

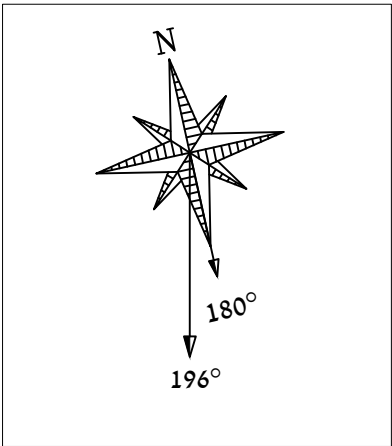
רמת גן – בן גוריון

מערכת סולארית מתח נמוך – 69.55kW



רשימת תוכניות:

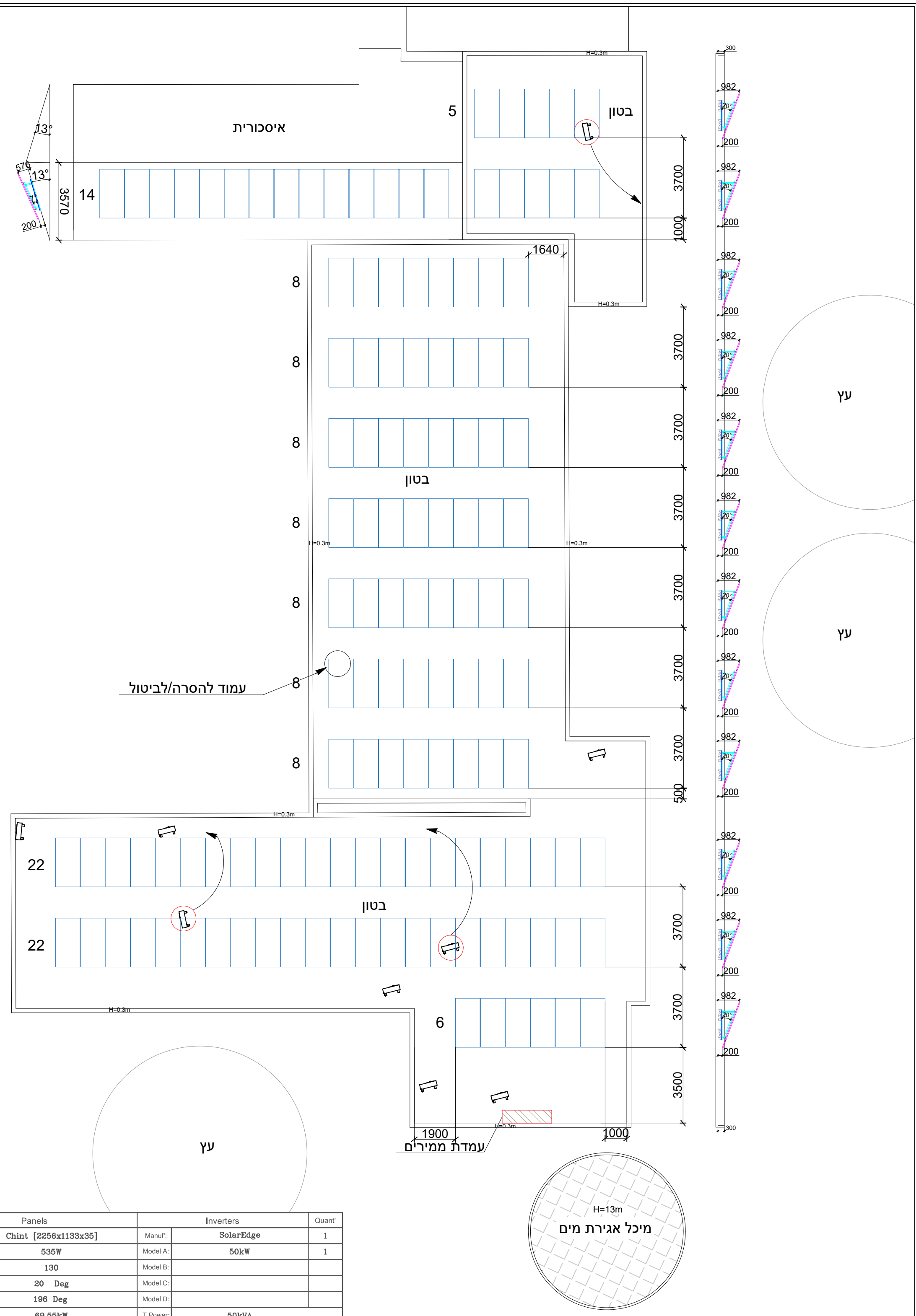
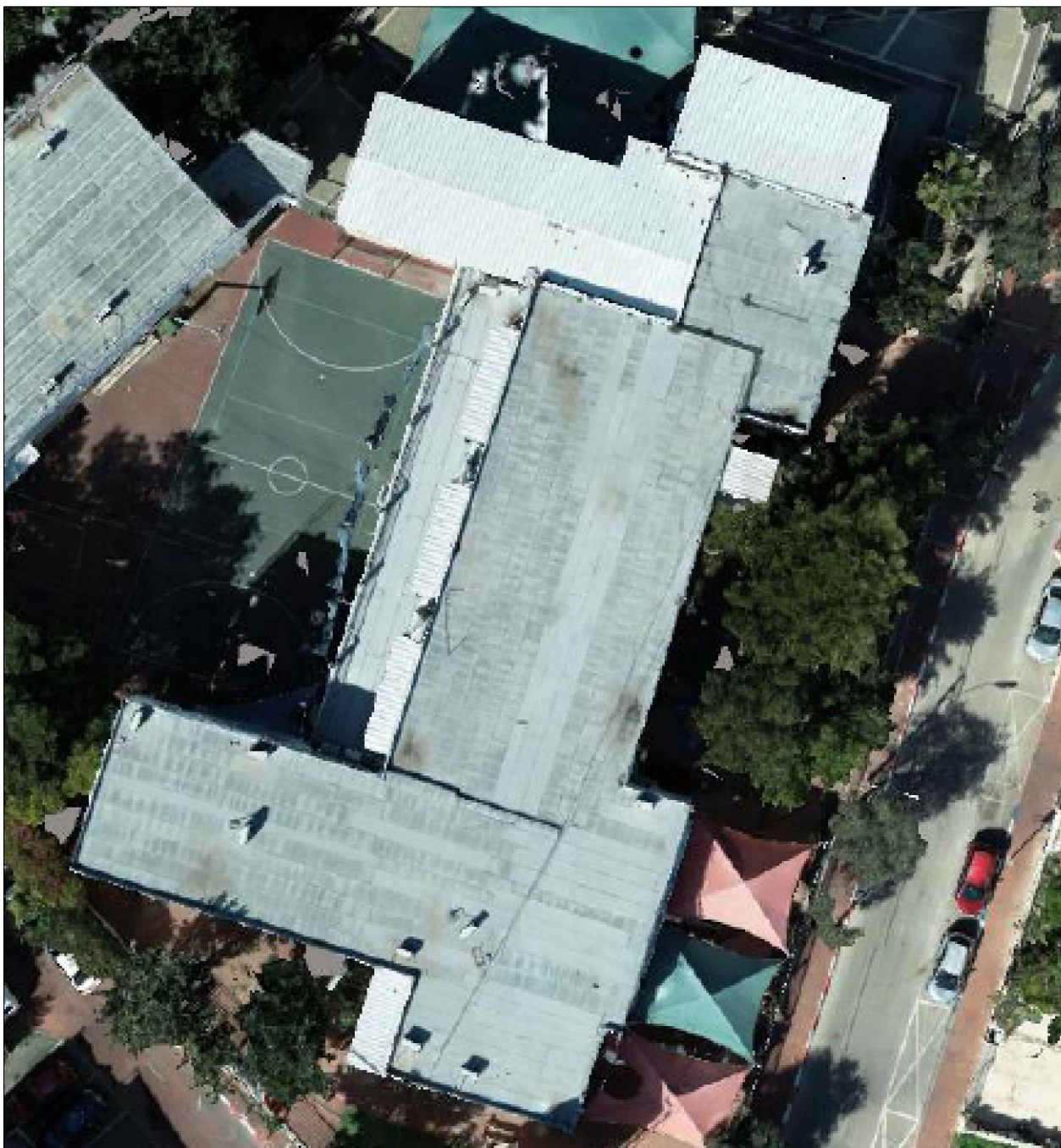
- Ben Gurion - G001 – הצבת פאנלים
- Ben Gurion - G002 – חיווט פאנלים
- Ben Gurion - B001 – תכנית קונסטרוקציה
- Ben Gurion - E001 – חד קווי
- Ben Gurion - C001 – סימולציה PVSyst
- Ben Gurion - C003 – חישוב הפסדי הולכה DC
- Ben Gurion - C004 – חישוב הפסדי הולכה AC



Ben Gurion - Design Layout

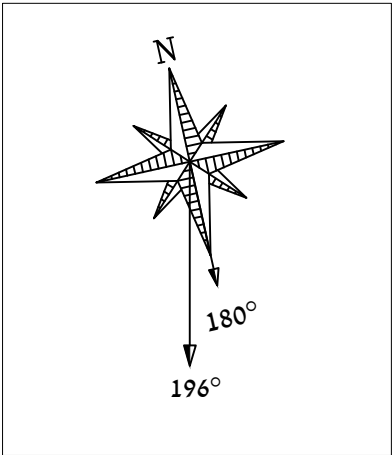
ביצוע כל עבודה בכפוף
להוראות ממונה הבטיחות

יש להתקין קו חיים בהתאם
להוראות תקנות הבטיחות



בן גוריון, רמת גן - חלוקה לסטרינגים/ממירים							535		הספק פאנל בודד(W)	
							130		מ"ס פאנלים כללי :	
							50		הספק כללי AC (KW) :	
							69.55		הספק כללי DC (KW) :	
							139.10%		יחס AC/DC :	
AC/DC	(kW) AC	הספק (kW) DC	מ"ס פאנלים	מס' אופטימיזרים P1100	מ"ס סטרינגים	כניסת mppt	סוג ממיר (kW)	ממיר	גג	בטון
139.10%	50	69.55	32	16	2	Primary	Solar Edge 50kW	1		
			34	17		Secondary				
			32	16						
			32	16						
139.10%	50	69.55	130	65						ה"כ כמות:

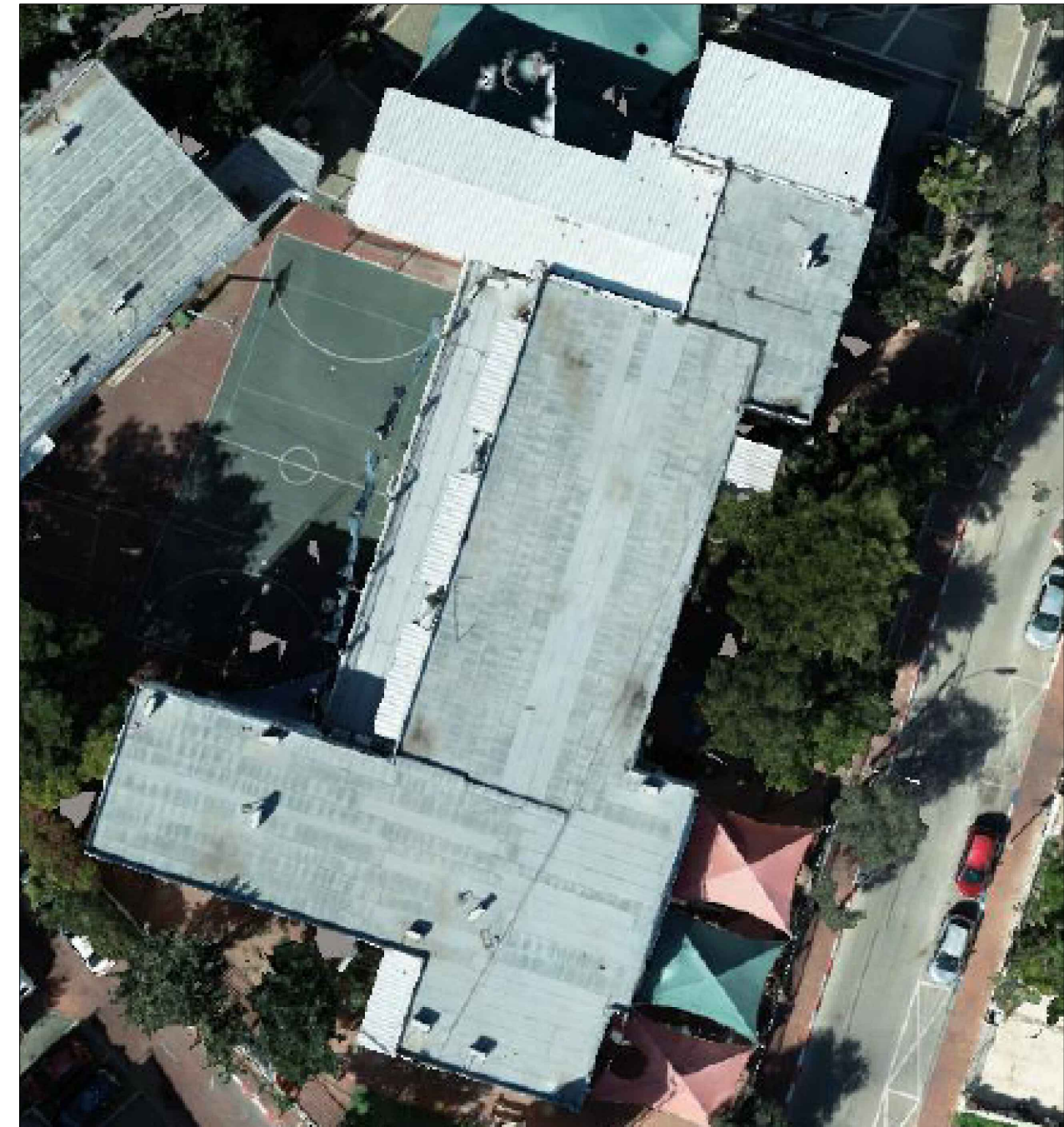
Title: תוכנית הצבת פאנלים		DRAWING NUMBER: Ben Gurion - G001		REV				DATE				DRAWN				COMMENTS				Panels		Inverters		Quant
Client: מקורות אנרגיה	Site location: רמת גן	DATE: 04/04/2021	Scale: ####	Print size: A2	Sheet: 1/1												Manuf:	Chint [2256x1133x35]	Manuf:	SolarEdge	1			
		Designer: Moshe Yadgarov	APPROVAL / STAMP													Model: 535W	Model A: 50kW	1						
		Approved: Boris Habarov														Quant: 130	Model B:							
		STATUS: לאישור		REV: AO												Tilt: 20 Deg	Model C:							
																Azimuth: 196 Deg	Model D:							
																T.Power: 69.55kW	T.Power: 50kVA							



Ben Gurion - String Layout

ביצוע כל עבודה בכפוף להוראות ממונה הבטיחות

יש להתקין קו חיים בהתאם להוראות תקנות הבטיחות

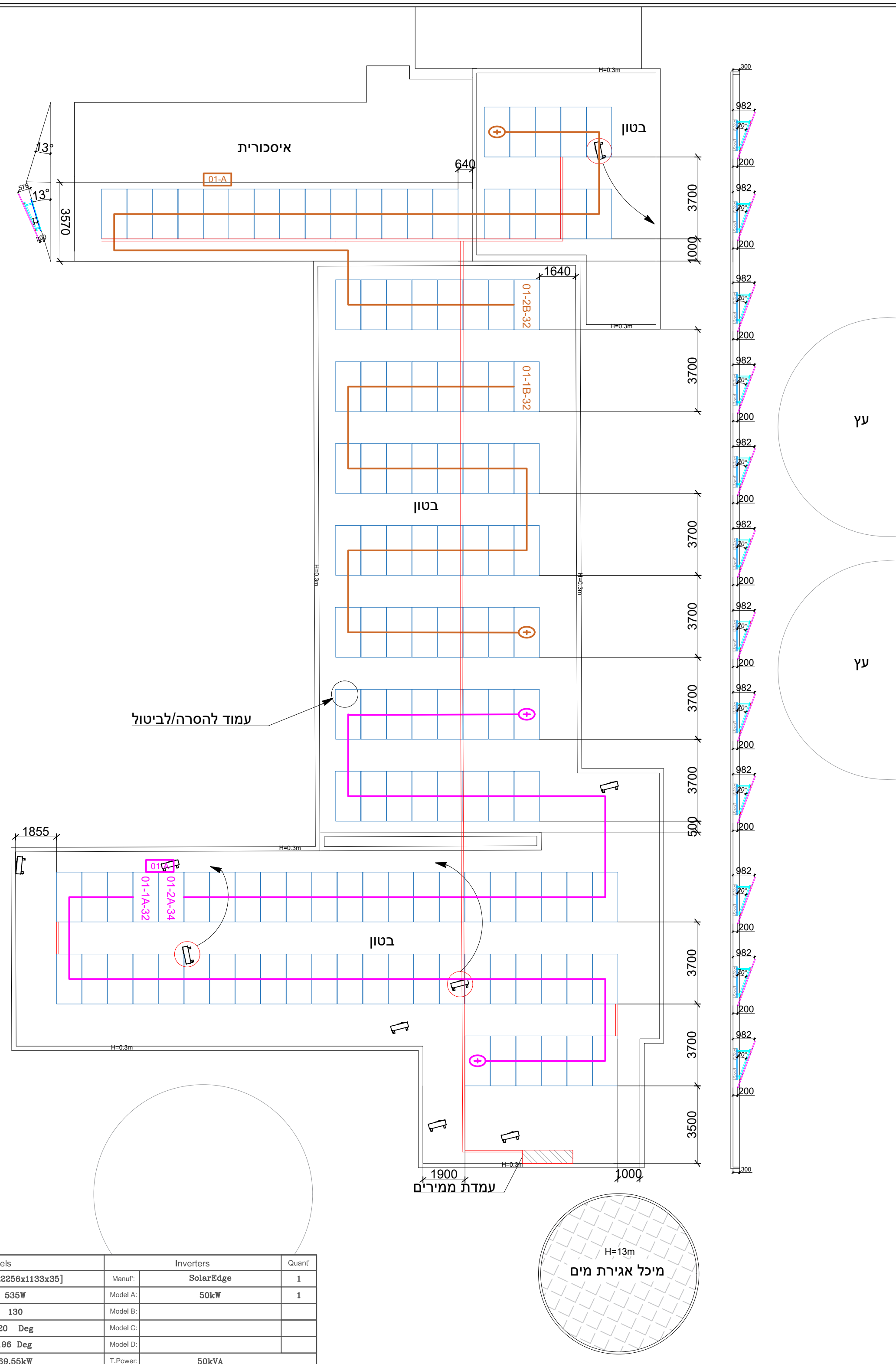


מקרא חיווט:

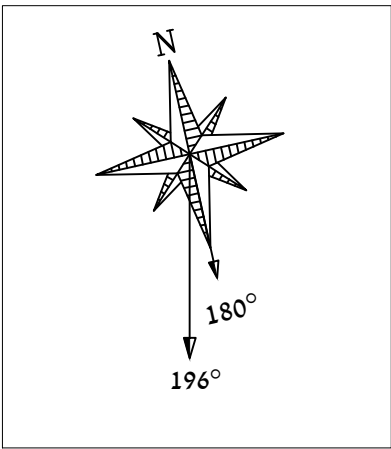
XX - YY - ZZ
XX - מספר ממיר
YY - כניסת mppt
ZZ - כמות פאנלים

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

בן גוריון, רמת גן - חלוקה לסטרינגים/ממירים						535		הספק פאנל בודד (W)		
						130		מ"ס פאנלים כללי :		
						50		הספק כללי AC (kW) :		
						69.55		הספק כללי DC (kW) :		
						139.10%		יחס AC/DC :		
AC/DC	(kW) AC	הספק DC	מ"ס פאנלים	מס' אופטימיזרים P1100	מ"ס סטרינגים	כניסת mppt	סוג ממיר (kW)	ממיר	גג	
139.10%	50	69.55	32	16	2	Primary	Solar Edge 50kW	1	בטון	
			34	17						
			32	16		Secondary				2
			32	16						
139.10%	50	69.55	130	65					סה"כ כמות:	



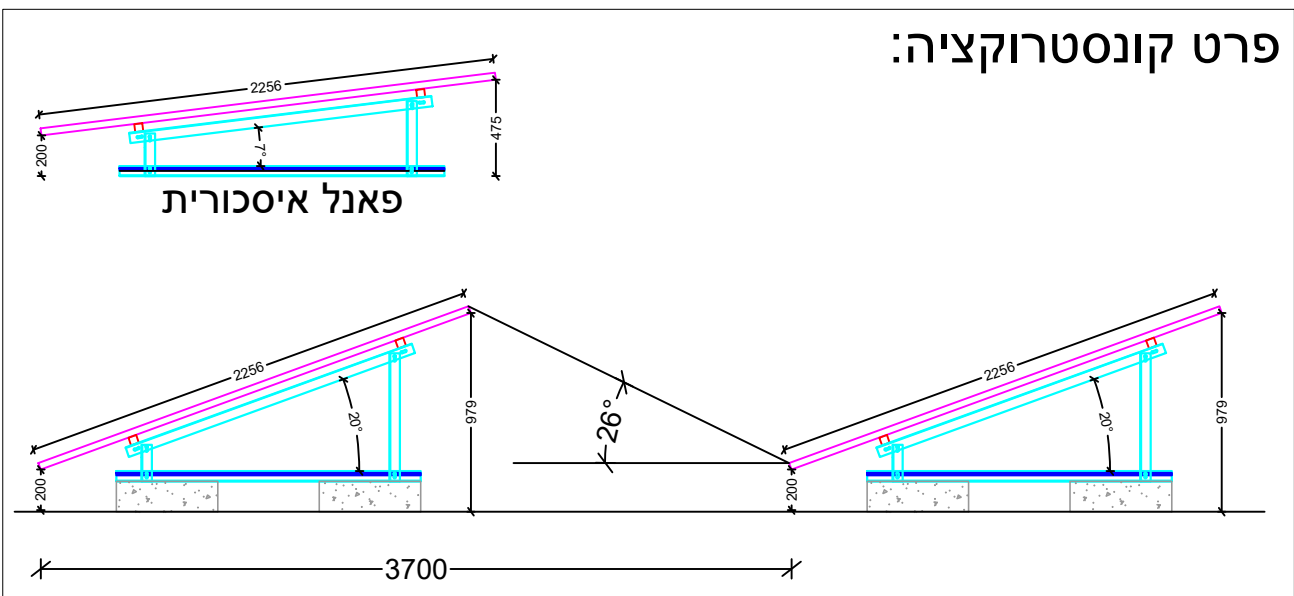
Title: תכנית חיווט פאנלים		DRAWING NUMBER: Ben Gurion - G002			REV	DATE	DRAWN	COMMENTS	Panels		Inverters		Quant
Client: מקורות אנרגיה	Site location: רמת גן	DATE: 04/04/2021	Scale: ###	Part size: A2	Sheet: 1/1				Manuf: Chint [2256x1133x35]	Manuf: SolarEdge			1
Designer: Moshe Yadgarov		APPROVAL / STAMP							Model: 535W	Model A: 50kW			1
Approved: Boris Habarov									Quant: 130	Model B:			
STATUS: לאישור									Tilt: 20 Deg	Model C:			
									Azimuth: 196 Deg	Model D:			
									T.Power: 69.55kW	T.Power: 50kVA			



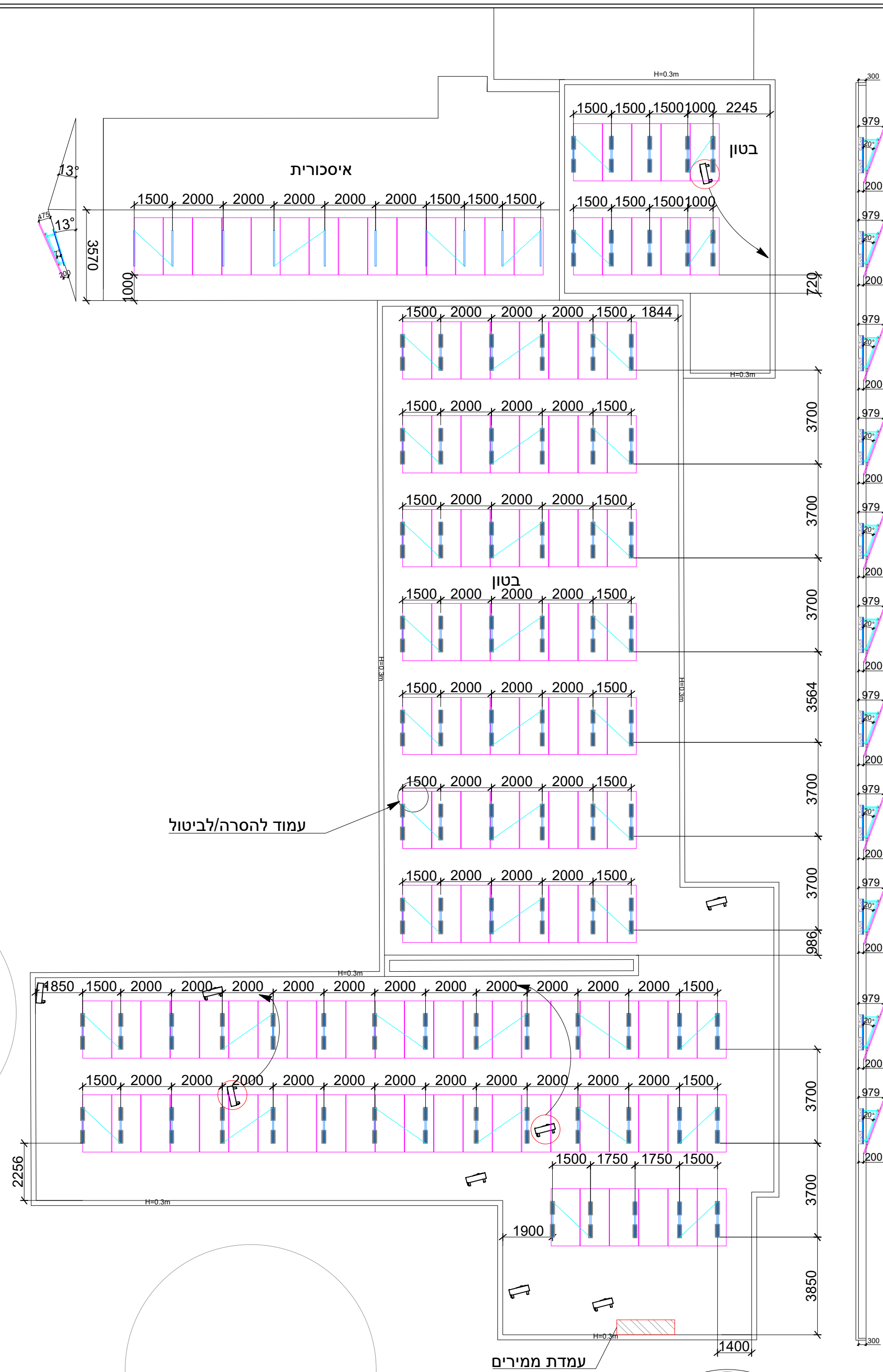
Ben Gurion - Construction

ביצוע כל עבודה בכפוף
להוראות ממנה הבטיחות

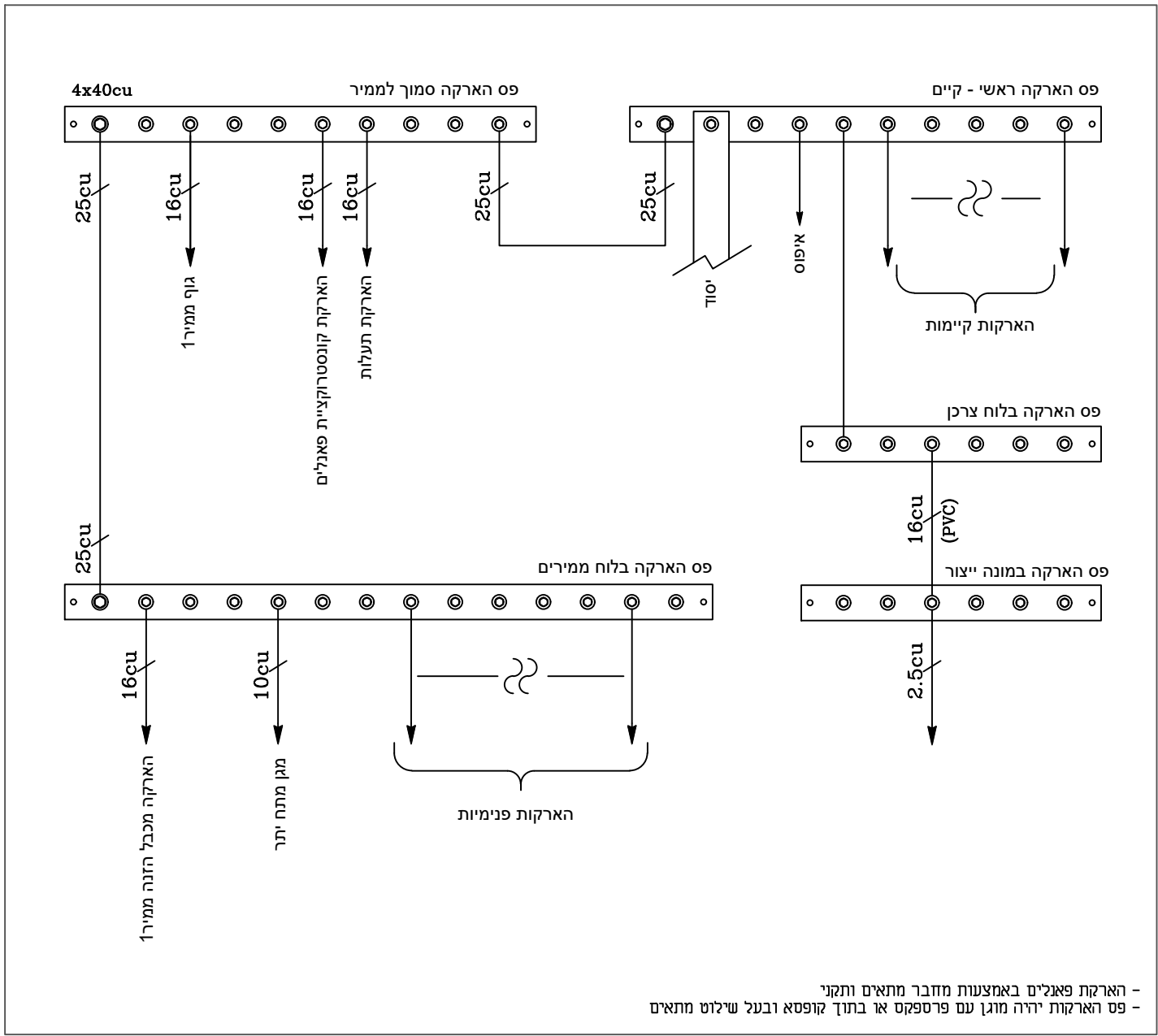
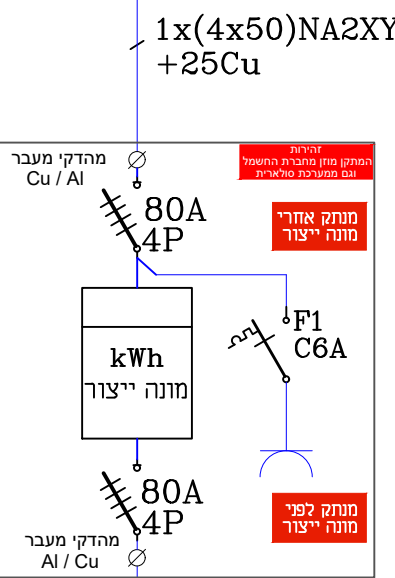
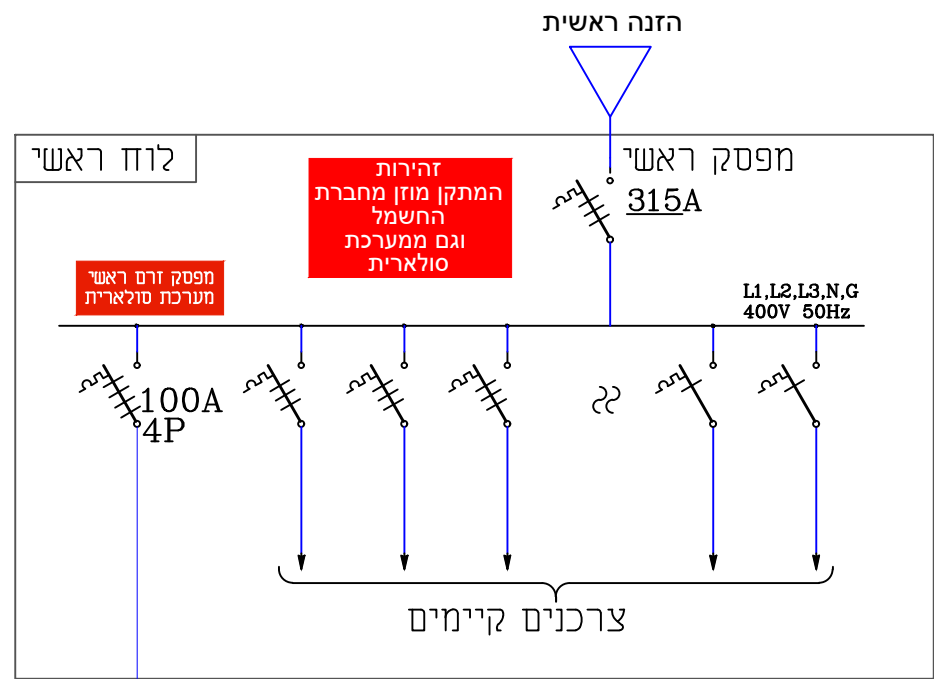
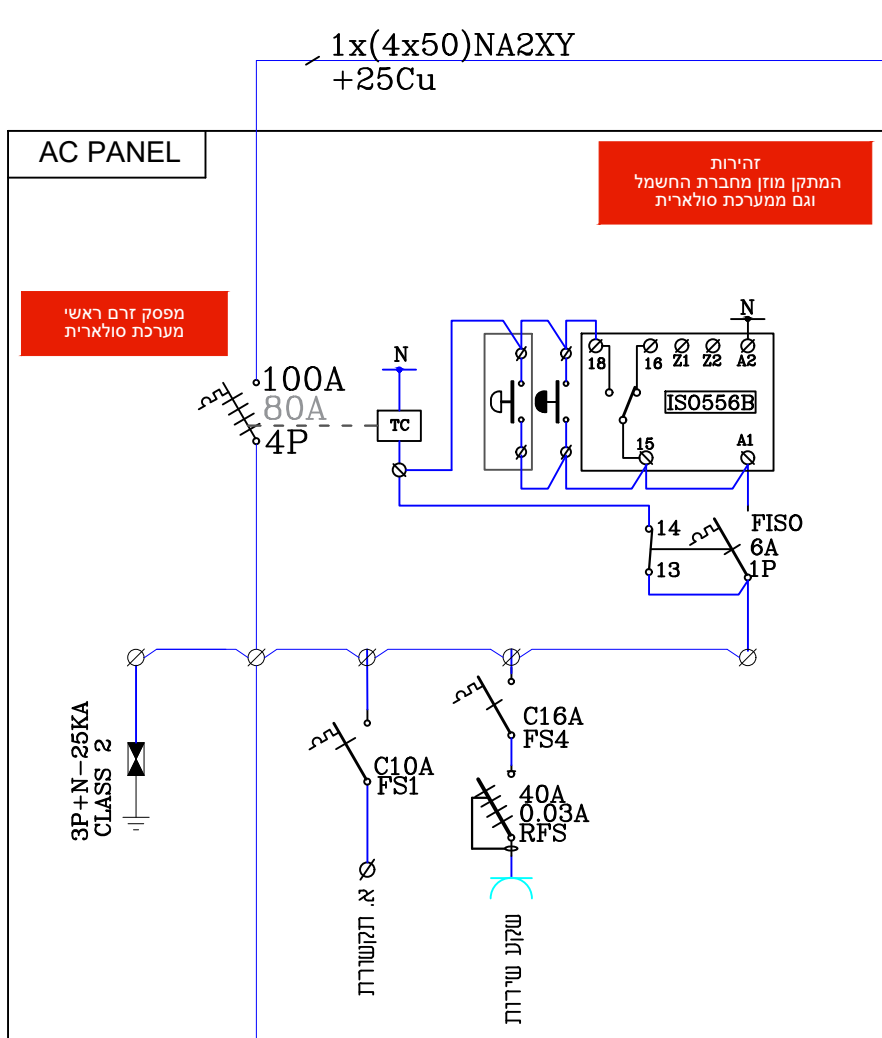
יש להתקין קו חיים בהתאם
להוראות תקנות הבטיחות



כתב כמויות - רגליים		
כמות	תיאור	פריט
86	רגל קדמית 180 מ"מ 20 מעלות	פאנל בודד
10	רגל קדמית 210 מ"מ 20 מעלות	פאנל בודד איסכורית
43	אורך 2.3 מ'	דיאגונל
172	אבן שפה 42/39 ק"ג	אבנים



Title: תכנית קונסטרוקציה			DRAWING NUMBER: Ben Gurion - B001				<table><tr><th>REV</th><th>DATE</th><th>DRAWN</th><th>COMMENTS</th></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td><td> </td></tr></table>				REV	DATE	DRAWN	COMMENTS																																					Panels		Inverters		Quant'
REV	DATE	DRAWN	COMMENTS																																																				
Client:	מקורות אנרגיה	Site location:	רמת גן	DATE:	04/04/2021	Scale:	####	Print size:	A2	Sheet:	1/1	Manuf':	Chint [2256x1133x35]	Manuf':	SolarEdge	1																																							
					Designer:	Moshe Yadgarov			APPROVAL / STAMP		Model:	535W	Model A:	50kW	1																																								
Approved:					Boris Habarov			Model B:			130	Model C:	20 Deg																																										
STATUS:					לאישור	REV:	א	Model D:			198 Deg																																												
T.Power:					69.55kW	T.Power:	50kVA																																																



- Notes:
1. Elec. panel should be compatible with IL elec. norm 61439
 2. Cables, cores, ducts & modules should be marked with proper marking
 3. Live elec. contacts must be insulated

Ben Gurion - Single line

בן גוריון, רמת גן - חלוקה לסטרינגים/ממירים						535		הספק פאנל בודד(W)		
						130		מ"ס פאנלים כללי :		
						50		הספק כללי AC (KW) :		
						69.55		הספק כללי DC (KW) :		
						139.10%		יחס AC/DC :		
גג	ממיר	סוג ממיר (kW)	כניסת mppt	מ"ס סטרינגים	מס' אופטימיזרים P1100	מ"ס פאנלים	הספק DC (kW)	הספק AC (kW)	AC/DC	
בטון	1	Solar Edge 50kW	Primary	2	16	32	69.55	50	139.10%	
			Secondary			34				
				2		16				32
										32
סה"כ כמות:					65	130	69.55	50	139.10%	

Title: תכנית חד קוויית		DRAWING NUMBER: Ben Gurion - E001			REV	DATE	DRAWN	COMMENTS	Panels		Inverters		Quant
Client: מקורות אנרגיה	Site location: רמת גן	DATE: 04/04/2021	Scale: ####	Part size: A2	Sheet: 1/1				Manuf': Chint [2256x1133x35]	Manuf': SolarEdge		1	
EnerCity שחר אנרגיה Solar Engineering		Designer: Moshe Yadgarov	APPROVAL / STAMP						Model: 535W	Model A: 50kW		1	
		Approved: Boris Habarov							Quant: 130	Model B:			
		STATUS: לאישור							Tilt: 20 Deg	Model C:			
		REV: AD							Azimuth: 196 Deg	Model D:			
									T.Power: 69.55kW	T.Power: 50kVA			

DC CABLE CALCULATION & POWER LOSSES

DATA		Cable Calculation										Production Losses	
Module Type	535	mm^2	Copper			Aluminum						Grid Load	100%
Imp [A]	11.72		4	6	16	25	35	50	95	120	240	Power Losses	0.44%
Vmp [V]	41.26												
Module amount	130	Length											
Total Power [kWp]	69,550		0	220	0	0	0	0	0	0	0	306W	

Inverter	Module No'	Module No' Inv/String	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 %	
1A	66	66	2	35310	23.44	64.50	3.59	2	6	20	1.7	39	0.11%	DCCB / DCB to INV Losses
ST-1	32	32	1	17120	11.72	36.75	3.59	1	6	50	4	49	0.29%	String Losses
ST-2	34	34	1	18190	11.72	36.75	3.59	1	6	40	3	39	0.22%	
												128	0.36%	Total losses
1B	64	64	2	34240	23.44	64.50	3.59	2	6	40	3.4	79	0.23%	DCCB / DCB to INV Losses
ST-1	32	32	1	17120	11.72	36.75	3.59	1	6	50	4	49	0.29%	String Losses
ST-2	32	32	1	17120	11.72	36.75	3.59	1	6	50	4	49	0.29%	
												178	0.52%	Total losses
												306	0.44%	TOTAL

69,550

TOTAL

DATA							AC CABLE CALCULATION & POWER LOSSES														Production Losses			
Module Type	535	Voltage [V]	400	Avg' Voltage Drop		0.91%																		
Imp [A]	11.72	Load [%]	100%	Max Voltage Drop		0.91%																		
Vmp [V]	41.26	Cos Ph	1	Power Losses		0.90%																		
Module amount	130	Total Power [kVA]	50.00			450.93W																		
Total Power [kWp]	69,550																							
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 (at cable temp.) [Ω/Km]	Z (impedance) [Ω/Km]	ΔU Cable [V]	Power Losses [W]	ΔU Cable [%]	ΔU AC Line [%]	Power Losses [%]	
INV 1	P0	130	69.6	50.00	72.17	4	4x35 NA2XY	Copper	35	1	Air	0.95	1	1	1	107.4	0.555	0.561	0.28	34.7	0.07%	0.91%	0.03%	
LVP	IEC Meter	130	69.6	50.00	72.17	40	4x50 NA2XY	Aluminum	50	1	Air	0.95	1	1	1	98.8	0.666	0.671	3.36	416.2	0.84%	0.84%	0.32%	
AC [kVA]		50.00																		450.9	Toatl Losses		0.90%	

PVsyst - Simulation report

Grid-Connected System

Project: SHR Ramat Gan_Ben Gurion

Variant: New simulation variant

Sheds on a building

System power: 68.5 kWp

Ramat Gan - Israel

Author

Green Panel (Israel)



Project: SHR Ramat Gan_Ben Gurion

Variant: New simulation variant

PVsyst V7.1.8

VC0, Simulation date:
08/04/21 14:02
with v7.1.8

Project summary

Geographical Site

Ramat Gan

Israel

Situation

Latitude 32.08 °N

Longitude 34.81 °E

Altitude 46 m

Time zone UTC+2

Project settings

Albedo 0.20

Meteo data

Ramat Gan

Meteonorm 7.3 (1990-2004), Sat=100% - Synthetic

System summary

Grid-Connected System

PV Field Orientation

Fixed plane

Tilt/Azimuth 20 / 16 °

Sheds on a building

Near Shadings

According to strings

Electrical effect 100 %

User's needs

Unlimited load (grid)

System information

PV Array

Nb. of modules 128 units

Pnom total 68.5 kWp

Inverters

Nb. of units 2 units

Pnom total 50.0 kWac

Pnom ratio 1.370

Results summary

Produced Energy 115.9 MWh/year Specific production 1692 kWh/kWp/year Perf. Ratio PR 76.81 %

Table of contents

Project and results summary	2
General parameters, PV Array Characteristics, System losses	3
Near shading definition - Iso-shadings diagram	5
Main results	6
Loss diagram	7
Special graphs	8

**PVsyst V7.1.8**

VC0, Simulation date:
08/04/21 14:02
with v7.1.8

General parameters**Grid-Connected System****PV Field Orientation****Orientation**

Fixed plane
Tilt/Azimuth 20 / 16 °

Horizon

Free Horizon

Sheds on a building**Sheds configuration**

Nb. of sheds 15 units

Sizes

Sheds spacing 3.70 m
Collector width 2.26 m
Ground Cov. Ratio (GCR) 61.0 %

Shading limit angle

Limit profile angle 26.1 °

Near Shadings

According to strings
Electrical effect 100 %

Models used

Transposition Perez
Diffuse Perez, Meteonorm
Circumsolar separate

User's needs

Unlimited load (grid)

PV Array Characteristics**PV module**

Manufacturer Longi Solar
Model LR5-72 HPH 535 M

(Original PVsyst database)

Unit Nom. Power 535 Wp
Number of PV modules 128 units
Nominal (STC) 68.5 kWp

SolarEdge Power Optimizer

Model P1100 Worldwide
Unit Nom. Power 1100 W
Modules 1 String x 2 in series

Array #1 - PV Array

Number of PV modules 64 units
Nominal (STC) 34.2 kWp
Optimizer Array 2 Strings x 16 In series

At operating cond. (50°C)

Pmpp 31.3 kWp
Output of optimizers
Voper 750 V
I at Poper 42 A

Array #2 - Sub-array #2

Number of PV modules 64 units
Nominal (STC) 34.2 kWp
Optimizer Array 2 Strings x 16 In series

At operating cond. (50°C)

Pmpp 31.3 kWp
Output of optimizers
Voper 750 V
I at Poper 42 A

Total PV power

Nominal (STC) 68 kWp
Total 128 modules
Module area 327 m²
Cell area 297 m²

Inverter

Manufacturer SolarEdge
Model SE50K/SE75K Unit

(Original PVsyst database)

Unit Nom. Power 25.0 kWac
Number of inverters 2 units
Total power 50.0 kWac

Number of inverters 1 Unit
Total power 25.0 kWac

Operating voltage 750 V
Pnom ratio (DC:AC) 1.29

Number of inverters 1 Unit
Total power 25.0 kWac

Operating voltage 750 V
Pnom ratio (DC:AC) 1.29

Total inverter power

Total power 50 kWac
Nb. of inverters 2 units
Pnom ratio 1.37



PVsyst V7.1.8

VC0, Simulation date:
08/04/21 14:02
with v7.1.8

Array losses

Array Soiling Losses

Loss Fraction 3.0 %

LID - Light Induced Degradation

Loss Fraction 2.0 %

Strings Mismatch loss

Loss Fraction 0.1 %

Thermal Loss factor

Module temperature according to irradiance

Uc (const) 23.0 W/m²K

Uv (wind) 0.0 W/m²K/m/s

Module Quality Loss

Loss Fraction 0.3 %

IAM loss factor

ASHRAE Param: IAM = 1 - bo(1/cosi -1)

bo Param. 0.05

DC wiring losses

Global array res. 246 mΩ

Global wiring resistance 123 mΩ

Loss Fraction 1.5 % at STC

Module mismatch losses

Loss Fraction (Fixed voltage) 0.0 %

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 0.8 % at STC

Inverter: SE50K/SE75K Unit

Wire section (1 Inv.) Copper 1 x 3 x 50 mm²

Wires length 190 m

Inverter: SE50K/SE75K Unit

Wire section (1 Inv.) Copper 1 x 3 x 10 mm²

Wires length 0 m

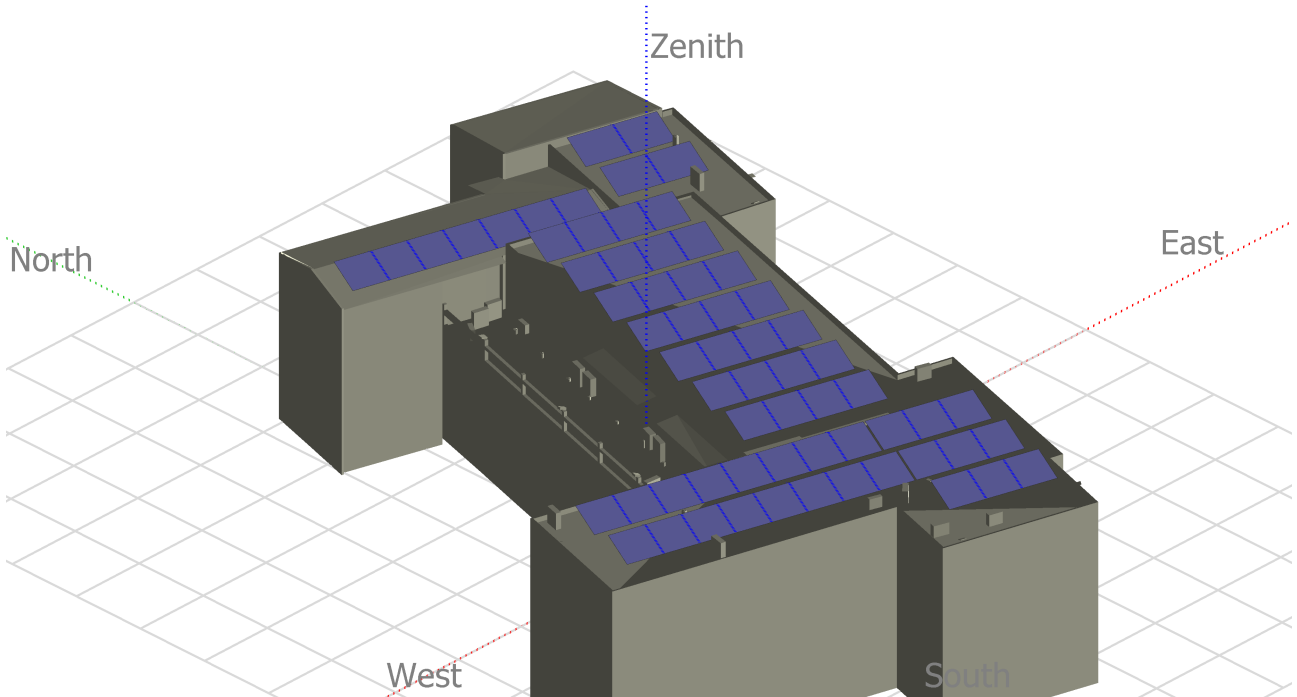


PVsyst V7.1.8

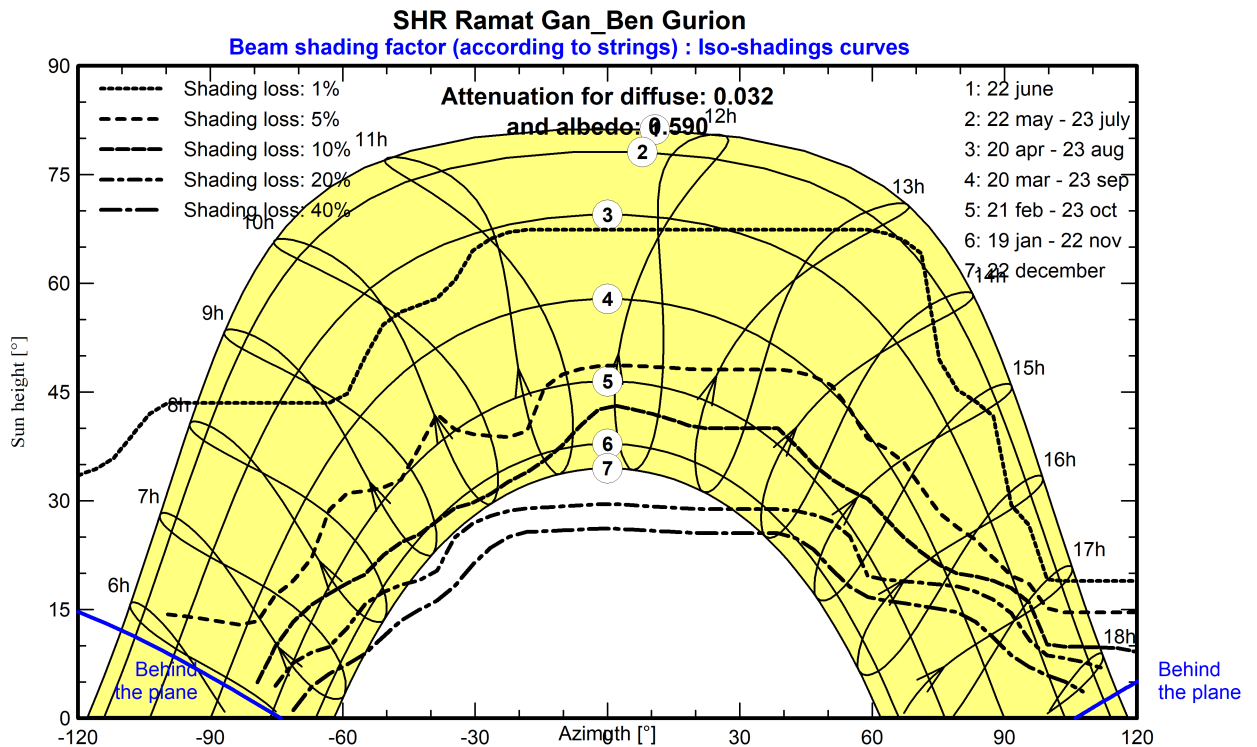
VC0, Simulation date:
08/04/21 14:02
with v7.1.8

Near shadings parameter

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram





Project: SHR Ramat Gan_Ben Gurion

Variant: New simulation variant

PVsyst V7.1.8

VC0, Simulation date:

08/04/21 14:02

with v7.1.8

Main results

System Production

Produced Energy

115.9 MWh/year

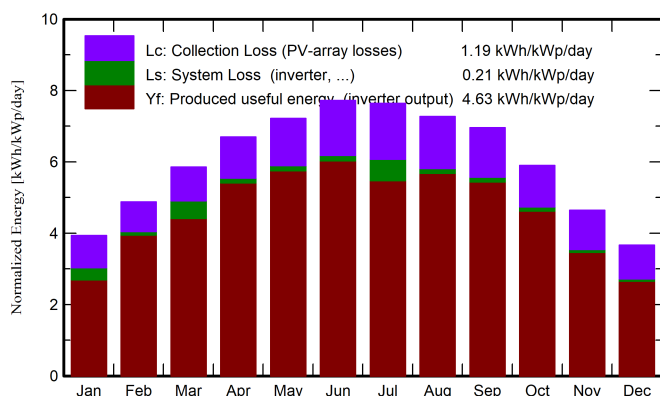
Specific production

1692 kWh/kWp/year

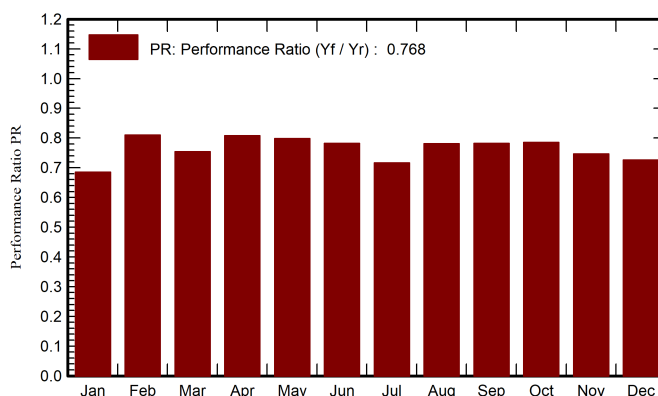
Performance Ratio PR

76.81 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	MWh	MWh	ratio
January	92.1	38.65	12.89	121.9	111.9	6.44	5.72	0.685
February	110.6	46.40	13.53	136.6	127.1	7.76	7.58	0.810
March	159.8	62.31	16.27	181.6	170.4	10.42	9.37	0.754
April	190.0	71.96	19.23	201.0	188.6	11.39	11.12	0.808
May	226.6	76.41	22.47	223.6	209.9	12.52	12.22	0.798
June	241.9	59.07	25.29	231.5	217.6	12.70	12.40	0.782
July	243.9	61.59	28.17	236.7	222.4	12.91	11.62	0.717
August	218.1	66.52	28.42	225.3	211.8	12.35	12.06	0.782
September	186.5	47.52	26.35	208.8	196.5	11.46	11.18	0.782
October	149.4	46.27	23.76	182.8	171.1	10.07	9.83	0.785
November	105.1	34.92	18.84	139.3	129.0	7.29	7.12	0.746
December	84.7	38.69	15.00	113.6	103.8	5.78	5.65	0.726
Year	2008.7	650.32	20.90	2202.6	2060.3	121.08	115.85	0.768

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

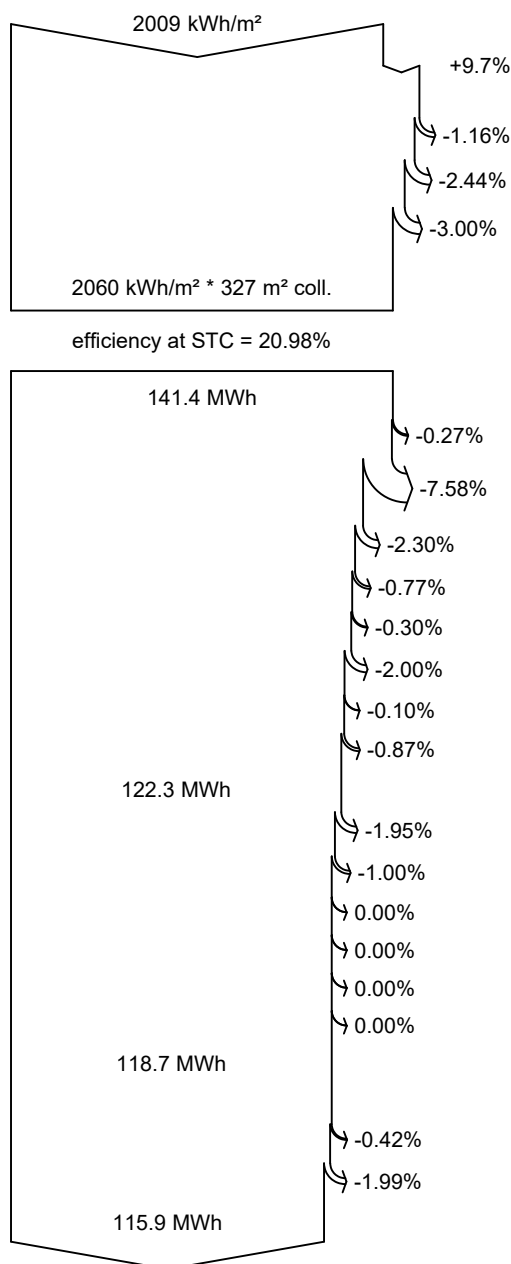
PR Performance Ratio



PVsyst V7.1.8

VC0, Simulation date:
08/04/21 14:02
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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

Module quality 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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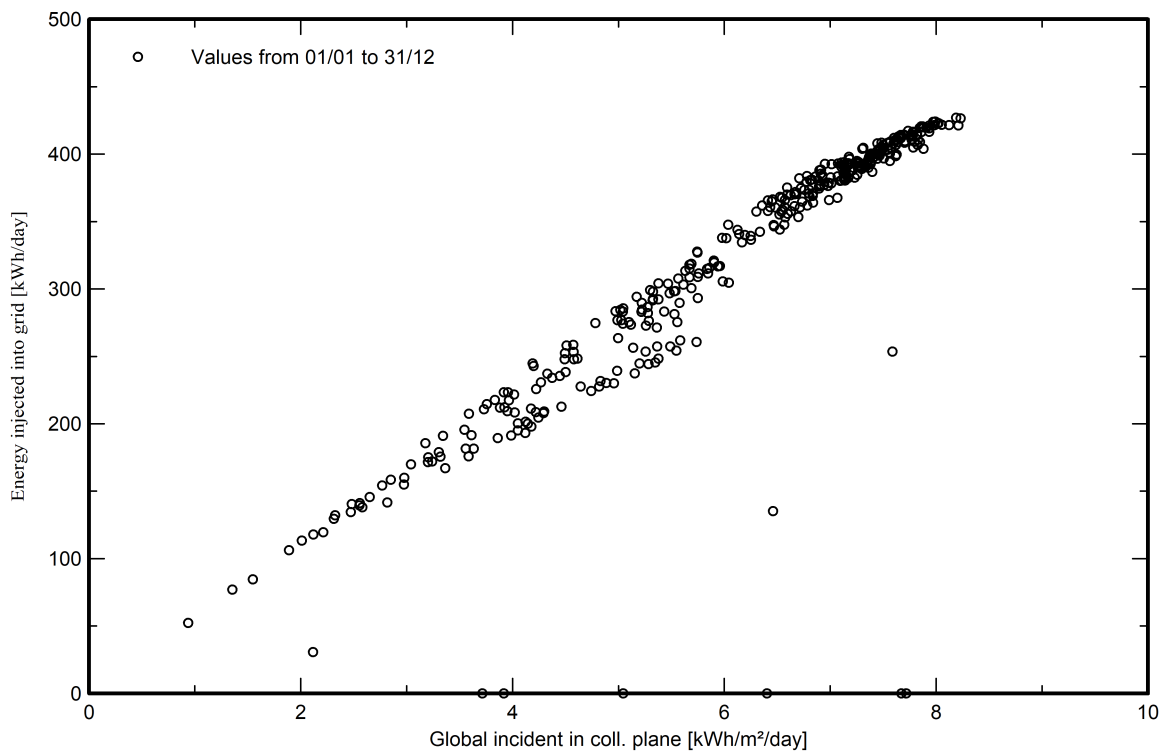
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Special graphs

Daily Input/Output diagram



System Output Power Distribution

