

Appendix C Proposal Information

- C.1 Preliminary layout, structural and electrical single line diagrams
- C.2 Specification sheet for an example Suntech 270 Watt Poly-Crystalline solar panel
- C.3 Specification sheet for example inverters
- C.4 Specification sheet for example kiosk transformers
- C.5 Example PV mounting system (Habdank) brochure

Design Unit 30 MWac
total required area approx 73 ha

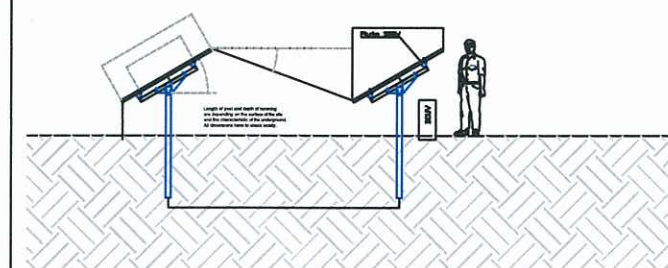
LEGEND

	module-strings
	distribution cabinet
	medium voltage substation
	inverterstation
	cable trench
	fence

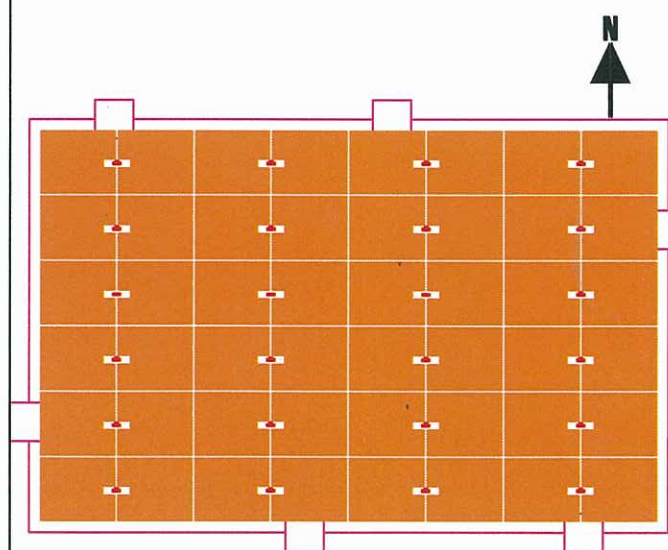
CABLING

module designation	Suntech pluto 300 W
# of modules	109,440
# of modules per string	14
# of strings	5472
inverter	SMA SC630
# of distribution cabinet DCUV	480
# of distribution cabinet DCHV	48
total power	30 MWac

DETAIL DRAWING



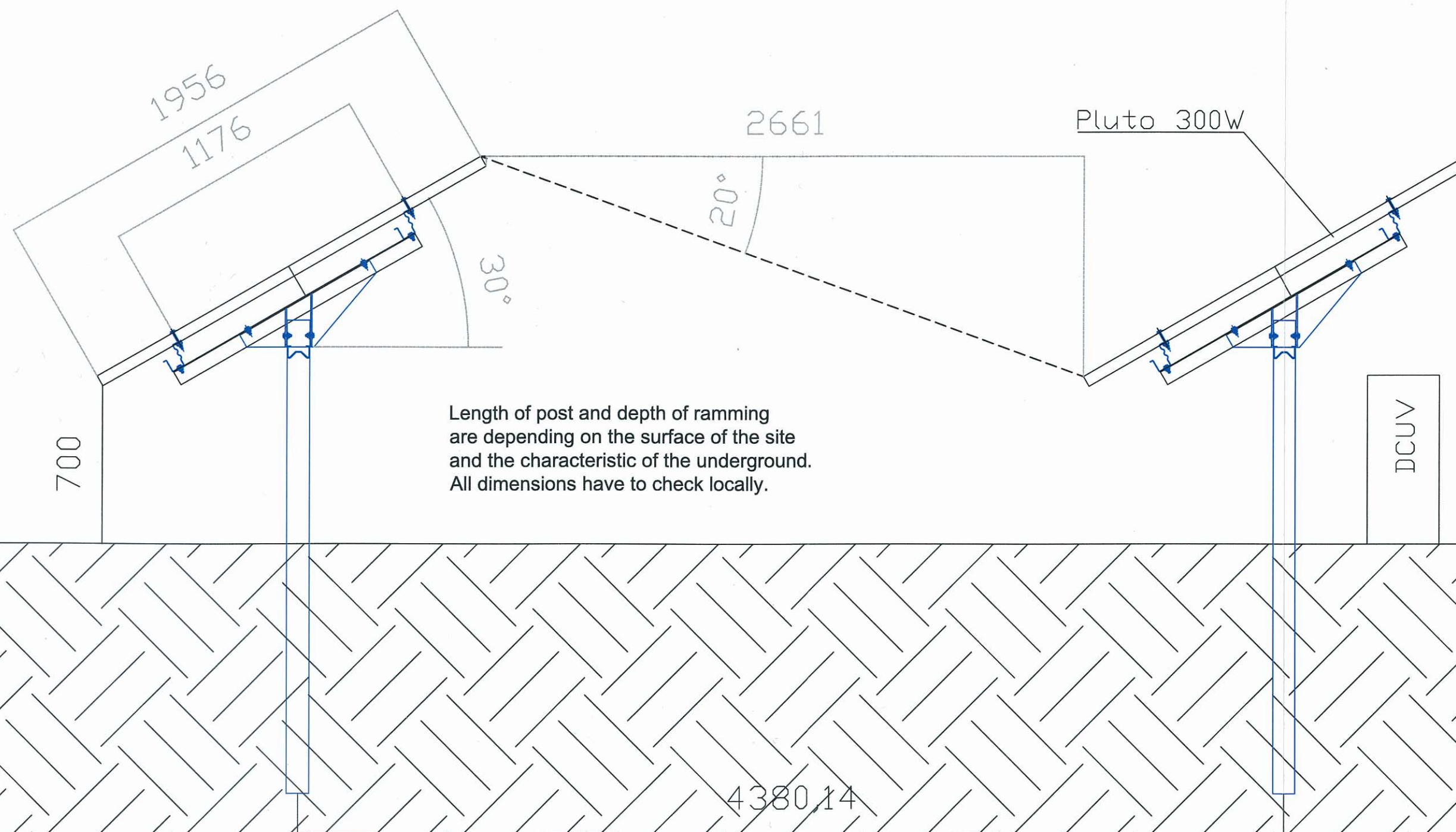
OVERVIEW

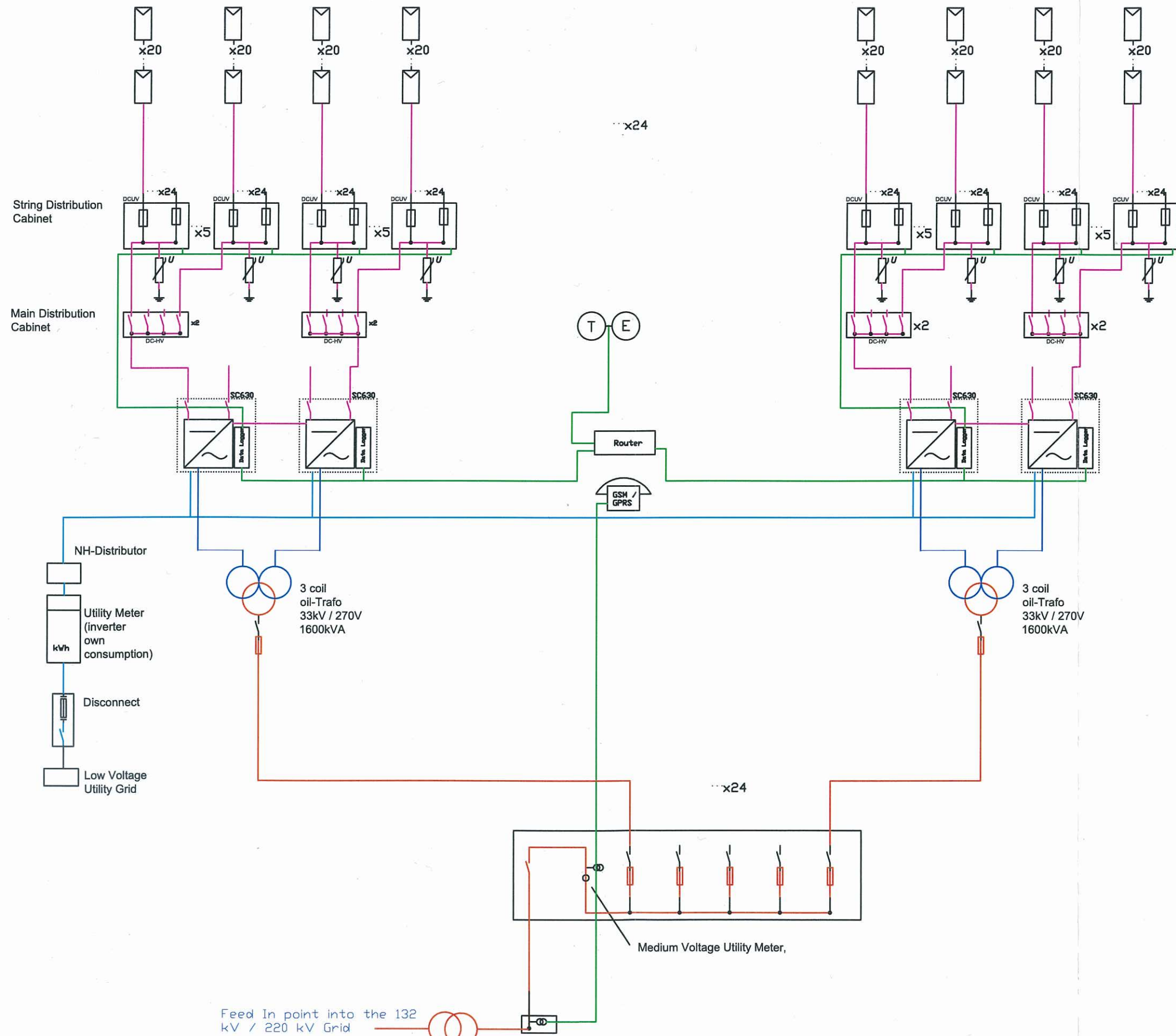


Phoenix Solar AG
Schillerstr.1/6
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Tel: 0731/140540
Fax: 0731/1405419
www.phoenixsolar.de
Revisionsdaten:



scale:		project: PV-Plant - generic 30 MWac Preliminary Design
unit:		
date	name	plancontents: Module Site Plan
02/02/2011	E. Bindel	





- DC
- low voltage 270V (AC)
- low voltage 230V (AC)
- Dataline
- medium voltage 33kV (AC)

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Maßstab:	Projekt:
Einheit:	PV Power Plant
Datum	Solar Flagship 30 MWac base unit
05.02.10	Bindel
05.02.10	DeDucq
Name	Planinhalt:
	Single Line Diagram

270 Watt

POLY-CRYSTALLINE SOLAR PANEL

Features

- High conversion efficiency based on leading innovative photovoltaic technologies
- High reliability with guaranteed $\pm 3\%$ power output tolerance, ensuring return on investment
- Withstands high wind-pressure and snow load (passed IEC 5400Pa mechanical loading test), and extreme temperature variations

Quality and Safety

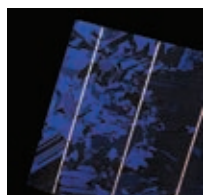
- 25-year power output warranty *
- Rigorous quality control meeting the highest international standards
- ISO 9001:2000 (Quality Management System) and ISO 14001:2004 (Environmental Management System) certified factories manufacturing world class products
- IEC61215, IEC61730, conformity to CE

Recommended Applications

- On-grid utility systems
- On-grid commercial systems
- Off-grid ground mounted systems



* Refer to Suntech's warranty document for terms and conditions



Unique Suntech Back Surface Field (BSF) structure and anti-reflective coating increase cell conversion efficiency.



Thermal isolation between the lamination and latest designed J-box improves panel performance stability. The new J-box also provides perfect interconnection between modules and inverters to ensure the fully utilization of module power output (option with MC4 connector).



Suntech was named Frost and Sullivan's 2008 Solar Energy Development Company of the Year



Special design on drainage holes and rigid construction prevents frame from deforming or breaking due to freezing weather and other forces.

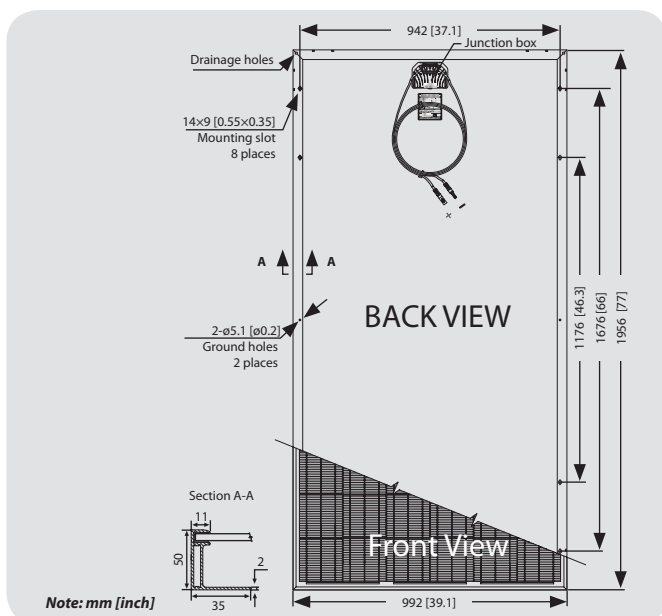


Advanced cell texturing and passivation processes improve module low light irradiance performance and provide more field power output.

Electrical Characteristics

Characteristics	STP280-24/Vd	STP270-24/Vd	STP260-24/Vd
Open - Circuit Voltage (Voc)	44.8V	44.5V	44.0V
Optimum Operating Voltage (Vmp)	35.2V	35.0V	34.8V
Short - Circuit Current (Isc)	8.33A	8.20A	8.09A
Optimum Operating Current (Imp)	7.95A	7.71A	7.47A
Maximum Power at STC (Pmax)	280Wp	270Wp	260Wp
Operating Temperature	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Maximum System Voltage	1000V DC	1000V DC	1000V DC
Maximum Series Fuse Rating	20A	20A	20A
Power Tolerance	±3 %	±3 %	±3 %

STC: Irradiance 1000W/m², Module temperature 25°C, AM=1.5



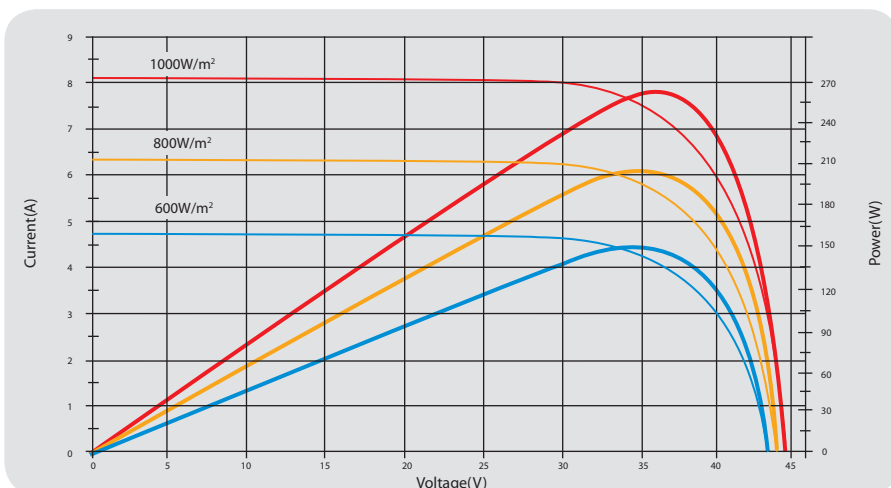
Mechanical Characteristics

Solar Cell	Poly-crystalline 156×156mm (6inch)
No. of Cells	72 (6×12)
Dimensions	1956×992×50mm (77.0×39.1×2.0inch)
Weight	27 kg (59.5lbs.)
Front Glass	4mm(0.16inch) tempered glass
Frame	Anodized aluminium alloy
Junction Box	IP67 rated
Output Cables	H+S RADOX® SMART cable 4.0mm ² (0.006inch ²), symmetrical lengths (-) 1000mm (39.4inch) and (+) 1000mm (39.4inch), RADOX® SOLAR integrated twist locking connectors or MC4 connectors

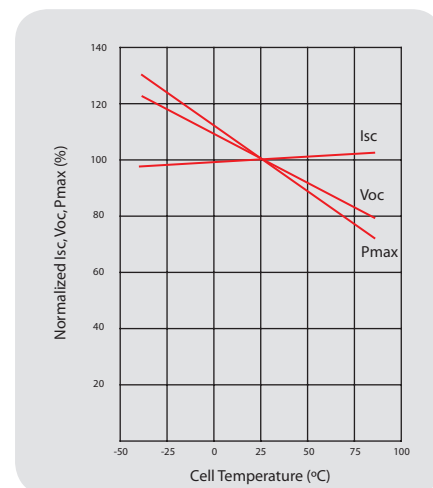
Temperature Coefficients

Nominal Operating Cell Temperature (NOCT)	45±2/°C
Temperature Coefficient of Pmax	-0.47%/°C
Temperature Coefficient of Voc	-0.34%/°C
Temperature Coefficient of Isc	0.045%/°C

Current-Voltage & Power-Voltage Curve (260W)



Temperature Dependence of Isc, Voc, Pmax



Specifications are subjected to change without further notice

SC 500CP / 630CP / 800CP Outdoor

Low system costs

- > Direct deployment in the field due to outdoor enclosure
- > Simplified shipping without concrete substation
- > Easy installation due to a separate connection compartment
- > Optional: extended input voltage range up to 1,100 V

High performance as a standard

- > Full nominal power at ambient temperatures up to 50 °C
- > 10 % additional power in continuous operation at ambient temperatures up to 25 °C
- > Powerful grid management functions (including LVRT)



SUNNY CENTRAL CP OUTDOOR

Out.Standing

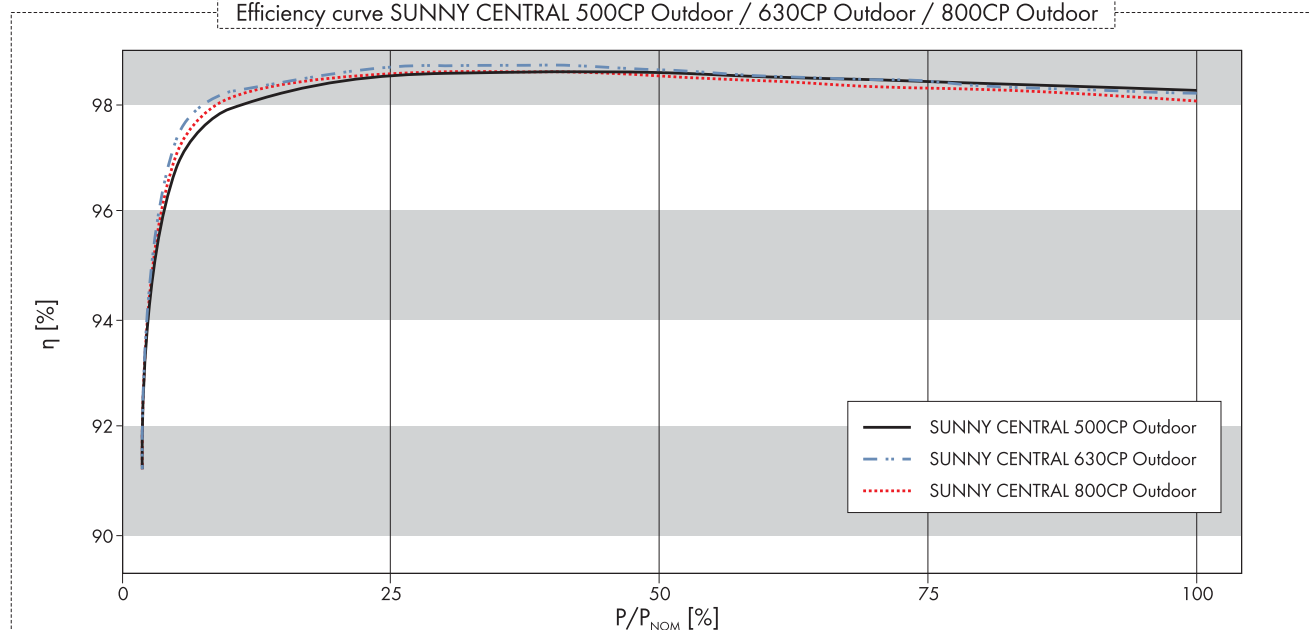
The completely new design of the Sunny Central Compact Power series saves you real money. The compact and weatherproof enclosure is easy to load and transport and can be installed almost anywhere – there is no need for heavy protective concrete substations any longer. The innovative cooling concept OptiCool allows the inverter to operate at full nominal power with ambient temperatures up to 50 °C. With the powerful grid management functions you are perfectly prepared for today's utility requirements as well as those still to come. The intelligent power management is the most important feature: in continuous operation, the Sunny Central 800CP Outdoor can feed 880 kVA to the grid at ambient temperatures of up to 25 °C – that's 10 % more than the rated nominal power. Thus, the specific price is reduced even further.

Technical Data

SUNNY CENTRAL 500 / 630 / 800CP Outdoor

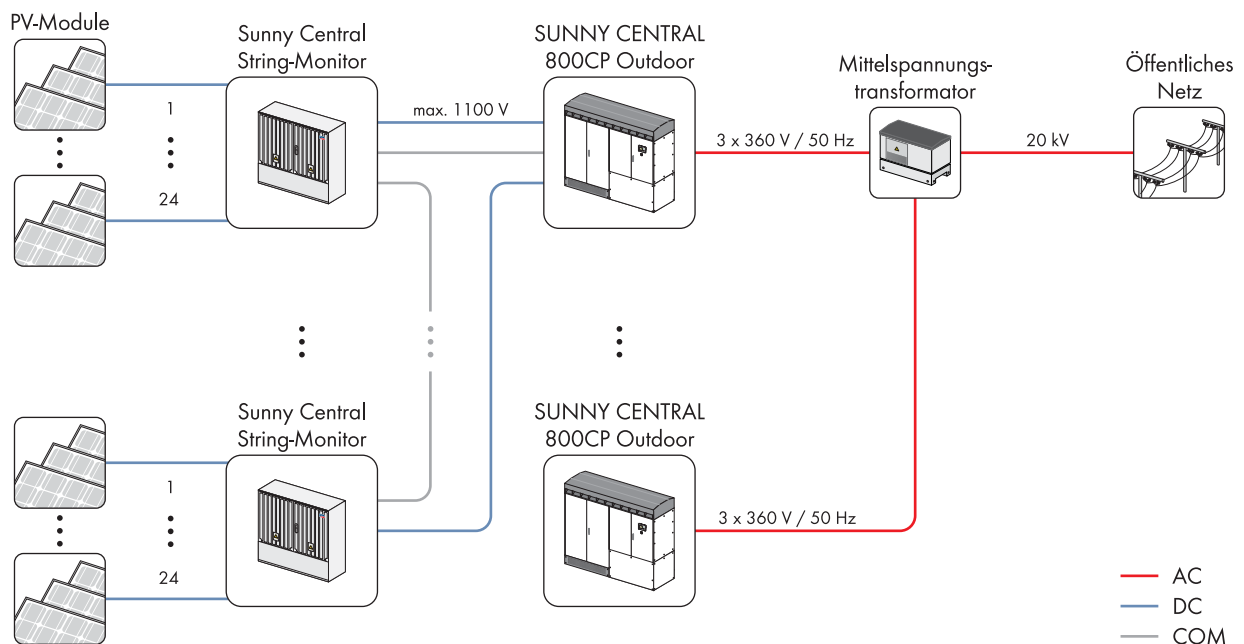
	SC 500CP Outdoor	SC 630CP Outdoor	SC 800CP Outdoor
Input data			
PV voltage range, MPPT	430 V – 820 V ⁵⁾	500 V – 820 V ⁵⁾	570 – 820 V ⁵⁾
Max. DC voltage	1000 V / 1100 V ¹⁾ Optional	1000 V / 1100 V ¹⁾ Optional	1000 V / 1100 V ¹⁾ Optional
Max. DC current	1250 A	1350 A	1400 A
Number of DC inputs	9 fused inputs		
Output data			
Nominal AC output	500 kVA @ 50° C	630 kVA @ 50° C	800 kVA @ 50° C
Max. AC-power	550 kVA @ 25° C	700 kVA @ 25° C	880 kVA @ 25° C
Max. AC current	1167	1271	1411
Nominal AC current	1069 A	1155 A	1283 A
Harmonic distortion of grid current	< 3 % at nominal power		
AC voltage range ±10 %	243 ... 297 V	284 ... 347 V	324 ... 396 V
Nominal AC voltage	270 V	315 V	360 ³⁾
AC grid frequency	50 Hz / 60 Hz	50 Hz / 60 Hz	50 Hz / 60 Hz
Adjustable displacement power factor (cos φ)	0.9 leading – 0.9 lagging		
Efficiency ²⁾			
Max. efficiency (@ U_AC _{nom})	98.6 % @ U_DC 450V	98.7 % @ U_DC 500V	98.6 % @ U_DC 600V
Euro-Eta (@ U_AC _{nom})	98.4 % @ U_DC 450V	98.5 % @ U_DC 500V	98.4 % @ U_DC 600V
CEC-Eta	98.5 %	98.5 %	98.4 %
Dimensions and Weight			
Width / Height / Depth in mm (W / H / D)	2562 / 2279 / 956	2562 / 2279 / 956	2562 / 2279 / 956
Weight approx. (kg)	1800	1800	1800
Power consumption			
Internal consumption in operation / day	< 1500 W ⁴⁾	< 1500 W ⁴⁾	< 1500 W ⁴⁾
Internal consumption in standby / night	< 100 W	< 100 W	< 100 W
External auxiliary supply	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz	3 x 230 V, 50 / 60 Hz
Operating temperature range	-20 °C ... +50 °C	-20 °C ... +50 °C	-20 °C ... +50 °C
Relative humidity, not condensing	15 ... 95 %	15 ... 95 %	15 ... 95 %
Max. altitude (above sea level)	2000 m	2000 m	2000 m
Fresh air consumption	3000 m³ / h	3000 m³ / h	3000 m³ / h
Protection rating as per EN 60529	IP54	IP54	IP54
Protection rating as per EN 60721-3-3 Ambient conditions: fixed location, with protection against wind and weather	• Classification of chemically active substances 3C1L • Classification of mechanically active substances: 3S2	• Classification of chemically active substances: 3C1L • Classification of mechanically active substances: 3S2	• Classification of chemically active substances: 3C1L • Classification of mechanically active substances: 3S2

Efficiency curve SUNNY CENTRAL 500CP Outdoor / 630CP Outdoor / 800CP Outdoor

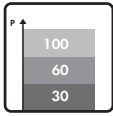


	SC 500CP Outdoor	SC 630CP Outdoor	SC 800CP Outdoor
Type name	SC-500-CP-10	SC-630-CP-10	SC-800-CP-10
Features			
Sunny WebBox	Yes	Yes	Yes
Communication	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)	Ethernet (optical fiber optional)
Communication with Sunny String-Monitor	RS485	RS485	RS485
Display	Yes	Yes	Yes
Cabinet color	RAL 9016	RAL 9016	RAL 9016
Color of base	RAL 7005	RAL 7005	RAL 7005
Color of roof	RAL 7004	RAL 7004	RAL 7004
Ground fault monitoring / isolation monitoring	Yes	Yes	Yes
Circuit breaker AC side	Yes	Yes	Yes
Motor driven fuse-switch-disconnector on DC side	Yes	Yes	Yes
AC overvoltage protector	Yes	Yes	Yes
DC overvoltage protector	Yes	Yes	Yes
Overvoltage protectors for auxiliary supply	Yes	Yes	Yes
Standards			
EMC	EN 61000-6-2 EN 61000-6-4	EN 61000-6-2 EN 61000-6-4	EN 61000-6-2 EN 61000-6-4
Grid monitoring	as per BDEW regulations	as per BDEW regulations	as per BDEW regulations
CE conformity	Yes	Yes	Yes

- 1) At 1100 V_{DC} the max. MPP-voltage increases to 850 V_{DC}, startup < 1000 V DC. MPP voltages between 820 V_{DC} and 850 V_{DC} are can only be processed up to 500 hours per year.
- 2) Efficiency measured without internal power supply
- 3) Further AC-voltages, DC-voltages and power classes can be configured.
- 4) Internal consumption at nominal power
- 5) Bei 1.05 U_{AC,nom} and cos φ=1

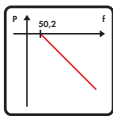


Powerful grid management functions



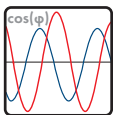
Remote controlled power reduction in case of grid overload

In order to avoid short-term grid overload, the grid operator presets a nominal active power value which the inverter will implement within 60 seconds. The nominal value is transmitted to the inverters via a ripple control receiver in combination with the SMA Power Reducer Box. Typical limit values are 100, 60, 30 or 0 per cent of the nominal power.



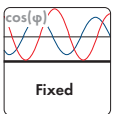
Frequency-dependent control of active power

As a grid frequency of 50.2 Hz, the inverter automatically reduces the fed-in of active power according to a definable characteristic curve which thereby contributes to the stabilization of the grid frequency.



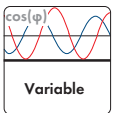
Static voltage support based on reactive power

SMA inverters feed capacitive or inductive to the grid in order to stabilize the grid voltage. Three different modes are available:



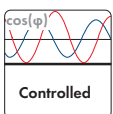
a) Fixed definition of the reactive power by the grid operator

The grid operator defines a fixed reactive power value or a fixed displacement factor between $\cos(\varphi)_{\text{leading}} = 0.90$ and $\cos(\varphi)_{\text{lagging}} = 0.90$.



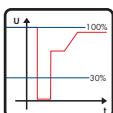
b) Definition of a dynamic setpoint of the reactive power by the utility operator

The grid operator defines a dynamic displacement factor - any value between $\cos(\varphi)_{\text{leading}} = 0.90$ und $\cos(\varphi)_{\text{lagging}} = 0.90$. It is transmitted through a communication unit. The evaluation can e.g. be (evaluated and) processed by the SMA Power Reducer Box.



c) Control of the reactive power over a characteristic curve

The reactive power or the phase shift is controlled by a pre-defined characteristic curve - depending on the active power fed into the grid or the grid voltage.



Limited Dynamic Grid Support

The inverter continues to feed to the grid after short term voltage drops - as long as the grid voltage is within a defined voltage window.

Dynamic Grid Support

LVRT (Low-Voltage Ride Through): The inverter stays connected to the grid during voltage drops and supports the grid by feeding reactive power.

