PVsyst - Simulation report

Standalone system

Project: renewable energy project

Variant: New simulation variant

Standalone system with batteries

System power: 11.10 kWp

GIU Dorms - Egypt

Author

PVsyst V8.0.2
VC0, Simulation date:
09/12/24 20:51
with V8.0.2

Project summary

Geographical Site
GIU Dorms
Egypt

Situation

Latitude	30.07 °N
Longitude	31.51 °E
Altitude	234 m
Time zone	UTC+2

Project settings

Albedo	0.20

Weather data
GIU Dorms
Meteonorm 8.1 (1996-2015), Sat=21% - Synthetic

System summary

Standalone system

Orientation #1
Seasonal tilt adjustment

Azimuth	0 °
Summer Tilt	10 °
Winter	46 °

Oct.-Nov.-Dec.-Jan.-Feb.-Mar.

Standalone system with batteries

User's needs
Daily household consumers
Constant over the year
Average 30.4 kWh/Day

System information

PV Array

Nb. of modules	20 units
Pnom total	11.10 kWp

Battery pack

Technology	Lithium-ion, LFP
Nb. of units	8 units
Voltage	48 V
Capacity	1600 Ah

Results summary

Useful energy from solar	11045 kWh/year	Specific production	995 kWh/kWp/year	Perf. Ratio PR	46.67 %
Missing Energy	38 kWh/year	Available solar energy	19757 kWh/year	Solar Fraction SF	99.64 %
Excess (unused)	8174 kWh/year				

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General parameters

Standalone system

Standalone system with batteries

Orientation #1
Seasonal tilt adjustment

Azimuth	0 °
Summer Tilt	10 °
Winter	46 °

Oct.-Nov.-Dec.-Jan.-Feb.-Mar.

Sheds configuration
No 3D scene defined

Models used

Transposition	Perez
Diffuse	Perez, Meteonorm
Circumsolar	separate

User's needs
Daily household consumers
Constant over the year
Average 30.4 kWh/Day

PV Array Characteristics

PV module

Manufacturer	Jinkosolar
Model	JKM-555N-72HL4-BDV
(Original PVsyst database)	
Unit Nom. Power	555 Wp
Number of PV modules	20 units
Nominal (STC)	11.10 kWp
Modules	4 string x 5 In series
At operating cond. (50°C)	
Pmpp	10.27 kWp
U mpp	192 V
I mpp	53 A

Controller

Manufacturer	Victron
Model	SmartSolar MPPT RS 450/200
Technology	MPPT converter
Temp coeff.	-2.7 mV/°C/Elem.
Converter	
Maxi and EURO efficiencies	96.0 / 95.0 %

Battery Management control

Threshold commands as	SOC calculation
Charging	SOC = 0.96 / 0.80
Discharging	SOC = 0.10 / 0.35

Battery

Manufacturer	Powmr
Model	48V 200Ah Lithium LiFePO4 Battery-Wall
Technology	Lithium-ion, LFP
Nb. of units	8 in parallel
Discharging min. SOC	10.0 %
Stored energy	69.1 kWh
Battery Pack Characteristics	
Voltage	48 V
Nominal Capacity	1600 Ah (C10)
Temperature	Fixed 20 °C

Total PV power

Nominal (STC)	11 kWp
Total	20 modules
Module area	51.7 m²

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.	59 mΩ
Loss Fraction	1.5 % at STC

Serie Diode Loss

Voltage drop	0.7 V
Loss Fraction	0.3 % 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 %

Array losses

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	0.963	0.892	0.814	0.679	0.438	0.000

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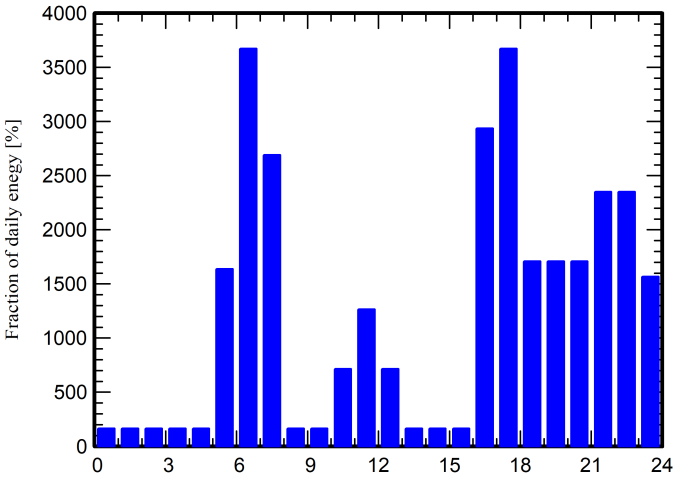
Detailed User's needs

Daily household consumers, Constant over the year, average = 30.4 kWh/day

Annual values

	Nb.	Power	Use	Energy
		W	Hour/day	Wh/day
Lmp	8	18/lamp	8.5	1224
laptop / Mobile / headphones	8	80/app	2.0	1280
kattle, microwave, rice cocker	3	1000/app	0.5	1500
Fridge / Deep-freeze	2		24	3398
Dish- and Cloth-washer	1		2	2200
AC	2	1400 tot	6.0	16800
electric heater	1	1125 tot	3.0	3375
Stand-by consumers			24.0	576
Total daily energy				30353

Hourly distribution



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Main results

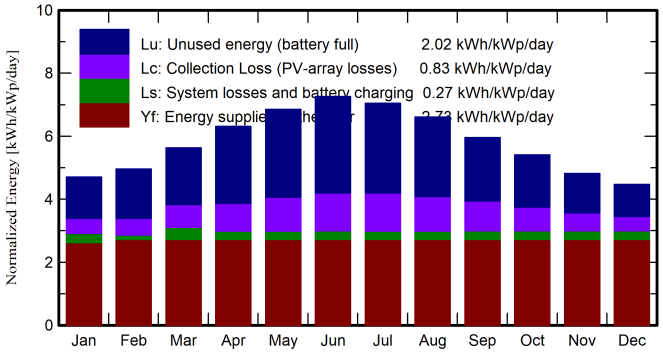
System Production

Useful energy from solar	11045 kWh/year	Perf. Ratio PR	46.67 %
Available solar energy	19757 kWh/year	Solar Fraction SF	99.64 %
Excess (unused)	8174 kWh/year		
Loss of Load		**Battery aging (State of Wear)**	
Time Fraction	0.0 %	Cycles SOW	96.6 %
Missing Energy	38 kWh/year	Static SOW	90.0 %
		Battery lifetime	10.0 years

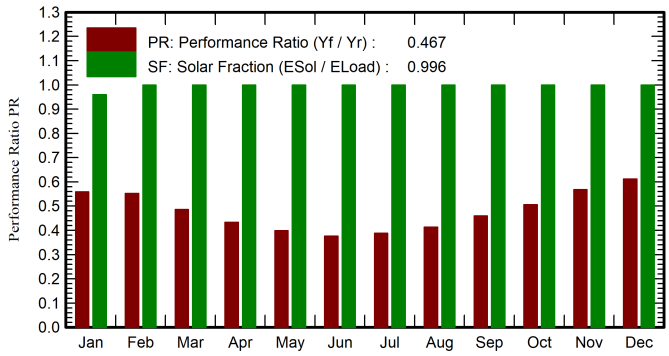
Economic evaluation

Investment		Yearly cost		LCOE	
Global	457,269.31 EGP	Annuities	0.00 EGP/yr	Energy cost	0.00 EGP/kWh
Specific	41.2 EGP/Wp	Run. costs	0.00 EGP/yr		
		Payback period	27.6 years		

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	95.3	144.1	1408	448	37.5	904	941	0.960
February	106.7	136.9	1336	484	0.0	850	850	1.000
March	156.3	171.7	1644	618	0.0	941	941	1.000
April	183.1	185.5	1763	810	0.0	911	911	1.000
May	211.5	208.4	1943	958	0.0	941	941	1.000
June	220.1	213.4	1969	1016	0.0	911	911	1.000
July	219.3	214.0	1961	976	0.0	941	941	1.000
August	200.9	200.7	1851	866	0.0	941	941	1.000
September	168.5	174.7	1625	670	0.0	911	911	1.000
October	135.4	165.1	1555	568	0.0	941	941	1.000
November	100.2	143.0	1369	414	0.0	911	911	1.000
December	88.3	137.0	1333	346	0.0	941	941	1.000
Year	1885.5	2094.4	19757	8174	37.5	11045	11082	0.996

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		

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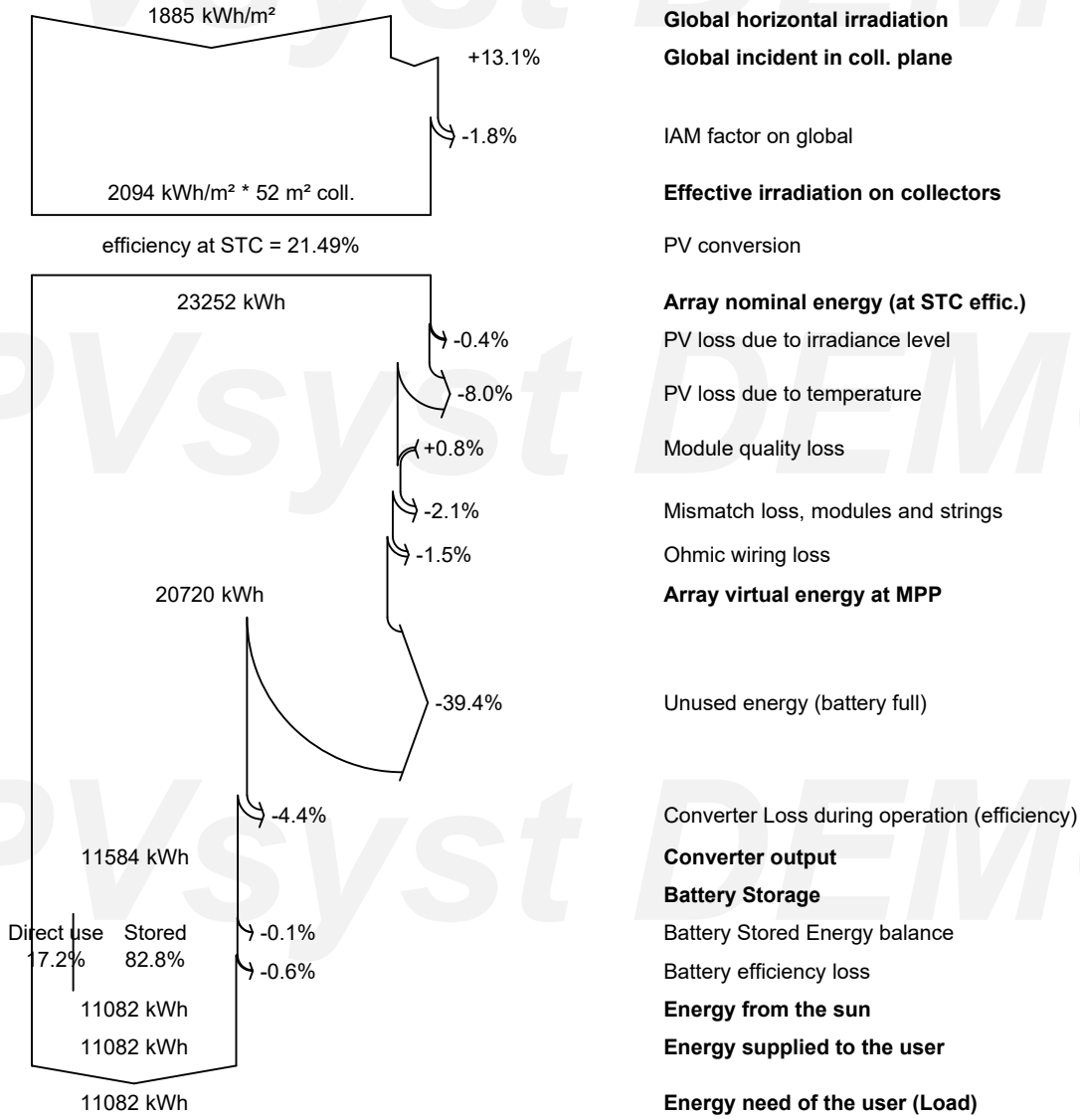
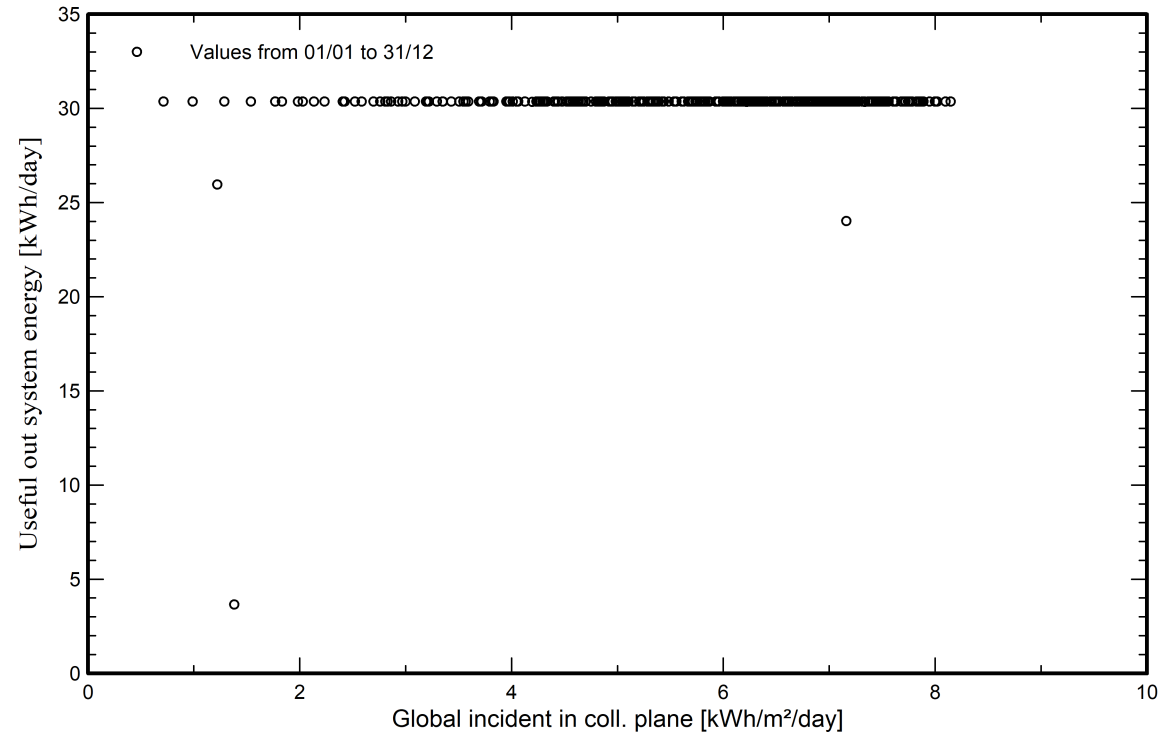
Loss diagram

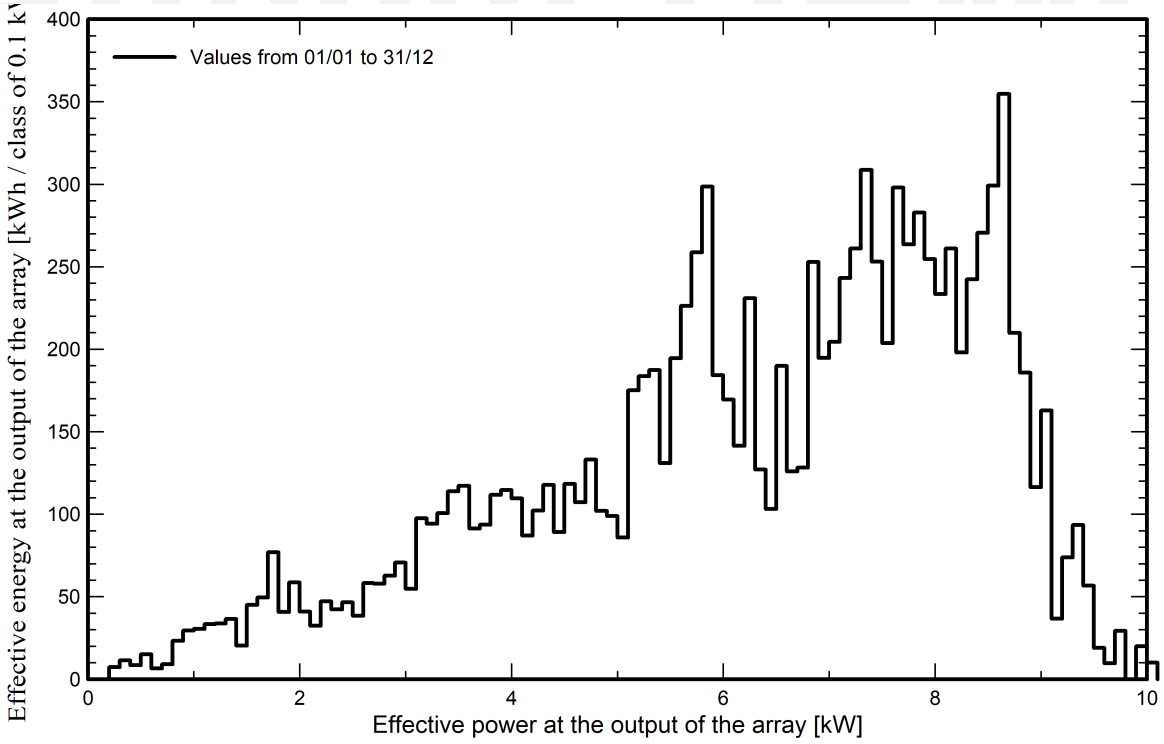


Predef. graphs

Daily Input/Output diagram



Array Power Distribution



Cost of the system

Installation costs

Item	Quantity units	Cost EGP	Total EGP
PV modules			
JKM-555N-72HL4-BDV	20	4,856.30	97,126.00
Batteries	8	26,263.00	210,104.00
Controllers			79,797.00
Other components			
Accessories, fasteners	1	51,668.31	51,668.31
Combiner box	1	18,574.00	18,574.00
		Total	457,269.31
		Depreciable asset	438,695.31

Operating costs

Item	Total EGP/year
Total (OPEX)	0.00

System summary

Total installation cost	457,269.31 EGP
Operating costs	0.00 EGP/year
Excess energy (battery full)	8.2 MWh/year
Used solar energy	11.0 MWh/year
Used energy cost	0.8280 EGP/kWh

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Financial analysis

Simulation period

Project lifetime	50 years	Start year	2025

Income variation over time

Inflation	0.00 %/year
Production variation (aging)	0.00 %/year
Discount rate	0.00 %/year

Depreciable assets

Asset	Depreciation method	Depreciation period (years)	Salvage value (EGP)	Depreciable (EGP)
PV modules				
JKM-555N-72HL4-BDV	Straight-line	20	0.00	97,126.00
Batteries	Straight-line	20	0.00	210,104.00
Controllers	Straight-line	20	0.00	79,797.00
Accessories, fasteners	Straight-line	20	0.00	51,668.31
		Total	0.00	438,695.31

Financing

Own funds	457,269.31 EGP

Electricity sale

Feed-in tariff	1.50000 EGP/kWh

Return on investment

Payback period	27.6 years
Net present value (NPV)	371,085.76 EGP
Internal rate of return (IRR)	2.64 %
Return on investment (ROI)	81.2 %

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Financial analysis

Detailed economic results (EGP)

Year	Electricity sale	Own funds	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
0	0	457,269	0	0	0	0	0	-457,269	0.0%
1	16,567	0	0	21,935	0	0	16,567	-440,702	3.6%
2	16,567	0	0	21,935	0	0	16,567	-424,135	7.2%
3	16,567	0	0	21,935	0	0	16,567	-407,568	10.9%
4	16,567	0	0	21,935	0	0	16,567	-391,001	14.5%
5	16,567	0	0	21,935	0	0	16,567	-374,434	18.1%
6	16,567	0	0	21,935	0	0	16,567	-357,867	21.7%
7	16,567	0	0	21,935	0	0	16,567	-341,300	25.4%
8	16,567	0	0	21,935	0	0	16,567	-324,732	29.0%
9	16,567	0	0	21,935	0	0	16,567	-308,165	32.6%
10	16,567	0	0	21,935	0	0	16,567	-291,598	36.2%
11	16,567	0	0	21,935	0	0	16,567	-275,031	39.9%
12	16,567	0	0	21,935	0	0	16,567	-258,464	43.5%
13	16,567	0	0	21,935	0	0	16,567	-241,897	47.1%
14	16,567	0	0	21,935	0	0	16,567	-225,330	50.7%
15	16,567	0	0	21,935	0	0	16,567	-208,763	54.3%
16	16,567	0	0	21,935	0	0	16,567	-192,196	58.0%
17	16,567	0	0	21,935	0	0	16,567	-175,629	61.6%
18	16,567	0	0	21,935	0	0	16,567	-159,061	65.2%
19	16,567	0	0	21,935	0	0	16,567	-142,494	68.8%
20	16,567	0	0	21,935	0	0	16,567	-125,927	72.5%
21	16,567	0	0	0	16,567	0	16,567	-109,360	76.1%
22	16,567	0	0	0	16,567	0	16,567	-92,793	79.7%
23	16,567	0	0	0	16,567	0	16,567	-76,226	83.3%
24	16,567	0	0	0	16,567	0	16,567	-59,659	87.0%
25	16,567	0	0	0	16,567	0	16,567	-43,092	90.6%
26	16,567	0	0	0	16,567	0	16,567	-26,525	94.2%
27	16,567	0	0	0	16,567	0	16,567	-9,958	97.8%
28	16,567	0	0	0	16,567	0	16,567	6,610	101.4%
29	16,567	0	0	0	16,567	0	16,567	23,177	105.1%
30	16,567	0	0	0	16,567	0	16,567	39,744	108.7%
31	16,567	0	0	0	16,567	0	16,567	56,311	112.3%
32	16,567	0	0	0	16,567	0	16,567	72,878	115.9%
33	16,567	0	0	0	16,567	0	16,567	89,445	119.6%
34	16,567	0	0	0	16,567	0	16,567	106,012	123.2%
35	16,567	0	0	0	16,567	0	16,567	122,579	126.8%
36	16,567	0	0	0	16,567	0	16,567	139,146	130.4%
37	16,567	0	0	0	16,567	0	16,567	155,713	134.1%
38	16,567	0	0	0	16,567	0	16,567	172,281	137.7%
39	16,567	0	0	0	16,567	0	16,567	188,848	141.3%
40	16,567	0	0	0	16,567	0	16,567	205,415	144.9%
41	16,567	0	0	0	16,567	0	16,567	221,982	148.5%
42	16,567	0	0	0	16,567	0	16,567	238,549	152.2%
43	16,567	0	0	0	16,567	0	16,567	255,116	155.8%
44	16,567	0	0	0	16,567	0	16,567	271,683	159.4%
45	16,567	0	0	0	16,567	0	16,567	288,250	163.0%
46	16,567	0	0	0	16,567	0	16,567	304,817	166.7%
47	16,567	0	0	0	16,567	0	16,567	321,384	170.3%
48	16,567	0	0	0	16,567	0	16,567	337,952	173.9%
49	16,567	0	0	0	16,567	0	16,567	354,519	177.5%
50	16,567	0	0	0	16,567	0	16,567	371,086	181.2%
Total	**828,355**	**457,269**	**0**	**438,695**	**497,013**	**0**	**828,355**	**371,086**	**181.2%**

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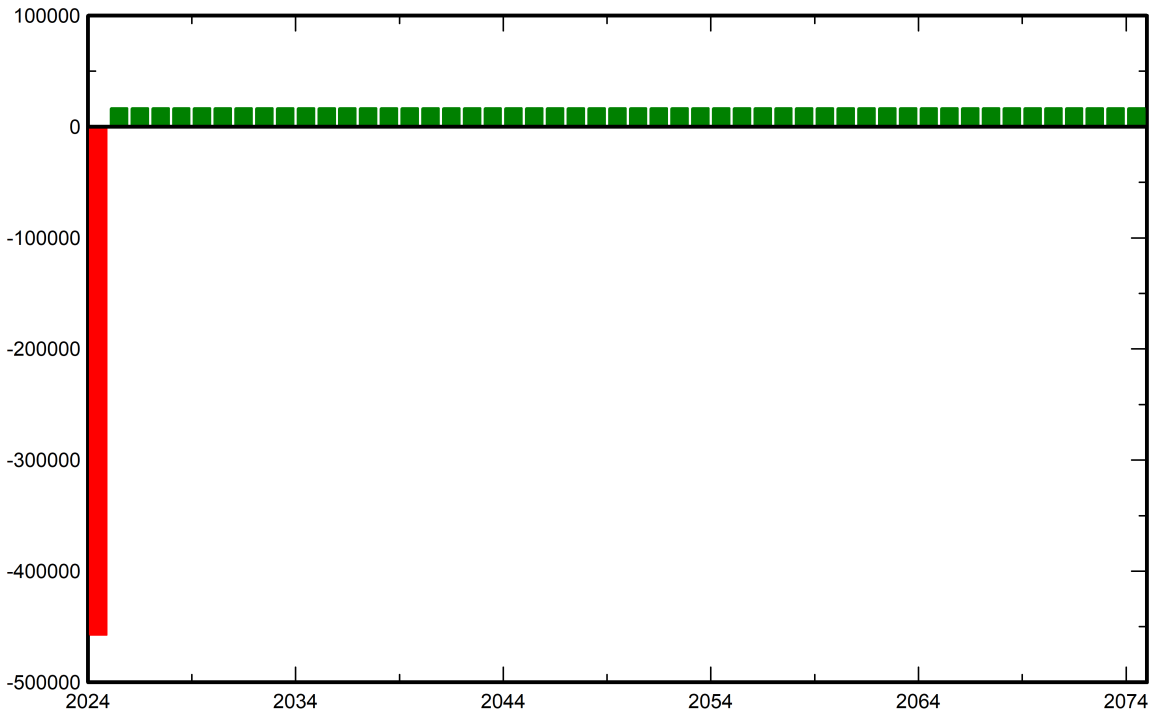
Financial analysis

Yearly net profit (EGP)



Cumulative cashflow (EGP)