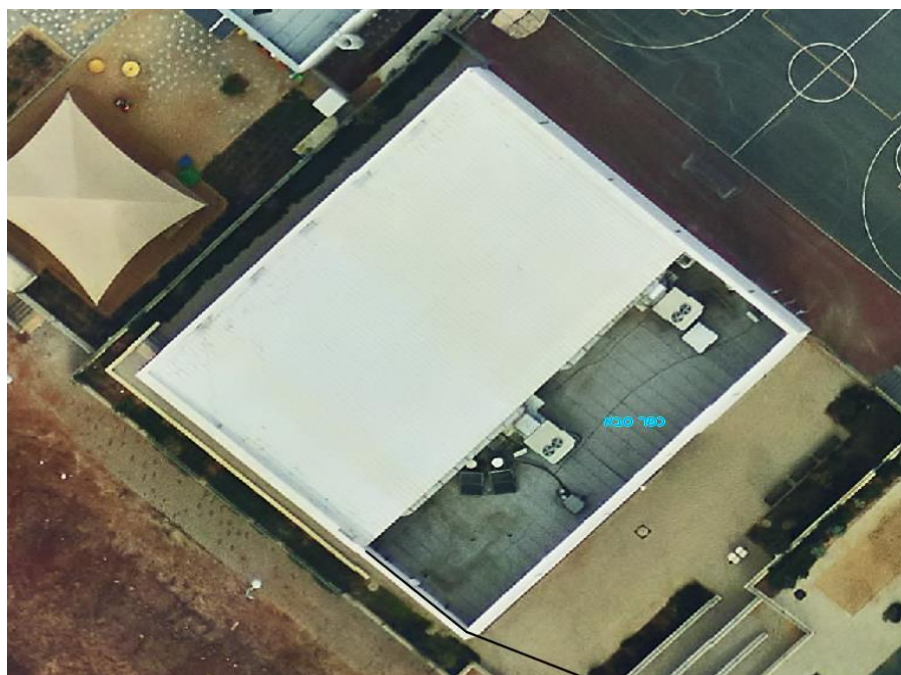


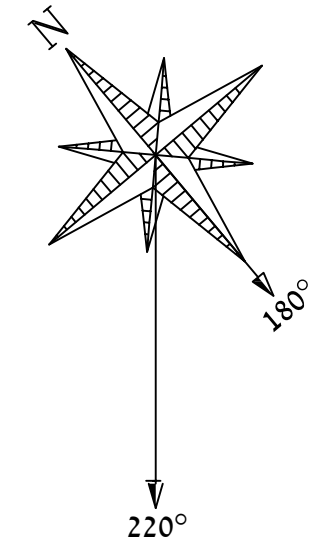
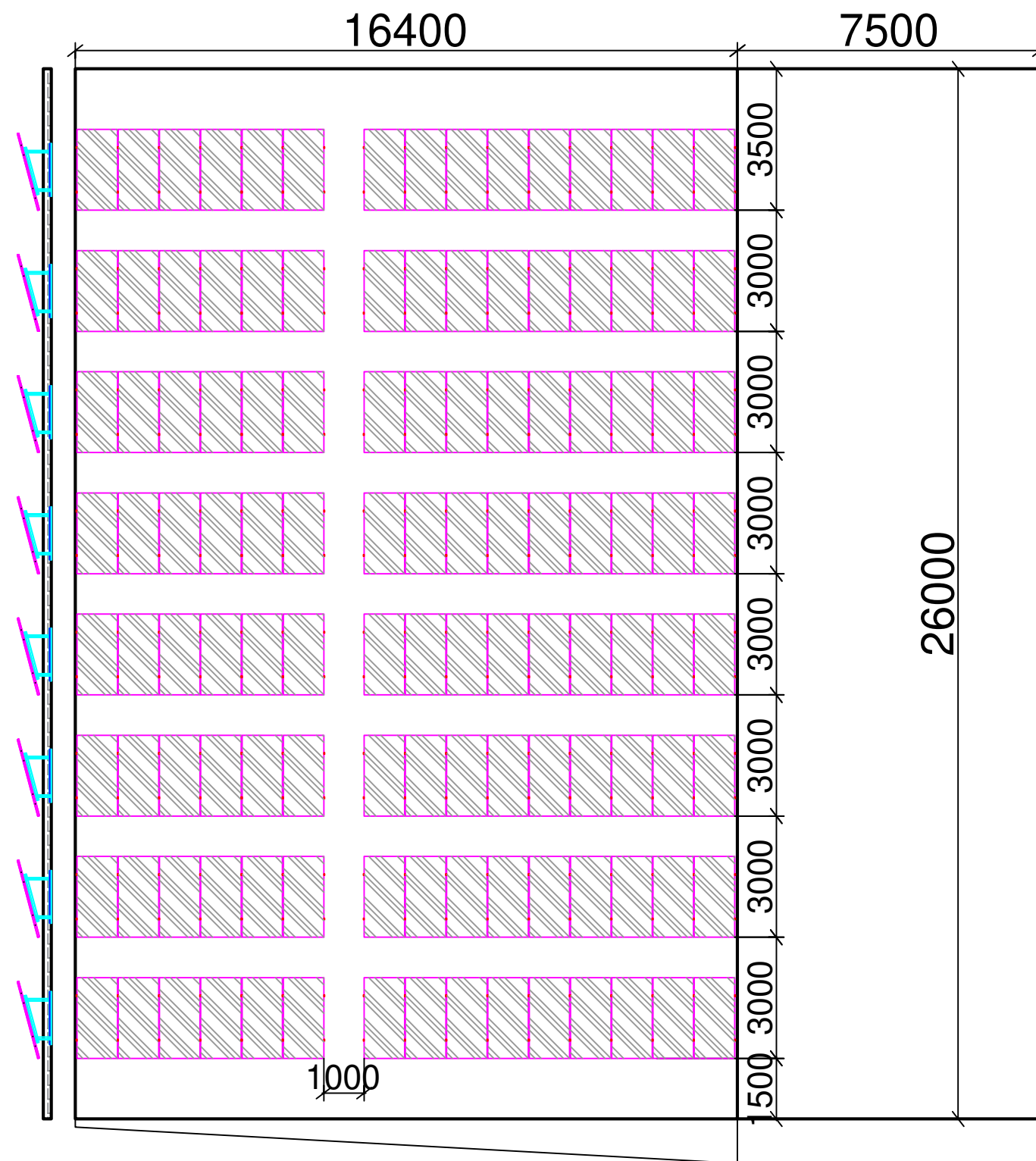
# אולם ספורט רחל המשוררת - כפר סבא

## מערכת סולארית תעריפית – 48 Kw



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

# Rachel poet Gym- Layout Desgin



מיקום לוחות חשמל יוכל להשתנות  
בהתאם לתוואי חיבור ללוח מוזן

יש לבצע כל עבודה  
לפי הנחיות  
ממונה הבטיחות

## אולם ספורט רחל המשוררת - חלוקה לסטרינגים/ממירים

AC/DC Ratio	AC הספק (kW)	הספק כללי AC (KW) :		סוג ממיר (kW)	ממיר	מפנה
		35	48			
137.14%	20	14.4	18	SMA-20-A	1	א סכורית
		14.4	18	SMA-20-B		
128.00%	15	12.8	16	SMA-15-A	2	
		6.4	16	SMA-15-B		
137.14%	35	48				סה"כ כמות פנלים:

תאור	שם תכנית	תאריך	השינוי	גרסה	פרטי פנלים		פרטי ממירים	
					נתונים	פרטים	נתונים	פרטים
מקום ההתקנה: כפר סבא	שם חלקי: רחל המשוררת	RPG-E-D-001		P1	JINKO	כמות: 2	נתונים: SMA	פרטים: יצור
מספר: 1	תאריך: 03/03/2020	תאריך: אריק בר		P2	400w	דגם: 1	נתונים: SMA-20	פרטים: ידגם א
גרסה: P0	חתימה:	תכנון:		P3	120	כמות: 1	נתונים: SMA-15	פרטים: ידגם ב
גודל דף: A3		אישר:		P4	15 deg	הטייה:		פרטים: ידגם ג
				P5	220 deg	אזימוט:		פרטים: ידגם ד
					48 kWp	הספק כולל:	35 kW	פרטים: הספק כולל

## Grid-Connected System: Simulation parameters

**Project :** Rachel poet Gym - Kfar Sava

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

**Simulation variant :** Rachel poet Gym - Kfar Sava

Simulation date 03/03/20 16h30

<b>Simulation parameters</b>	System type	<b>Sheds on ground</b>		
<b>Collector Plane Orientation</b>	Tilt	15°	Azimuth 29°	
<b>Sheds configuration</b>	Nb. of sheds	16	Identical arrays	
	Sheds spacing	3.00 m	Collector width	2.03 m
Shading limit angle	Limit profile angle	27.1°	Ground cov. Ratio (GCR)	67.6 %
<b>Models used</b>	Transposition	Perez	Diffuse	Perez, Meteonorm
<b>Horizon</b>	Free Horizon			
<b>Near Shadings</b>	According to strings		Electrical effect	100 %
<b>User's needs :</b>	Unlimited load (grid)			

**PV Arrays Characteristics (2 kinds of array defined)**

<b>PV module</b>	Si-mono	Model	<b>JKM 400M-72H</b>		
Custom parameters definition		Manufacturer	Jinkosolar		
<b>Sub-array "Sub-array #1"</b>					
Number of PV modules	In series	16 modules	In parallel	3 strings	
Total number of PV modules	Nb. modules	48	Unit Nom. Power	400 Wp	
Array global power	Nominal (STC)	<b>19.20 kWp</b>	At operating cond.	17.46 kWp (50°C)	
Array operating characteristics (50°C)	U mpp	595 V	I mpp	29 A	
<b>Sub-array "Sub-array #2"</b>					
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)	<b>28.80 kWp</b>	At operating cond.	26.18 kWp (50°C)	
Array operating characteristics (50°C)	U mpp	670 V	I mpp	39 A	
<b>Total</b>	Arrays global power	Nominal (STC)	<b>48 kWp</b>	Total	120 modules
		Module area	<b>241 m<sup>2</sup></b>	Cell area	218 m <sup>2</sup>

<b>Sub-array "Sub-array #1" : Inverter</b>	Model	<b>Sunny Tripower 15000TL-10</b>		
Custom parameters definition	Manufacturer	SMA		
Characteristics	Operating Voltage	150-800 V	Unit Nom. Power	15.0 kWac
Inverter pack	Nb. of inverters	1 units	Total Power	15.0 kWac
			Pnom ratio	1.28

<b>Sub-array "Sub-array #2" : Inverter</b>	Model	<b>Sunny Tripower 20000TL-30</b>		
Original PVsyst database	Manufacturer	SMA		
Characteristics	Operating Voltage	320-800 V	Unit Nom. Power	20.0 kWac
Inverter pack	Nb. of inverters	1 units	Total Power	20 kWac
			Pnom ratio	1.44
<b>Total</b>	Nb. of inverters	2	Total Power	35 kWac

**PV Array loss factors**

## Grid-Connected System: Simulation parameters

Array Soiling Losses		Loss Fraction	4.0 %
Thermal Loss factor	Uc (const) 18.0 W/m <sup>2</sup> K	Uv (wind)	0.0 W/m <sup>2</sup> K / m/s
Wiring Ohmic Loss	Array#1 225 mOhm	Loss Fraction	1.0 % at STC
	Array#2 190 mOhm	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
<b>System loss factors</b>			
	Wires: 3x16.0 mm <sup>2</sup> 29 m	Loss Fraction	1.0 % at STC

## Grid-Connected System: Near shading definition

**Project :** Rachel poet Gym - Kfar Sava

**Simulation variant :** Rachel poet Gym - Kfar Sava

**Main system parameters**

System type **Sheds on ground**

**Near Shadings**

PV Field Orientation

PV modules

PV Array

Inverter

Inverter

Inverter pack

User's needs

According to strings

tilt 15°

Model JKM 400M-72H

Nb. of modules 120

Model Sunny Tripower 15000TL-10

Model Sunny Tripower 20000TL-30

Nb. of units 2.0

Unlimited load (grid)

Electrical effect 100 %

azimuth 29°

Pnom 400 Wp

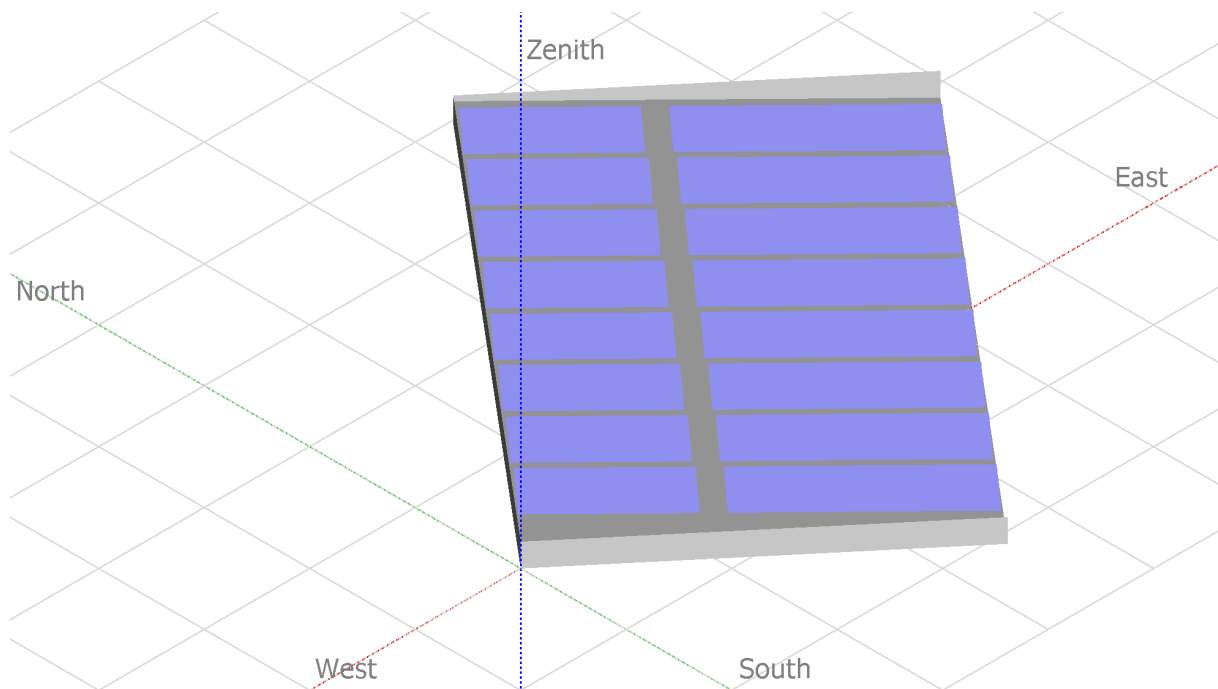
Pnom total **48.0 kWp**

15.00 kW ac

20.00 kW ac

Pnom total **35.0 kW ac**

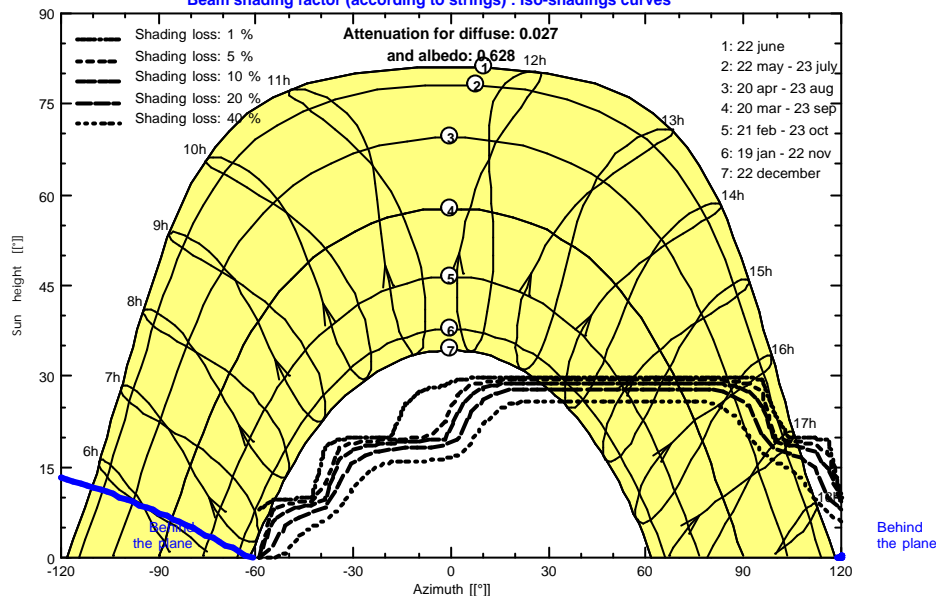
### Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Rachel poet Gym - Kfar Sava

Beam shading factor (according to strings) : Iso-shadings curves



## Grid-Connected System: Main results

**Project :** Rachel poet Gym - Kfar Sava

**Simulation variant :** Rachel poet Gym - Kfar Sava

**Main system parameters**

System type **Sheds on ground**

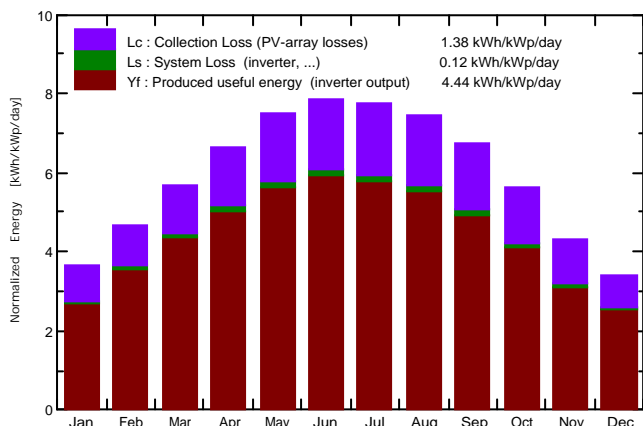
**Near Shadings**

According to strings	Electrical effect	100 %
PV Field Orientation tilt	azimuth	29°
PV modules Model	Pnom	400 Wp
PV Array Nb. of modules	Pnom total	<b>48.0 kWp</b>
Inverter Model		15.00 kW ac
Inverter Model		20.00 kW ac
Inverter pack Nb. of units	Pnom total	<b>35.0 kW ac</b>
User's needs Unlimited load (grid)		

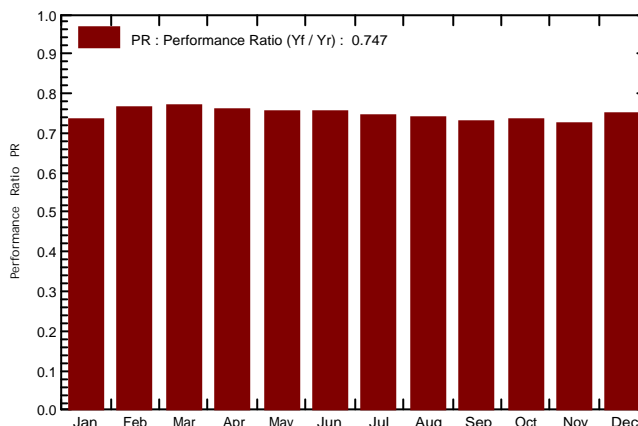
**Main simulation results**

System Production **Produced Energy 77.82 MWh/year** Specific prod. 1621 kWh/kWp/year  
 Performance Ratio PR 74.69 %

**Normalized productions (per installed kWp): Nominal power 48.0 kWp**



**Performance Ratio PR**



### Rachel poet Gym - Kfar Sava Balances and main results

	GlobHor kWh/m <sup>2</sup>	DiffHor kWh/m <sup>2</sup>	T_Amb °C	GlobInc kWh/m <sup>2</sup>	GlobEff kWh/m <sup>2</sup>	EArray MWh	E_Grid MWh	PR
January	92.1	35.95	13.02	113.9	102.7	4.128	4.021	0.735
February	110.8	45.88	13.71	130.6	118.6	4.915	4.788	0.764
March	159.8	54.33	16.34	176.2	162.0	6.683	6.500	0.769
April	190.0	65.86	19.21	199.0	183.3	7.465	7.263	0.760
May	232.8	65.16	22.41	231.8	214.4	8.617	8.385	0.753
June	241.8	59.25	25.15	235.9	218.6	8.767	8.528	0.753
July	244.0	60.77	27.63	240.7	223.0	8.850	8.609	0.745
August	224.7	57.72	27.93	231.7	214.3	8.436	8.209	0.738
September	186.4	45.74	26.06	201.7	186.2	7.276	7.080	0.731
October	149.5	44.60	23.67	173.9	159.0	6.293	6.129	0.734
November	104.9	36.41	18.89	129.5	117.4	4.620	4.501	0.724
December	84.6	36.83	15.08	105.8	95.1	3.906	3.810	0.750
<b>Year</b>	<b>2021.3</b>	<b>608.49</b>	<b>20.80</b>	<b>2170.7</b>	<b>1994.7</b>	<b>79.957</b>	<b>77.823</b>	<b>0.747</b>

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 Gym - Kfar Sava

**Simulation variant :** Rachel poet Gym - Kfar Sava

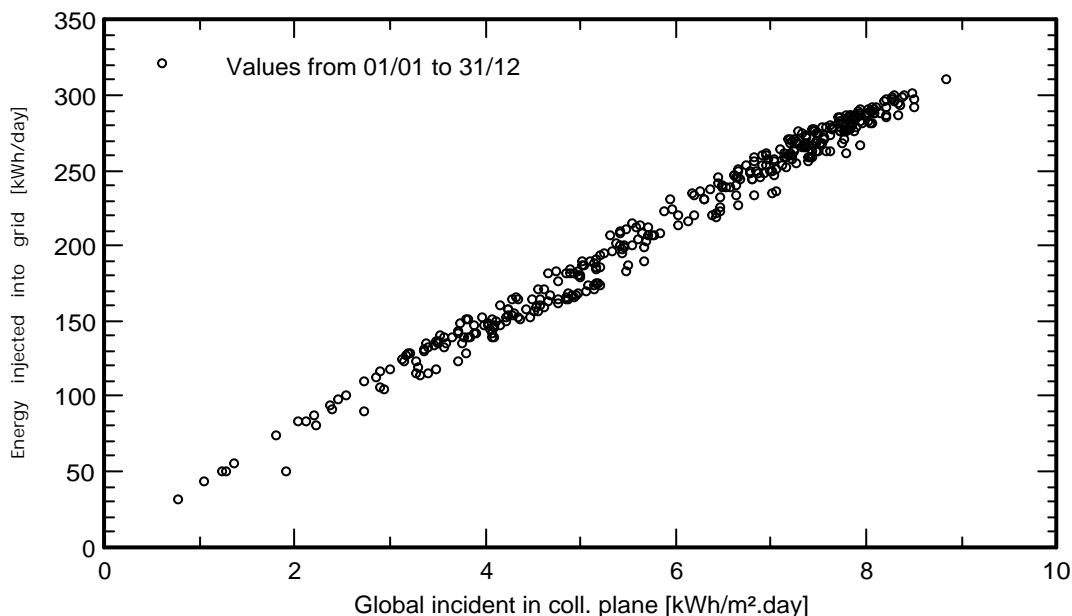
**Main system parameters**

System type **Sheds on ground**

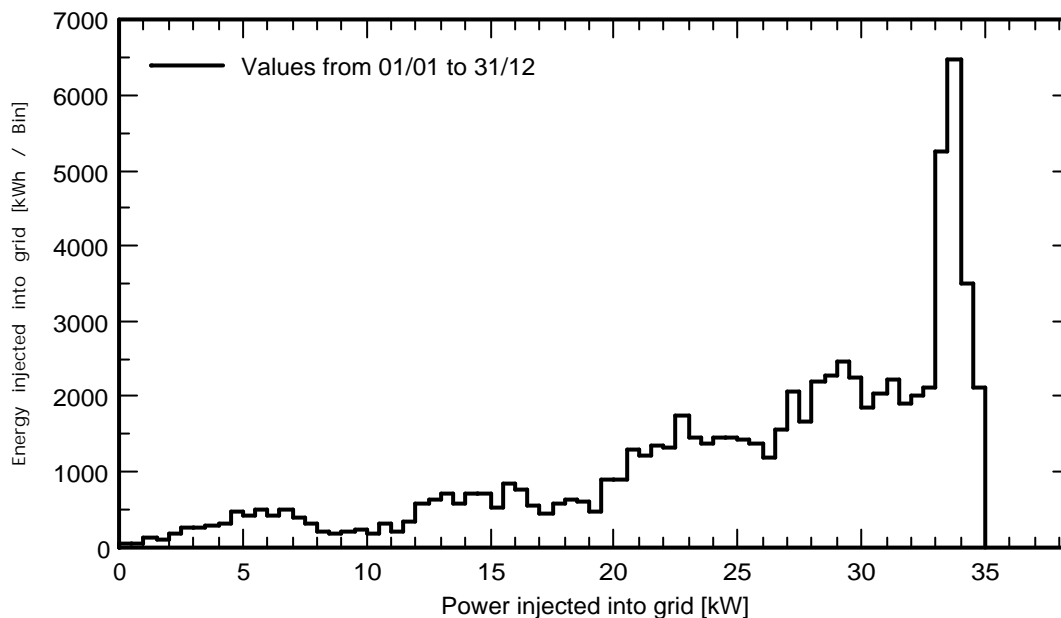
**Near Shadings**

According to strings	Electrical effect	100 %
tilt 15°	azimuth	29°
Model JKM 400M-72H	Pnom	400 Wp
Nb. of modules 120	Pnom total	<b>48.0 kWp</b>
Model Sunny Tripower 15000TL-10		15.00 kW ac
Model Sunny Tripower 20000TL-30		20.00 kW ac
Nb. of units 2.0	Pnom total	<b>35.0 kW ac</b>
Unlimited load (grid)		

### Daily Input/Output diagram



### System Output Power Distribution



## Grid-Connected System: Loss diagram

**Project :** Rachel poet Gym - Kfar Sava

**Simulation variant :** Rachel poet Gym - Kfar Sava

**Main system parameters**

System type **Sheds on ground**

**Near Shadings**

PV Field Orientation

PV modules

PV Array

Inverter

Inverter

Inverter pack

User's needs

According to strings

tilt 15°

Model JKM 400M-72H

Nb. of modules 120

Model Sunny Tripower 15000TL-10

Model Sunny Tripower 20000TL-30

Nb. of units 2.0

Unlimited load (grid)

Electrical effect 100 %

azimuth 29°

Pnom 400 Wp

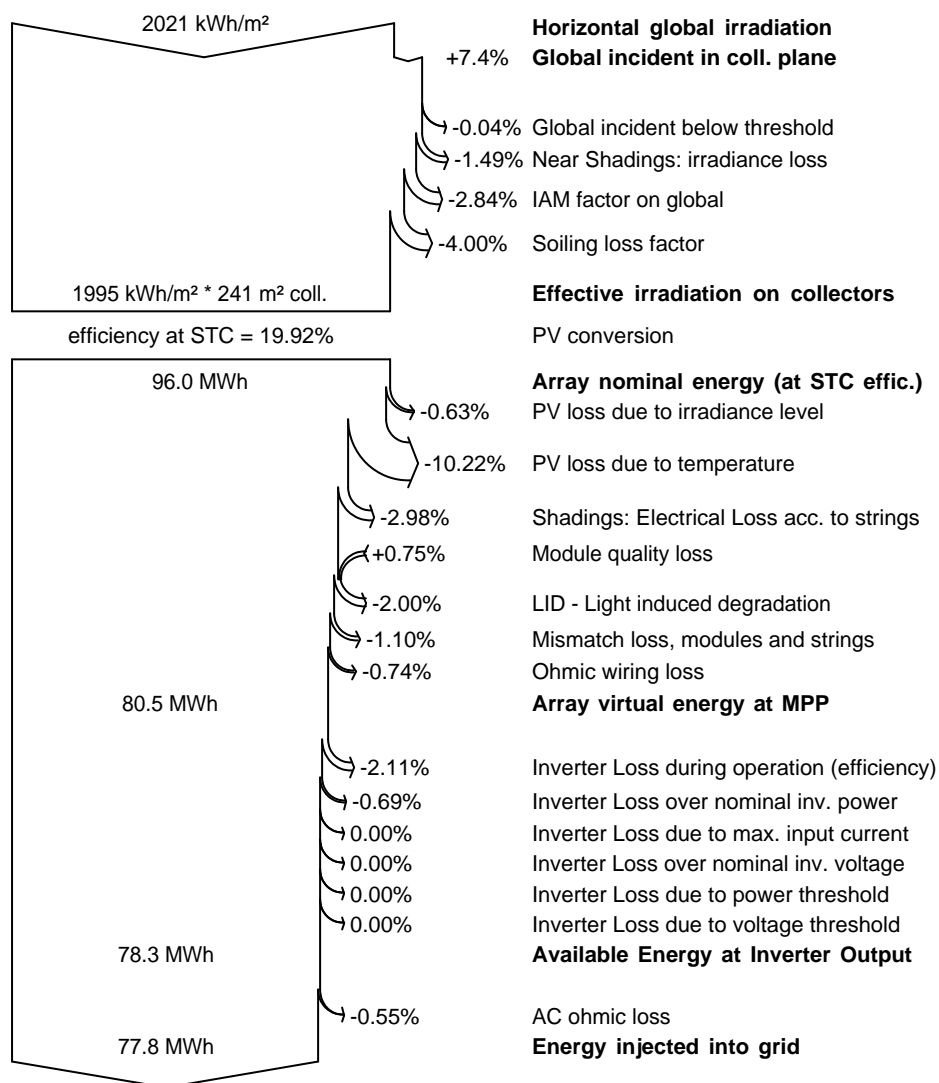
Pnom total **48.0 kWp**

15.00 kW ac

20.00 kW ac

Pnom total **35.0 kW ac**

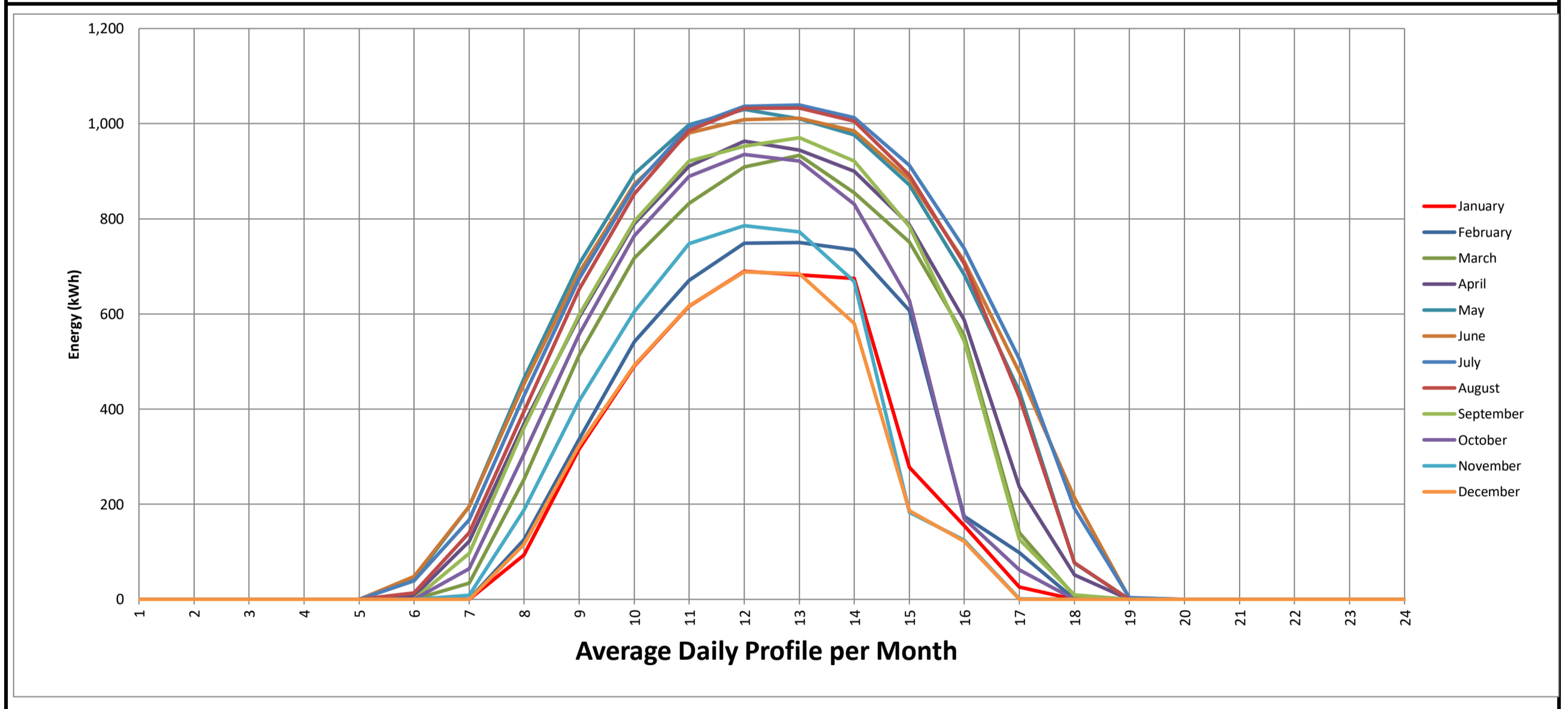
### Loss diagram over the whole year



## משב ייצור אולם ספורט רחל המשוררת - כפר סבא

שנתי - קוט"ש	שנתי ש	תעריף פסגה	ק"צ 45	חורף 45	מעבר 45	תעריף גבע	ק"צ 45	חורף 45	מעבר 45	תעריף שפל	ק"צ 45	חורף 45	מעבר 45	שנתי ש	שנתי - קוט"ש
77,823	35,020	קוט"ש	אחוז	ש	אחוז	קוט"ש	אחוז	ש	אחוז	קוט"ש	אחוז	ש	אחוז	77,823	סה"כ
4,687	1,858	11.33%	1,035	6.48%	2,300	3.81%	730	3.81%	1,622	11.33%	2,109	11.33%	4,687	ק"צ	
4,129	1,858	11.33%	1,233	6.48%	2,741	3.81%	603	3.81%	1,339	11.33%	1,858	11.33%	4,129	ק"צ	
20	9	0.12%	1,768	15.76%	3,929	0.33%	32	0.33%	72	0.12%	9	0.12%	20	חורף	
75	34	0.12%	2,073	15.76%	4,607	0.33%	48	0.33%	107	0.12%	34	0.12%	75	חורף	
0	0	0.00%	1,678	15.76%	3,730	0.33%	36	0.33%	80	0.12%	0	0.00%	0	חורף	
4,344	1,955	40.71%	502	10.81%	1,116	10.65%	468	10.65%	1,039	40.71%	1,955	40.71%	4,344	מעבר	
5,357	2,411	40.71%	428	10.81%	952	10.65%	429	10.65%	954	40.71%	2,411	40.71%	5,357	מעבר	
5,374	2,418	40.71%	606	10.81%	1,347	10.65%	749	10.65%	1,664	40.71%	2,418	40.71%	5,374	מעבר	
5,682	2,557	40.71%	614	10.81%	1,364	10.65%	667	10.65%	1,481	40.71%	2,557	40.71%	5,682	מעבר	
4,828	2,173	40.71%	534	10.81%	1,186	10.65%	479	10.65%	1,065	40.71%	2,173	40.71%	4,828	מעבר	
3,055	1,375	40.71%	757	10.81%	1,681	10.65%	627	10.65%	1,393	40.71%	1,375	40.71%	3,055	מעבר	
3,039	1,367	40.71%	346	10.81%	769	10.65%	312	10.65%	693	40.71%	1,367	40.71%	3,039	מעבר	
40,590	18,265	52.16%	11,575	33.05%	25,722	14.79%	5,180	14.79%	11,511	52.16%	18,265	52.16%	40,590	סה"כ	

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
0.415	0	0	0	1	14	39	48	43	7	0	0	0	0	0
2.807	0	8	64	97	140	167	195	196	122	34	1	0	0	0
9.724	115	188	305	361	395	428	453	464	369	252	126	93	0	0
17.464	324	418	557	598	652	674	687	705	593	514	336	316	0	0
23.792	493	605	765	795	853	868	873	895	789	717	542	491	0	0
27.847	617	748	889	922	985	994	980	998	911	833	671	616	0	0
29.534	688	786	935	952	1,032	1,037	1,009	1,030	963	909	749	690	0	0
29.457	685	772	921	971	1,033	1,039	1,011	1,010	945	933	750	682	0	0
27.791	580	668	831	921	1,006	1,013	984	977	900	855	735	675	0	0
21.271	187	183	629	784	892	913	883	872	788	751	607	277	0	0
14.434	122	125	170	543	706	738	711	683	588	555	174	155	0	0
6.947	0	1	62	126	425	505	477	438	237	140	98	26	0	0
1.712	0	0	0	10	77	191	214	76	51	7	0	0	0	0
0.018	0	0	0	0	0	3	3	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
0.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>MWh</b>	<b>77.82</b>													



# אולם ספורט 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	
74.69%	1,621		35,020	0.45		78	
PR	GlobInc	KWh/KWp	הכנסה	MWh	חודש	הנחות יסוד	
73.53%	113.93	83.77	1,809	4.02	ינואר	1	גג אסכורית
76.41%	130.56	99.76	2,155	4.79	פברואר	15°	זווית כלפי האופק
76.85%	176.20	135.42	2,925	6.50	מרץ	220°	אזימוט מבנה
76.05%	198.97	151.31	3,268	7.26	אפריל	120	פאנלים - JINKO 400
75.35%	231.84	174.68	3,773	8.38	מאי	2	ממירים - SMA
75.32%	235.90	177.67	3,838	8.53	יוני	35	הספק מותקן AC
74.51%	240.72	179.36	3,874	8.61	יולי	48.00	הספק מותקן DC
73.81%	231.69	171.01	3,694	8.21	אוגוסט	137.14%	יחס ביצוע AC/DC
73.12%	201.71	147.49	3,186	7.08	ספטמבר	78	Mwh/year
73.42%	173.90	127.68	2,758	6.13	אוקטובר	1,621	Kwh/Kwp/year
72.41%	129.50	93.77	2,025	4.50	נובמבר	74.69%	PR
75.03%	105.80	79.38	1,715	3.81	דצמבר	0.45	מחיר חשמל ממוצע ש"ח לקילוואט
74.69%	2,170.71	1,621.32	35,020	77.82	סה"כ		