

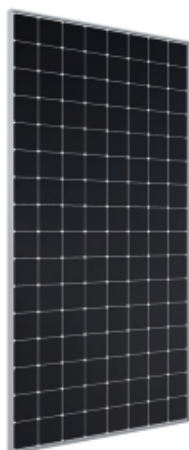
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# LAMPIRAN

Lampiran 1 Lembaran Data Panel Surya



SunPower X-Series: X21-470-COM

SunPower® Commercial DC Panel

SunPower X-Series panels combine the top efficiency, durability and warranty available in the market today, resulting in more long-term energy and savings.<sup>1,2</sup>



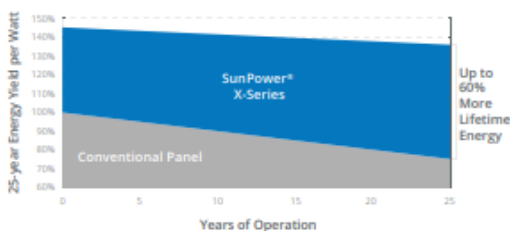
**Maximum Power. Minimalist Design.**

Generates more power and savings per available space, making it easier to meet your organization's goals.



**Highest Lifetime Energy and Savings**

Designed to deliver 60% more energy in the same space over 25 years in real-world conditions like partial shade and high temperatures.<sup>2</sup>



**Fundamentally Different. And Better.**



**The SunPower Maxeon® Solar Cell**

- Enables highest efficiency panels available<sup>2</sup>
- Unmatched reliability<sup>3</sup>
- Patented solid metal foundation prevents breakage and corrosion



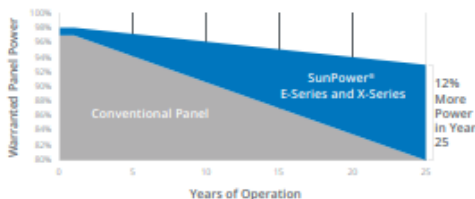
**As Sustainable As Its Energy**

- Ranked #1 in Silicon Valley Toxics Coalition 2015 Solar Scorecard<sup>4</sup>
- First solar panels to achieve Cradle to Cradle Certified™ Silver recognition<sup>5</sup>
- Contributes to more LEED categories than conventional panels<sup>6</sup>



**Best Reliability, Best Warranty**

With more than 25 million panels deployed around the world, SunPower technology is proven to last. That's why we stand behind our panel with the industry's best 25-year Combined Power and Product Warranty, including the highest Power Warranty in solar.

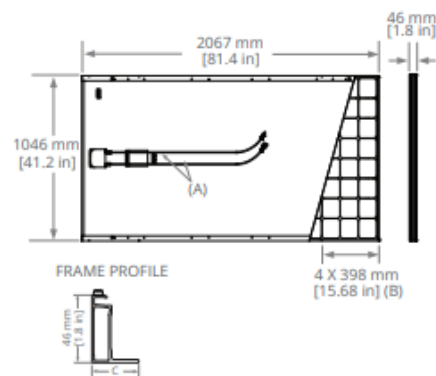


## X-Series: X21-470-COM SunPower® Commercial DC Panel

Electrical Data	Electrical Data	
	SPR-X21-470-COM	SPR-X21-460-COM
Nominal Power (P <sub>nom</sub> ) <sup>7</sup>	470 W	460 W
Power Tolerance	+5.0%	+5.0%
Panel Efficiency	21.7%	21.3%
Rated Voltage (V <sub>mpp</sub> )	77.6 V	77.3 V
Rated Current (I <sub>mpp</sub> )	6.06 A	5.95 A
Open-Circuit Voltage (V <sub>oc</sub> )	91.5 V	90.5 V
Short-Circuit Current (I <sub>sc</sub> )	6.45 A	6.39 A
Max. System Voltage	1000 V UL & 1000 V IEC	
Maximum Series Fuse	15 A	
Power Temp. Coef.	-0.29% / °C	
Voltage Temp. Coef.	-223.2 mV / °C	
Current Temp. Coef.	2.9 mA / °C	

Tests And Certifications	
Standard Tests <sup>8</sup>	UL1703 (Type 2 Fire Rating), IEC 61215, IEC 61730
Quality Management Certs	ISO 9001:2015, ISO 14001:2015
EHS Compliance	RoHS, OHSAS 18001:2007, lead free, Recycle Scheme, REACH SVHC-163
Sustainability	Cradle to Cradle Certified™ Silver. "Declare." listed.
Ammonia Test	IEC 62716
Desert Test	10.1109/PVSC.2013.6744437
Salt Spray Test	IEC 61701 (maximum severity)
PID Test	1000 V: IEC 62804, PVEL 600 hr duration
Available Listings	UL, TUV, MCS, PSEC, CEC

Operating Condition And Mechanical Data	
Temperature	-40° F to +185° F (-40° C to +85° C)
Impact Resistance	1 inch (25 mm) diameter hail at 52 mph (23 m/s)
Appearance	Class A
Solar Cells	128 Monocrystalline Maxeon Gen III
Tempered Glass	High-transmission tempered anti-reflective
Junction Box	IP-65, 1230 mm cables / MC4 Compatible
Weight	56 lbs (25.4 kg)
Max. Load	Wind: 50 psf, 2400 Pa, 244 kg/m <sup>2</sup> front & back Snow: 112 psf, 5400 Pa, 550 kg/m <sup>2</sup> front
Frame	Class 2 silver anodized; stacking pins



- (A) Cable Length: 1230 mm +/-10 mm  
 (B) Stacking Pins  
 (C) Long Side: 32 mm [1.3 in]  
 Short Side: 22 mm [0.9 in]

1 SunPower 360 W compared to a Conventional Panel on same-sized arrays (260 W, 16% efficient, approx. 1.6 m<sup>2</sup>), 4% more energy per watt (based on PV5yr pan files), 0.75%/yr slower degradation (Campeau, Z. et al. "SunPower Module Degradation Rate," SunPower white paper, 2013).

2 Based on search of datasheet values from websites of top 10 manufacturers per IHS, as of January 2017.

3 #1 rank in "Fraunhofer PV Durability Initiative for Solar Modules: Part 3," PVTech Power Magazine, 2015. Campeau, Z. et al. "SunPower Module Degradation Rate," SunPower white paper, 2013.

4 SunPower is rated #1 on Silicon Valley Toxics Coalition's Solar Scorecard.

5 Cradle to Cradle Certified is a multi-attribute certification program that assesses products and materials for safety to human and environmental health, design for future use cycles, and sustainable manufacturing.

6 X-Series and E-Series panels additionally contribute to LEED Materials and Resources credit categories.

7 Standard Test Conditions (1000 W/m<sup>2</sup> irradiance, AM 1.5, 25° C), NREL calibration Standard: SOMS current, IACCS FF and Voltage.

8 Type 2 fire rating per UL1703:2013, Class C fire rating per UL1703:2002.

See [www.sunpower.com/company](http://www.sunpower.com/company) for more reference information.

For more details, see extended datasheet: [www.sunpower.com/solar-resources](http://www.sunpower.com/solar-resources). Specifications included in this datasheet are subject to change without notice.

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Please read the safety and installation guide.

SUNPOWER®

1-800-SUNPOWER

527837 Rev B / LTR\_US

[sunpower.com](http://sunpower.com)

Lampiran 2 Lembaran Data Turbin Angin



**Vertical Wind  
Turbine Brochure**

*Aeolos wind turbine  
SINCE 1986*



**Aeolos-V 3kW**

AEOLOS

**Specification**

Generator Type: Three Phase Permanent Magnet  
 Rotor Height: 5.3m (17.38 ft)  
 Rotor Width: 4.2m (13.77 ft)  
 Turbine Weight: 385kg (848.8 lbs)  
 Blades Material: Fiber Glass  
 Blade Quantity: 3 pcs  
 Working Temperature: -30 °C to 60 °C  
 Design Lifetime: 20 years  
 Working Humidity: ≤95%  
 Protection Class: Ip55

**Performance**

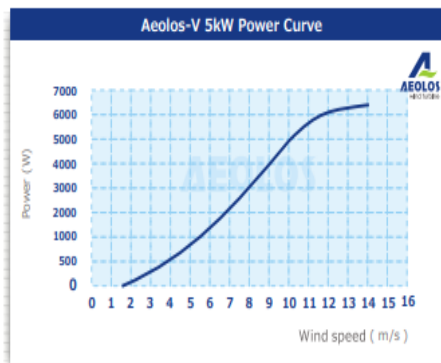
Rated Power: 5000 W  
 Max Output Power: 7000 W  
 Cut In Wind Speed: 2.5m/s (5.6 mph)  
 Rated Wind Speed: 10m/s (22.3 mph)  
 Survival Wind Speed: 55m/s (122.65 mph)  
 Generator Efficiency: 96%  
 Noise Level: < 45 dB(A)  
 Warranty: 5 year

**Safety**

Blades RPM Limitation: 150 RPM  
 PWM Dump Load: 7.5 kW Box  
 Mechanical Brake: Manual/Auto

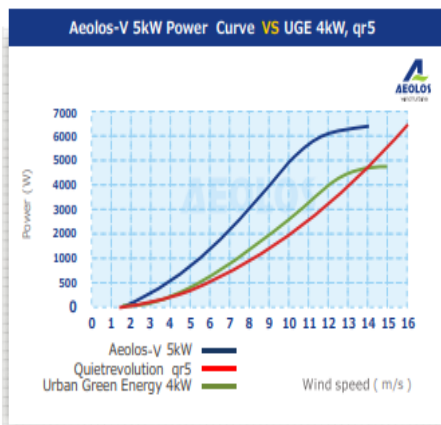
**Optional**

Remote Monitoring System ( Internet/Wireless)  
 Auto Hydraulic Brake System ( Unattended Site )  
 Off Grid : 48 V or 96 V  
 Grid Tie : 300 V



**Aeolos-V 5kW Wind Turbine Annual Energy Output**

Wind Speed(m/s)	Annual Energy Output (kWh)	Wind Speed(m/s)	Annual Energy Output (kWh)
3 m/s	2278 kWh	8 m/s	26280 kWh
4 m/s	4380 kWh	9 m/s	35741 kWh
5 m/s	6657 kWh	10 m/s	42924 kWh
6 m/s	11386 kWh	11 m/s	49932 kWh
7 m/s	17958 kWh	12 m/s	53436 kWh



## Lampiran 3 Lembaran Data Inverter

Technical data	Sunny Boy 6.0-US		Sunny Boy 7.0-US		Sunny Boy 7.7-US	
	208 V	240 V	208 V	240 V	208 V	240 V
<b>Input (DC)</b>						
Max. PV power	9600 Wp		9940 Wp		10905 Wp	
Max. DC Voltage			600 V			
Rated MPPT Voltage range	220 - 480 V		245 - 480 V		270 - 480 V	
MPPT operating voltage range			100 - 550 V			
Min. DC voltage / start voltage			100 V / 125 V			
Max. operating input current per MPPT			10 A			
Max. short circuit current per MPPT			18 A			
Number of MPPT tracker / string per MPPT tracker			3 / 1			
<b>Output (AC)</b>						
AC nominal power	5200 W	6000 W	6660 W	7000 W	6660 W	7680 W
Max. AC apparent power	5200 VA	6000 VA	6660 VA	7000 VA	6660 VA	7680 VA
Nominal voltage / adjustable	208 V / ●	240 V / ●	208 V / ●	240 V / ●	208 V / ●	240 V / ●
AC voltage range	183 - 229 V	211 - 264 V	183 - 229 V	211 - 264 V	183 - 229 V	211 - 264 V
AC grid frequency			60 Hz / 50 Hz			
Max. output current	25.0 A	25.0 A	32.0 A	29.2 A	32.0 A	32.0 A
Power factor (cos φ)			1			
Output phases / line connections			1 / 2			
Harmonics			< 4 %			
<b>Efficiency</b>						
Max. efficiency	97.3 %	97.7 %	97.3 %	97.9 %	97.3 %	97.5 %
CEC efficiency	96.7 %	96.9 %	96.4 %	96.8 %	96.4 %	96.8 %
<b>Protection devices</b>						
DC disconnect device / DC reverse polarity protection			● / ●			
Ground fault monitoring / Grid monitoring			●			
AC short circuit protection			●			
All-pole sensitive residual current monitoring unit (RCMU)			●			
Arc fault circuit interrupter (AFCI)			●			
Protection class / overvoltage category			I / IV			
<b>General data</b>						
Dimensions (W / H / D) in mm (in)			535 x 730 x 198 (21.1 x 28.5 x 7.8)			
Packaging Dimensions (W / H / D) in mm (in)			600 x 800 x 300 (23.6 x 31.5 x 11.8)			
Weight / packaging weight			26 kg (57 lb) / 30 kg (66 lb)			
Temperature range: operating / non-operating			-25°C ... +60°C / -40°C ... +60°C			
Environmental protection rating			NEMA 3R			
Noise emission (typical)	39 dB(A)				45 dB(A)	
Internal power consumption at night			< 5 W			
Topology / Cooling concept	Transformerless / Convection				Transformerless / Fan	
<b>Features</b>						
Ethernet ports			2			
Secure Power Supply			●*			
Display (2 x 16 characters)			●			
2.4 GHz WLAN / External WLAN antenna			●/○			
Cellular (4G / 3G) / Revenue Grade Meter			○/○**			
Warranty: 10 / 15 / 20 years			●/○/○			
Certificates and approvals			UL 1741, UL 1741 SA incl. CA Rule 21 RSD, UL 1998, UL 1699B Ed. 1, IEEE1547, FCC Part 15 (Class A & B), CAN/CSA V22.2 107.1-1, HECO Rule 14H, PV Rapid Shutdown System Equipment			
● Standard features ○ Optional features – Not available						
NOTE: US inverters ship with gray lids. Data at nominal conditions ** Not compatible with the SunSpec Rapid Shutdown functionality **Standard in SBX.X1TP-US-41						
Type designation	SB6.0-1SP-US-41 / SB6.0-1TP-US-41		SB7.0-1SP-US-41 / SB7.0-1TP-US-41		SB7.7-1SP-US-41 / SB7.7-1TP-US-41	

**POWER+ SOLUTION**

The SMA Power+ Solution combines legendary SMA inverter performance and intelligent DC module-level electronics in one cost-effective, comprehensive package. This means that you can achieve maximum solar power production for your customers while also realizing significant installation savings.

**NEW!** This rapid shutdown solution fulfills UL 1741, NEC 2014, and NEC 2017 requirements and is compatible with the power line-based SunSpec Rapid Shutdown communication signal over DC wires, making it the most simple and cost-effective rapid shutdown solution on the market.


Visit [www.SMA-America.com](http://www.SMA-America.com) for more information.






## Lampiran 4 Lembaran Data Baterai

RESU





CHANGE YOUR ENERGY, CHARGE YOUR LIFE



Models	48V			
	RESU3.3	RESU6.5	RESU10	RESU13
Total Energy [kWh] <sup>1)</sup>	3.3	6.5	9.8	13.1
Usable Energy [kWh] <sup>2)</sup>	2.9	5.9	8.8	12.4
Capacity [Ah]	63	126	189	252
Nominal Voltage [V]	51.8			
Voltage Range [V]	42.0-58.8			
Max Power [kW]	3.0	4.2	5.0	5.0
Peak Power [kW] (for 3 sec.)	3.3	4.6	7.0	7.0 11.0 (Backup Mode)
Dimension [W x H x D, mm]	452 x 403 x 120	452 x 656 x 120	452 x 484 x 227	452 x 626 x 227
Weight [kg]	31	52	75	99
Enclosure Protection Rating	IP55			
Communication	CAN2.0B			
Certificates	Cell	UL1642		
	Product	UL1973 / TUV (IEC 62619) / CE / FCC / RCM		TUV (IEC 62619) / CE / FCC / RCM

1) Total Energy is measured at the initial stage of battery life under the condition as follows : Temperature 25°C  
 2) Usable Energy is based on battery cell only  
 • Compatible Inverter Brands : SMA, Ingeteam, GoodWe, Sungrow, Victron Energy, Selectronic - More brands to be added





**RESU Plus is an expansion kit specially designed for 48V models of the RESU series. With RESU Plus, RESU3.3/6.5/10 are cross-connected with each other, and RESU13 is connected with the same model.**

- Dimension : 216 x 156 x 121 (W x H x D, mm)
- Number of Expandable Battery Units : Up to 2EA
- IP55

## Lampiran 5 Lembaran Data Generator Kapal





## Marine Engines

# 6 M26.2

**4 Stroke diesel engine, direct injection**

Bore and stroke	150 x 150 mm
Number of cylinders	6 in line
Total displacement	15,90 litres
Compression ratio	15/1
Engine rotation (ISO 1204 standard)	counterclockwise
Idle speed	700 rpm
Flywheel housing	SAE 1
Flywheel	SAE 14"



### Customer benefits

**Genuine marine design** with simple solutions, easy routine maintenance, engine block inspection hatches

**Global environment care** with low exhaust emissions and controlled fuel consumption at any running cycle

**Simple technology with mechanical injection**

**Life cycle cost efficiency** with extended mean time between overhauls (MBTO)

### Rated power - Fuel consumption

Duty	kW	hp	rpm	Fuel consumption g/kWh	l/h	IMO	CCNR	CE97/68
P1	331	450	1800	198	78	II	II	IIIA
P1	368	500	1800	205	90	II	II	IIIA
P2	404	550	1900	209	101	II	II	IIIA
P2	442	600	1950	211	111	II	-	-

	P1 duty	P2 duty
Application	unrestricted continuous	continuous
Engine load variations	very little or none	continuous
Average engine load factor	80 to 100 %	30 to 80 %
Annual working time	more than 5000 h	3000 to 5000 h
Time at full load	unlimited	8 h each 12 h

### Power definition

(Standard ISO 3046/1 - 1995 (F))

<b>Reference conditions</b>	<b>Fuel oil</b>	<b>Our ratings also comply with classification societies maximum temperature definition without power derating.</b>
Ambient temperature 25 °C / 77 °F	Relative density 0,840 ± 0,005	Ambient temperature 45 °C / 113 °F
Barometric pressure 100 kPa	Lower calorific power 42 700 kJ/kg	Raw water temperature 32 °C / 90 °F
Relative humidity 30%R	Consumption tolerances 0 ± 5%	
Raw water temperature 25 °C / 77 °F	Inlet limit temperature 35 °C / 95 °F	

[Baudouin.com](http://Baudouin.com)



### Standard equipment

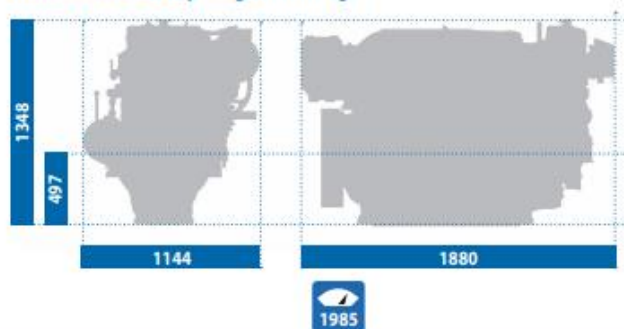
<b>Engine and block</b>	<p>Cast iron cylinder block          One inspection door per cylinder for access to conrod cap          Cast iron cylinder liners, wet type          Separate cast iron cylinder heads equipped with 4 valves          Replaceable valves guides and seats          8 cylinders head tightening bolts          Hardened steel forged crankshaft with induction hardened journals, crankpins and radius          Camshaft with polynomial cams profile          Distribution with tempered, hardened and grinded helicoidal gears          Chromium-Molibdenum steel conrods          Lube oil cooled light alloy pistons with high performance piston rings</p>
<b>Cooling system</b>	<p>Fresh / raw water heat exchanger with integrated thermostatic valves and expansion tank          Cast iron centrifugal fresh water pump, mechanically driven          Bronze self-priming raw water pump, mechanically driven</p>
<b>Lubrication system</b>	<p>Full flow screwable oil filters          Lube oil purifier with replaceable cartridge          Fresh water cooled lube oil cooler</p>
<b>Fuel system</b>	<p>In line injection pump with flanged mechanical governor          Double wall injection bundle with leakage collector          Duplex fuel filters replaceable engine running</p>
<b>Intake air and exhaust system</b>	<p>Fresh water cooled turbo blower          Double flow raw water cooled intake air cooler</p>
<b>Electrical system</b>	<p>Voltage: 24Vcc          Electrical starter on flywheel crown          175A battery charger</p>

### Optional equipment

<p>Cooling system adapted for box / keel cooling          Connection for emergency raw water and lube oil circuits          Bilge pump          Air starter with storage bottles and compressor</p>	<p>Free end PTO          Resilient mounts under engine          Equipment and factory trial according to Major Classification Societies rules          Cabin heating</p>
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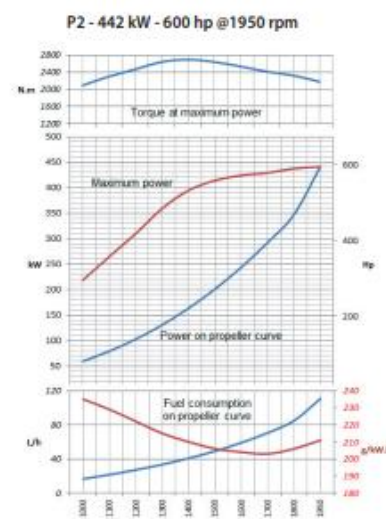
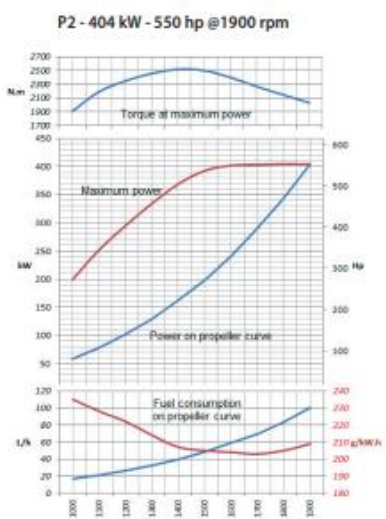
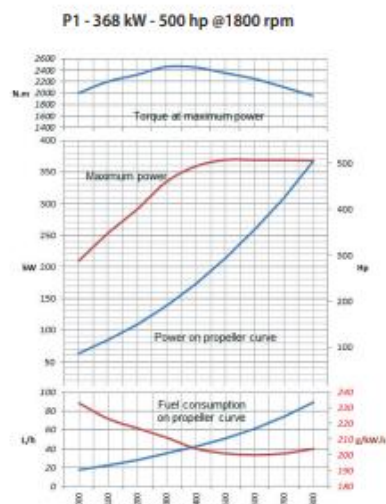
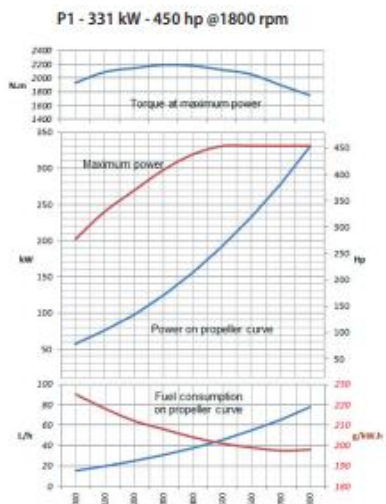
\* contact us for further information regarding our options.

### Dimensions and dry weight (mm / kg)





Performance



M.D.115-EN.03\_19 Moteur Baudouin ne peut être modifié sans avis préalable. Document non contractuel.

## Lampiran 6 Hasil Input RetScreen

	Unit	Climate data location	Facility location	Source
Latitude		-8.6	-8.6	
Longitude		116.1	115.8	
Climate zone		1A - Very hot - Humid		NASA
Elevation	m	197	197	NASA - NASA
Heating design temperature	°C	23.5		NASA
Cooling design temperature	°C	28.4		NASA
Earth temperature amplitude	°C	1.9		NASA

Month	Air temperature	Relative humidity	Precipitation	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days 18 °C	Cooling degree-days 10 °C
	°C	%	mm	kWh/m <sup>2</sup> /d	kPa	m/s	°C	°C-d	°C-d
January	26.6	83.2%	217.86	4.91	100.0	4.4	28.9	0	513
February	26.6	82.8%	232.30	4.92	100.0	4.6	28.6	0	464
March	26.6	83.3%	187.85	5.34	100.1	3.3	28.9	0	513
April	26.8	81.3%	134.96	5.52	100.1	3.7	29.0	0	503
May	26.8	77.4%	62.38	5.35	100.2	4.9	28.4	0	521
June	26.5	74.5%	37.39	4.92	100.2	5.6	27.8	0	494
July	26.0	72.5%	27.08	4.96	100.3	5.7	27.1	0	495
August	25.8	72.1%	15.41	5.47	100.3	5.3	26.9	0	489
September	26.0	74.9%	22.40	6.06	100.3	4.7	27.5	0	480
October	26.4	77.9%	81.47	6.27	100.2	3.7	28.5	0	508
November	26.5	82.3%	174.24	5.76	100.1	3.2	29.2	0	495
December	26.5	82.7%	224.61	5.33	100.1	3.2	29.1	0	512
<b>Annual</b>	<b>26.4</b>	<b>78.7%</b>	<b>1,417.93</b>	<b>5.40</b>	<b>100.2</b>	<b>4.4</b>	<b>28.3</b>	<b>0</b>	<b>5,987</b>
Source	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA
Measured at						m	10	0	







## Lampiran 9 Hasil Simulasi HOMER

### 1. Hasil Simulasi Pertama

Architecture							Cost			System	
SPR-X21 (kW)	6 M26.2 (kW)	LGChem3.3	SB7.0 US (kW)	Dispatch	NPC (Rp)	COE (Rp)	Operating cost (Rp/yr)	Initial capital (Rp)	Ren. Frac. (%)	Total Fuel (L/yr)	
9.87	404	10	27.0	CC	Rp12.7B	Rp23,507	Rp514M	Rp4.66B	37.2	13,661	
	404	10	23.9	CC	Rp14.2B	Rp26,341	Rp689M	Rp3.41B	0	24,477	
	404			CC	Rp45.4B	Rp84,301	Rp2.71B	Rp2.96B	0	97,929	
9.87	404		8.02	CC	Rp47.5B	Rp88,319	Rp2.77B	Rp4.23B	0	95,473	

### 2. Hasil Simulasi Kedua

Architecture							Cost			System	
Aeolus-V5kW	6 M26.2 (kW)	LGChem3.3	SB7.0 US (kW)	Dispatch	NPC (Rp)	COE (Rp)	Operating cost (Rp/yr)	Initial capital (Rp)	Ren. Frac. (%)	Total Fuel (L/yr)	
2	404	10	28.0	CC	Rp12.9B	Rp23,978	Rp552M	Rp4.27B	25.6	16,164	
	404	10	23.9	CC	Rp14.2B	Rp26,341	Rp689M	Rp3.41B	0	24,477	
	404			CC	Rp45.4B	Rp84,301	Rp2.71B	Rp2.96B	0	97,929	
2	404			CC	Rp45.6B	Rp84,687	Rp2.67B	Rp3.81B	0	93,265	

### 3. Hasil Simulasi Ketiga

Architecture							Cost			System	
SPR-X21 (kW)	Aeolus-V5kW	6 M26.2 (kW)	LGChem3.3	SB7.0 US (kW)	Dispatch	NPC (Rp)	COE (Rp)	Operating cost (Rp/yr)	Initial capital (Rp)	Ren. Frac. (%)	Total Fuel (L/yr)
4.70	1	404	10	26.4	CC	Rp9.99B	Rp18.576	Rp356M	Rp4.43B	31.7	7,507
4.70		404	10	25.4	CC	Rp10.0B	Rp18.637	Rp365M	Rp4.00B	9.92	9,900

### 4. Hasil Simulasi Keempat

Architecture							Cost			System	
SPR-X21 (kW)	Aeolus-V5kW	6 M26.2 (kW)	LGChem3.3	SB7.0 US (kW)	Dispatch	NPC (Rp)	COE (Rp)	Operating cost (Rp/yr)	Initial capital (Rp)	Ren. Frac. (%)	Total Fuel (L/yr)
		404	10	23.9	CC	Rp9.69B	Rp18.009	Rp402M	Rp3.41B	0	12,271
4.70		404	10	24.4	CC	Rp10.1B	Rp18.800	Rp391M	Rp4.00B	8.50	10,078

### 5. Hasil Simulasi Kelima

Architecture							Cost			System	
SPR-X21 (kW)	Aeolus-V5kW	6 M26.2 (kW)	LGChem3.3	SB7.0 US (kW)	Dispatch	NPC (Rp)	COE (Rp)	Operating cost (Rp/yr)	Initial capital (Rp)	Ren. Frac. (%)	Total Fuel (L/yr)
		404	10	23.9	CC	Rp9.69B	Rp18.009	Rp402M	Rp3.41B	0	12,271
	1	404	10	25.4	LF	Rp9.90B	Rp18.396	Rp388M	Rp3.84B	6.03	10,357