Version 7.2.10

PVsyst - Simulation report

Grid-Connected System

Project: TUBES EET NURRAHMAN

Variant: New simulation variant

No 3D scene defined, no shadings

System power: 20.25 kWp

Batununggal - Indonesia

Author

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Project summary

Geographical Site
Batununggal
Indonesia

Situation

Latitude	-6.96 °S
Longitude	107.63 °E
Altitude	670 m
Time zone	UTC+7

Project settings
Albedo 0.20

Meteo data
Batununggal
Meteonorm 8.0 (2010-2014), Sat=100% - Synthetic

System summary

Grid-Connected System
No 3D scene defined, no shadings

PV Field Orientation
Fixed plane
Tilt/Azimuth 11 / 0 °

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	54 units
Pnom total	20.25 kWp

Inverters

Nb. of units	2 units
Pnom total	20.00 kWac
Pnom ratio	1.013

Results summary

Produced Energy	32.29 MWh/year	Specific production	1595 kWh/kWp/year	Perf. Ratio PR	84.38 %

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General parameters

Grid-Connected System — **No 3D scene defined, no shadings**

PV Field Orientation

Orientation	Sheds configuration	Models used
Fixed plane	No 3D scene defined	Transposition Perez
Tilt/Azimuth 11 / 0 °		Diffuse Perez, Meteonorm
		Circumsolar separate

Horizon
Free Horizon

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Generic
Model	LG 375 Q1K-A6
(Original PVsyst database)	
Unit Nom. Power	375 Wp
Number of PV modules	54 units
Nominal (STC)	20.25 kWp
Modules	3 Strings x 18 In series
At operating cond. (50°C)	
Pmpp	18.79 kWp
U mpp	607 V
I mpp	31 A

Inverter

Manufacturer	Generic
Model	Symo 10.0-3-M
(Original PVsyst database)	
Unit Nom. Power	10.00 kWac
Number of inverters	2 * MPPT 0.62 2 units
Total power	20.0 kWac
Operating voltage	200-800 V
Pnom ratio (DC:AC)	1.01

Total PV power

Nominal (STC)	20 kWp
Total	54 modules
Module area	97.9 m²
Cell area	88.8 m²

Total inverter power

Total power	20 kWac
Number of inverters	2 units
Pnom ratio	1.01

Array losses

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 20.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 319 mΩ
Loss Fraction 1.5 % at STC

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction 2.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

IAM loss factor
Incidence effect (IAM): Fresnel AR coating, n(glass)=1.526, n(AR)=1.290

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

Main results

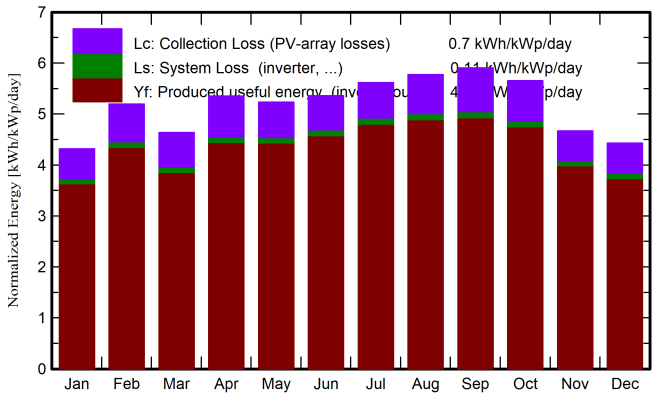
System Production

Produced Energy	32.29 MWh/year	Specific production	1595 kWh/kWp/year
		Performance Ratio PR	84.38 %

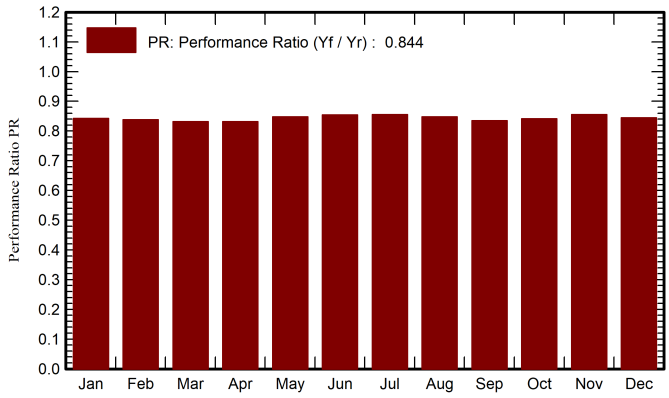
Economic evaluation

Investment		Yearly cost		LCOE	
Global	527094908.57 IDR	Annuities	0.00 IDR/yr	Energy cost	1435 IDR/kWh
Specific	26029 IDR/Wp	Run. costs	10718693.79 IDR/yr		
		Payback period	3.0 years		

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray MWh	E_Grid MWh	PR ratio
January	141.9	77.80	20.42	133.8	129.8	2.345	2.283	0.842
February	150.9	70.43	20.17	145.4	141.3	2.529	2.467	0.838
March	144.2	73.78	20.84	143.8	140.3	2.488	2.423	0.832
April	154.4	63.72	21.04	160.5	157.0	2.772	2.704	0.832
May	150.8	68.33	21.57	162.2	158.6	2.853	2.785	0.848
June	146.6	59.41	21.01	160.8	157.7	2.850	2.782	0.854
July	159.6	61.16	20.83	174.2	171.2	3.092	3.017	0.855
August	168.7	69.33	21.03	179.0	175.8	3.148	3.073	0.848
September	173.8	71.31	21.00	177.3	173.5	3.071	2.998	0.835
October	179.3	85.62	21.56	175.3	171.3	3.059	2.986	0.841
November	146.7	92.37	20.85	140.0	136.1	2.486	2.424	0.855
December	146.9	77.93	20.80	137.4	133.3	2.412	2.349	0.844
Year	1863.8	871.20	20.93	1889.7	1845.8	33.105	32.290	0.844

Legends

GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

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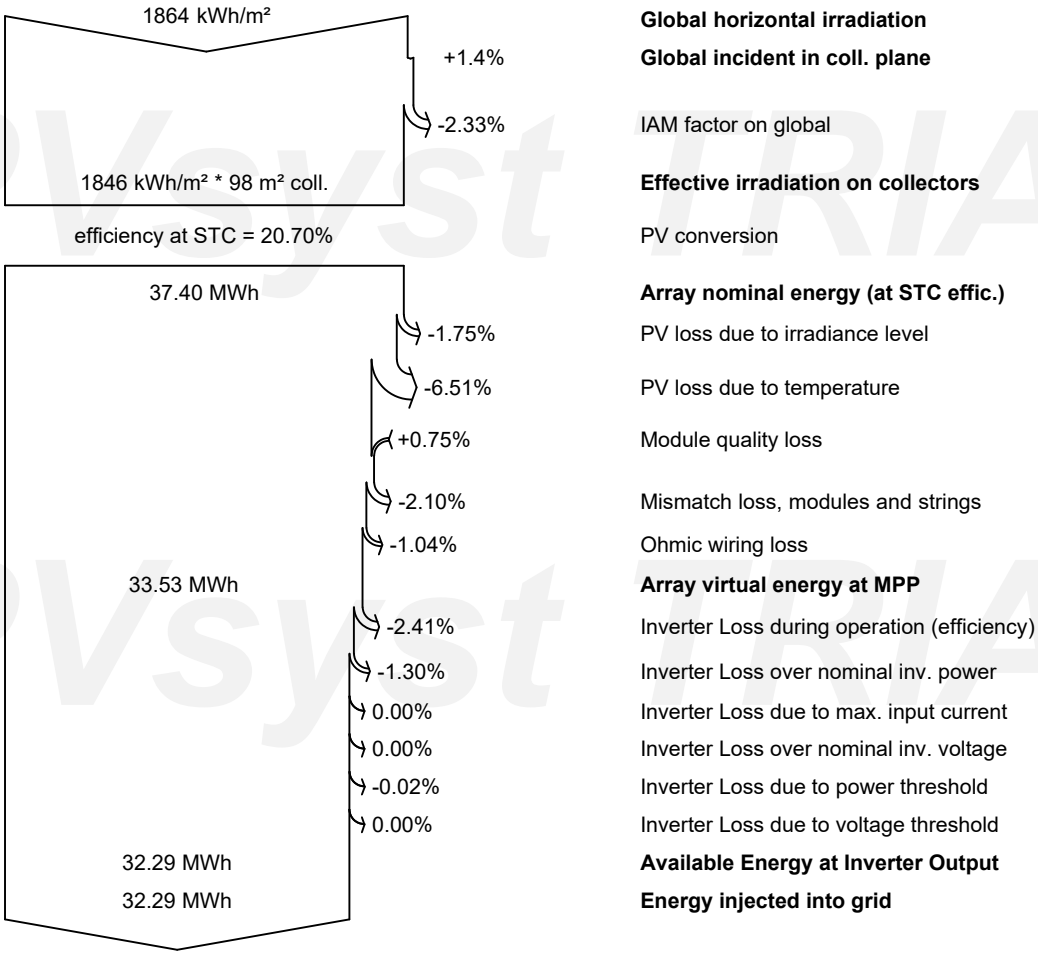
Loss diagram



Global horizontal irradiation
Global incident in coll. plane
IAM factor on global
Effective irradiation on collectors
PV conversion
Array nominal energy (at STC effic.)
PV loss due to irradiance level
PV loss due to temperature
Module quality loss
Mismatch loss, modules and strings
Ohmic wiring loss
Array virtual energy at MPP
Inverter Loss during operation (efficiency)
Inverter Loss over nominal inv. power
Inverter Loss due to max. input current
Inverter Loss over nominal inv. voltage
Inverter Loss due to power threshold
Inverter Loss due to voltage threshold
Available Energy at Inverter Output
Energy injected into grid

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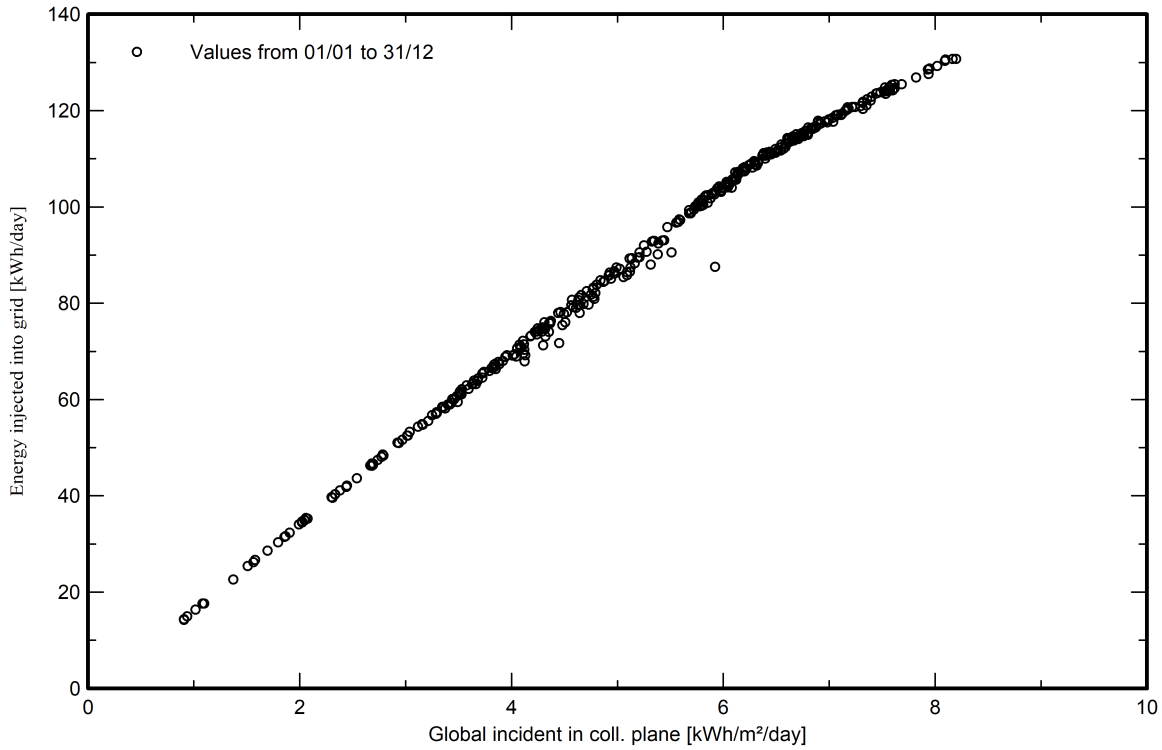
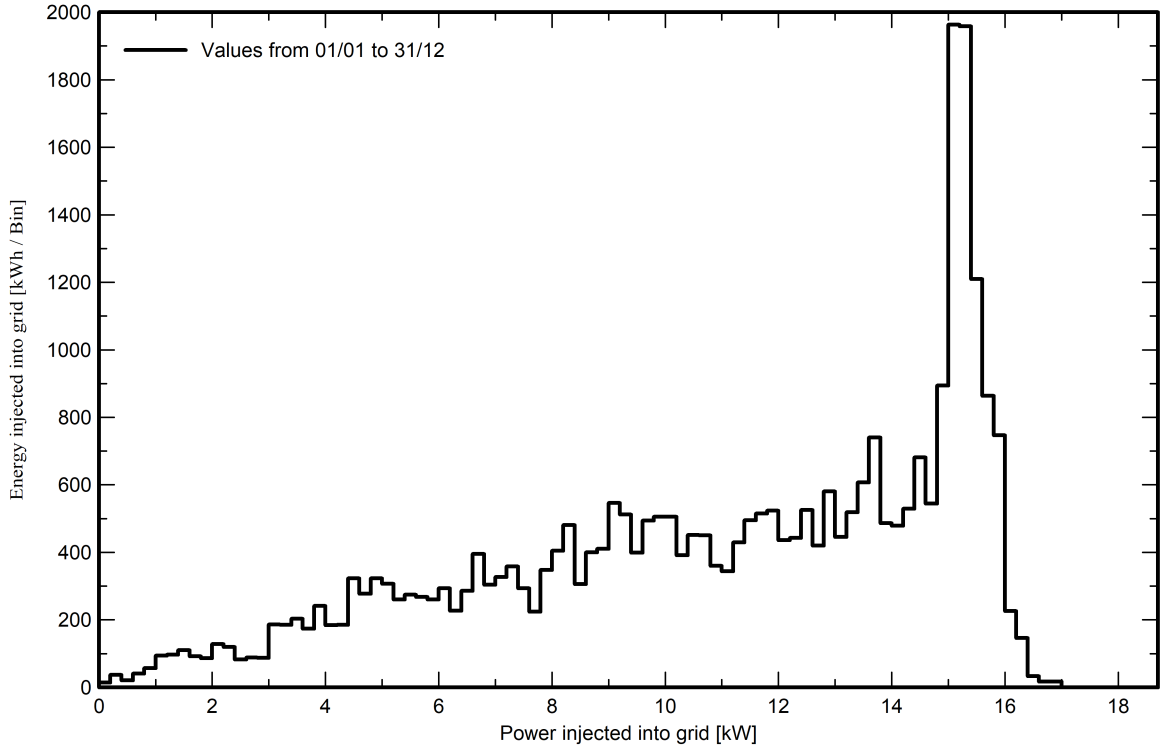
Special graphs

Daily Input/Output diagram



System Output Power Distribution



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Cost of the system

Installation costs

Item	Quantity units	Cost IDR	Total IDR
PV modules			
LG 375 Q1K-A6	54	7006430.90	378347268.48
Supports for modules	54	1390164.86	75068902.48
Inverters			
Symo 10.0-3-M	2	36839368.81	73678737.62
Total			527094908.57
Depreciable asset			527094908.57

Operating costs

Item	Total IDR/year
Maintenance	
Salaries	1500000.00
Repairs	1500000.00
Cleaning	3000000.00
Security fund	3000000.00
Total (OPEX)	9000000.00
Including inflation (1.80%)	10718693.79

System summary

Total installation cost	527094908.57 IDR
Operating costs (incl. inflation 1.80%/year)	10718693.79 IDR/year
Produced Energy	32.3 MWh/year
Cost of produced energy (LCOE)	1435.011 IDR/kWh

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Financial analysis

Simulation period

Project lifetime	20 years	Start year	2022

Income variation over time

Inflation	1.80 %/year
Production variation (aging)	Aging tool results
Discount rate	3.50 %/year

Income dependent expenses

Income tax rate	0.00 %/year
Other income tax	0.00 %/year
Dividends	0.00 %/year

Electricity sale

Feed-in tariff	6125.0000 IDR/kWh
Duration of tariff warranty	20 years
Annual connection tax	0.00 IDR/kWh
Annual tariff variation	0.0 %/year
Feed-in tariff decrease after warranty	50.00 %

Return on investment

Payback period	3.0 years
Net present value (NPV)	2661560766.42 IDR
Return on investment (ROI)	504.9 %

Detailed economic results (kIDR)

	Electricity sale	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
2022	197773	9000	0	188773	0	188773	182390	34.6%
2023	197773	9162	0	188611	0	188611	358460	68.0%
2024	197773	9327	0	188446	0	188446	528428	100.3%
2025	197773	9495	0	188278	0	188278	692502	131.4%
2026	197773	9666	0	188108	0	188108	850884	161.4%
2027	197773	9840	0	187934	0	187934	1003768	190.4%
2028	197773	10017	0	187756	0	187756	1151343	218.4%
2029	197773	10197	0	187576	0	187576	1293790	245.5%
2030	197773	10381	0	187393	0	187393	1431286	271.5%
2031	197773	10568	0	187206	0	187206	1564000	296.7%
2032	197773	10758	0	187016	0	187016	1692095	321.0%
2033	197773	10951	0	186822	0	186822	1815731	344.5%
2034	197773	11148	0	186625	0	186625	1935059	367.1%
2035	197773	11349	0	186424	0	186424	2050229	389.0%
2036	197773	11553	0	186220	0	186220	2161382	410.1%
2037	197773	11761	0	186012	0	186012	2268656	430.4%
2038	197773	11973	0	185800	0	185800	2372184	450.0%
2039	197773	12189	0	185585	0	185585	2472096	469.0%
2040	197773	12408	0	185365	0	185365	2568515	487.3%
2041	197773	12631	0	185142	0	185142	2661561	504.9%
Total	**3955466**	**214374**	**0**	**3741092**	**0**	**3741092**	**2661561**	**504.9%**

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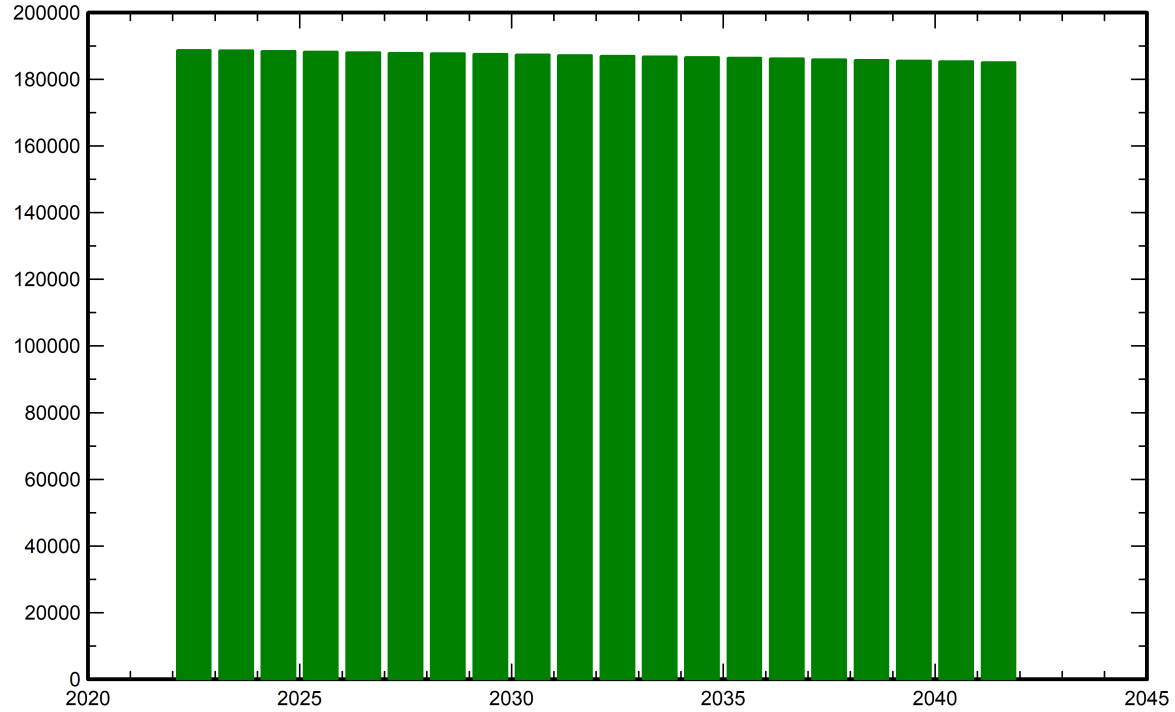
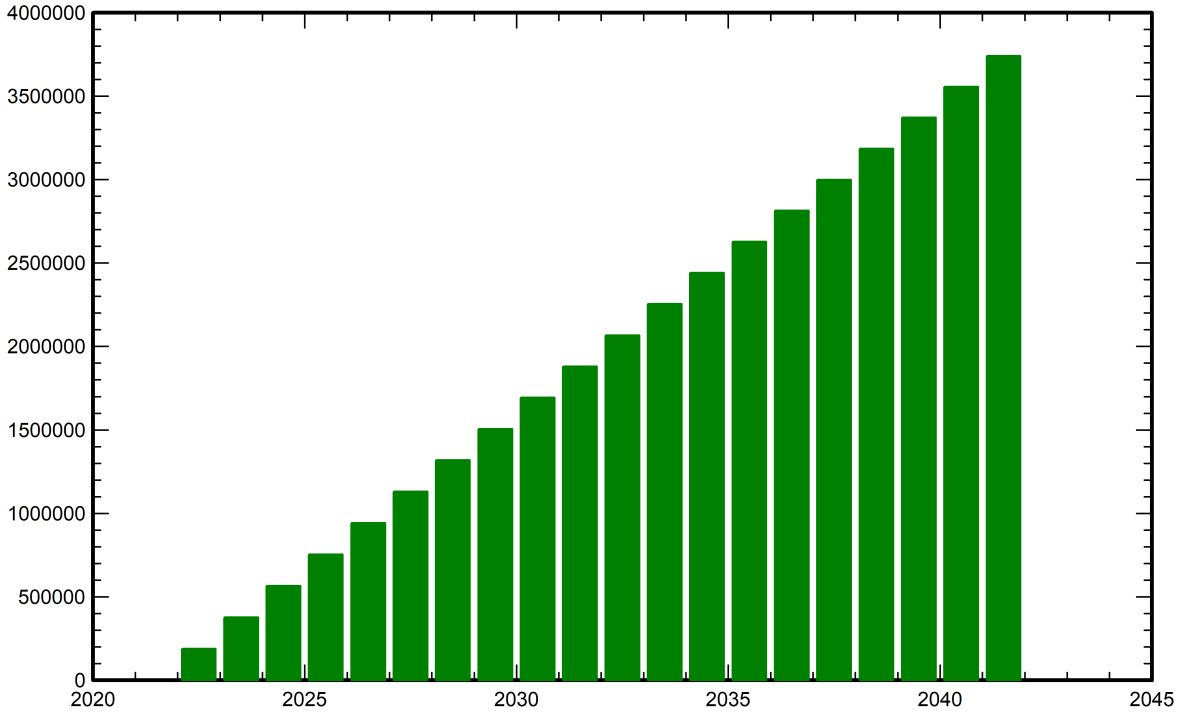
Financial analysis

Yearly net profit (kIDR)



Cumulative cashflow (kIDR)



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CO_2 Emission Balance

Total: 578.6 tCO_2

Generated emissions

Total: 38.30 tCO_2

Source: Detailed calculation from table below:

Replaced Emissions

Total: 711.0 tCO_2

System production: 32.29 MWh/yr

Grid Lifecycle Emissions: 734 gCO_2/kWh

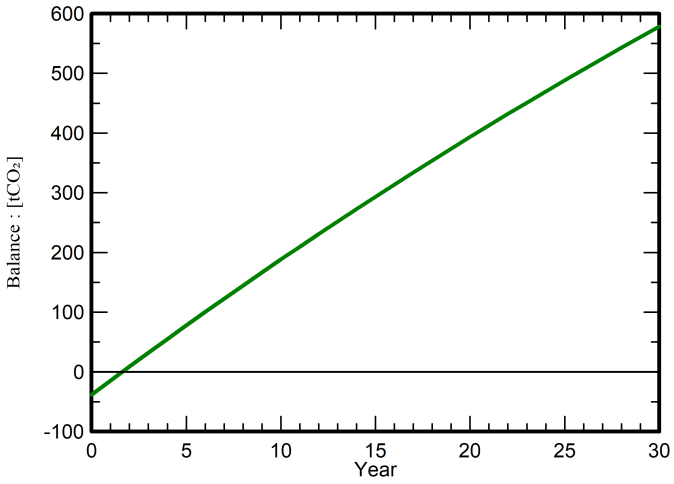
Source: IEA List

Country: Indonesia

Lifetime: 30 years

Annual degradation: 1.0 %

Saved CO_2 Emission vs. Time



System Lifecycle Emissions Details

Item	LCE	Quantity	Subtotal
			[$kgCO_2$]
Modules	1713 kgCO2/kWp	20.3 kWp	34683
Supports	4.90 kgCO2/kg	540 kg	2644
Inverters	485 kgCO2/units	2.00 units	970