

# בית ספיר - כפר סבא

## מערכת סולארית תעריפית – 216 Kw



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



## Grid-Connected System: Simulation parameters

**Project :** **Beit Sapir - Kfar Sava**

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

**Simulation variant :** **Beit Sapir - Kfar Sava**

Simulation date 03/03/20 18h16

<b>Simulation parameters</b>	System type	<b>Sheds on a building</b>	
<b>Collector Plane Orientation</b>	Tilt	15°	Azimuth 15°
<b>Sheds configuration</b>	Nb. of sheds	25	
	Sheds spacing	4.50 m	Collector width 3.21 m
Shading limit angle	Limit profile angle	30.8°	Ground cov. Ratio (GCR) 71.4 %
<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)		
<b>Grid power limitation</b>	Active Power	150 kW	Pnom ratio 1.440

### PV Array Characteristics

<b>PV module</b>	Si-mono	Model	<b>JKM 400M-72H</b>	
Custom parameters definition		Manufacturer	Jinkosolar	
Number of PV modules		In series	18 modules	In parallel 30 strings
Total number of PV modules		Nb. modules	540	Unit Nom. Power 400 Wp
Array global power		Nominal (STC)	<b>216 kWp</b>	At operating cond. 196 kWp (50°C)
Array operating characteristics (50°C)		U mpp	670 V	I mpp 293 A
Total area		Module area	<b>1086 m<sup>2</sup></b>	Cell area 980 m <sup>2</sup>

<b>Inverter</b>	Model	<b>Sunny Tripower 60-10</b>		
Original PVSyst database	Manufacturer	SMA		
Characteristics	Operating Voltage	570-800 V	Unit Nom. Power	60.0 kWac
Inverter pack	Nb. of inverters	3 units	Total Power	180 kWac
			Pnom ratio	1.20

### PV Array loss factors

Array Soiling Losses		Loss Fraction	3.0 %
Thermal Loss factor	Uc (const)	15.0 W/m <sup>2</sup> K	Uv (wind) 0.0 W/m <sup>2</sup> K / m/s
Wiring Ohmic Loss	Global array res.	25 mOhm	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

Wiring Ohmic Loss	Wires: 3x185.0 mm <sup>2</sup>	75 m	Loss Fraction 1.0 % at STC
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## Grid-Connected System: Near shading definition

**Project :** Beit Sapir - Kfar Sava

**Simulation variant :** Beit Sapir - Kfar Sava

**Main system parameters**

System type **Sheds on a building**

**Near Shadings**

PV Field Orientation

PV modules

PV Array

Inverter

Inverter pack

User's needs

According to strings

tilt 15°

Model JKM 400M-72H

Nb. of modules 540

Model Sunny Tripower 60-10

Nb. of units 3.0

Unlimited load (grid)

Electrical effect 100 %

azimuth 15°

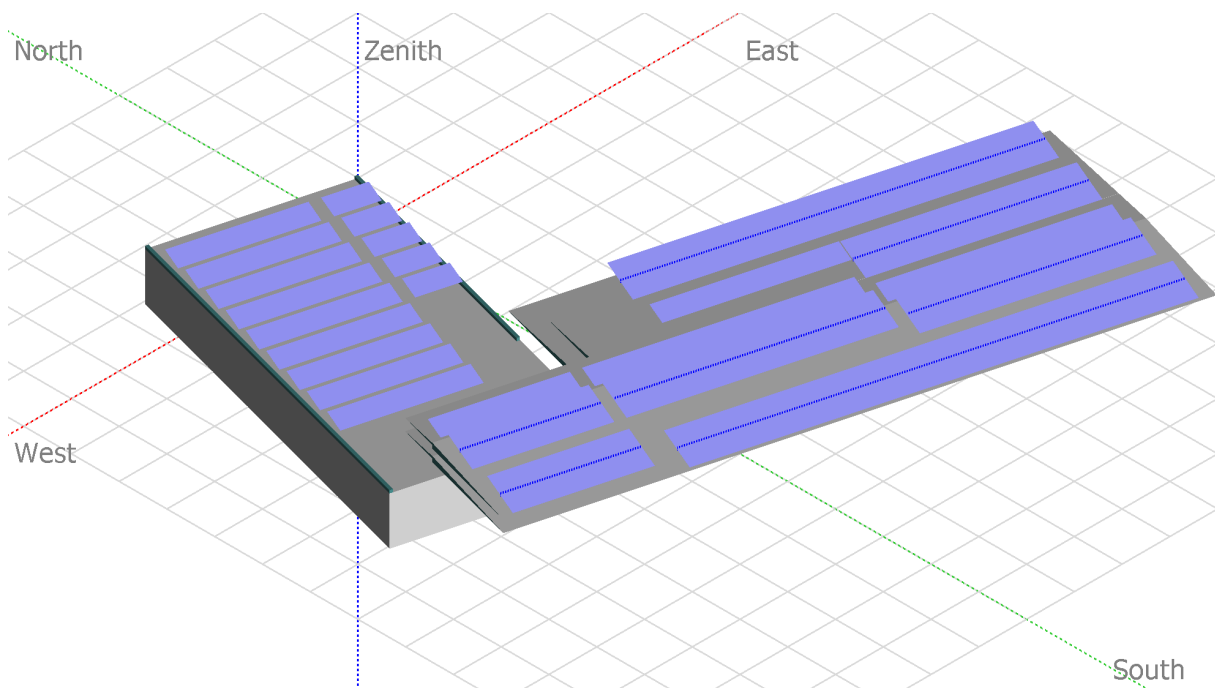
Pnom 400 Wp

Pnom total **216 kWp**

Pnom 60.0 kW ac

Pnom total **180 kW ac**

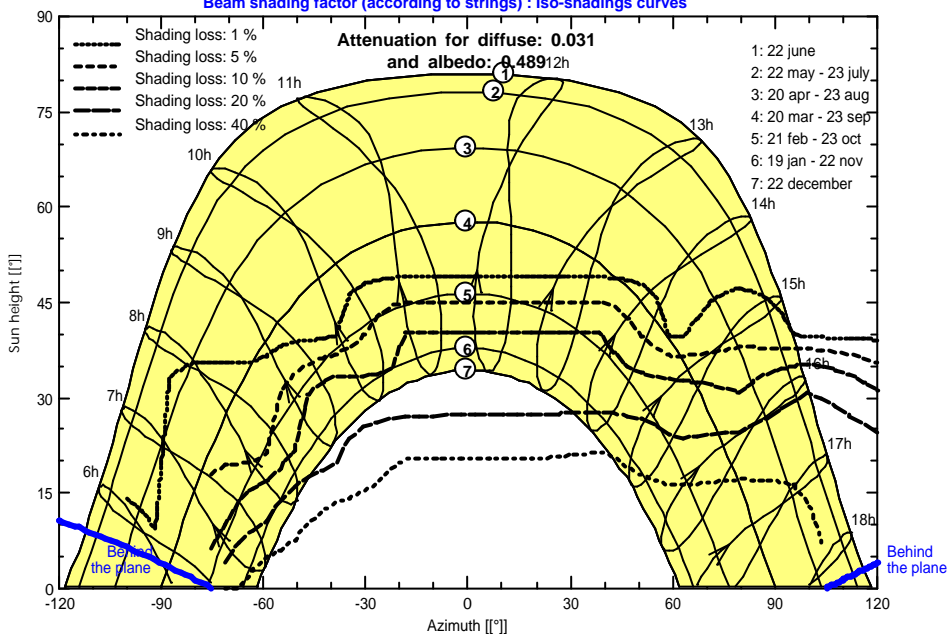
### Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

Beit Sapir - Kfar Sava

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



## Grid-Connected System: Main results

**Project :** Beit Sapir - Kfar Sava

**Simulation variant :** Beit Sapir - Kfar Sava

**Main system parameters**

System type **Sheds on a building**

**Near Shadings**

According to strings

Electrical effect 100 %

PV Field Orientation

tilt 15°

azimuth 15°

PV modules

Model JKM 400M-72H

Pnom 400 Wp

PV Array

Nb. of modules 540

Pnom total **216 kWp**

Inverter

Model Sunny Tripower 60-10

Pnom 60.0 kW ac

Inverter pack

Nb. of units 3.0

Pnom total **180 kW ac**

User's needs

Unlimited load (grid)

**Main simulation results**

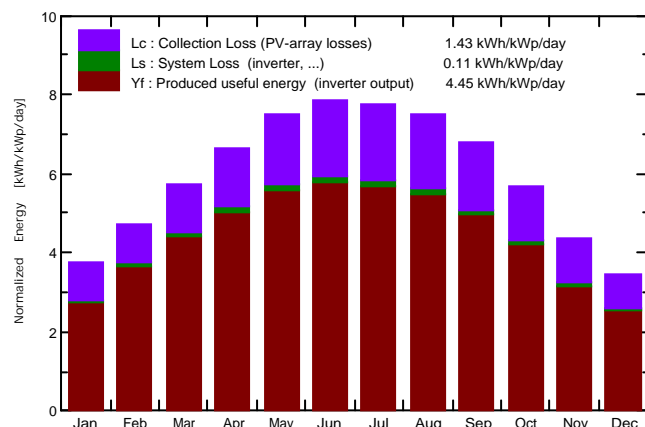
System Production

**Produced Energy 350.8 MWh/year**

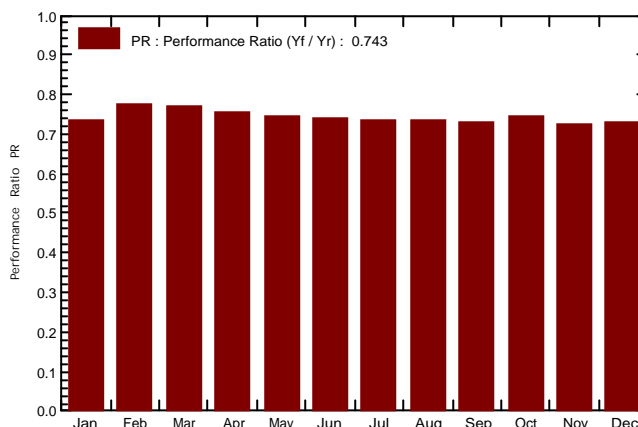
Specific prod. 1624 kWh/kWp/year

Performance Ratio PR 74.29 %

Normalized productions (per installed kWp): Nominal power 216 kWp



Performance Ratio PR



### Beit Sapir - 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	116.2	105.2	18.90	18.47	0.736
February	110.8	45.88	13.71	132.2	121.5	22.64	22.11	0.775
March	159.8	54.33	16.34	178.1	165.8	30.28	29.54	0.768
April	190.0	65.86	19.21	200.0	186.3	33.50	32.69	0.757
May	232.8	65.16	22.41	231.8	216.4	38.33	37.41	0.747
June	241.8	59.25	25.15	235.5	220.1	38.44	37.53	0.738
July	244.0	60.77	27.63	240.5	224.9	39.05	38.13	0.734
August	224.7	57.72	27.93	232.2	217.2	37.62	36.75	0.733
September	186.4	45.74	26.06	203.7	190.5	32.99	32.21	0.732
October	149.5	44.60	23.67	176.5	163.6	29.04	28.37	0.744
November	104.9	36.41	18.89	131.6	120.2	21.08	20.61	0.725
December	84.6	36.83	15.08	108.0	97.1	17.34	16.96	0.727
Year	2021.3	608.49	20.80	2186.2	2028.7	359.21	350.79	0.743

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 :** Beit Sapir - Kfar Sava

**Simulation variant :** Beit Sapir - Kfar Sava

**Main system parameters**

System type **Sheds on a building**

**Near Shadings**

According to strings

Electrical effect 100 %

PV Field Orientation

tilt 15°

azimuth 15°

PV modules

Model JKM 400M-72H

Pnom 400 Wp

PV Array

Nb. of modules 540

Pnom total **216 kWp**

Inverter

Model Sunny Tripower 60-10

Pnom 60.0 kW ac

Inverter pack

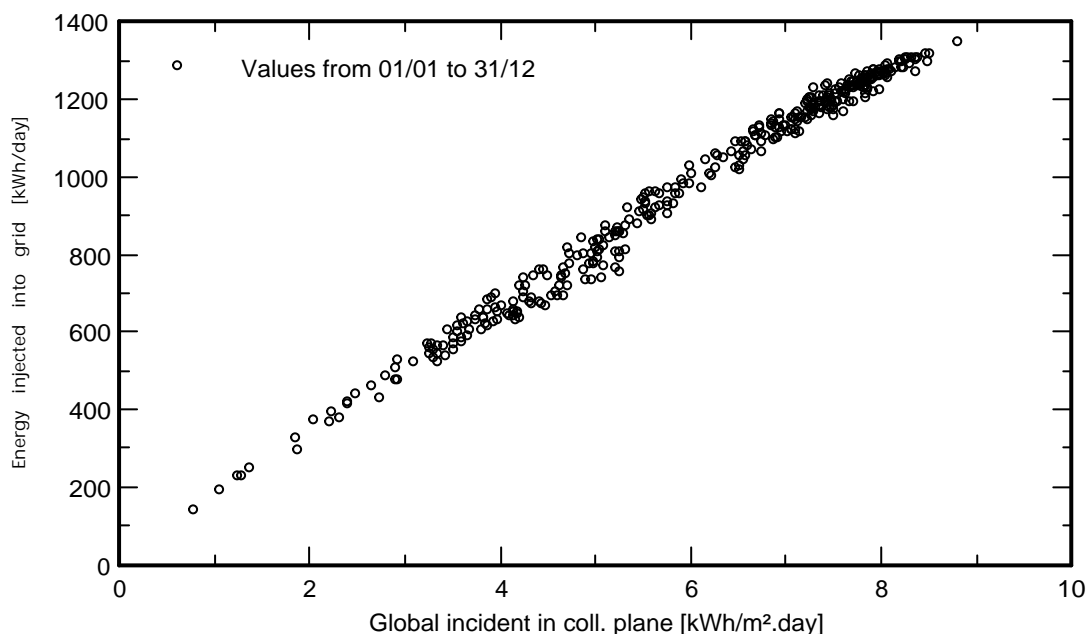
Nb. of units 3.0

Pnom total **180 kW ac**

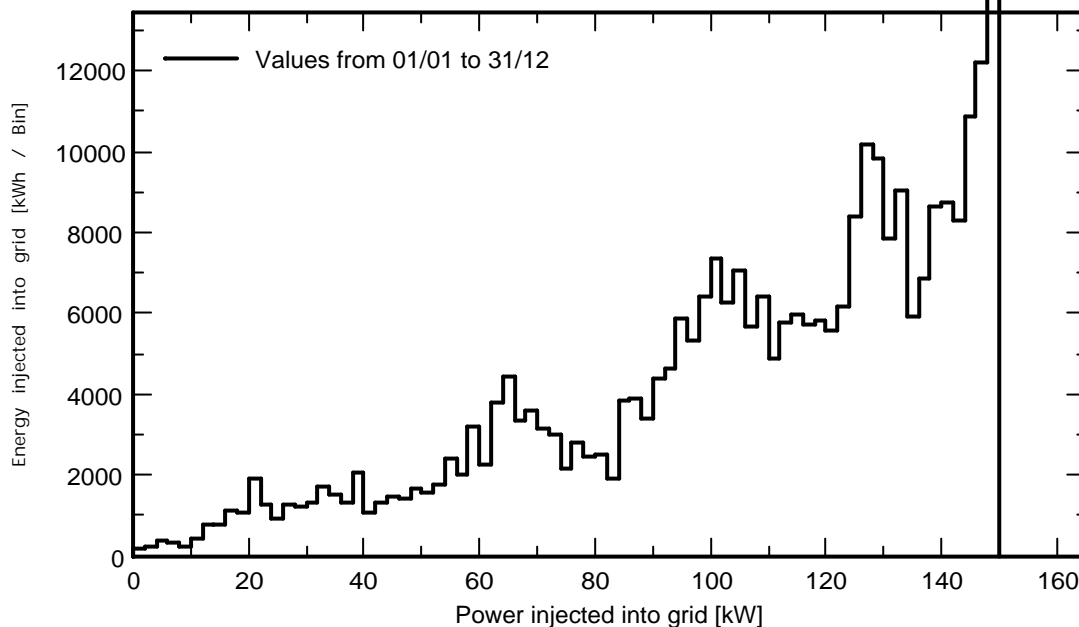
User's needs

Unlimited load (grid)

### Daily Input/Output diagram



### System Output Power Distribution



## Grid-Connected System: Loss diagram

**Project :** Beit Sapir - Kfar Sava

**Simulation variant :** Beit Sapir - Kfar Sava

**Main system parameters**

System type **Sheds on a building**

**Near Shadings**

PV Field Orientation

PV modules

PV Array

Inverter

Inverter pack

User's needs

According to strings

tilt 15°

Model JKM 400M-72H

Nb. of modules 540

Model Sunny Tripower 60-10

Nb. of units 3.0

Unlimited load (grid)

Electrical effect 100 %

azimuth 15°

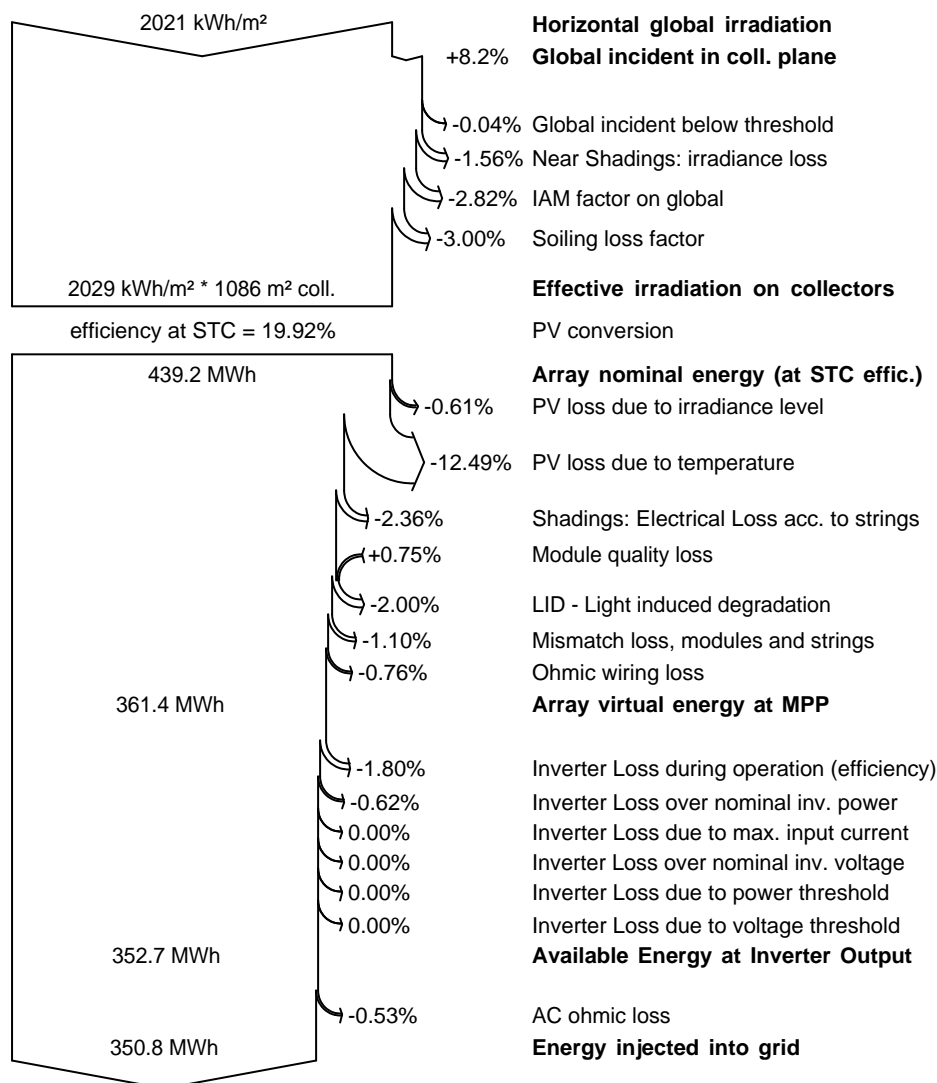
Pnom 400 Wp

Pnom total **216 kWp**

Pnom 60.0 kW ac

Pnom total **180 kW ac**

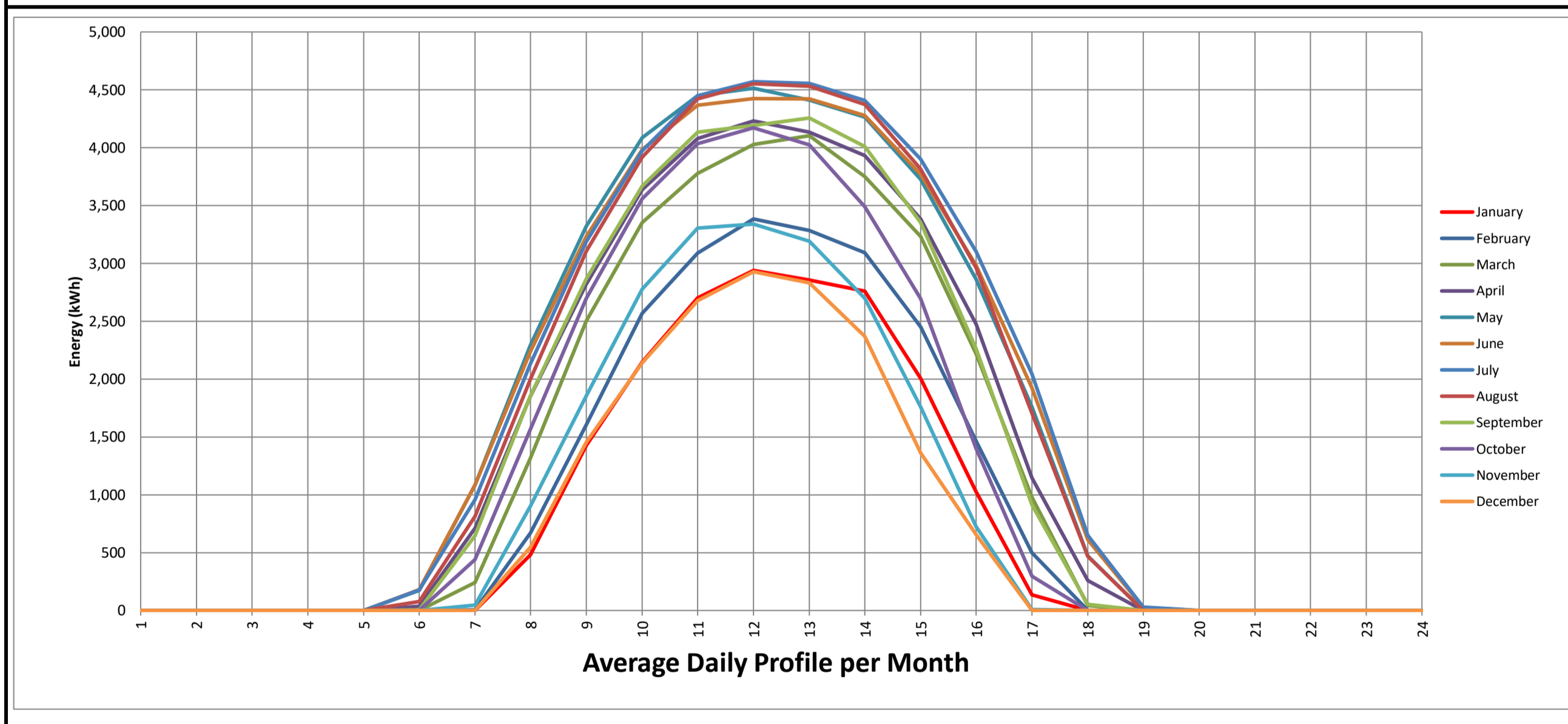
### Loss diagram over the whole year



## משב ייצור בית ספיר - כפר סבא

שנתי - קוט"ש	שנתי ₪	תעריף פסגה	ק"צ 45	חורף 45	מעבר 45	תעריף גבע			תעריף שפל			קוט"ש	חודשי - קוט"ש	שנתי - ש"ח
						קוט"ש	חורף 45	מעבר 45	קוט"ש	חורף 45	מעבר 45			
350,795	157,858	קוט"ש	אחוז	₪	אחוז	קוט"ש	אחוז	₪	אחוז	קוט"ש	אחוז	₪	קוט"ש	ש"ח
20,293	9,132	20,293	6.50%	4,658	6.50%	10,352	3.97%	3,370	3.97%	7,488	10.88%	9,132	38,133	17,160
17,873	8,043	17,873	15.89%	5,596	15.89%	12,436	0.38%	2,897	0.38%	6,437	10.88%	8,043	36,746	16,536
105	47	105	10.86%	8,098	10.86%	17,995	10.65%	169	10.65%	376	40.74%	47	18,475	8,314
387	174	387	10.86%	9,524	10.86%	21,165	10.65%	252	10.65%	561	40.74%	174	22,112	9,951
2	1	2	10.86%	7,461	10.86%	16,581	10.65%	171	10.65%	379	40.74%	1	16,962	7,633
19,760	8,892	19,760	10.86%	2,280	10.86%	5,067	10.65%	2,121	10.65%	4,713	40.74%	8,892	29,541	13,293
24,115	10,852	24,115	10.86%	1,926	10.86%	4,281	10.65%	1,934	10.65%	4,297	40.74%	10,852	32,693	14,712
24,007	10,803	24,007	10.86%	2,692	10.86%	5,982	10.65%	3,341	10.65%	7,425	40.74%	10,803	37,415	16,837
25,030	11,263	25,030	10.86%	2,714	10.86%	6,031	10.65%	2,910	10.65%	6,466	40.74%	11,263	37,526	16,887
21,861	9,837	21,861	10.86%	2,454	10.86%	5,453	10.65%	2,204	10.65%	4,899	40.74%	9,837	32,212	14,495
14,214	6,396	14,214	10.86%	3,487	10.86%	7,748	10.65%	2,885	10.65%	6,412	40.74%	6,396	28,374	12,768
13,935	6,271	13,935	10.86%	1,589	10.86%	3,532	10.65%	1,412	10.65%	3,139	40.74%	6,271	20,606	9,273
181,582	81,712	181,582	33.24%	52,480	33.24%	116,622	14.99%	23,666	14.99%	52,591	51.76%	81,712	350,795	157,858

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
1.770	0	0	0	5	75	177	178	172	37	0	0	0	0	0
16.524	0	46	442	646	814	957	1,086	1,085	712	241	4	0	0	0
48.924	546	904	1,568	1,857	1,999	2,134	2,238	2,293	1,851	1,316	668	482	0	0
82.404	1,453	1,854	2,697	2,865	3,107	3,189	3,233	3,320	2,822	2,502	1,606	1,427	0	0
109.055	2,140	2,778	3,557	3,667	3,919	3,974	3,984	4,087	3,635	3,351	2,567	2,146	0	0
124.605	2,678	3,305	4,034	4,134	4,421	4,449	4,367	4,447	4,079	3,777	3,089	2,701	0	0
129.509	2,927	3,340	4,172	4,191	4,553	4,570	4,424	4,514	4,231	4,027	3,384	2,939	0	0
127.677	2,831	3,192	4,023	4,256	4,532	4,557	4,423	4,413	4,132	4,103	3,286	2,855	0	0
118.963	2,368	2,698	3,491	4,011	4,374	4,406	4,279	4,265	3,930	3,749	3,092	2,758	0	0
97.121	1,362	1,758	2,693	3,352	3,813	3,900	3,770	3,726	3,383	3,233	2,453	2,006	0	0
66.122	655	724	1,399	2,264	2,963	3,101	2,981	2,861	2,476	2,219	1,466	1,025	0	0
31.260	2	7	298	912	1,706	2,043	1,923	1,760	1,146	980	498	134	0	0
6.998	0	0	0	51	469	648	613	473	258	41	1	0	0	0
0.150	0	0	0	0	0	28	27	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>350.79</b>													



# בית ספיר - כפר סבא

# סיכום פרופיל שעות משוקלל

PR	Kwh/Kwp/year		תמורה - ש"ח	מחיר חשמל ממוצע ש"ח לקילוואט		תפוקה שנתית - MWh/year	
74.29%	1,624		157,858	0.45		351	
PR	GlobInc	KWh/KWp	הכנסה	MWh	חודש	הנחות יסוד	
73.63%	116.17	85.53	8,314	18.47	ינואר	2	גג בטון צפון דרום + אסכורית
77.45%	132.17	102.37	9,951	22.11	פברואר	15°	זווית כלפי האופק
76.78%	178.11	136.76	13,293	29.54	מרץ	195°	אזימוט מבנה
75.68%	199.99	151.36	14,712	32.69	אפריל	540	פאנלים - JINKO 400
74.73%	231.79	173.22	16,837	37.41	מאי	3	ממירים - SMA
73.77%	235.51	173.73	16,887	37.53	יוני	150	הספק מותקן AC
73.40%	240.51	176.54	17,160	38.13	יולי	216.00	הספק מותקן DC
73.27%	232.18	170.12	16,536	36.75	אוגוסט	144.00%	יחס ביצוע AC/DC
73.20%	203.74	149.13	14,495	32.21	ספטמבר	351	Mwh/year
74.44%	176.48	131.36	12,768	28.37	אוקטובר	1,624	Kwh/Kwp/year
72.50%	131.58	95.40	9,273	20.61	נובמבר	74.29%	PR
72.75%	107.95	78.53	7,633	16.96	דצמבר	0.45	מחיר חשמל ממוצע ש"ח לקילוואט
74.29%	2,186.18	1,624.05	157,858	350.79	סה"כ		