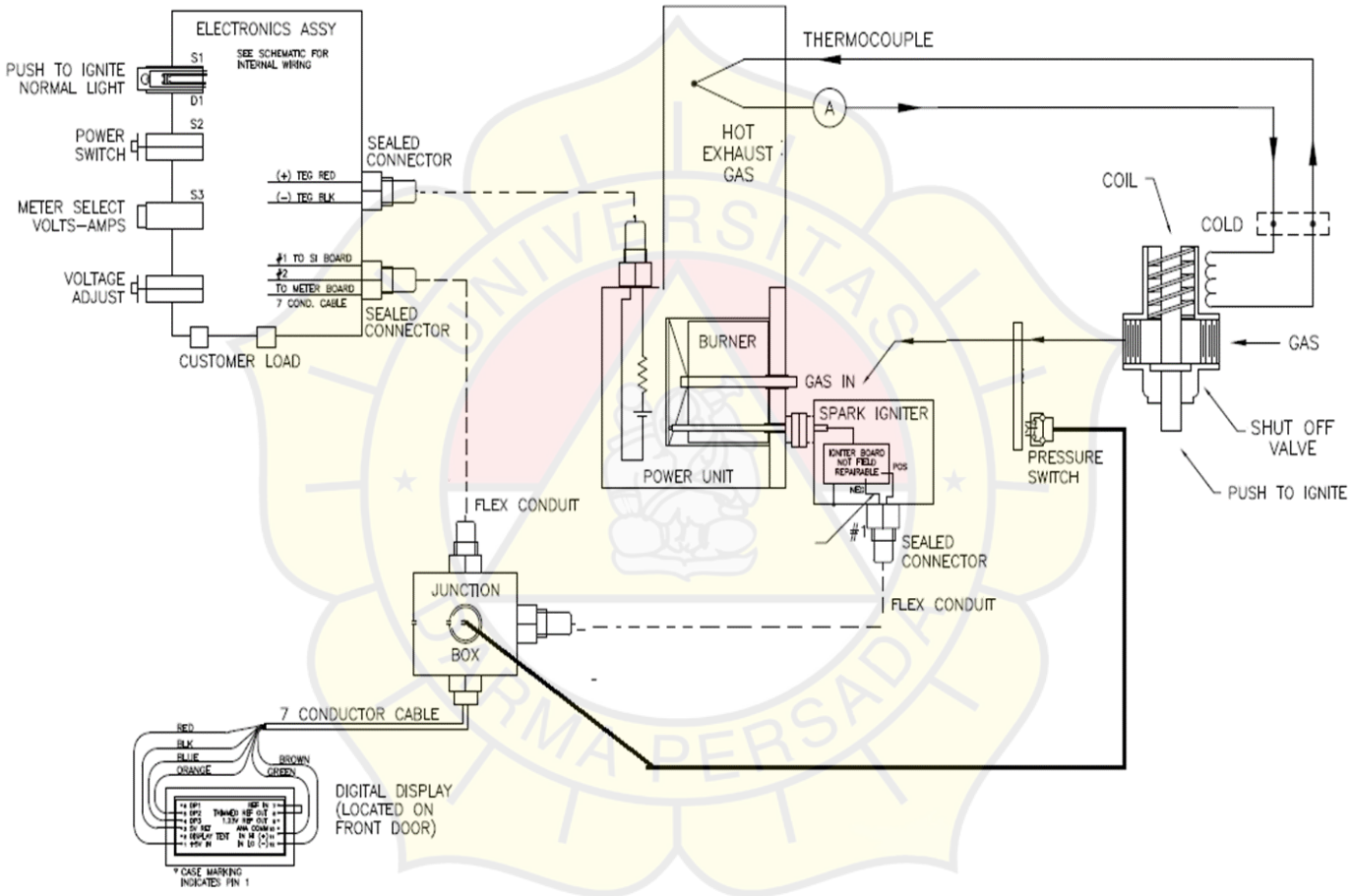
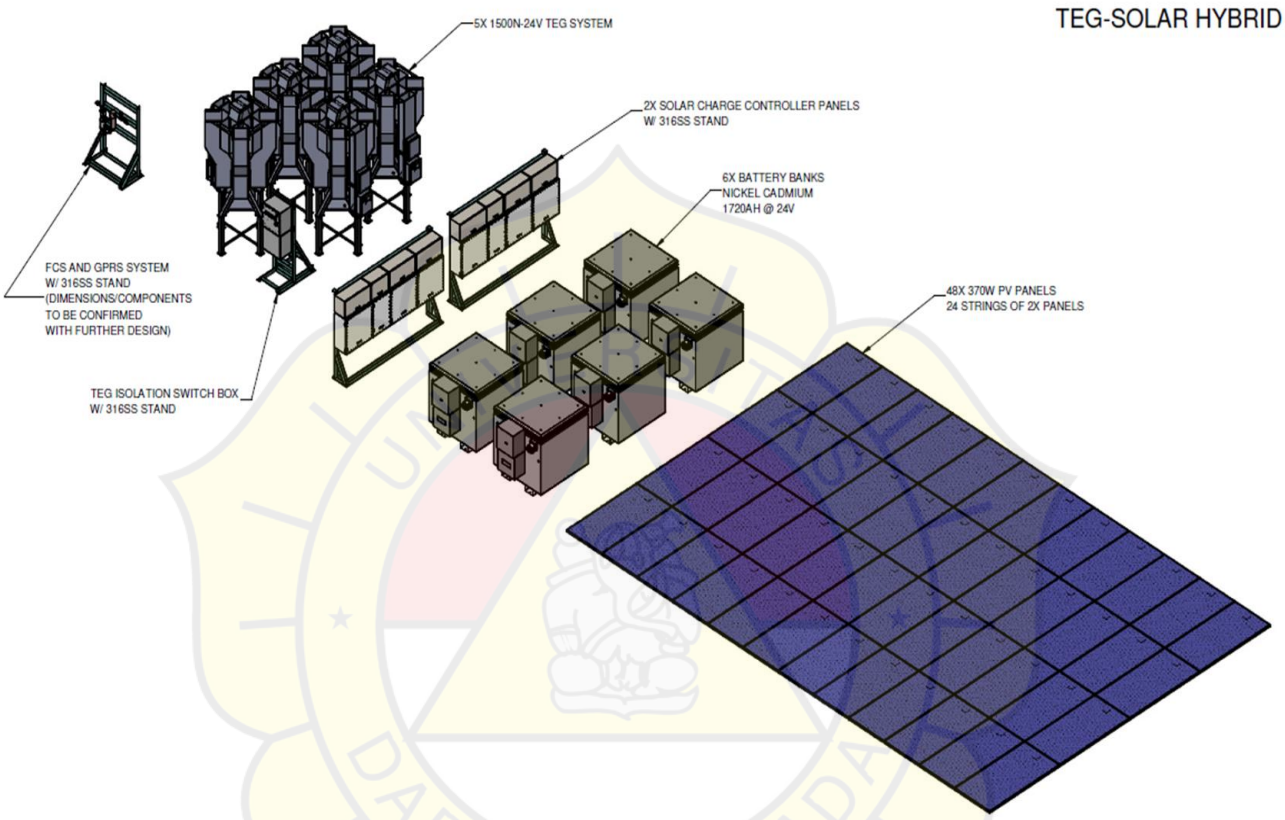
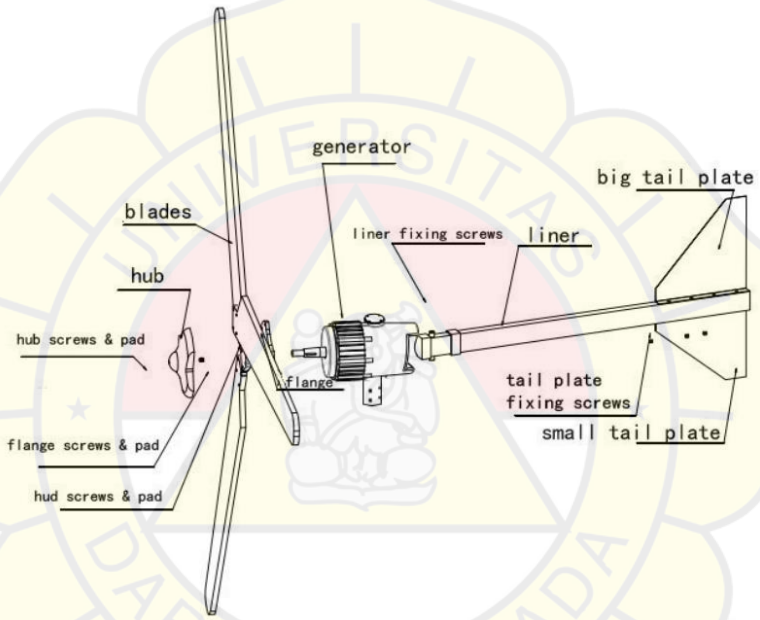

ELECTRONICS ASSY
SEE SCHEMATIC FOR INTERNAL WIRING
PUSH TO IGNITE NORMAL LIGHT
S1
D1
POWER SWITCH
S2
METER SELECT VOLTS–AMPS
S3
VOLTAGE ADJUST
CUSTOMER LOAD
SEALED CONNECTOR
(+) TEG RED
(–) TEG BLK
#1 TO SI BOARD
#2
TO METER BOARD
7 COND. CABLE
SEALED CONNECTOR
THERMOCOUPLE
A
HOT EXHAUST GAS
BURNER
GAS IN
SPARK IGNITER
IGNITER BOARD NOT FIELD REPAIRABLE
POS
NEG
POWER UNIT
#1
SEALED CONNECTOR
FLEX CONDUIT
JUNCTION BOX
FLEX CONDUIT
7 CONDUCTOR CABLE
RED
BLK
BLUE
ORANGE
BROWN
GREEN
DIGITAL DISPLAY (LOCATED ON FRONT DOOR)
* CASE MARKING INDICATES PIN 1
COIL
COLD
GAS
SHUT OFF VALVE
PRESSURE SWITCH
PUSH TO IGNITE


TEG-SOLAR HYBRID
5X 1500N-24V TEG SYSTEM
2X SOLAR CHARGE CONTROLLER PANELS
W/ 316SS STAND
6X BATTERY BANKS
NICKEL CADMIUM
1720AH @ 24V
48X 370W PV PANELS
24 STRINGS OF 2X PANELS
FCS AND GPRS SYSTEM
W/ 316SS STAND
(DIMENSIONS/COMPONENTS
TO BE CONFIRMED
WITH FURTHER DESIGN)
TEG ISOLATION SWITCH BOX
W/ 316SS STAND

Wind Turbine Generator

WTD Series

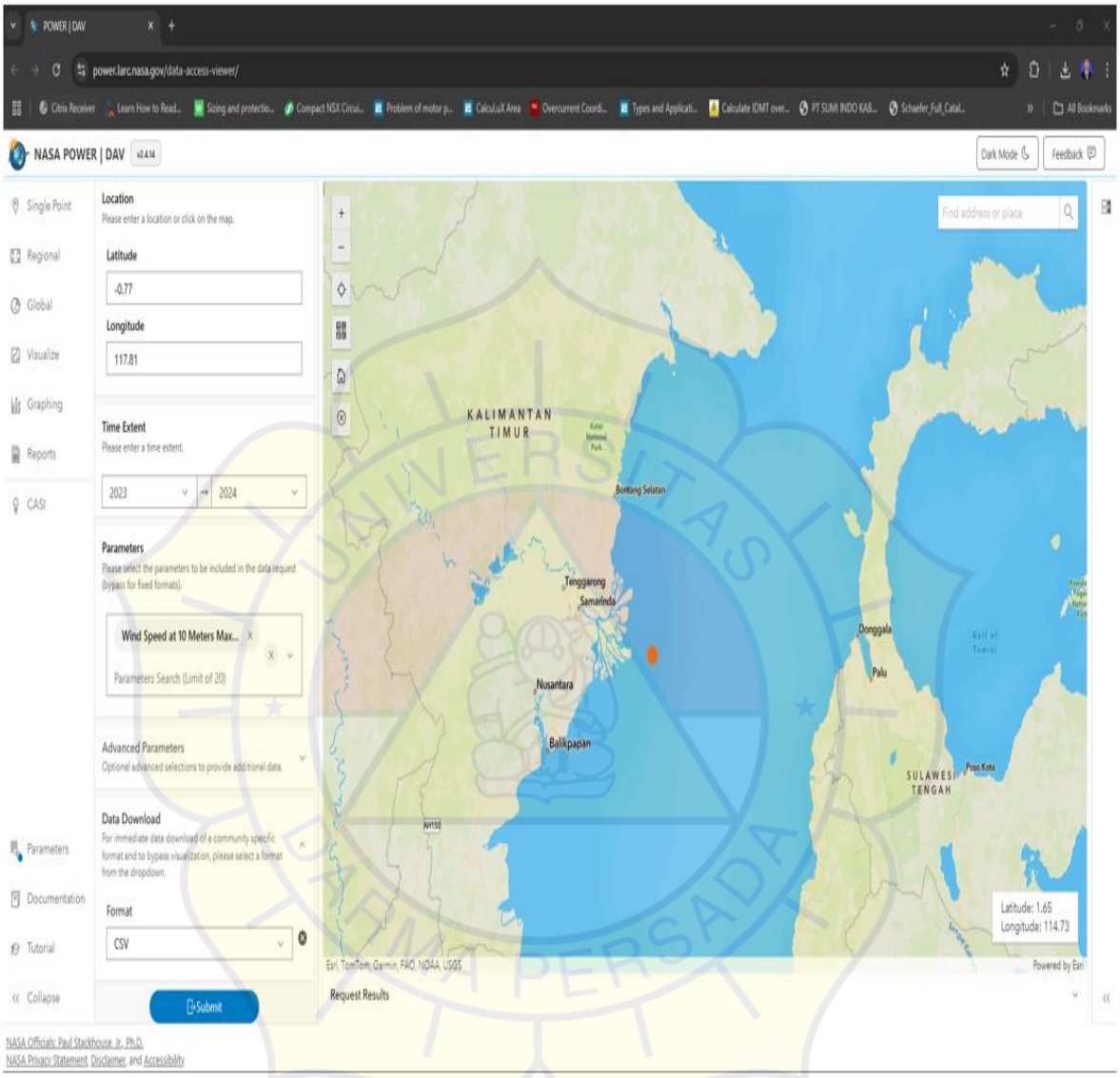
1000W - 2000W



WTD Series Wind Turbines		
Model	WTD1000-48	WTD2000-48
Rated Power (W)	1000	2000
Rotor Voltage (V)	48	48
Rotor diameter (m)	2.7	3.2
Start-up Wind Speed (m/s)	2.5	2.5
Rated Wind Speed (m/s)	12	12
Shell Material	Die-cast Aluminium	
Blade Material	High-strength Nylon Composite	

Untuk kecepatan angin rata-rata dalam 1 tahun diarea offshore platform Pertamina Hulu Mahakam

Source: https://power.larc.nasa.gov/data-access-viewer/ (NASA Database)



Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Des	Annual
2.73	2.81	2.72	2.83	2.33	2.44	3.98	3.04	3.12	3.19	2.28	2.89	2.87
3.27	4.02	2.52	2.9	2.25	2.42	3.06	3.29	2.87	3.07	2.42	2.57	2.88

Daya yang dihasilkan wind turbine

Diameter blade: 2.7m (sesuai data sheet)

Kecepatan angin (v): 2.88 m/s (*NASA Database)*

Daya listrik yang dihasilkan:

$P = 0.5 \; x \; \rho \; x \; A \; x \; V^3 \; x \; C_p$

Dimana:

P = Daya yg dihasilkan (Watt)

P = Densitas Udara (kg/m^3), kita asumsikan 1.225 Kg/m^3

A = Luas swept area ϖ x (r^2)

V= Kecepatan angin 2.88 m/s

C_p= effisiensi Turbine 0.4

Dengan rumus diatas didapat bahwa daya yang dihasilkan wind turbine adalah **33.5 Watt**

Besar Blade untuk 590 Watt

Swept Area:

590 Watt= *1.225 Kg/m^3 x A x (2.88 m/s)^3 x 0.4*

= 101.06 m^2

Diameter Blade

$101.06 = \pi \times (D / 2)^2$

D = 11.34 meter

Lampiran 5. Datasheet Battery

UNICAD

Nickel Cadmium Battery

Pelatihan Teknis Untuk
Pemasangan & Pemeliharaan
Battery Charger

A low life cycle cost battery solution

Cost-efficient low maintenance
Ownership costs of a battery include not only the initial investment in acquisition and installation, but also a provision to cover day-to-day operation and maintenance.

In the case of lead acid batteries, this can also include frequent replacement and all the costs associated with an unexpected battery failure.

With its high reliability and long life, the Ni-Cd battery can repay its initial investment within just 5 years, whilst operating faithfully for up to 20+ years.

By providing a choice of low, medium and high rate characteristics, plate technologies and cell configuration, Saft's broad range permits the optimisation of the battery for any application.