

רמת גן – בית ספר הבילויים

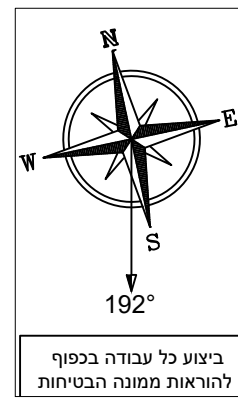
מערכת סולארית מתח נמוך – 120.42Kw



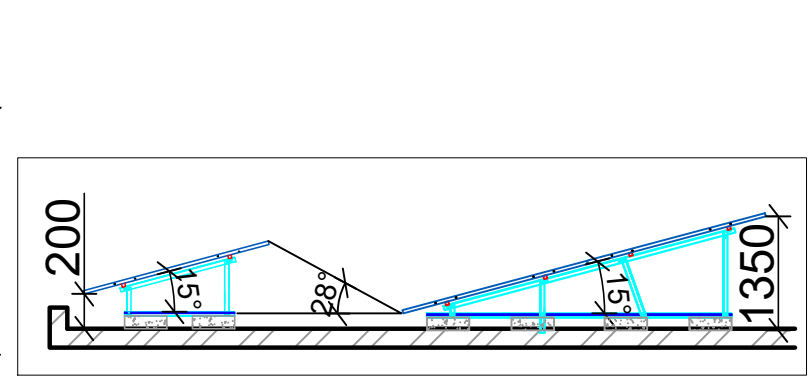
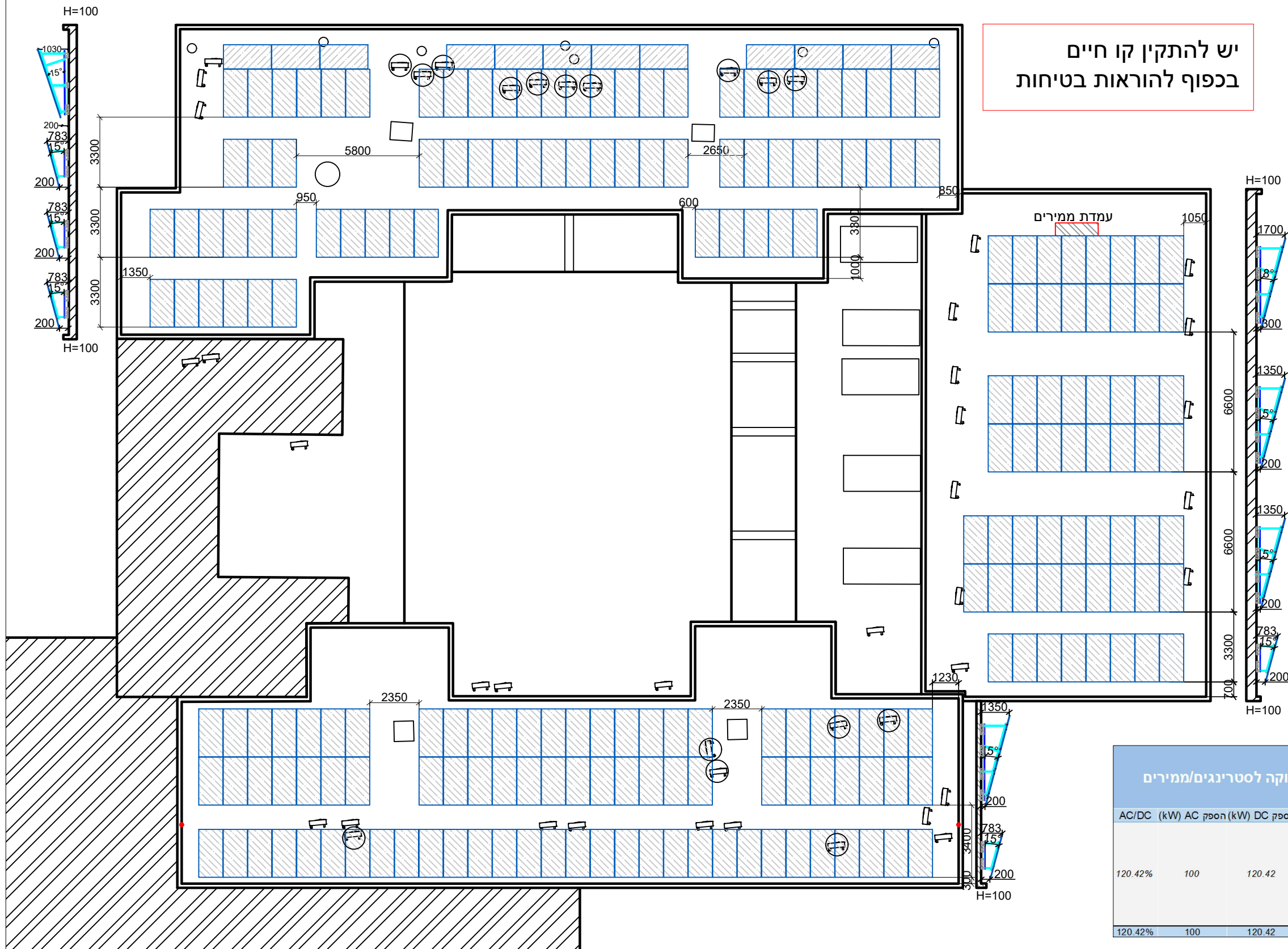
רשימת תוכניות:

- Habiluyim School - G001 – הצבת פאנלים
- Habiluyim School - G002 – חיווט פאנלים
- Habiluyim School - B001 – קונסטרוקציה
- Habiluyim School - E001 – חד קווי
- Habiluyim School - C003 – חישוב הפסדי הולכה DC
- Habiluyim School - C004 – חישוב הפסדי הולכה AC
- Habiluyim School - C001 – סימולציה PVSyst

Habiloyim Design Layout



יש להתקין קו חיים
בכפוף להוראות בטיחות



בית ספר הבילויים, רמת גן - חלוקה לסטרינגים/ממירים				540	הספק פאנל בודד (W)				
				223	מ"ס פאנלים כולי				
				100	הספק כולי AC (kW)				
				120.42	הספק כולי DC (kW)				
				120.42%	יעילות AC/DC				
AC/DC (kW)	הספק AC (kW)	הספק DC (kW)	מ"ס פאנלים	אופטימיזציה P1100	מ"ס סטרינגים	כניסת mppt (kW)	סוג ממיר	ממיר	גג
120.42%	100	120.42	28	14	3	Right	SE 100kW	1	בטון
			27	14					
			27	14					
			29	15	2	Center			
			29	15					
			28	14	3	Left			
			28	14					
27	14								
120.42%	100	120.42	223	114					סה"כ כמות

תוכנית הצבת פאנלים Client: שחר אנרגיה Site location: רמת גן		DRAWING NUMBER: Habiloyim school - G001 DATE: 30/8/21 Scale: #### Print size: A3 Sheet: 1/1		REV: A 1 DATE: 14/07/21 DRAWN: Roi N.		COMMENTS: Layout Update		Panels: Chint [2256x1133x35]		Inverters: Solar Edge		Quant': 1
Designer: Roi Nakash Approved: [Signature] STATUS: לאישור REV: A 1		APPROVAL / STAMP						Tilt: 15° Azimuth: 192° T.Power: 120.42kW		Model A: 100kW Model B: Model C: Model D: T.Power: 100kW		

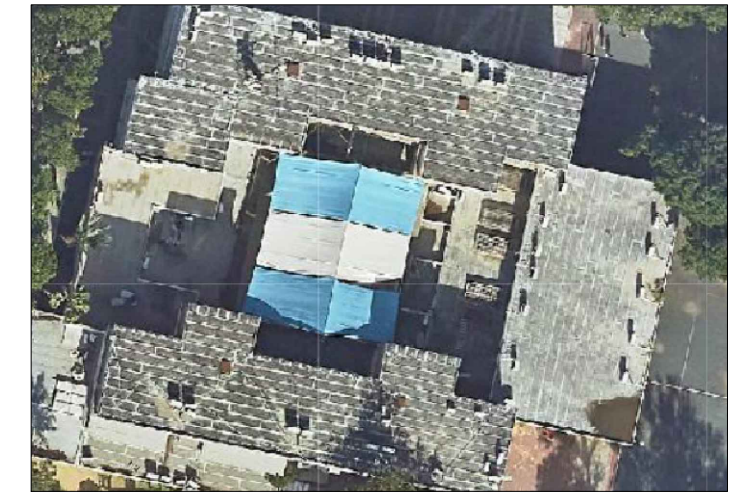
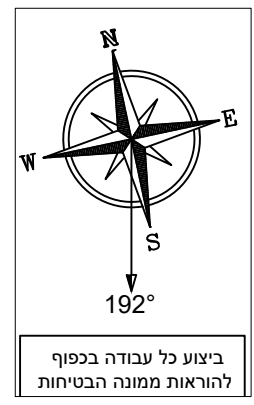


Habiloyim StringWiring

מקרא חיווט:

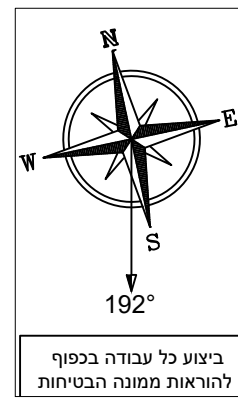
XX - YY - ZZ
 XX - מספר ממיר
 YY - mppt כניסת
 ZZ - כמות פאנלים

⊕ — כיוון חיבור סטרינג
 01-A קופסת איסוף סטרינג
 == DC תעלת רשת



Title: תוכנית חיווט פאנלים		DRAWING NUMBER: Habiluyim school - G002		REV	DATE	DRAWN	COMMENTS	Panels		Inverters		Quant'
Client: שחר אנרגיה	Site location: רמת גן	DATE: 30/8/21	Scale: ####	A 1	14/07/21	Roi N.	Layout Update	Manuf': Chint [2256x1133x35]	Manuf': Solar Edge	Model A: 100kW	Model B:	1
Designer: Roi Nakash		Print size: A3	Sheet: 1/1					Model: 540W	Model C:	Model D:		
Approved:		APPROVAL / STAMP						Quant': 223	Tilt: 15°			
STATUS: לאישור		REV: A 1						Azimuth: 192°				
ENERCITY RENEWABLE ENGINEERING								T.Power: 120.42kW		T.Power: 100kW		

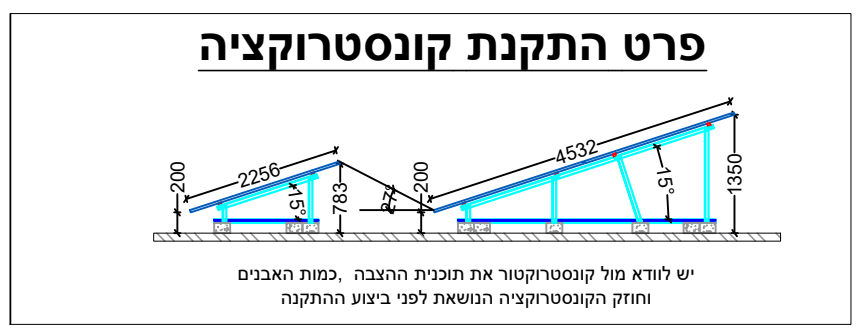
Habiloyim Construction



יש להתקין קו חיים
בכפוף להוראות בטיחות



כתב כמויות - רגליים הבילויים		
כמות	תיאור	פריט
58	גובה מהרצפה: 200 מ"מ זווית: 15°	פאנל בודד
30	גובה מהרצפה: 200 מ"מ זווית: 15°	פאנל כפול
18	גובה מהרצפה: 200 מ"מ זווית: 15°	פאנל בודד וחצי
6	גובה מהרצפה: 300 מ"מ זווית: 18°	פאנל כפול
72	אורך 2.3 מ 39 ק"ג	דיאגנל
562	גובה: 150, רוחב: 230, אורך: 500	אבנים



יש לוודא מול קונסטרוקטור את תוכנית ההצבה, כמות האבנים וחוזק הקונסטרוקציה הנושאת לפני ביצוע ההתקנה

Title: תוכנית קונסטרוקציה		DRAWING NUMBER: Habiluyim school - G001		REV	DATE	DRAWN	COMMENTS	Panels		Inverters		Quant'
Client: שחר אנרגיה	Site location: רמת גן	DATE: 30/8/21	Scale: ####	Print size: A3	Sheet: 1/1	A 1	14/07/21	Roi N.	Layout Update	Manuf': Chint [2256x1133x35]	Manuf': Solar Edge	
Designer: Roi Nakash		APPROVAL / STAMP							Model: 540W	Model A: 100kW	1	
Approved:		APPROVAL / STAMP							Quant': 223	Model B:		
STATUS: לאישור		REV: A 1							Tilt: 15°	Model C:		
									Azimuth: 192°	Model D:		
									T.Power: 120.42kW	T.Power: 100kW		



DC CABLE CALCULATION & POWER LOSSES

DATA		Cable Calculation							Production Losses		
Module Type	540	mm ²	Copper			Aluminum				Grid Load	100%
Imp [A]	12.86		4	6	10	25	35	50	70	Power Losses	0.25%
Vmp [V]	41.60										
Module amount	223	Length	0	510	0	0	0	0	0	303W	
Total Power [kWp]	120,420										

Inverter	Module No'	Parallel Strings	Power [W]	Current [A]	Max Current Carrying Capacity [A]	Resistance [Ω /1000m]	No' Cable Sets	Cross section [mm ²]	Cable Lengh [M]	Voltage Drop [V]	Power losses [W]	ΔP %	
INV-01	223		120420										
ST-1	28	1	15120	12.86	21.50	3.59	1	6	25	2.3	29.68	0.20%	String Losses
ST-2	27	1	14580	12.86	21.50	3.59	1	6	30	2.8	35.62	0.24%	String Losses
ST-3	27	1	14580	12.86	21.50	3.59	1	6	35	3.2	41.56	0.29%	String Losses
ST-4	29	1	15660	12.86	21.50	3.59	1	6	25	2.3	29.68	0.19%	String Losses
ST-5	29	1	15660	12.86	21.50	3.59	1	6	30	2.8	35.62	0.23%	String Losses
ST-6	28	1	15120	12.86	21.50	3.59	1	6	40	3.7	47.49	0.31%	String Losses
ST-7	28	1	15120	12.86	21.50	3.59	1	6	35	3.2	41.56	0.27%	String Losses
ST-8	27	1	14580	12.86	21.50	3.59	1	6	35	3.2	41.56	0.29%	String Losses
											302.78	0.25%	Total Losses
			120,420	TOTAL							303	0.25%	TOTAL

DATA				AC CABLE CALCULATION & POWER LOSSES												Production Losses	
Module Type	540	Voltage [V]	400													Avg' Voltage Drop	0.73%
Imp [A]	12.86	Load [%]	100%													Max Voltage Drop	0.78%
Vmp [V]	41.60	Cos Ph	1													Power Losses	0.75%
Module amount	223	Total Power [kVA]	100.00														745.85W
Total Power [kWp]	120,420																

FROM	TO	Module amount DC	DC Power [kW]	AC Power [kVA]	MAX AC Current [A]	Cable Length [m]	Cable Type		Cross Section [mm^2]	No' Cable sets	Installation type	K1	K2	K3	K4	Max Current Carrying Capacity [A]	R	Z (impedance)	ΔU Cable [V]	Power Losses [W]	ΔU Cable [%]	ΔU AC Line [%]	Power Losses [%]			
												Ambient Temp'	No' Cable sets	No' Cables in Conduit	Thermal resistance (W/km)		(at cable temp.) [Ω/Km]	[Ω/Km]								
INV-01	LVP	223	120.4	100.00	144.34	5	4x70 N2XY	Copper	70	1	Air	1	1	1	1	166.0	0.284	0.295	0.37	88.7	0.09%	0.78%	0.09%			
LVP	IEC Meter	223	120.4	100.00	144.34	40	4x120 NA2XY	Aluminum	120	1	Air	1	1	1	1	173.0	0.263	0.275	2.75	657.2	0.69%	0.69%	0.66%			
AC [kVA]	100.00																						745.9	Total Losses		0.75%

PVsyst - Simulation report

Grid-Connected System

Project: SHR Ramat Gan HaBiluim

Variant: New simulation variant

Sheds on a building

System power: 121 kWp

Ramat Yitzhak - Israel

Author

Green Panel (Israel)



Project: SHR Ramat Gan HaBiluim

Variant: New simulation variant

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Project summary

Geographical Site		Situation		Project settings	
Ramat Yitzhak		Latitude	32.08 °N	Albedo	0.20
Israel		Longitude	34.83 °E		
		Altitude	48 m		
		Time zone	UTC+2		
Meteo data					
Ramat Yitzhak					
Meteonorm 7.3 (1990-2004), Sat=100% - Synthetic					

System summary

Grid-Connected System		Sheds on a building		User's needs	
PV Field Orientation		Near Shadings		Unlimited load (grid)	
Fixed plane		According to strings			
Tilt/Azimuth	15 / 12 °	Electrical effect	100 %		
System information					
PV Array					
Nb. of modules	224 units	Inverters		3 units	
Pnom total	121 kWp	Nb. of units		99.9 kWac	
		Pnom total		1.211	
		Pnom ratio			

Results summary

Produced Energy	203.1 MWh/year	Specific production	1679 kWh/kWp/year	Perf. Ratio PR	77.12 %
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General parameters

Grid-Connected System		Sheds on a building			
PV Field Orientation		Sheds configuration		Models used	
Orientation		Nb. of sheds	25 units	Transposition	Perez
Fixed plane		Sizes		Diffuse	Perez, Meteonorm
Tilt/Azimuth	15 / 12 °	Sheds spacing	4.21 m	Circumsolar	separate
		Collector width	3.22 m		
		Ground Cov. Ratio (GCR)	76.7 %		
Horizon		Near Shadings		User's needs	
Free Horizon		According to strings		Unlimited load (grid)	
		Electrical effect	100 %		

PV Array Characteristics

PV module		Inverter	
Manufacturer	Longi Solar	Manufacturer	SolarEdge
Model	LR5-72 HPH 540 M	Model	SE66.6K/SE100K-EU-APAC/AUS Unit (400V)
(Original PVsyst database)		(Original PVsyst database)	
Unit Nom. Power	540 Wp	Unit Nom. Power	33.3 kWac
Number of PV modules	224 units	Number of inverters	3 units
Nominal (STC)	121 kWp	Total power	99.9 kWac
Optimizer Array	8 Strings x 14 In series	Operating voltage	750 V
At operating cond. (50°C)		Pnom ratio (DC:AC)	1.13
Pmpp	111 kWp		
Output of optimizers			
Voper	750 V		
I at Poper	147 A		
SolarEdge Power Optimizer			
Model	P1100 Worldwide		
Unit Nom. Power	1100 W		
Modules	1 String x 2 in series		
Physical inverters			
SE66.6K/SE100K-EU-APAC/AUS Unit (400V)			
units 3 strings			
3 strings of 14 optimizers P1100 Worldwide			
SE66.6K/SE100K-EU-APAC/AUS Unit (400V)			
units 2 strings			
2 strings of 14 optimizers P1100 Worldwide			
Total PV power		Total inverter power	
Nominal (STC)	121 kWp	Total power	99.9 kWac
Total	224 modules	Nb. of inverters	3 units
Module area	573 m ²	Pnom ratio	1.21
Cell area	519 m ²		



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Array losses

Array Soiling Losses		Thermal Loss factor		DC wiring losses	
Loss Fraction	3.0 %	Module temperature according to irradiance		Global array res.	70 mΩ
		Uc (const)	23.0 W/m ² K	Loss Fraction	1.5 % at STC
		Uv (wind)	0.0 W/m ² K/m/s		
LID - Light Induced Degradation		Module Quality Loss		Module mismatch losses	
Loss Fraction	2.0 %	Loss Fraction	0.0 %	Loss Fraction (Fixed voltage)	0.0 %
Strings Mismatch loss		IAM loss factor			
Loss Fraction	0.1 %	ASHRAE Param: IAM = 1 - bo(1/cosi -1)			
		bo Param.	0.05		

System losses

Unavailability of the system	
Time fraction	2.0 %
	7.3 days, 3 periods

AC wiring losses

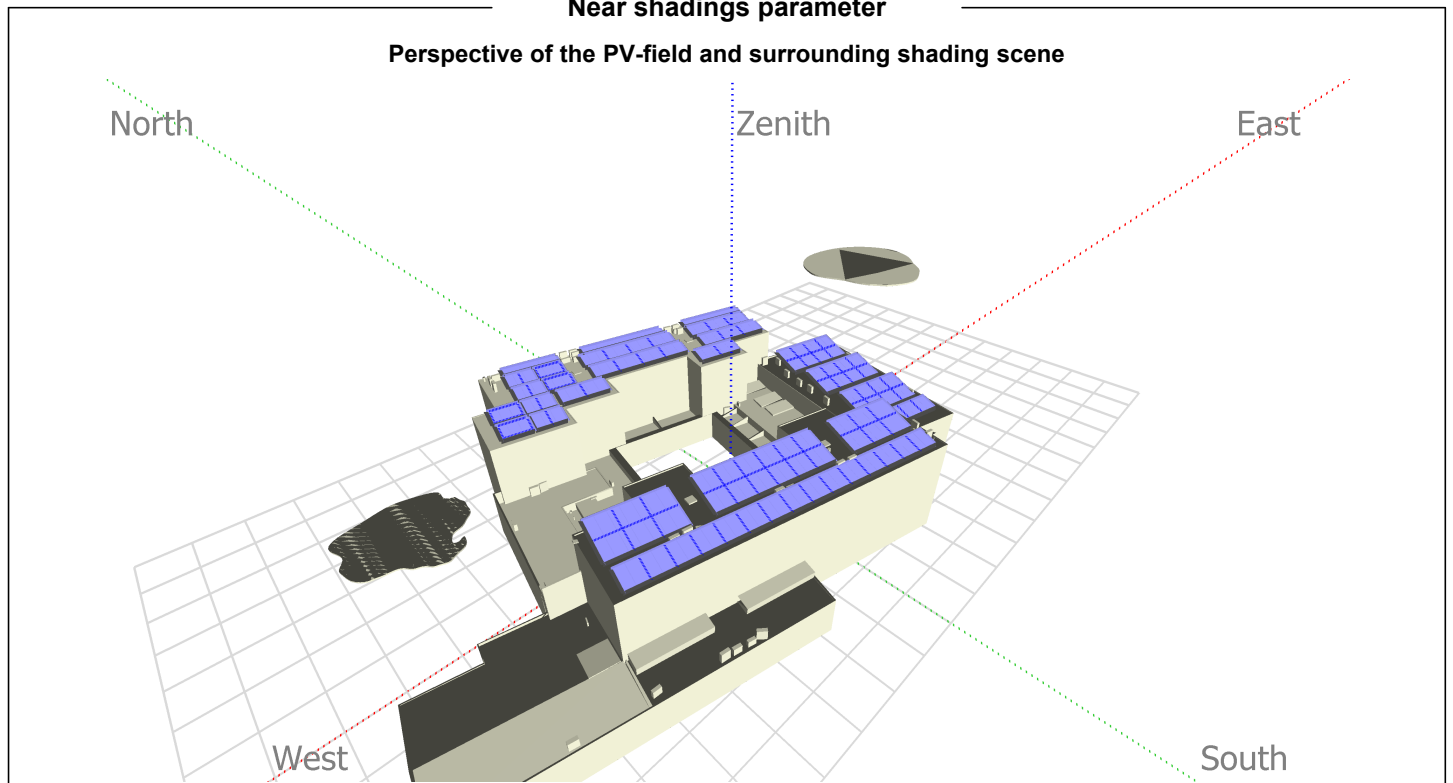
Inv. output line up to injection point	
Inverter voltage	400 Vac tri
Loss Fraction	1.35 % at STC
Inverter: SE66.6K/SE100K-EU-APAC/AUS Unit (400V)	
Wire section (3 Inv.)	Alu 3 x 3 x 120 mm ²
Average wires length	208 m



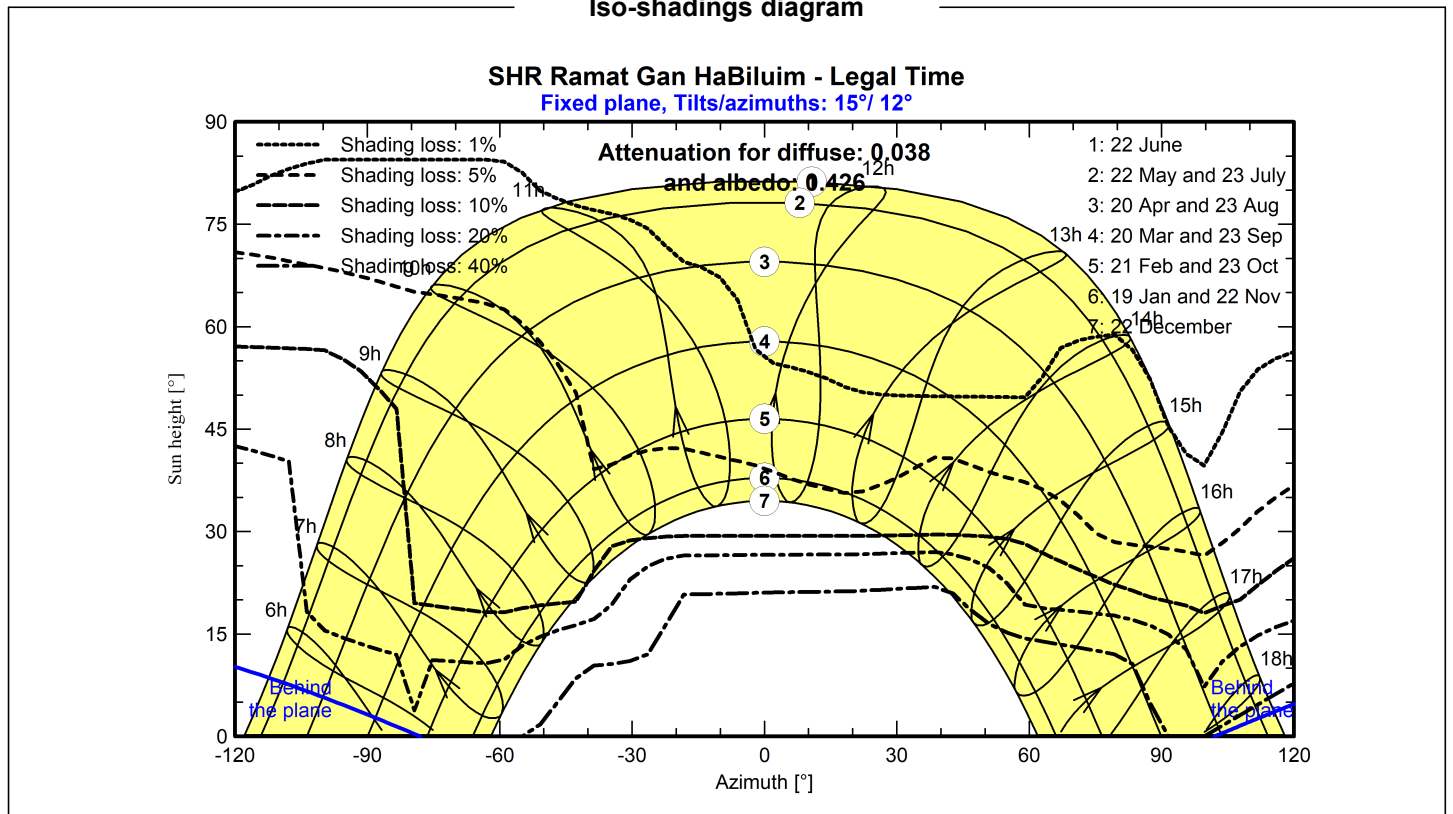
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Near shadings parameter



Iso-shadings diagram





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Main results

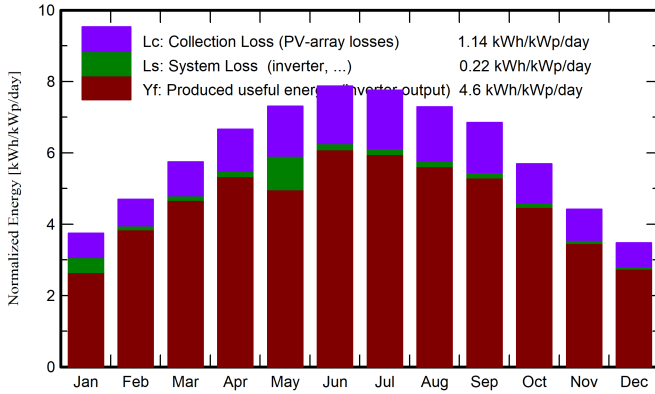
System Production

Produced Energy 203.1 MWh/year

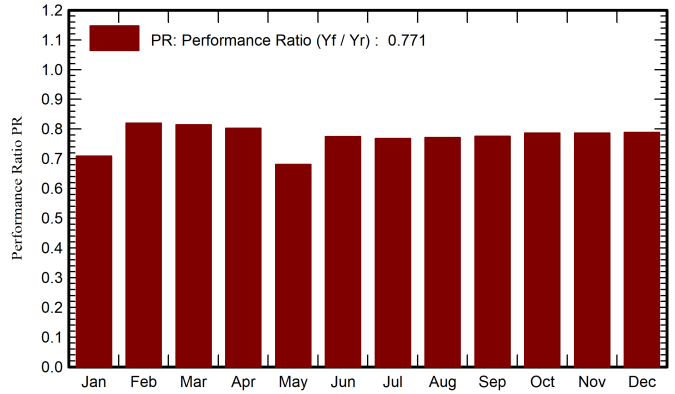
Specific production
Performance Ratio PR

1679 kWh/kWp/year
77.12 %

Normalized productions (per installed kWp)



Performance Ratio PR



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 ratio
January	92.1	38.67	12.89	116.0	105.7	11.51	9.94	0.709
February	110.6	46.31	13.53	131.6	121.2	13.40	13.06	0.820
March	159.8	62.32	16.27	178.1	165.3	18.01	17.53	0.814
April	190.0	71.88	19.23	199.9	185.4	19.94	19.40	0.802
May	226.6	76.21	22.47	226.6	210.1	22.19	18.65	0.681
June	241.9	59.57	25.29	236.1	218.7	22.74	22.11	0.774
July	244.0	61.51	28.18	240.5	223.2	23.00	22.36	0.769
August	218.2	67.04	28.43	225.9	209.7	21.65	21.06	0.771
September	186.5	47.45	26.36	205.4	190.9	19.81	19.27	0.776
October	149.5	46.08	23.76	176.5	163.5	17.25	16.79	0.786
November	105.0	34.10	18.84	132.4	121.4	12.92	12.59	0.786
December	84.7	38.07	15.00	107.9	97.9	10.56	10.30	0.789
Year	2008.9	649.21	20.90	2176.9	2012.9	212.98	203.06	0.771

Legends

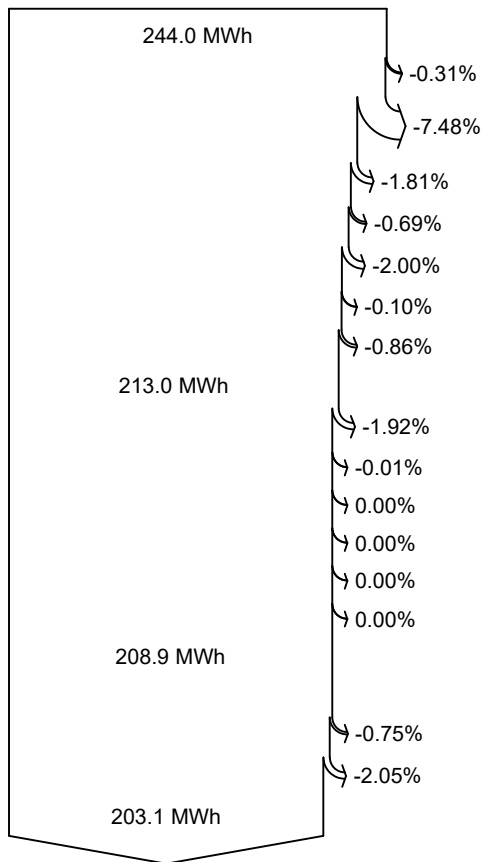
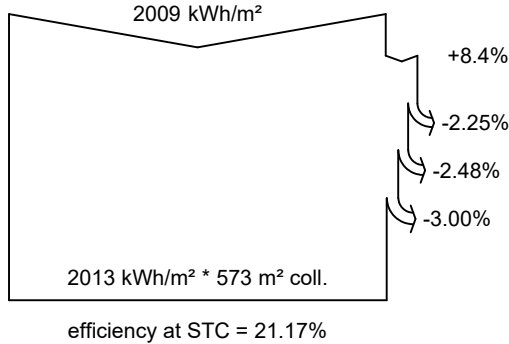
- GlobHor Global horizontal irradiation
- DiffHor Horizontal diffuse irradiation
- T_Amb Ambient Temperature
- GlobInc Global incident in coll. plane
- GlobEff Effective Global, corr. for IAM and shadings
- EArray Effective energy at the output of the array
- E_Grid Energy injected into grid
- PR Performance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



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Loss diagram



Global horizontal irradiation

Global incident in coll. plane

Near Shadings: irradiance loss

IAM factor on global

Soiling loss factor

Effective irradiation on collectors

PV conversion

Array nominal energy (at STC effic.)

PV loss due to irradiance level

PV loss due to temperature

Shadings: Electrical Loss acc. to strings

Optimizer efficiency loss

LID - Light induced degradation

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

AC ohmic loss

System unavailability

Energy injected into grid

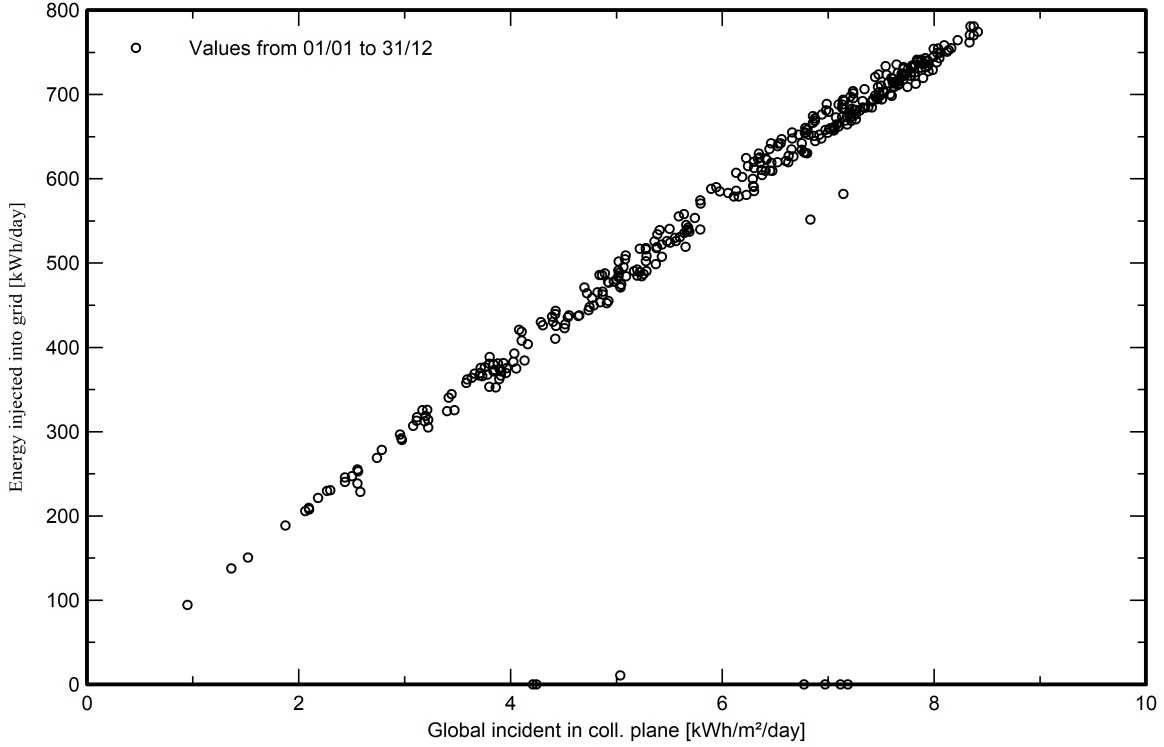


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Special graphs

Daily Input/Output diagram



System Output Power Distribution

