

LAMPIRAN A – LEMBAR BIMBINGAN SKRIPSI



SEKOLAH TINGGI TEKNIK – PLN

LEMBAR BIMBINGAN SKRIPSI

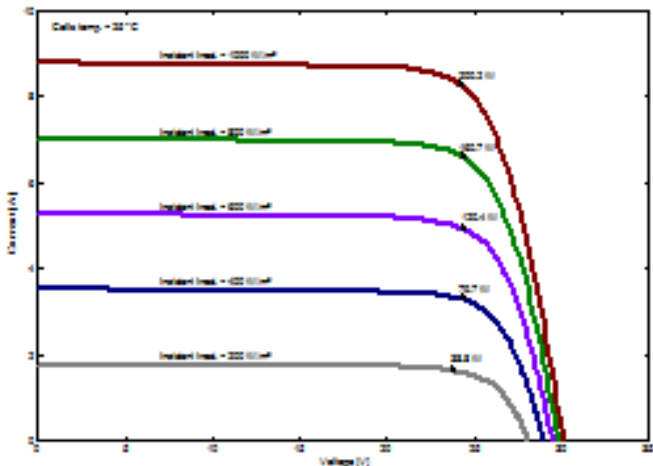
Nama Mahasiswa : Surya Budi Gultom
NIM : 2013-11-016
Program Studi : Teknik Elektro
Jenjang : Sarjana
Pembimbing Utama : Dr., Ir., Uno Bintang Sudibyo
Judul Skripsi : PERENCAAN PENGGUNAAN PLTS ON GRID PADA
GUDANG PENYIMPANAN TEMPAT PELELANGAN
IKAN MUARA ANGKE

NO.	TANGGAL	MATERI BIMBINGAN	PARAF PEMBIMBING
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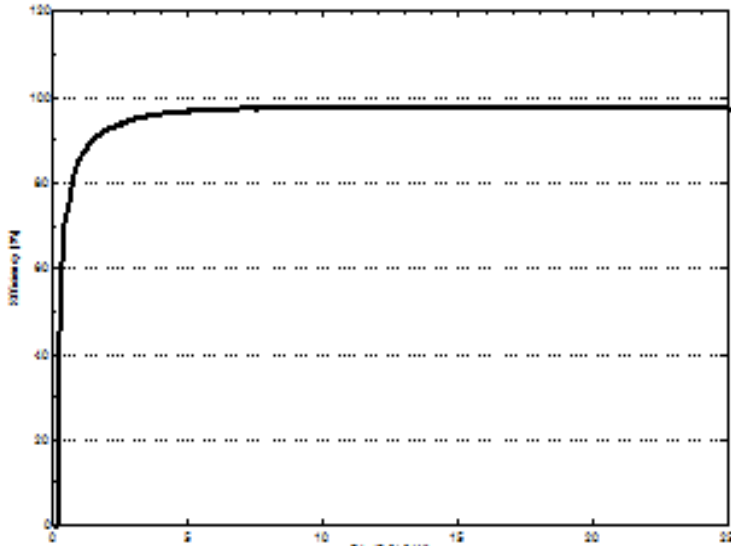
LAMPIRAN A – LEMBAR BIMBINGAN SKRIPSI

NO.	TANGGAL	MATERI BIMBINGAN	PARAF PEMBIMBING
10.			
11.			
12.			
13.			
14.			

LAMPIRAN B – SPESIFIKASI MODUL SURYA

PVSYST V6.43			12/02/18 00h42		
Characteristics of a PV module					
Manufacturer, model :		Ecosol PV tech, Mono 200 Wp 48 cells			
Availability :		Prod. from 2006			
Data source :		Manufacturer 2013			
STC power (manufacturer)		Pnom 200 Wp		Technology	
Module size (W x L)		0.992 x 1.324 m²		Rough module area	
Number of cells		1 x 48		Sensitive area (cells)	
				Si-mono	
				Amodule 1.31 m²	
				Acells 1.14 m²	
Specifications for the model (manufacturer or measurement data)					
Reference temperature		TRef 25 °C		Reference irradiance	
Open circuit voltage		Voc 30.1 V		Short-circuit current	
Max. power point voltage		Vmpp 24.3 V		Max. power point current	
=> maximum power		Pmpp 200.2 W		Isc temperature coefficient	
				GRef 1000 W/m²	
				Isc 8.78 A	
				Imp 8.24 A	
				muIsc 4.0 mA/°C	
One-diode model parameters					
Shunt resistance		Rshunt 220 ohm		Diode saturation current	
Serie resistance		Rserie 0.26 ohm		Voc temp. coefficient	
				Diode quality factor	
Specified Pmax temper. coeff.		muPMaxR -0.47 %/°C		Diode factor temper. coeff.	
				IoRef 0.196 nA	
				MuVoc -115 mV/°C	
				Gamma 1.00	
				muGamma -0.001 1/°C	
Reverse Bias Parameters, for use in behaviour of PV arrays under partial shadings or mismatch					
Reverse characteristics (dark)		BRev 3.20 mA/V²		(quadratic factor (per cell))	
Number of by-pass diodes per module		3		Direct voltage of by-pass diodes	
				-0.7 V	
Model results for standard conditions (STC: T=25°C, G=1000 W/m², AM=1.5)					
Max. power point voltage		Vmpp 24.3 V		Max. power point current	
Maximum power		Pmpp 200.2 Wc		Power temper. coefficient	
Efficiency(/ Module area)		Eff_mod 15.2 %		Fill factor	
Efficiency(/ Cells area)		Eff_cells 17.6 %			
				Imp 8.23 A	
				muPmpp -0.46 %/°C	
				FF 0.758	
PV module: Ecosol PV tech, Mono 200 Wp 48 cells					
					

LAMPIRAN C – SPESIFIKASI INVERTER

PVSYST V6.43		12/02/18 00h39						
Characteristics of a grid inverter								
Manufacturer, model :		Gefran S.p.A, APV 25k-TL_A70						
Availability :		Prod. from 2010						
Data source :		Manufacturer 2010						
Input characteristics (PV array side)								
Operating mode		MPPT						
Minimum MPP Voltage	Vmin	488 V	Nominal PV Power	Pnom DC	28 kW			
Maximum MPP Voltage	Vmax	850 V	Maximum PV Power	Pmax DC	30 kW			
Absolute max. PV Voltage	Vmax array	965 V	Maximum PV Current	Imax DC	N/A A			
Min. Voltage for PNom	Vmin PNom	N/A V	Power Threshold	Pthresh.	125 W			
Behaviour at Vmin/Vmax		Limitation		Behaviour at Pnom		Limitation		
Output characteristics (AC grid side)								
Grid Voltage	Unom	320 V	Nominal AC Power	Pnom AC	25 kWac			
Grid frequency	Freq	50 Hz	Maximum AC Power	Pmax AC	25 kWac			
	Triphased		Nominal AC current	Inom AC	45 A			
Maximum efficiency	Max Eff.	97.6 %	Maximum AC current	Imax AC	46 A			
European average efficiency	Euro Eff.	96.9 %						
Remarks and Technical features				Sizes: Width		800 mm		
Technology: Transformerless				Height		1600 mm		
Protection: -10 - +50°C, IP 33: Indoor installable				Depth		600 mm		
Control:				Weight		230.00 kg		
Efficiency profile vs Input power								
								

LAMPIRAN C – SPESIFIKASI INVERTER

RADIUS Industrial • Three-phase inverter



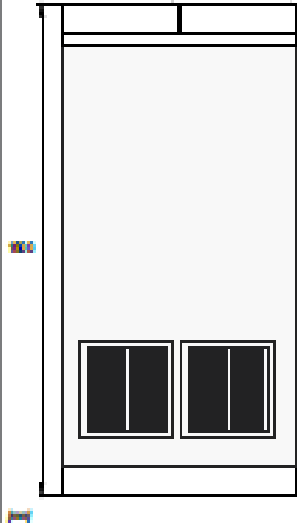
	APV236-T (with transformer)	APV236-TL (without transformer)
Input power (DC side)	23 kW	23 kW
Output power (AC side)	20 kW	23 kW

5 years
warranty

EMC
Class **B**

Dimensions and weight

Right (R) Side



1600

600

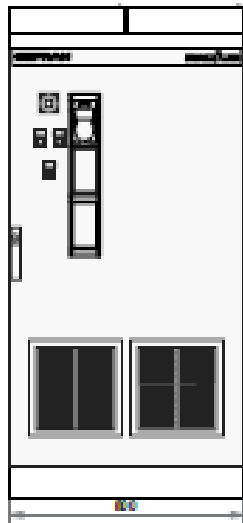
Left (L) Side



1600

600

Front (F) View



1600

600

Model			APV236	APV236-TL
Dimensions:				
Width x Height x Depth		mm (inches)	600 x 1600 x 600 (31.5 x 62.99 x 23.62)	
Weight		kg (lbs)	360 (772)	230 (507)

2

LAMPIRAN C – SPESIFIKASI INVERTER

Technical data

Central Inverter - Model			APV200k-T	APV200k-TL
DC INPUT				
Recommended maximum PV power	P _{oc, max}	[kW]	23.5 (1)	29 (1)
MPPT voltage range	U _{oc}	[V]	465...850	493...850
Minimum operating voltage	U _{oc min}	[V]	465	493
Maximum voltage allowed	U _{oc max}	[V]	1000	1000 (2)
Maximum current allowed	I _{oc max}	[A]	43	51
AC OUTPUT				
Power rating	P _{ac nom}	[kW]	20	25 (3)
Rated Output voltage	U _{ac nom}	[V]	400 (±15%)	290 (4)
Current rating	I _{ac nom}	[A]	20.9	50
Short circuit current (±1.5%In)	I _{sc}	[A]	43.3	75
Grid frequency	f _{ac}	[Hz]	50	50
Harmonic distortion	THD grid	[%]	≤ 3	≤ 3
Power factor	cosφ _{hi}		0.99	0.99
EFFICIENCY RATING				
Maximum efficiency		[%]	98.71	99.12
European efficiency (Euro-ETA) (5, 10, 20, 30, 50, 75, 100% of P _{ac nom})		[%]	98.01 (5) (98.71; 93.82; 95.89; 96.84; 96.71; 96.46; 96.93)	97.4 (5) (98.27; 96.71; 97.67; 97.91; 98.12; 97.74; 97.13)
GENERAL DATA				
Protection class			IP33	IP33
Power switch on AC side			yes	no
Power switch on DC side			yes	yes
Reverse polarity protection diodes on DC side			yes	yes
Ground fault monitoring			optional	optional
Overcurrent protection	AC side		yes	yes
	DC side		no	no
no	AC side		no	no
	DC side		optional	optional
Remote plant monitoring			optional	optional
Ground kit			optional (1)	optional (1)
Ambient temperature range (without power derating)		[%]	from -10 °C to + 50 °C	from -10 °C to + 50 °C
Requested air flow (input)		[m³/s]	1.200	1.200
Cooling			Thermostatically-controlled	Thermostatically-controlled
Relative humidity of air		[%]	from 5% to 95% without condensation	from 5% to 95% without condensation
Maximum altitude		[m]	1000 m (2000 m with derating)	1000 m (2000 m with derating)
Topology			With isolation transformer	Without transformer

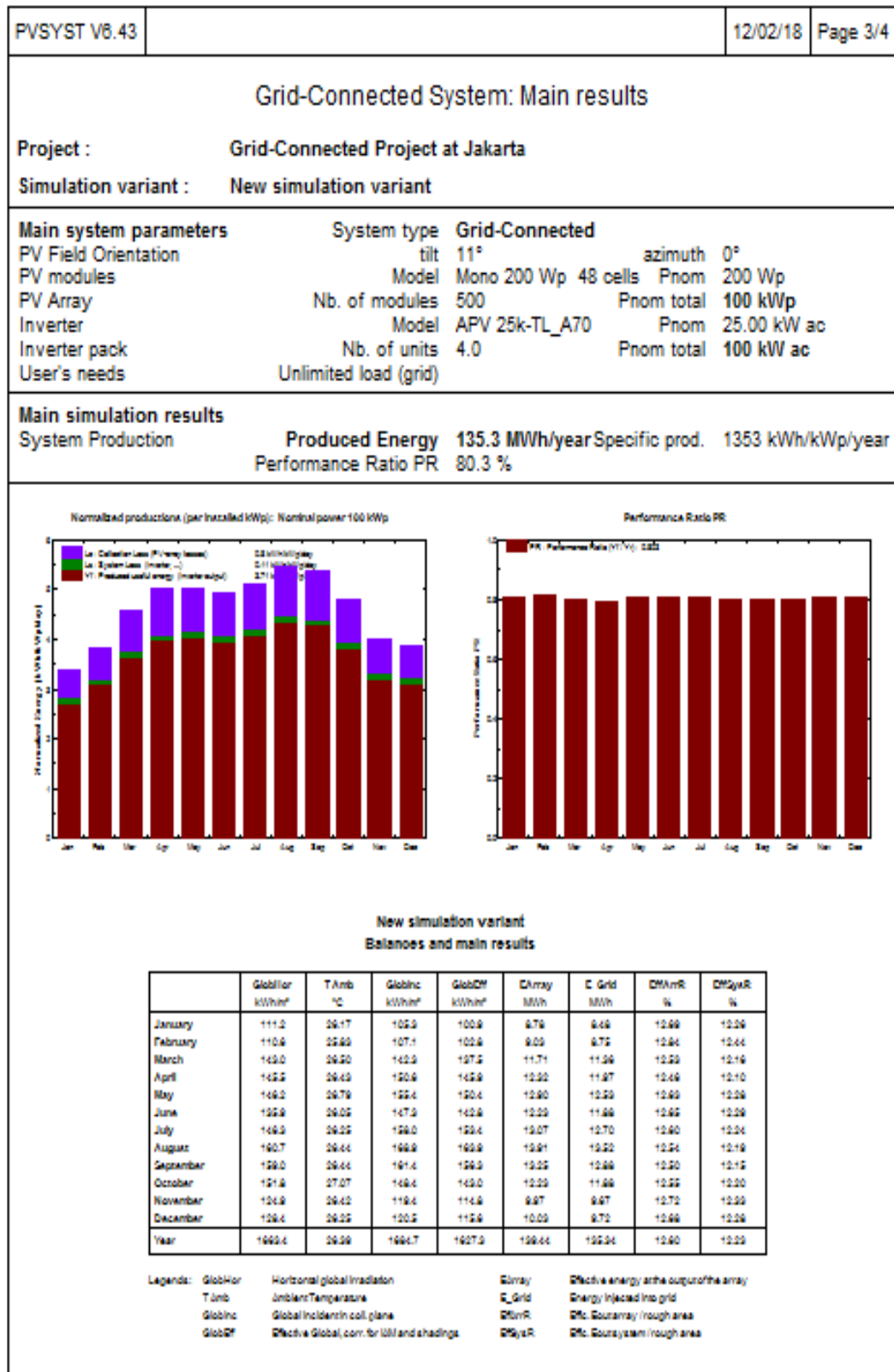
LAMPIRAN D – HASIL SIMULASI PVSYST

PVSYST V8.43				12/02/18	Page 1/4
Grid-Connected System: Simulation parameters					
Project :		Grid-Connected Project at Jakarta			
Geographical Site		Jakarta	Country	Indonesia	
Situation		Latitude	6.1°S	Longitude	106.8°E
Time defined as		Legal Time	Time zone UT+7	Altitude	-2 m
		Albedo	0.20		
Meteo data:		Jakarta	Meteonorm 7.1 (2010-2014), Sat=100% - Synthetic		
Simulation variant :		New simulation variant			
		Simulation date	12/02/18 03h06		
Simulation parameters					
Collector Plane Orientation		Tilt	11°	Azimuth	0°
Models used		Transposition	Perez	Diffuse	Perez, Meteonorm
Horizon		Free Horizon			
Near Shadings		No Shadings			
PV Arrays Characteristics (4 kinds of array defined)					
PV module		Si-mono	Model	Mono 200 Wp 48 cells	
Original PVSyst database		Manufacturer	Ecosol PV tech		
Sub-array "Sub-array #1"					
Number of PV modules		In series	25 modules	In parallel	5 strings
Total number of PV modules		Nb. modules	125	Unit Nom. Power	200 Wp
Array global power		Nominal (STC)	25.00 kWp	At operating cond.	22.08 kWp (50°C)
Array operating characteristics (50°C)		U mpp	536 V	I mpp	41 A
Sub-array "Sub-array #2"					
Number of PV modules		In series	25 modules	In parallel	5 strings
Total number of PV modules		Nb. modules	125	Unit Nom. Power	200 Wp
Array global power		Nominal (STC)	25.00 kWp	At operating cond.	22.08 kWp (50°C)
Array operating characteristics (50°C)		U mpp	536 V	I mpp	41 A
Sub-array "Sub-array #3"					
Number of PV modules		In series	25 modules	In parallel	5 strings
Total number of PV modules		Nb. modules	125	Unit Nom. Power	200 Wp
Array global power		Nominal (STC)	25.00 kWp	At operating cond.	22.08 kWp (50°C)
Array operating characteristics (50°C)		U mpp	536 V	I mpp	41 A
Sub-array "Sub-array #4"					
Number of PV modules		In series	25 modules	In parallel	5 strings
Total number of PV modules		Nb. modules	125	Unit Nom. Power	200 Wp
Array global power		Nominal (STC)	25.00 kWp	At operating cond.	22.08 kWp (50°C)
Array operating characteristics (50°C)		U mpp	536 V	I mpp	41 A
Total Arrays global power		Nominal (STC)	100 kWp	Total	500 modules
		Module area	657 m²	Cell area	569 m²
Inverter		Model	APV 25k-TL_A70		
Original PVSyst database		Manufacturer	Gefran S.p.A		
Characteristics		Operating Voltage	488-850 V	Unit Nom. Power	25.0 kWac

LAMPIRAN D – HASIL SIMULASI PVSYST

PVSYST V8.43		12/02/18		Page 2/4
Grid-Connected System: Simulation parameters (continued)				
Sub-array "Sub-array #1"	Nb. of inverters	1 units	Total Power	25 kWac
Sub-array "Sub-array #2"	Nb. of inverters	1 units	Total Power	25 kWac
Sub-array "Sub-array #3"	Nb. of inverters	1 units	Total Power	25 kWac
Sub-array "Sub-array #4"	Nb. of inverters	1 units	Total Power	25 kWac
Total	Nb. of inverters	4	Total Power	100 kWac
PV Array loss factors				
Thermal Loss factor	Uc (const)	20.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Array#1	221 mOhm	Loss Fraction	1.5 % at STC
	Array#2	221 mOhm	Loss Fraction	1.5 % at STC
	Array#3	221 mOhm	Loss Fraction	1.5 % at STC
	Array#4	221 mOhm	Loss Fraction	1.5 % at STC
	Global		Loss Fraction	1.5 % at STC
Module Quality Loss			Loss Fraction	-0.8 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Param.	0.05
User's needs :	Unlimited load (grid)			

LAMPIRAN D – HASIL SIMULASI PVSYST



LAMPIRAN E – TARIF LISTRIK ENERGI TERBARUKAN



