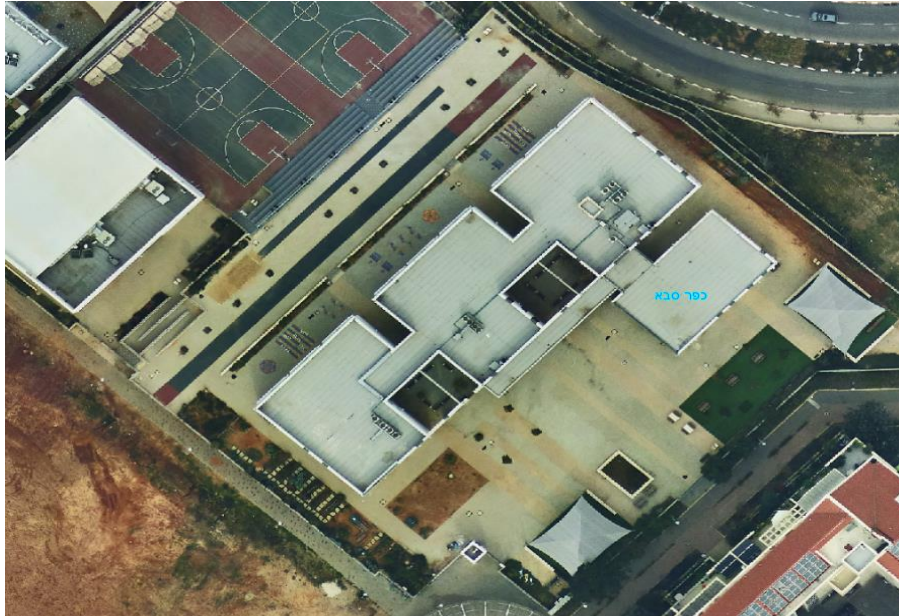


רחל המשוררת - כפר סבא

מערכת סולארית תעריפית – 158.4 Kw

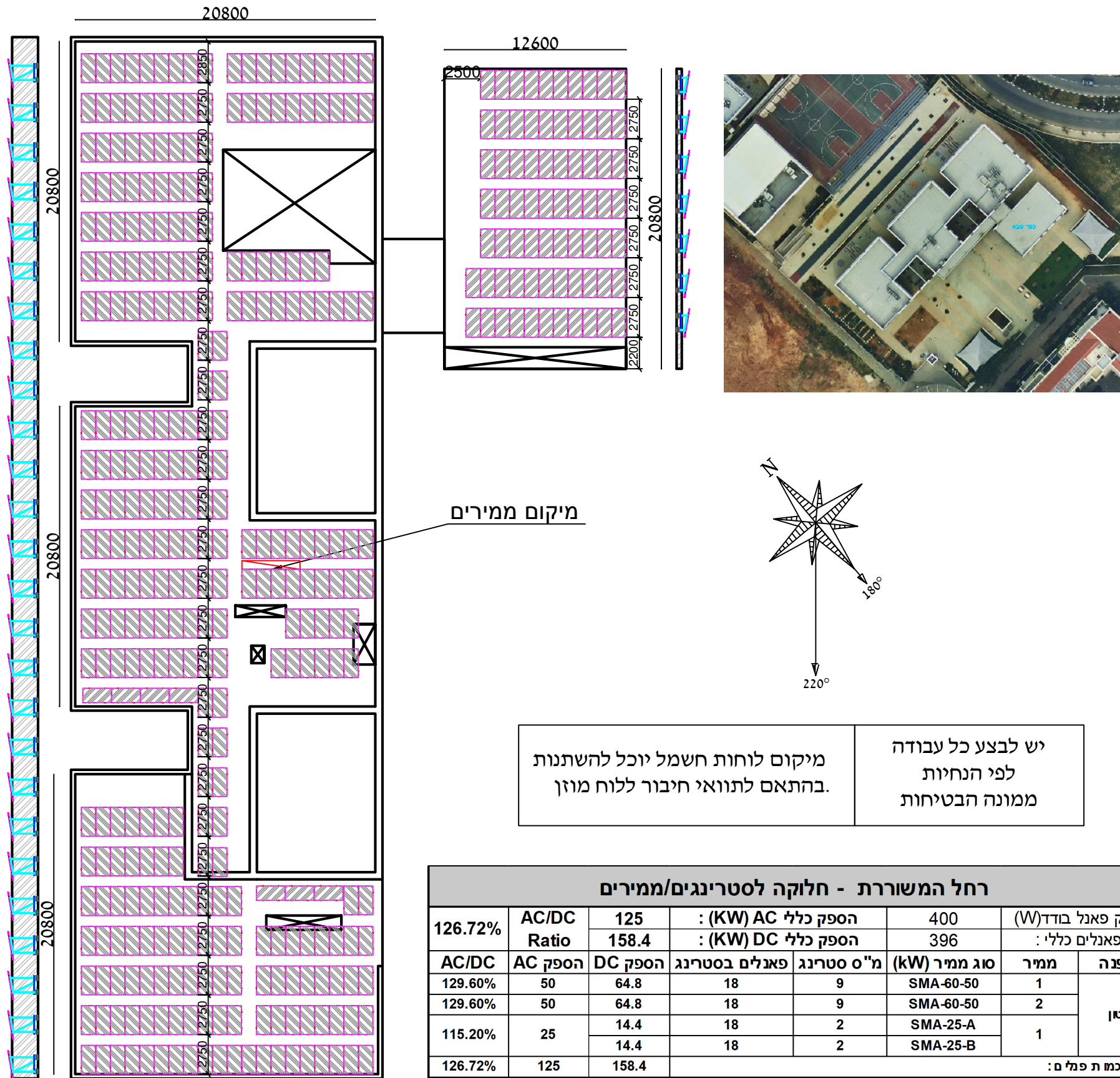


- Rachel poet- -E-D-001 – הצבת פאנלים
- Rachel poet- -E-D-002 – תכנית קונסטרוקצייה
- Rachel poet- -E-D-003 – תכנית קושרות
- Rachel poet- -E-D-004 – תכנית חיווט פאנלים וכבילה
- Rachel poet- -E-D-005 – תכנית הצבת ממירים
- Rachel poet- -E-D-006 – שרטוטי רגליים
- Rachel poet- -E-D-007 – תכנית חד קווית חשמלית
- Rachel poet- -E-D-008 – תכנית חד קווית הארקות
- Rachel poet- -E-C-002 – סימולציית Pvsyst
- Rachel poet- -E-C-003 – חישוב הפסדי הולכה DC
- Rachel poet- -E-C-004 – חישוב הפסדי הולכה AC
- Rachel poet- -E-C-005 – בדיקות מתחים DC אופגריד
- Rachel poet- -E-C-006 – בדיקות מתחים DC אונגריד
- Rachel poet- -E-C-007 – בדיקות מתחים AC אונגריד
- Rachel poet- -E-C-008 – בדיקות קבלה אופגריד
- Rachel poet- -E-C-009 – בדיקות קבלה אונגריד

מרץ 2020

מתכנן : אריק בר

Rachel poet- Layout Desgin



יש לבצע כל עבודה לפי הנחיות ממונה הבטיחות

מיקום לוחות חשמל יוכל להשתנות בהתאם לתוואי חיבור ללוח מוזן

רחל המשוררת - חלוקה לסטרינגים/ממירים						
126.72%	AC/DC Ratio	125	הספק כללי AC (KW)	400	הספק פאנל בודד (W)	
		158.4	הספק כללי DC (KW)	396	מ"ס פאנלים כללי:	
AC/DC	AC הספק	DC הספק	פאנלים בסטרינג	מ"ס סטרינג	סוג ממיר (kW)	ממיר
129.60%	50	64.8	18	9	SMA-60-50	1
129.60%	50	64.8	18	9	SMA-60-50	2
115.20%	25	14.4	18	2	SMA-25-A	1
		14.4	18	2	SMA-25-B	
126.72%	125	158.4	סה"כ כמות פנלים:			

פרטים	פרטי ממירים		פרטי פנלים		גרסה	השינוי	תאריך	שם תכנית	תאור	תכנית הצבת פאנלים	
	פרטים	נתונים	כמות	פרטים						נתונים	מיקום ההתקנה
יצור	SMA	3	JINKO	נתונים	P1		Rachel poet-E-D-001	תאור	מיקום ההתקנה	כפר סבא	סכום
ידגם א	SMA-60-50	2	400w	דגם	P2			תאריך	03/03/2020	1	1
ידגם ב	SMA-25	1	396	כמות	P3			תכנון	אריק בר	1	1
ידגם ג			13 deg	הטייה	P4			אישור		גרסה	גודל דף
ידגם ד			220 deg	אזימוט	P5					P0	A3
הספק כולל	125 kW		158.4 kWp	הספק כולל							



Grid-Connected System: Simulation parameters

Project : Rachel poet - Kfar Sava				
Geographical Site	Kfar Sava	Country	Israel	
Situation Time defined as	Latitude	32.19° N	Longitude	34.95° E
	Legal Time	Time zone UT+2	Altitude	43 m
	Albedo	0.20		
Meteo data:	Kfar Sava	Meteonorm 7.2 (1990-2004), Sat=100% - Synthetic		

Simulation variant : Rachel poet - Kfar Sava	
Simulation date	03/03/20 17h33

Simulation parameters	System type	Sheds on a building		
Collector Plane Orientation	Tilt	13°	Azimuth	40°
Sheds configuration	Nb. of sheds	49	Collector width	2.01 m
Shading limit angle	Sheds spacing	2.73 m	Ground cov. Ratio (GCR)	73.5 %
	Limit profile angle	30.2°		
Models used	Transposition	Perez	Diffuse	Perez, Meteonorm
Horizon	Free Horizon			
Near Shadings	Linear shadings			
User's needs :	Unlimited load (grid)			
Grid power limitation	Active Power	125 kW	Pnom ratio	1.267

PV Arrays Characteristics (2 kinds of array defined)				
PV module	Si-mono	Model	JKM 400M-72H	
Custom parameters definition		Manufacturer	Jinkosolar	
Sub-array "Sub-array #1"				
Number of PV modules	In series	18 modules	In parallel	18 strings
Total number of PV modules	Nb. modules	324	Unit Nom. Power	400 Wp
Array global power	Nominal (STC)	130 kWp	At operating cond.	118 kWp (50°C)
Array operating characteristics (50°C)	U mpp	670 V	I mpp	176 A
Sub-array "PV Array"				
Number of PV modules	In series	18 modules	In parallel	4 strings
Total number of PV modules	Nb. modules	72	Unit Nom. Power	400 Wp
Array global power	Nominal (STC)	28.80 kWp	At operating cond.	26.18 kWp (50°C)
Array operating characteristics (50°C)	U mpp	670 V	I mpp	39 A
Total	Arrays global power	Nominal (STC)	158 kWp	Total
		Module area	797 m²	Cell area
				396 modules
				719 m ²
Sub-array "Sub-array #1" : Inverter				
Original PVsyst database	Model	Sunny Tripower 60-10		
Characteristics	Manufacturer	SMA		
Inverter pack	Operating Voltage	570-800 V	Unit Nom. Power	60.0 kWac
	Nb. of inverters	2 units	Total Power	120 kWac
			Pnom ratio	1.08
Sub-array "PV Array" : Inverter				
Original PVsyst database	Model	Sunny Tripower 25000TL-30		
Characteristics	Manufacturer	SMA		
Inverter pack	Operating Voltage	390-800 V	Unit Nom. Power	25.0 kWac
	Nb. of inverters	1 units	Total Power	25 kWac
			Pnom ratio	1.15
Total	Nb. of inverters	3	Total Power	145 kWac

Grid-Connected System: Simulation parameters

PV Array loss factors

Array Soiling Losses		Loss Fraction	3.0 %
Thermal Loss factor	Uc (const) 14.0 W/m ² K	Uv (wind)	0.0 W/m ² K / m/s
Wiring Ohmic Loss	Array#1	Loss Fraction	1.0 % at STC
	Array#2	Loss Fraction	1.0 % at STC
	Global	Loss Fraction	1.0 % at STC
LID - Light Induced Degradation		Loss Fraction	2.0 %
Module Quality Loss		Loss Fraction	-0.8 %
Module Mismatch Losses		Loss Fraction	1.0 % at MPP
Strings Mismatch loss		Loss Fraction	0.10 %
Incidence effect, ASHRAE parametrization	IAM = 1 - bo (1/cos i - 1)	bo Param.	0.05

System loss factors

	Wires: 3x120.0 mm ² 66 m	Loss Fraction	1.0 % at STC
--	-------------------------------------	---------------	--------------

Grid-Connected System: Near shading definition

Project : Rachel poet - Kfar Sava

Simulation variant : Rachel poet - Kfar Sava

Main system parameters

System type **Sheds on a building**

Near Shadings

PV Field Orientation

PV modules

PV Array

Inverter

Inverter

Inverter pack

User's needs

Linear shadings

tilt 13°

Model JKM 400M-72H

Nb. of modules 396

Model Sunny Tripower 60-10

Model Sunny Tripower 25000TL-30

Nb. of units 3.0

Unlimited load (grid)

azimuth 40°

Pnom 400 Wp

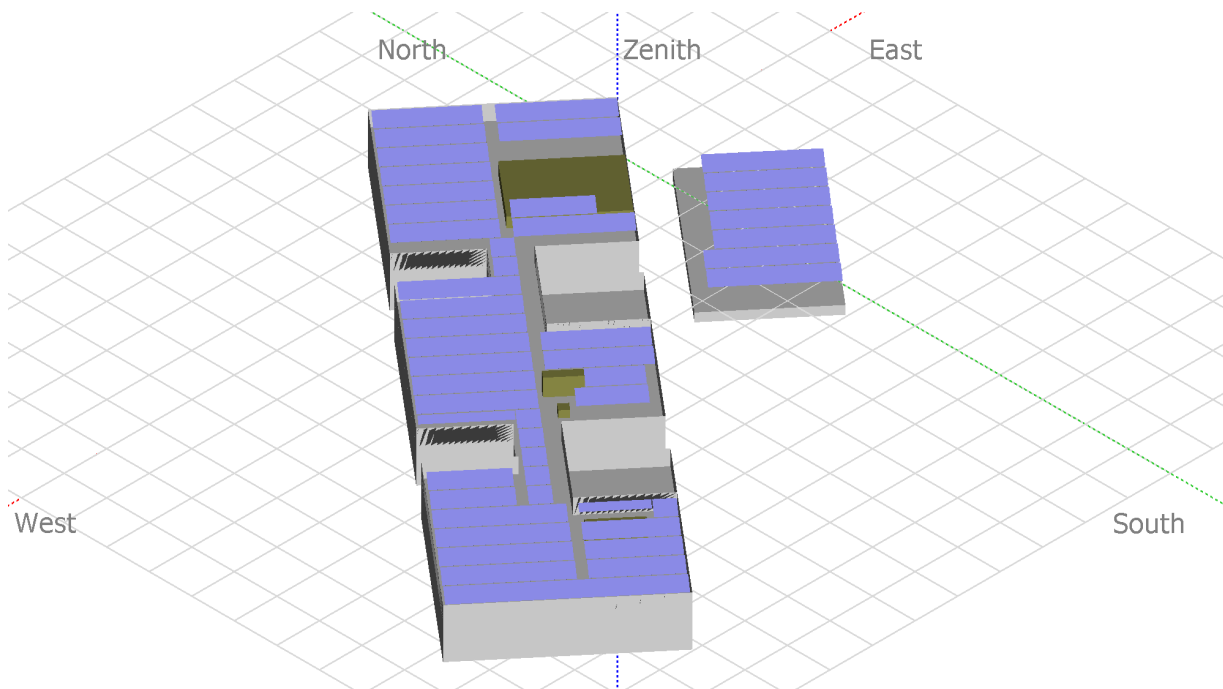
Pnom total **158 kWp**

Pnom 60.0 kW ac

Pnom 25.00 kW ac

Pnom total **145 kW ac**

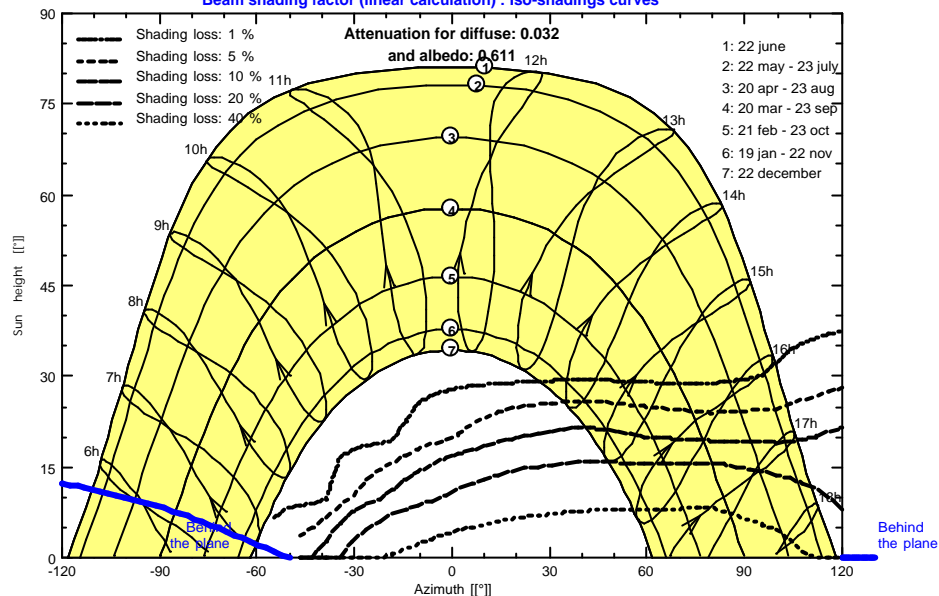
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Rachel poet - Kfar Sava

Beam shading factor (linear calculation) : Iso-shadings curves



Grid-Connected System: Main results

Project : Rachel poet - Kfar Sava

Simulation variant : Rachel poet - Kfar Sava

Main system parameters

System type **Sheds on a building**

Near Shadings

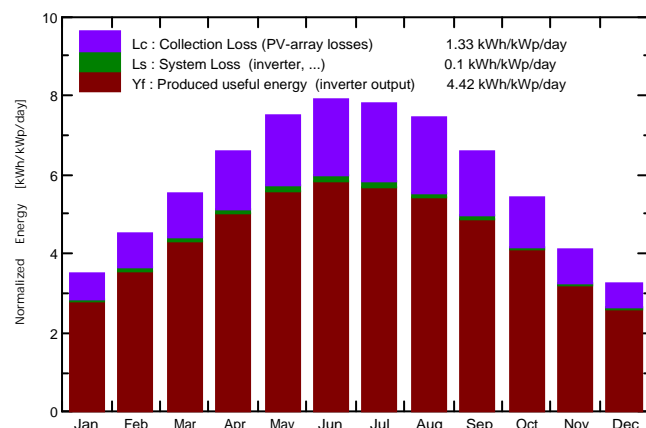
Linear shadings

PV Field Orientation	tilt	13°	azimuth	40°
PV modules	Model	JKM 400M-72H	Pnom	400 Wp
PV Array	Nb. of modules	396	Pnom total	158 kWp
Inverter	Model	Sunny Tripower 60-10	Pnom	60.0 kW ac
Inverter	Model	Sunny Tripower 25000TL-30	Pnom	25.00 kW ac
Inverter pack	Nb. of units	3.0	Pnom total	145 kW ac
User's needs	Unlimited load (grid)			

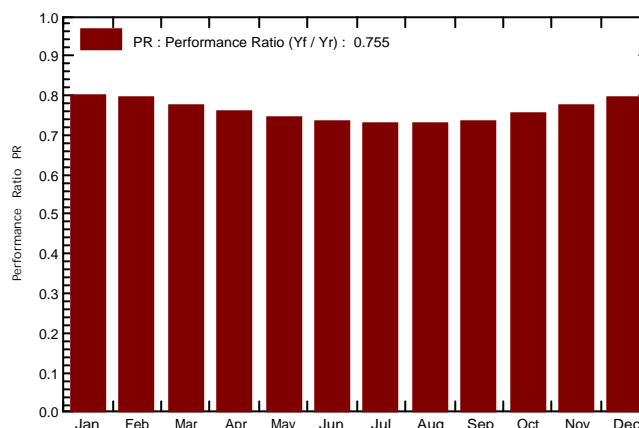
Main simulation results

System Production **Produced Energy 255.6 MWh/year** Specific prod. 1613 kWh/kWp/year
 Performance Ratio PR **75.51 %**

Normalized productions (per installed kWp): Nominal power 158 kWp



Performance Ratio PR



Rachel poet - Kfar Sava Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray MWh	E_Grid MWh	PR
January	92.1	35.95	13.02	108.4	98.1	14.07	13.75	0.801
February	110.8	45.88	13.71	125.9	114.9	16.27	15.90	0.797
March	159.8	54.33	16.34	172.2	159.4	21.70	21.19	0.777
April	190.0	65.86	19.21	197.1	182.8	24.37	23.80	0.762
May	232.8	65.16	22.41	232.5	216.4	28.15	27.49	0.746
June	241.8	59.25	25.15	237.7	221.7	28.39	27.73	0.736
July	244.0	60.77	27.63	242.1	225.6	28.62	27.96	0.729
August	224.7	57.72	27.93	230.7	214.8	27.27	26.65	0.729
September	186.4	45.74	26.06	197.9	183.9	23.64	23.10	0.737
October	149.5	44.60	23.67	167.9	154.4	20.55	20.09	0.756
November	104.9	36.41	18.89	123.6	112.6	15.57	15.22	0.778
December	84.6	36.83	15.08	100.4	90.5	12.94	12.66	0.796
Year	2021.3	608.49	20.80	2136.5	1975.1	261.55	255.55	0.755

Legends: GlobHor Horizontal global irradiation
 DiffHor Horizontal diffuse irradiation
 T_Amb T amb.
 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

Grid-Connected System: Special graphs

Project : Rachel poet - Kfar Sava

Simulation variant : Rachel poet - Kfar Sava

Main system parameters

System type **Sheds on a building**

Near Shadings

Linear shadings

PV Field Orientation

tilt 13°

azimuth 40°

PV modules

Model JKM 400M-72H

Pnom 400 Wp

PV Array

Nb. of modules 396

Pnom total **158 kWp**

Inverter

Model Sunny Tripower 60-10

Pnom 60.0 kW ac

Inverter

Model Sunny Tripower 25000TL-30

Pnom 25.00 kW ac

Inverter pack

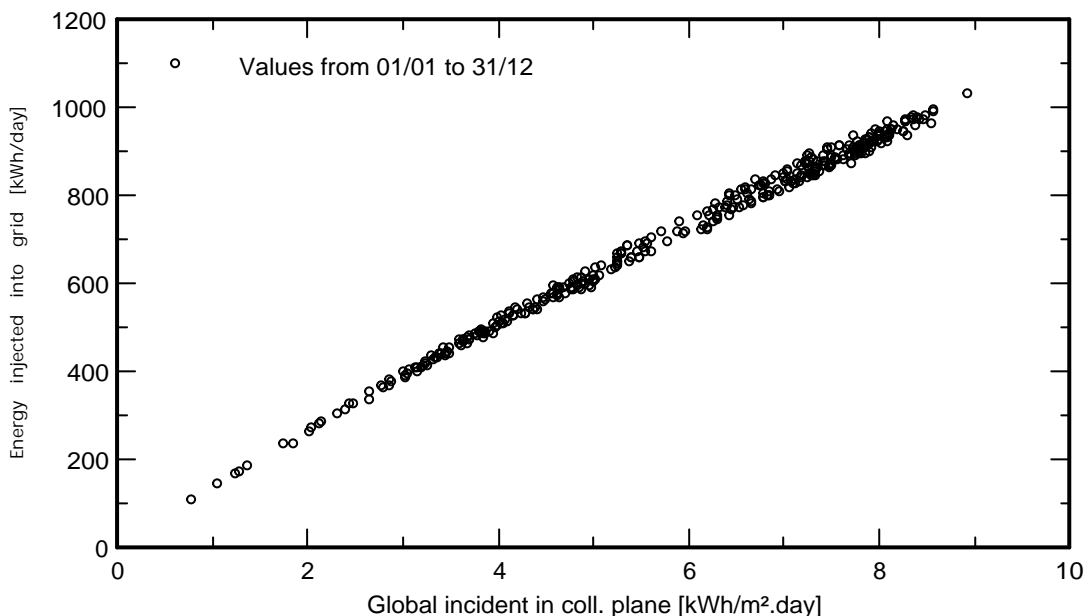
Nb. of units 3.0

Pnom total **145 kW ac**

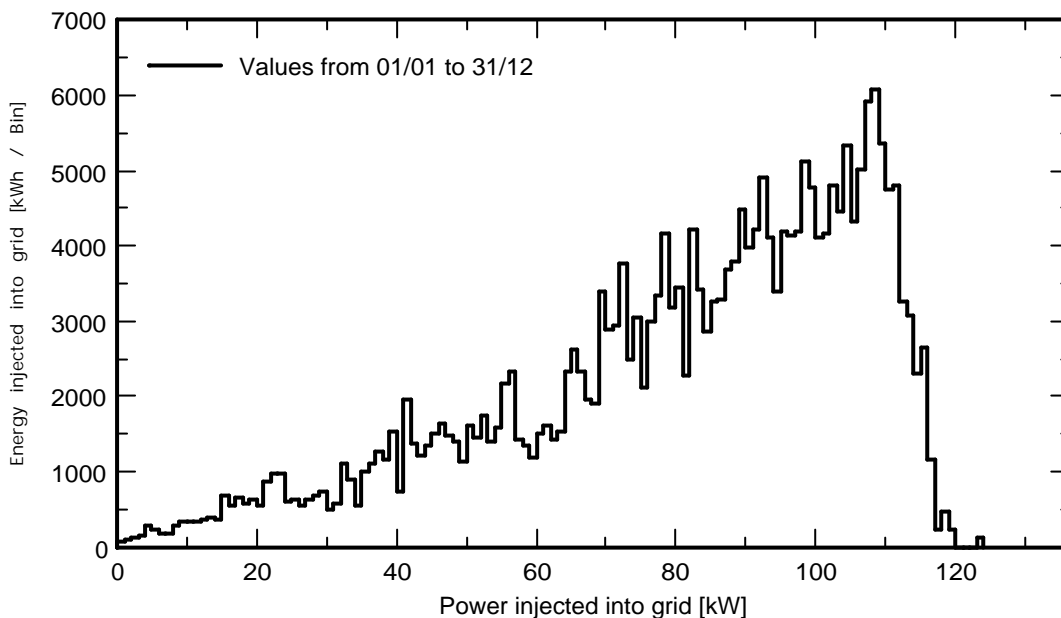
User's needs

Unlimited load (grid)

Daily Input/Output diagram



System Output Power Distribution



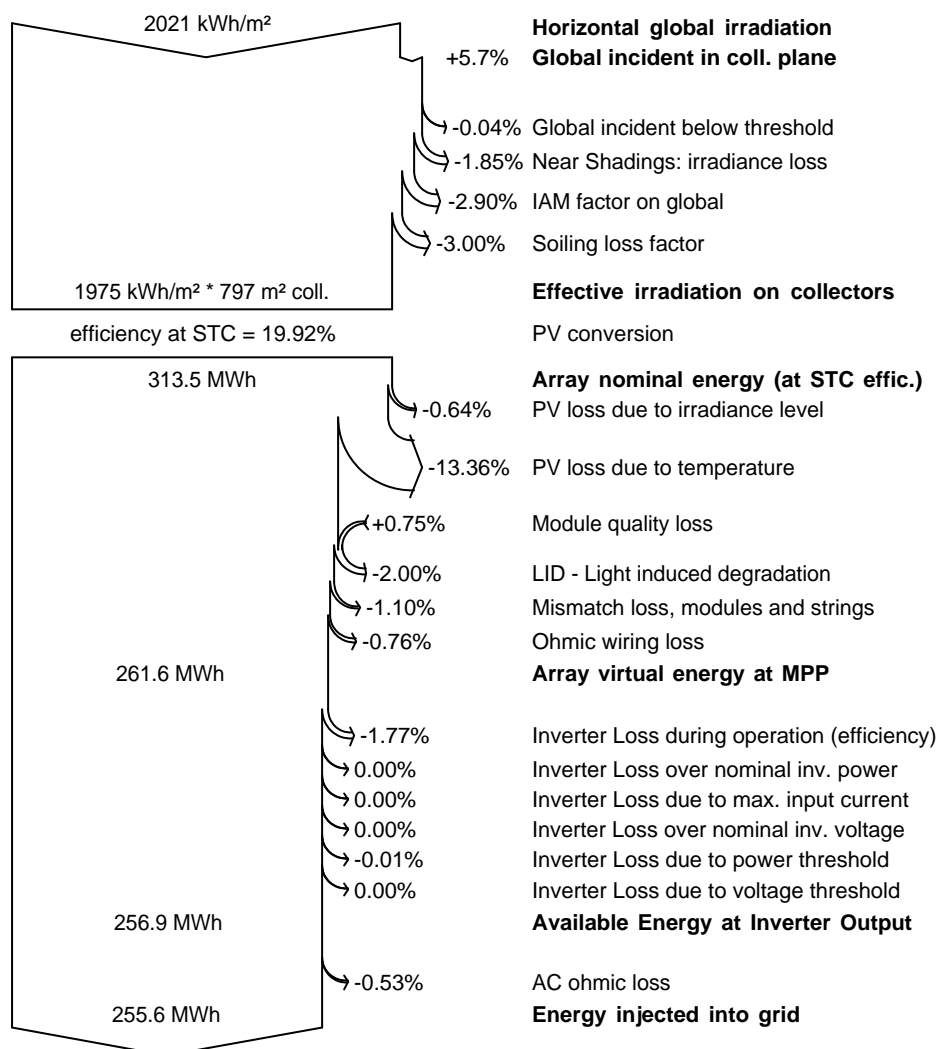
Grid-Connected System: Loss diagram

Project : Rachel poet - Kfar Sava

Simulation variant : Rachel poet - Kfar Sava

Main system parameters	System type	Sheds on a building	
Near Shadings	Linear shadings		
PV Field Orientation	tilt	13°	azimuth 40°
PV modules	Model	JKM 400M-72H	Pnom 400 Wp
PV Array	Nb. of modules	396	Pnom total 158 kWp
Inverter	Model	Sunny Tripower 60-10	Pnom 60.0 kW ac
Inverter	Model	Sunny Tripower 25000TL-30	Pnom 25.00 kW ac
Inverter pack	Nb. of units	3.0	Pnom total 145 kW ac
User's needs	Unlimited load (grid)		

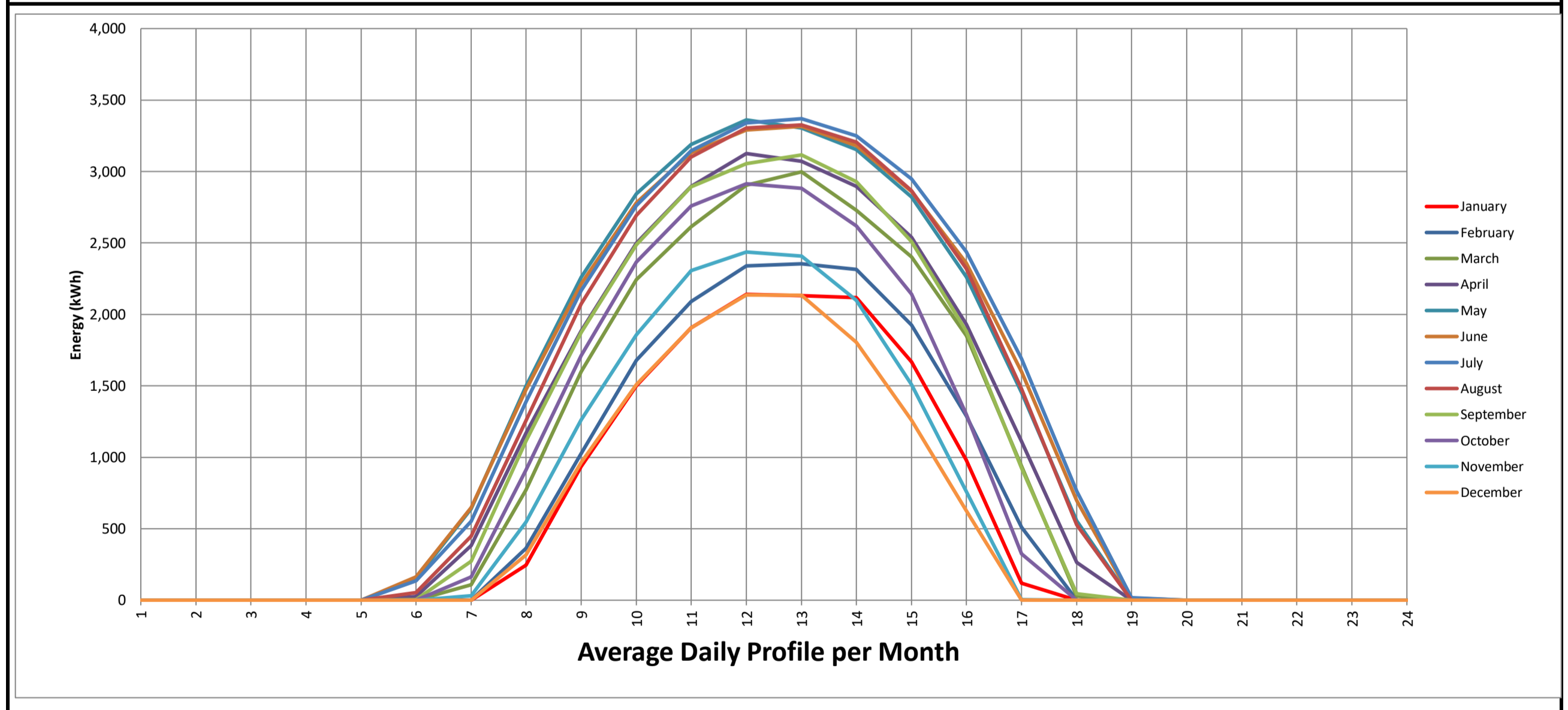
Loss diagram over the whole year



משב ייצור רחל המשוררת - כפר סבא

שנתי - קוט"ש	שנתי ש	תעריף פסגה	ק"צ	חורף	מעבר	תעריף גבע	ק"צ	חורף	מעבר	תעריף שפל	ק"צ	חורף	מעבר	שנתי ש	שנתי - קוט"ש
114,998	114,998	132,876	52.00%	59,794	52.00%	37,789	14.79%	17,005	14.79%	84,886	33.22%	38,199	33.22%	255,551	255,551
12,584	12,584	15,186	11.15%	6,834	11.15%	5,327	3.82%	2,397	3.82%	7,452	6.41%	3,353	6.41%	27,965	255,551
11,995	11,995	13,296	11.15%	5,983	11.15%	4,442	3.82%	1,999	3.82%	8,917	6.41%	4,013	6.41%	26,655	255,551
6,185	6,185	94	0.19%	42	0.19%	194	0.29%	87	0.29%	13,457	16.07%	6,056	16.07%	13,745	255,551
7,153	7,153	400	0.19%	180	0.19%	329	0.29%	148	0.29%	15,168	16.07%	6,825	16.07%	15,896	255,551
5,696	5,696	1	0.19%	1	0.19%	224	0.29%	101	0.29%	12,434	16.07%	5,595	16.07%	12,659	255,551
9,534	9,534	14,179	40.66%	6,381	40.66%	3,377	10.67%	1,519	10.67%	3,631	10.74%	1,634	10.74%	21,187	255,551
10,709	10,709	17,550	40.66%	7,898	40.66%	3,155	10.67%	1,420	10.67%	3,092	10.74%	1,391	10.74%	23,798	255,551
12,372	12,372	17,615	40.66%	7,927	40.66%	5,517	10.67%	2,483	10.67%	4,361	10.74%	1,962	10.74%	27,493	255,551
12,480	12,480	18,460	40.66%	8,307	40.66%	4,840	10.67%	2,178	10.67%	4,434	10.74%	1,995	10.74%	27,734	255,551
10,396	10,396	15,699	40.66%	7,064	40.66%	3,513	10.67%	1,581	10.67%	3,891	10.74%	1,751	10.74%	23,103	255,551
9,042	9,042	10,057	40.66%	4,526	40.66%	4,559	10.67%	2,052	10.67%	5,478	10.74%	2,465	10.74%	20,094	255,551
6,850	6,850	10,338	40.66%	4,652	40.66%	2,313	10.67%	1,041	10.67%	2,571	10.74%	1,157	10.74%	15,222	255,551

Average Daily Profile	MONTH												Hour of day	
	12	11	10	9	8	7	6	5	4	3	2	1		
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.457	0	0	0	3	54	136	163	148	27	0	0	0	0	0
8.903	0	33	164	272	447	553	649	639	382	107	3	0	0	0
30.280	316	546	913	1,114	1,257	1,388	1,474	1,497	1,168	771	363	245	0	0
54.722	964	1,262	1,713	1,873	2,073	2,167	2,212	2,260	1,885	1,601	1,026	936	0	0
74.581	1,508	1,857	2,366	2,487	2,693	2,762	2,782	2,843	2,497	2,244	1,679	1,501	0	0
87.513	1,907	2,308	2,758	2,894	3,102	3,145	3,131	3,190	2,896	2,613	2,091	1,906	0	0
94.095	2,136	2,437	2,914	3,054	3,304	3,339	3,292	3,361	3,126	2,903	2,341	2,140	0	0
94.267	2,135	2,407	2,881	3,116	3,326	3,370	3,316	3,305	3,070	2,998	2,354	2,130	0	0
88.488	1,804	2,099	2,618	2,929	3,207	3,249	3,182	3,154	2,897	2,729	2,314	2,117	0	0
75.219	1,261	1,508	2,143	2,510	2,866	2,947	2,861	2,823	2,539	2,404	1,926	1,669	0	0
54.797	626	761	1,299	1,881	2,321	2,439	2,358	2,263	1,932	1,851	1,289	980	0	0
27.838	1	5	324	926	1,478	1,691	1,600	1,455	1,113	938	511	120	0	0
7.888	0	0	0	44	527	762	698	554	266	28	1	0	0	0
0.091	0	0	0	0	0	17	16	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MWh	255.55													



רחל המשוררת - כפר סבא

סיכום פרופיל שעות משוקלל

PR	Kwh/Kwp/year		תמורה - ש"ח	מחיר חשמל ממוצע ש"ח לקילוואט		תפוקה שנתית - MWh/year	
75.51%	1,613		114,998	0.45		256	
PR	GlobInc	KWh/KWp	הכנסה	MWh	חודש	הנחות יסוד	
80.05%	108.40	86.78	6,185	13.75	ינואר	2	גג בטון צפון דרום
79.70%	125.92	100.36	7,153	15.90	פברואר	13°	זווית כלפי האופק
77.67%	172.20	133.75	9,534	21.19	מרץ	220°	אזימוט מבנה
76.21%	197.13	150.24	10,709	23.80	אפריל	396	פאנלים - JINKO 400
74.65%	232.51	173.57	12,372	27.49	מאי	3	ממירים - SMA
73.65%	237.74	175.09	12,480	27.73	יוני	125	הספק מותקן AC
72.94%	242.05	176.54	12,584	27.96	יולי	158.40	הספק מותקן DC
72.93%	230.75	168.28	11,995	26.65	אוגוסט	126.72%	יחס ביצוע AC/DC
73.69%	197.93	145.85	10,396	23.10	ספטמבר	256	Mwh/year
75.58%	167.85	126.86	9,042	20.09	אוקטובר	1,613	Kwh/Kwp/year
77.75%	123.59	96.10	6,850	15.22	נובמבר	75.51%	PR
79.60%	100.40	79.92	5,696	12.66	דצמבר	0.45	מחיר חשמל ממוצע ש"ח לקילוואט
75.51%	2,136.47	1,613.33	114,998	255.55	סה"כ		