



Oost-West Legging Zonnepanelen,
Study/Motivatie met Calculatie en Berekening
K2 D-Dome 2.0 Montage/Opstelling materialen
SolarEdge Omvormer/Optimizer

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Ref.nr.: 2016-04-29/01
Uw ref.: Solar-nu.nl-D-Dome-vs-S-Dome
Betreft: K2 Montageopstelling D-Dome 2.0 vs S-Dome (South)

Bleiswijk, 160429

Beste,

Hieronder een study met gegevensoverzicht.

**K2 Montageopstelling,
D-Dome 2.0 (Oost-West) v.s. S-Dome (Zuid)**



1-1.D-Dome 2.0 (Oost-West)

D-Dome 2.0 is de Dubbel-Dome met een Oost-West opstelling.

1,82m² per module

28,8kg per module ballast. (Som gewicht per module $18,8 + 4,2 + 28,8 = 51,8\text{kg.PP}$) (61%)

30,5kg per m² (106,6%)

148watt/m² (270PP) (143,7%)

Kostprijs K2 D-Dome 2.0 PP ca.EUR.37,50 PP (richtprijs PP incl.BTW) (54%)

Meer vermogen per m² en minder kosten, is meer rendement



2-1.S-Dome 2.0 (Zuid)

S-Dome 2.0 is de Enkele-Dome met een Zuid opstelling.

2,63m² per module

57,8kg per module ballast. (Som gewicht per module $18,8 + 8,2 + 57,8 = 84,8\text{kg.PP}$)

28,6kg per m² (93,8%)

103watt/m² (270PP) (69,6%)

Kostprijs K2 D-Dome 2.0 PP ca.EUR.69,50 PP (richtprijs PP incl.BTW) (185,3%)

Solar-nu.nl

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Met groet, Ton Verbakel

Bijgevoegd PDF voorbeeld:

D-Dome 2.0 (Oost-West)

1-1: K2-D-Dome Calculatie, stormvast met ballast en materiaal overzicht.

1-2: SolarEdge Calculatie Systeem met 50 zonnepanelen.

50 Panelen met geïnstalleerd vermogen 13250w. met jaarlijks 11.820kWh.

Bij een gelijk dakoppervlak D-Dome vs S-Dome.

72 Panelen met geïnstalleerd vermogen 19080w. met jaarlijks 16.985kWh.(143,7%)

S-Dome 2.0 (Zuid)

2-1: K2-S-Dome Calculatie, stormvast met ballast en materiaal overzicht.

3-2: SolarEdge Calculatie Systeem met 50 zonnepanelen.

50 Panelen met geïnstalleerd vermogen 13250w. met jaarlijks 11.856kWh.(100,3%)

Voordelen D-Dome 2.0 (Oost-West):

1-Meer vermogen op het zelfde dakoppervlak.

2-Meer vermogen per m2 is 143,7%

3-Meergewicht per m2 is maar 6,6%

4-Minder ballast per m2. (maar 50% benodigd)

5-Minder montagemateriaalkosten, maar 54% benodigd.

6-Minder windgevoelig door ingesloten systeem.

7-Minder K2 montagemateriaal is snellere montage en minder bekabeling.



Mounting systems for solar technology



K2 SYSTEMS
CALCULATION BASIS

PROJECT: D-Dome 2.0
DRAFTSMAN: Ton Verbakel
DATE: 29-4-2016



INFORMATION

PROJECT DATA

Project Name: D-Dome 2.0

Project Address: Zernikestraat 7,
2665 JJ - BLEISWIJK

Project Number: 160428-01

CUSTOMER

Customer: Solar-nu.nl

Contact Person: Ton Verbakel

Address: Zernikestraat 7,
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Telefax: +31847102357

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DELIVERY ADDRESS

Zernikestraat 7,
2665 JJ - BLEISWIJK

BUILDING DATA

LOCATION

Ground level 0 m

BUILDING TYPE

Building Length 12,00 m

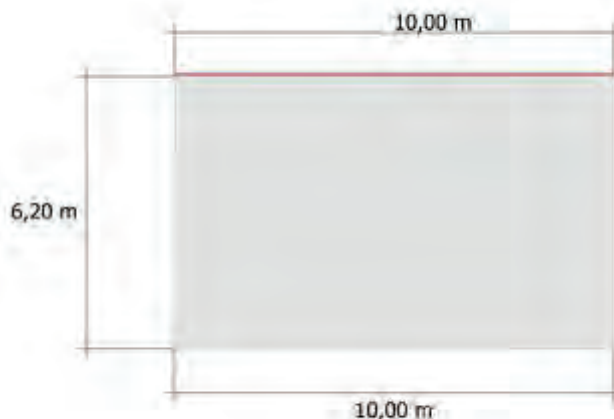
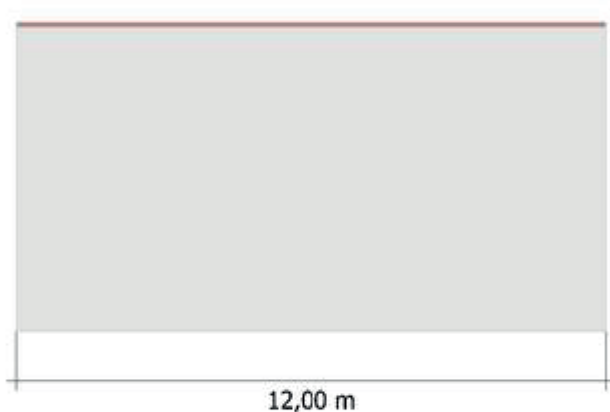
Building Width 10,00 m

Building Height 6,20 m

Parapet Wall Height 0,00 m

Roof Slope 0 °

Friction Coefficient 0,50



LOADS

SNOW LOAD

Snow Load Zone: Belgium
 Shape Coefficient Relating To Snow: $\mu_i = 0,800$
 Snow Load On Ground: $S_k = 0,500 \text{ kN/m}^2$ Snow Load: $S_i = 0,400 \text{ kN/m}^2$

WIND LOAD

Wind Velocity: 24 m/s
 Terrain Category: I: Lakes, humble cover of vegetation
 Gust Velocity Pressure: $q_p = 0,896 \text{ kN/m}^2$

ROOF AREAS

Area	Displacement Verification		Uplift Verification
	cpe_vert	cpe_hor	cpe
O1 (50..98 Modules)	-0,130	0,300	-0,180

DEAD WEIGHT

Modul Area: $A_M = 1,64 \text{ m}^2$
 Module Weight: $G_M = 19,50 \text{ kg}$
 Dead Weight: $g_M = 0,117 \text{ kN/m}^2$

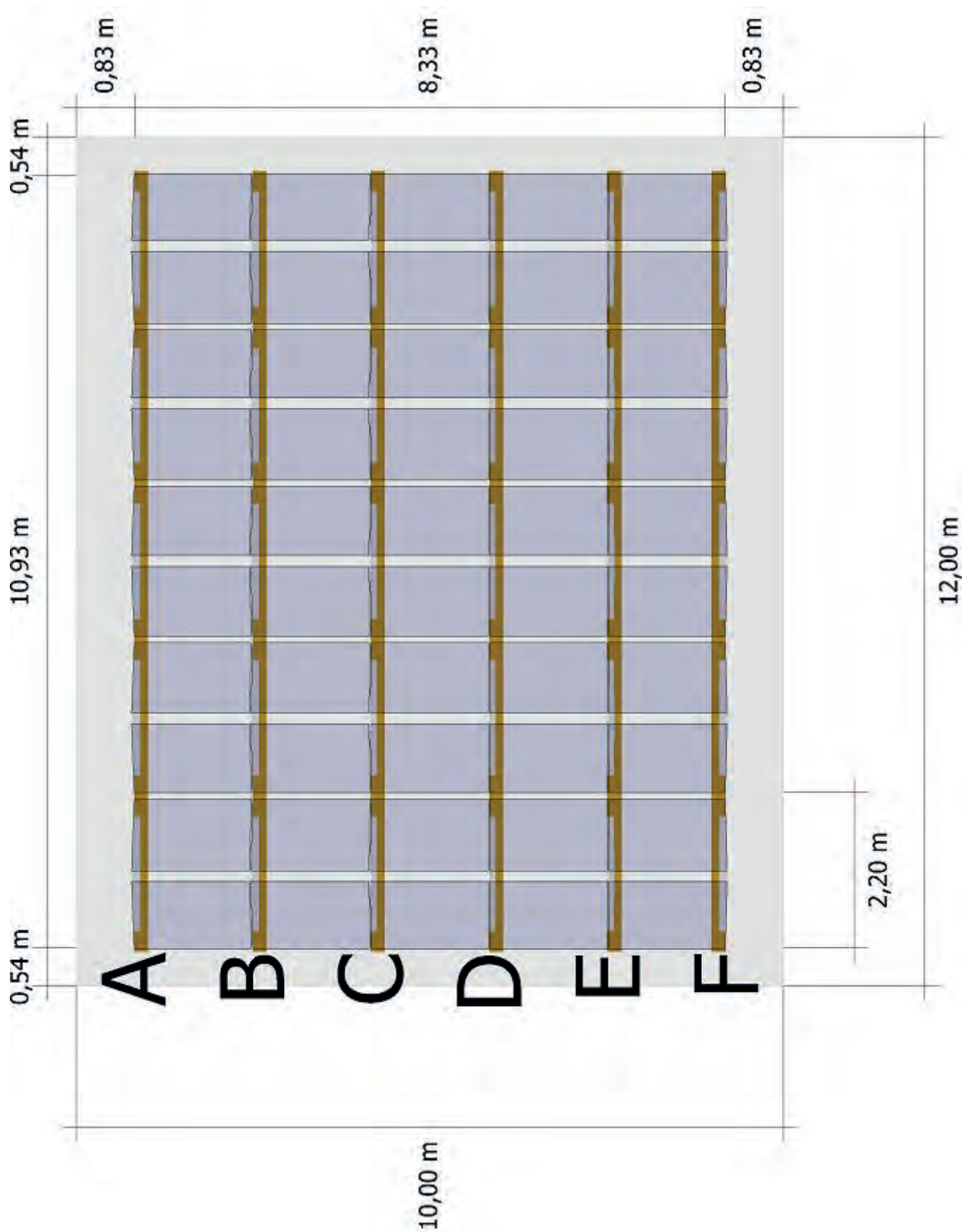
LOAD COMBINATION

Partial Safety Coefficient Permanent:	$\gamma_G = 1,35$
Partial Safety Coefficient First Variable:	$\gamma_{Q1} = 1,50$
Partial Safety Coefficient N Variables:	$\gamma_{Qn} = 1,50$
Partial Safety Coefficient Exceptional:	$\gamma_A = 1,00$
Combination Coefficient Relating To Wind:	$\psi_{0,W} = 0,60$
Combination Coefficient Relating To Snow:	$\psi_{0,S} = 0,50$
Combination Coefficient Relating To Snow 1000 M Above Sea Level:	$\psi_{0,S} = 0,70$

Lk1:	$E_d = 1,35 * G_k + 1,50 * S_k$
Lk2:	$E_d = 1,35 * G_k + 1,50 * W_{k,Pressure}$
Lk3:	$E_d = 1,35 * G_k + 1,50 * (W_{k,Pressure} + 0,5 * S_k)$
Lk4:	$E_d = 1,35 * G_k + 1,50 * (S_k + 0,6 * W_{k,Pressure})$
Lk5:	$E_d = G_k + A_d + 0,2 * W_{k,Pressure}$
Lk6:	$E_d = G_k + 1,50 * W_{k,Suction}$
Uplift Verification:	$E_d = 0,9 * G_k + 1,50 * W_{k,Suction}$
Displacement Verification:	$E_d = 0,9 * G_k + 1,50 * W_{k,Suction}$

ROOF STRUCTURE

Modules:	50	Module Length:	1650 mm
		Module Width:	992 mm
		Module Height:	40 mm
		Module Weight:	19,50 kg



CONFIGURATION

Rails

Description	K2 SpeedRail 22
Moment Of Inertia Iy	1,53 cm ⁴
Moment Of Inertia Iz	7,74 cm ⁴
Section Modulus Wy:	1,08 cm ³
Section Modulus Wz:	2,46 cm ³

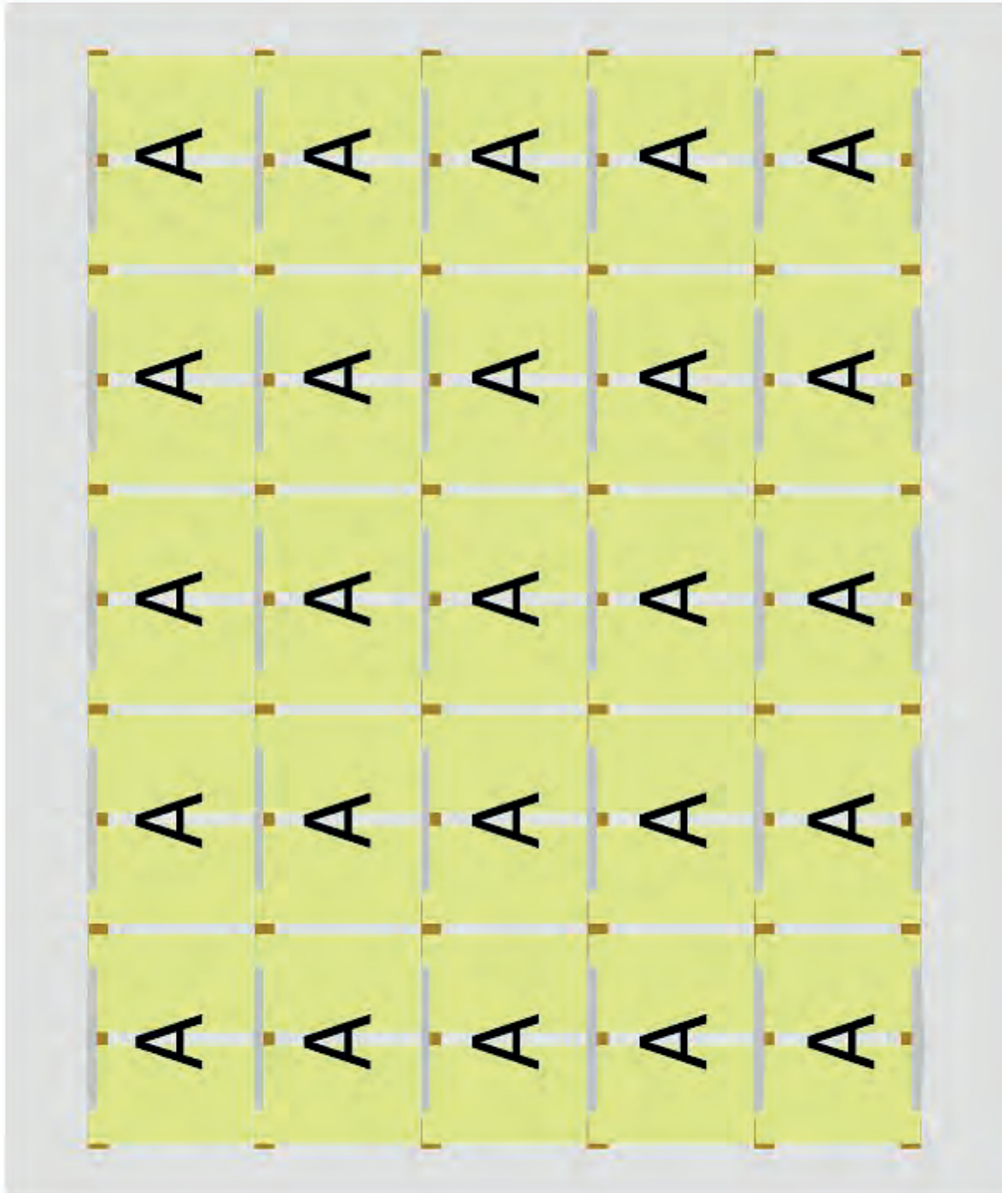


LAYOUT

Ballast accessory

- Base Rail
Base Rail A - F:

A Porter (57,53 kg)



MAXIMUM UTILIZATION

Centre distance basic profiles:	1,670 m
Load Assumption On Module:	1,23 kN/m ²
System Utilisation:	51,13 %

Area	Ballasting [kg] per double module	Total Weight [kg/m ²] (projected module area)	Quantity Of Modules
I	57,53	30,49	50

Total weight referred to entire roof area: 21,93 kg/m²

This value results from the entire ballast, module weight and dead weight of the mounting system divided by the entire roof area.

THE SYSTEM HAS BEEN CALCULATED SUCCESSFULLY.

CALCULATION NOTICE

- The analysis is only made for the substructure. The rails are considered as multi span beams with a cantilever using evenly distributed loads.
- Please assure that module used has got the module manufacturers approval for the Dome-Systems. View the latest list of approved modules here: <http://www.k2-systems.com/en/downloads/approved-module-list.html>.
- The design rules comply with the EURO CODE ANB EN 1990 - Basis of structural design.
- The determination of wind loads is based on the National Annex to ANB EN 1991-1-4 ANB - wind loads. The different sections have been combined for clarity.
- The determination of the snow load is based on the National Annex to ANB EN 1991-1-3 ANB - Snow loads. Any snow bag possibility has to be considered by a higher snow load.
- The values of the material load capacity are taken from the manufacturer's technical handbook.
- With any roof pitch of more than 3° the system additionally has to be mechanically fastened.

BILL OF MATERIAL

Position	Number	Article	Quantity	Weight
1	2001696	K2 BSP Wing Solar 470x180 18mm	66	66,000 kg
2	2001977	SpeedRail 22; 520 mm	66	22,040 kg
3	2001962	Dome D1000 2.0	30	29,670 kg
4	2001968	Dome SD 2.0	60	13,800 kg
5	2001729	Hexagonal socket head cap screw DIN 912/EN ISO 4762, M8x20, SER, A2-70	120	2,600 kg
6	1001643	M K2 Slot nut with clip, Stainless steel	120	2,100 kg
7	2000081	K2 Dome Porter	50	70,000 kg
8	2000155	K2 Dome Porter screw SET	50	2,970 kg
9	1004908	K2 Set XS Middle Clamp 39-44mm, 13mm, M8	80	5,600 kg
10	1005170	K2 Set End Clamp 39-41mm	40	3,000 kg
Sum				217,78 kg



Project:

1604-D-Dome Oost-West
woensdag 27 april 2016 11:46
D-Dome Oost-West

Location:

Rotterdam, Netherlands

System data:

Installed power: 13,25 kWp
Max achieved DC power: 12,50 kW
Inverter active power: 12,00 kW
Maximum apparent power: 12,00 kVA

PV Array # 1: PV Array # 1

Tilt	Azimuth	Mounting
8°	90°	Co-planar with roof
Trina Solar Energy, TSM-265DC05A.05, 265,00 W		

PV Array # 2: PV Array # 2

Tilt	Azimuth	Mounting
8°	270°	Co-planar with roof
Trina Solar Energy, TSM-265DC05A.05, 265,00 W		

Inverter design

Inverter 1: SE6000

String 1: PV Array # 1: 13 x P300
String 2: PV Array # 2: 13 x P300

Inverter 2: SE6000

String 1: PV Array # 1: 12 x P300
String 2: PV Array # 2: 12 x P300

Power optimizer extreme operating conditions

P300

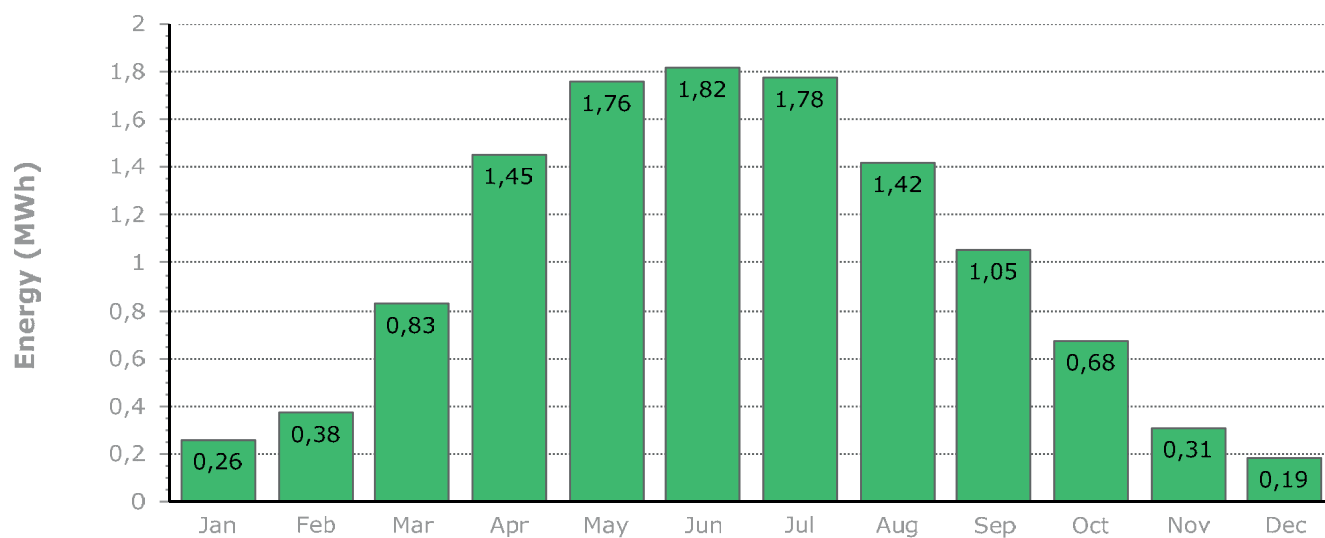
	Calculated	Limit	
Max input power	265 W	300 W	✓
Min input voltage	33 V	8 V	✓
Max input voltage	43 V	48 V	✓
Max input current	9 A	10 A	✓
Max output current	9 A	15 A	✓

* Calculated values are the absolute min/max of all arrays using this power optimizer configuration.



Energy estimation

Estimated monthly energy



Estimated yearly energy: 11,920 MWh

Energy yields are an approximation; they are not guaranteed by SolarEdge.

Bill of Materials

Inverters: SE6000-ER-01-NED, quantity: 2

Optimizers: P300-5RM4MRS, quantity: 50

Mounting systems for solar technology



K2 SYSTEMS

CALCULATION BASIS

PROJECT: 160429-Project S-Dome-48x
DRAFTSMAN: Ton Verbakel
DATE: 29-4-2016



INFORMATION

PROJECT DATA

Project Name: 160429-Project
S-Dome-48x
ZUID-OPSTELLING

Project Address: Zernikestraat 7
2665JJ Bleiswijk

Project Number: 160429

CUSTOMER

Customer: Solar-nu.nl
Contact Person: Ton Verbakel

Address: Zernikestraat 7
2665JJ Bleiswijk

Telephone: +31 (0) 105223593
Telefax: +31 (0) 847102357
Email: info@solar-nu.nl

DELIVERY ADDRESS

Zernikestraat 7
2665JJ Bleiswijk

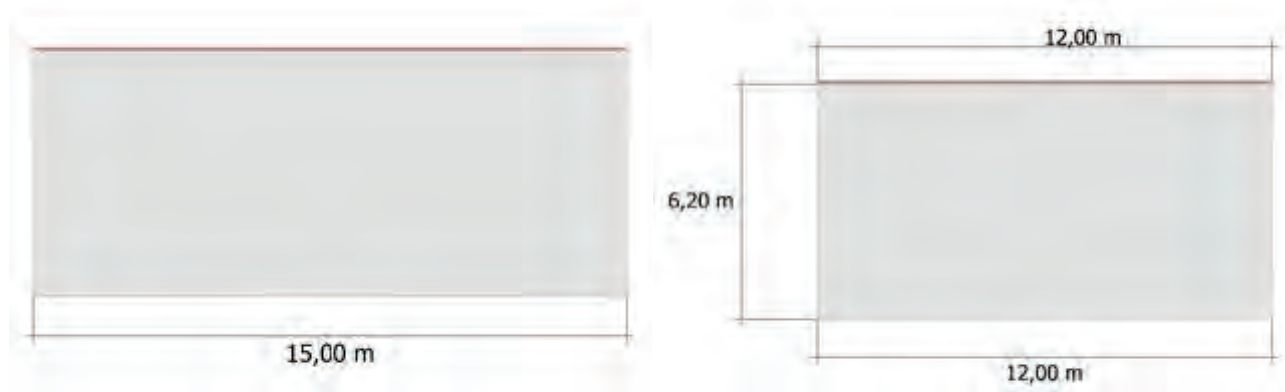
BUILDING DATA

LOCATION

Ground level 0 m

BUILDING TYPE

Building Length 15,00 m
Building Width 12,00 m
Building Height 6,20 m
Parapet Wall Height 0,20 m
Roof Slope 0 °
Friction Coefficient 0,65



LOADS

SNOW LOAD

Snow Load Zone: Belgium
 Shape Coefficient Relating To Snow: $\mu_i = 0,800$
 Snow Load On Ground: $S_k = 0,500 \text{ kN/m}^2$ Snow Load: $S_i = 0,400 \text{ kN/m}^2$

WIND LOAD

Wind Velocity: 25 m/s
 Terrain Category: I: Lakes, humble cover of vegetation
 Gust Velocity Pressure: $q_p = 0,972 \text{ kN/m}^2$

ROOF AREAS

Area	Displacement Verification			Uplift Verification
	cpe_vert	cpe_SN	cpe_NS	cpe
NW (36..99 Modules)	-0,247	0,230	-0,390	-0,260

DEAD WEIGHT

Modul Area: $A_M = 1,64 \text{ m}^2$
 Module Weight: $G_M = 18,60 \text{ kg}$
 Dead Weight: $g_M = 0,111 \text{ kN/m}^2$

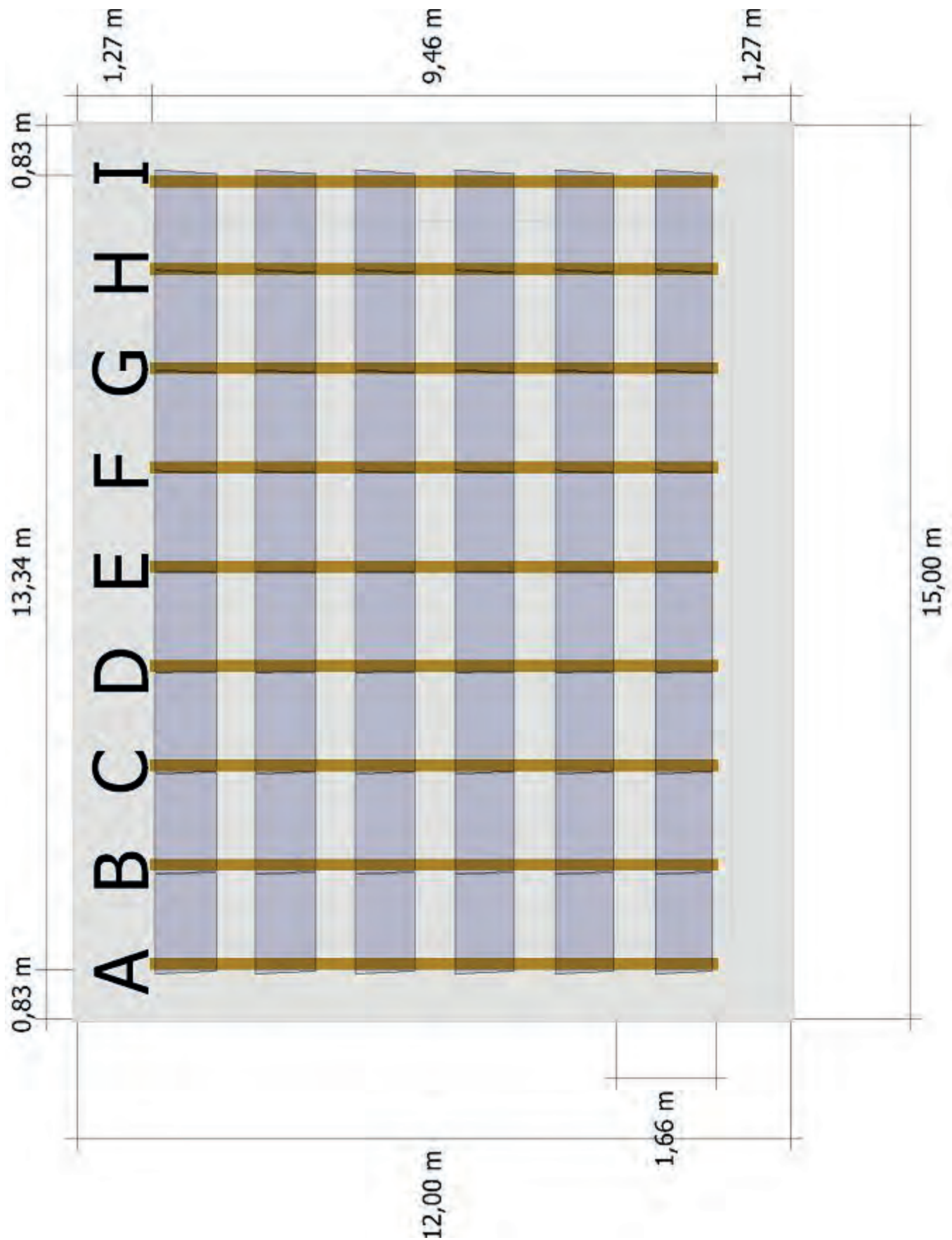
LOAD COMBINATION

Partial Safety Coefficient Permanent:	$\gamma_G = 1,35$
Partial Safety Coefficient First Variable:	$\gamma_{Q1} = 1,50$
Partial Safety Coefficient N Variables:	$\gamma_{Qn} = 1,50$
Partial Safety Coefficient Exceptional:	$\gamma_A = 1,00$
Combination Coefficient Relating To Wind:	$\psi_{0,W} = 0,60$
Combination Coefficient Relating To Snow:	$\psi_{0,S} = 0,50$
Combination Coefficient Relating To Snow 1000 M Above Sea Level:	$\psi_{0,S} = 0,70$

Lk1:	$E_d = 1,35 * G_k + 1,50 * S_k$
Lk2:	$E_d = 1,35 * G_k + 1,50 * W_{k,Pressure}$
Lk3:	$E_d = 1,35 * G_k + 1,50 * (W_{k,Pressure} + 0,5 * S_k)$
Lk4:	$E_d = 1,35 * G_k + 1,50 * (S_k + 0,6 * W_{k,Pressure})$
Lk5:	$E_d = G_k + A_d + 0,2 * W_{k,Pressure}$
Lk6:	$E_d = G_k + 1,50 * W_{k,Suction}$
Uplift Verification:	$E_d = 0,9 * G_k + 1,25 * W_{k,Suction}$
Displacement Verification:	$E_d = 0,9 * G_k + 1,10 * W_{k,Suction}$

ROOF STRUCTURE

Modules:	48	Module Length:	1650 mm
		Module Width:	992 mm
		Module Height:	35 mm
		Module Weight:	18,60 kg



CONFIGURATION

Rails

Description	K2 SpeedRail 22
Moment Of Inertia Iy	1,53 cm ⁴
Moment Of Inertia Iz	7,74 cm ⁴
Section Modulus Wy:	1,08 cm ³
Section Modulus Wz:	2,46 cm ³



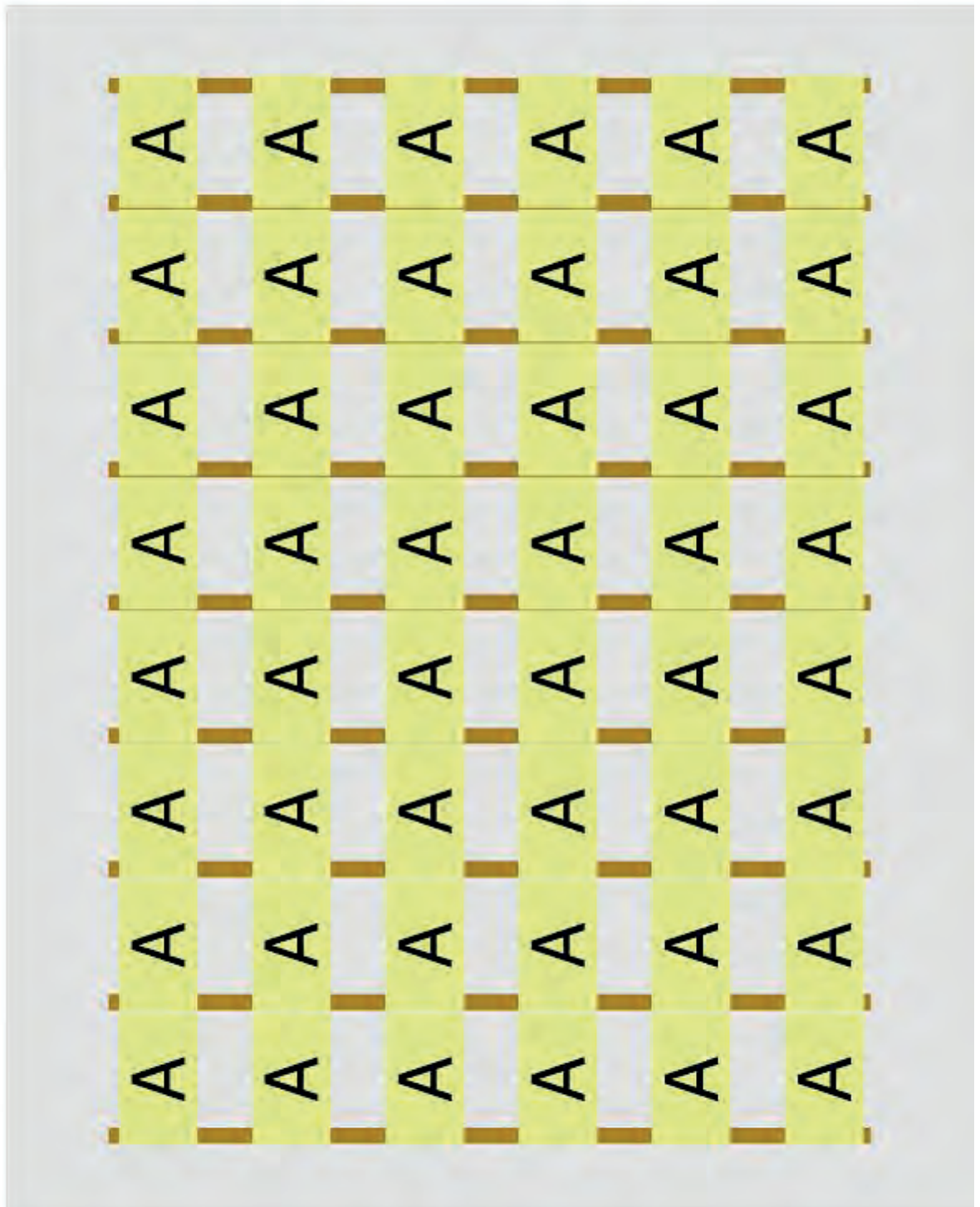
LAYOUT

Ballast accessory

A Porter (57,8 kg)

Ballast capacity

S1000	5,0 kg
Short Porter	20,0 kg
Porter	120,0 kg



MAXIMUM UTILIZATION

Centre distance basic profiles:	1,670 m
Load Assumption On Module Pressure:	1,54 kN/m ²
System Utilisation Pressure:	14,12 %
Load Assumption On Module Suction:	-0,98 kN/m ²
System Utilisation Suction:	19,26 %
rounding ballast:	5,0 kg

Area	Ballasting [kg] per module	Total Weight [kg/m ²] (occupied roof area)	Quantity Of Modules
I	57,8	28,6	48

Total weight referred to entire roof area: 22,6 kg/m²

This value results from the entire ballast, module weight and dead weight of the mounting system divided by the entire roof area.

THE SYSTEM HAS BEEN CALCULATED SUCCESSFULLY.

CALCULATION NOTICE

- The analysis is only made for the substructure. The rails are considered as multi span beams with a cantilever using evenly distributed loads.
- Please assure that module used has got the module manufacturers approval for the Dome-Systems. View the latest list of approved modules here: <http://www.k2-systems.uk.com/downloads/approved-module-list.html>.
- The distance between the module rows has been changed to 1,661 m.
- The design rules comply with the EURO CODE ANB EN 1990 - Basis of structural design.
- The determination of wind loads is based on the National Annex to ANB EN 1991-1-4 ANB - wind loads. The different sections have been combined for clarity.
- The determination of the snow load is based on the National Annex to ANB EN 1991-1-3 ANB - Snow loads. Any snow bag possibility has to be considered by a higher snow load.
- The values of the material load capacity are taken from the manufacturer's technical handbook.
- With any roof pitch of more than 3° the system additionally has to be mechanically fastened.
- With the selected row distance modules may get partly shaded.



BILL OF MATERIAL

Position	Number	Article	Quantity	Weight
1	2001695	K2 BSP Wing Solar Alu 470x180 18mm	63	63,000 kg
2	2001739	K2 BSP Wing Solar Alu 160x180 18mm	63	22,050 kg
3	2002031	K2 SpeedRail 22; 880 mm	63	35,480 kg
4	2001967	S Dome 1000 2.0	54	49,140 kg
5	2001968	Dome SD 2.0	54	12,420 kg
6	2001729	Hexagonal socket head cap screw DIN 912/EN ISO 4762, M8x20, SER, A2-70	162	2,600 kg
7	1001643	M K2 Slot nut with clip, Stainless steel	162	2,888 kg
8	2000081	K2 Dome Porter	96	134,400 kg
9	2000155	K2 Dome Porter screw SET	96	5,940 kg
10	1003586	K2 Set XS Middle Clamp 34-38mm, 13mm, M8	84	5,880 kg
11	1005169	K2 Set End Clamp 34-36mm	24	1,800 kg
12	1005843	K2 Dome Windbreaker 1700mm	48	52,800 kg
13	2001735	Hexagonal socket head cap screw DIN 912/EN ISO 4762, M8x16, SER, A2-70	192	2,200 kg
14	1000273	Washer 8,4x30x1,5 mm	192	1,400 kg
Sum				392,00 kg



Project:

1604-S-Dome SOUTH
woensdag 27 april 2016 11:52
1604-S-Dome SOUTH

Location:

Rotterdam, Netherlands

System data:

Installed power: 13,25 kWp
Max achieved DC power: 12,52 kW
Inverter active power: 12,00 kW
Maximum apparent power: 12,00 kVA

PV Array # 1: PV Array # 1

Tilt	Azimuth	Mounting
8°	180°	Co-planar with roof
Trina Solar Energy, TSM-265DC05A.05, 265,00 W		

Inverter design

Inverters 1-2: SE6000

String 1: PV Array # 1: 13 x P300
String 2: PV Array # 1: 12 x P300

Power optimizer extreme operating conditions

P300

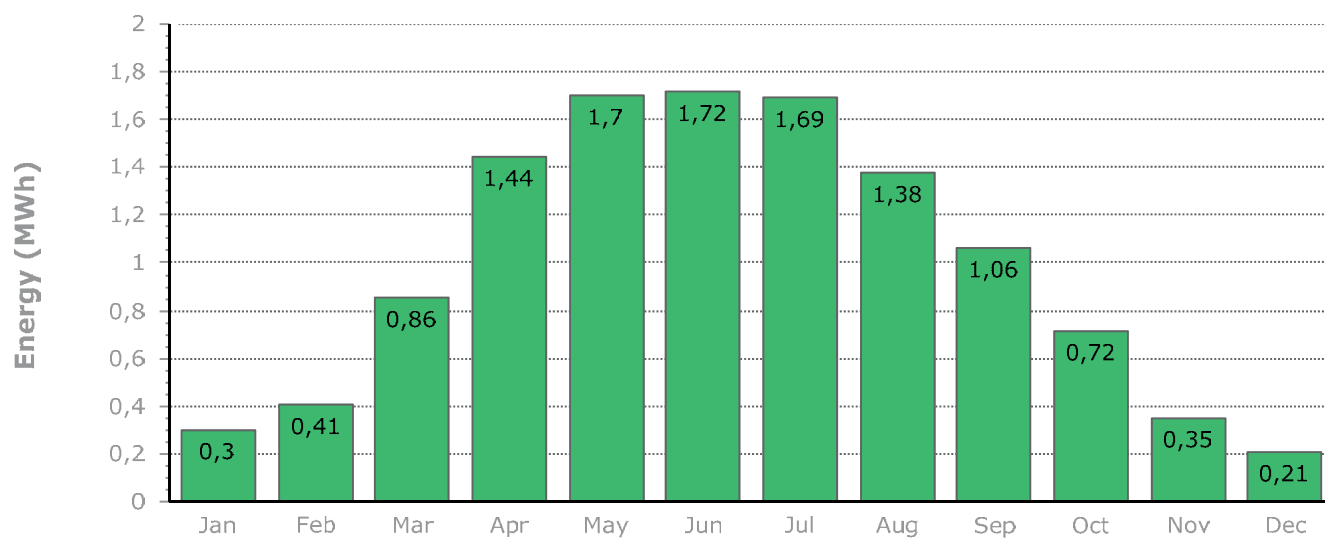
	Calculated	Limit	
Max input power	265 W	300 W	✓
Min input voltage	33 V	8 V	✓
Max input voltage	43 V	48 V	✓
Max input current	9 A	10 A	✓
Max output current	9 A	15 A	✓

* Calculated values are the absolute min/max of all arrays using this power optimizer configuration.



Energy estimation

Estimated monthly energy



Estimated yearly energy: 11,856 MWh

Energy yields are an approximation; they are not guaranteed by SolarEdge.

Bill of Materials

Inverters: SE6000-ER-01-NED, quantity: 2

Optimizers: P300-5RM4MRS, quantity: 50



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