REGIONE CAMPANIA
PROVINCIA DI CASERTA
COMUNE DI CASTELVOLTURNO

progetto di un impianto agrivoltaico per la produzione di energia elettrica ubicato nel Comune di Castel Volturno (CE) in Località Parco del Castello della potenza nominale di 14361,84 kW dotato di un sistema di accumulo dell'energia di 7200 kW, per una potenza in immissione di 12000 kW (due lotti da 6000 kW ciascuno) comprensivo delle opere di rete per la connessione dell'impianto alla rete elettrica nazionale

PROGETTO DEFINITIVO DELL'IMPIANTO DI PRODUZIONE COMPRENSIVO DELLE OPERE DI RETE PER LA CONNESSIONE

ELABORATO

DISCIPLINARE ELEMENTI TECNICI

DATA: Gennaio 2022	**Scala: -**	**Nome file:** NPDI_CV_D051_K1 - DISCIPLINARE ELEMENTI TECNICI

PROPONENTE

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GRIFONE PASQUALINO ORDINE ARCHITETTI PPC PROV. PESCARA architetto 25.01.2022 16:09:27 UTC

ORDINE DEGLI ARCHITETTI, PIANIFICATORI, PAESAGGISTI E CONSERVATORI PROVINCIA di PESCARA ARCHITETTO Pasqualino GRIFONE Albo A 1293

Agronomo Nicola Pierfranco Venti
Via A. Volta, 1
65026 Popoli (PE)

COLLEGIO DEI DOTTORI AGRONOMI E DEI DOTTORI FORESTALI DOTT. NICOLA VENTI Sez. A N. 175

revisione	descrizione	data	Elab. n.
A			K1
B			
C			

www.jinkosolar.com

Building Your Trust in Solar

Tiger Neo N-type 78HL4-BDV 590-610 Watt

BIFACIAL MODULE WITH DUAL GLASS

N-Type

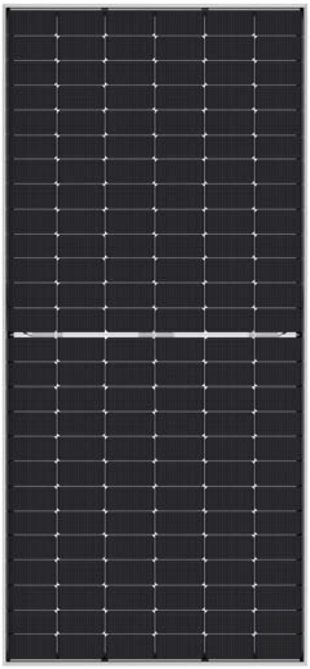
Positive power tolerance of 0~+3%

IEC61215(2016), IEC61730(2016)

ISO9001:2015: Quality Management System

ISO14001:2015: Environment Management System

ISO45001:2018
Occupational health and safety management systems



Key Features

SMBB Technology

Better light trapping and current collection to improve module power output and reliability.

Hot 2.0 Technology

The N-type module with Hot 2.0 technology has better reliability and lower LID/LETID.

PID Resistance

Excellent Anti-PID performance guarantee via optimized mass-production process and materials control.

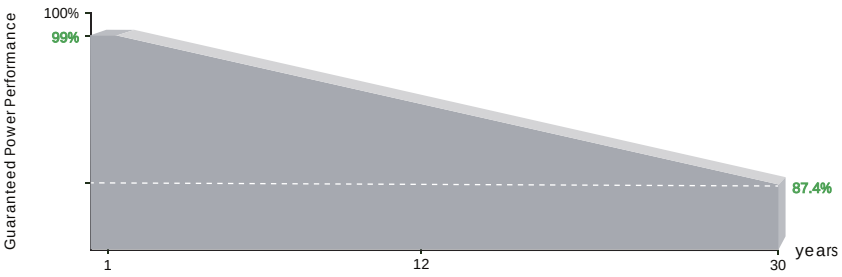
Enhanced Mechanical Load

Certified to withstand: wind load (2400 Pascal) and snow load (5400 Pascal).

Higher Power Output

Module power increases 5-25% generally, bringing significantly lower LCOE and higher IRR.

LINEAR PERFORMANCE WARRANTY

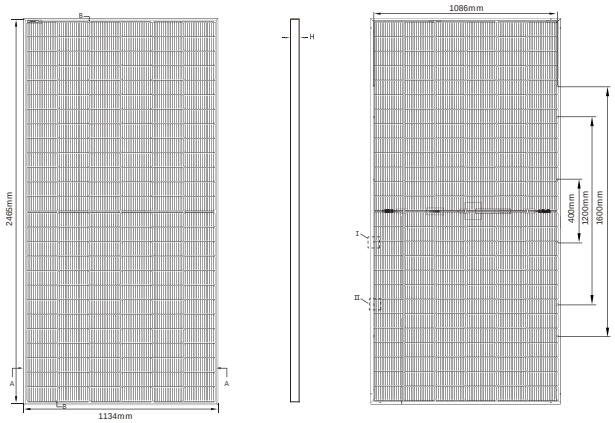


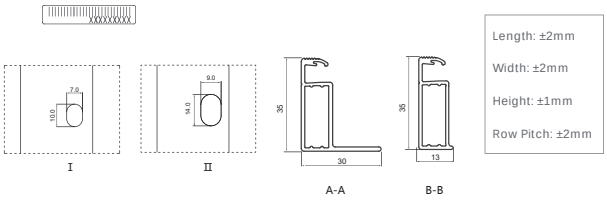
12 Year Product Warranty

30 Year Linear Power Warranty

0.40% Annual Degradation Over 30 years

Engineering Drawings



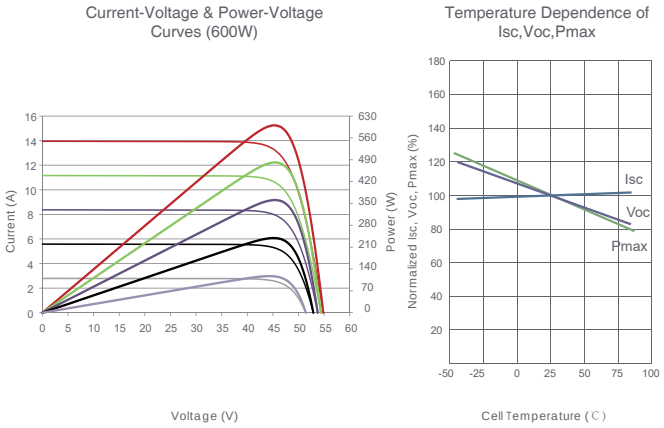


Packaging Configuration

(Two pallets = One stack)

31pcs/pallets, 62pcs/stack, 496pcs/ 40'HQ Container

Electrical Performance & Temperature Dependence



Mechanical Characteristics

Cell Type	N type Mono-crystalline
No. of cells	156 (2×78)
Dimensions	2465×1134×35mm (97.05×44.65×1.38 inch)
Weight	34.6kg (76.28 lbs)
Front Glass	2.0mm, Anti-Reflection Coating
Back Glass	2.0mm, Heat Strengthened Glass
Frame	Anodized Aluminium Alloy
Junction Box	IP68 Rated
Output Cables	TUV 1×4.0mm² (+): 400mm , (-): 200mm or Customized Length

SPECIFICATIONS

Module Type	JKM590N-78HL4-BDV		JKM595N-78HL4-BDV		JKM600N-78HL4-BDV		JKM605N-78HL4-BDV		JKM610N-78HL4-BDV	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	590Wp	444Wp	595Wp	447Wp	600Wp	451Wp	605Wp	455Wp	610Wp	459Wp
Maximum Power Voltage (Vmp)	44.91V	41.89V	45.08V	42.00V	45.25V	42.12V	45.42V	42.23V	45.60V	42.35V
Maximum Power Current (Imp)	13.14A	10.59A	13.20A	10.65A	13.26A	10.71A	13.32A	10.77A	13.38A	10.83A
Open-circuit Voltage (Voc)	54.76V	52.02V	54.90V	52.15V	55.03V	52.27V	55.17V	52.41V	55.31V	52.54V
Short-circuit Current (Isc)	13.71A	11.07A	13.79A	11.13A	13.87A	11.20A	13.95A	11.26A	14.03A	11.33A
Module Efficiency STC (%)	21.11%		21.29%		21.46%		21.64%		21.82%	
Operating Temperature(℃)	-40℃~+85℃									
Maximum system voltage	1500VDC (IEC)									
Maximum series fuse rating	30A									
Power tolerance	0~+3%									
Temperature coefficients of Pmax	-0.30%/℃									
Temperature coefficients of Voc	-0.25%/℃									
Temperature coefficients of Isc	0.046%/℃									
Nominal operating cell temperature (NOCT)	45±2℃									
Refer. Bifacial Factor	80±5%									

BIFACIAL OUTPUT-REARSIDE POWER GAIN

5%	Maximum Power (Pmax)	620Wp	625Wp	630Wp	635Wp	641Wp
	Module Efficiency STC (%)	22.16%	22.35%	22.54%	22.73%	22.91%
15%	Maximum Power (Pmax)	679Wp	684Wp	690Wp	696Wp	702Wp
	Module Efficiency STC (%)	24.27%	24.48%	24.68%	24.89%	25.10%
25%	Maximum Power (Pmax)	738Wp	744Wp	750Wp	756Wp	763Wp
	Module Efficiency STC (%)	26.38%	26.61%	26.83%	27.05%	27.28%

*STC: Irradiance 1000W/m² Cell Temperature 25°C AM=1.5

NOCT: Irradiance 800W/m² Ambient Temperature 20°C AM=1.5 Wind Speed 1m/s

SUNNY CENTRAL
2200 / 2475 / 2500-EV / 2750-EV / 3000-EV

SC-2200-10 / SC-2475-10 / SC-2500-EV-10 / SC-2750-EV-10 / SC-3000-EV-10

Efficient

- Up to 4 inverters can be transported in one standard shipping container
- Overdimensioning up to 225% is possible
- Full power at ambient temperatures of up to 35 °C

Robust

- Intelligent air cooling system OptiCool for efficient cooling
- Suitable for outdoor use in all climatic ambient conditions worldwide

Flexible

- Conforms to all known grid requirements worldwide
- Q on demand
- Available as a single device or turnkey solution, including medium-voltage block

Easy to Use

- Improved DC connection area
- Connection area for customer equipment
- Integrated voltage support for internal and external loads

SUNNY CENTRAL 2200 / 2475 / 2500-EV / 2750-EV / 3000-EV

The new Sunny Central: more power per cubic meter

With an output of up to 3000 kVA and system voltages of 1100 V DC or 1500 V DC, the SMA central inverter allows for more efficient system design and a reduction in specific costs for PV power plants. A separate voltage supply and additional space are available for the installation of customer equipment. True 1500 V technology and the intelligent cooling system OptiCool ensure smooth operation even in extreme ambient temperature as well as a long service life of 25 years.

SUNNY CENTRAL 1000 V

Technical Data	Sunny Central 2200	Sunny Central 2475*
Input (DC)		
MPP voltage range V_{DC} (at 25 °C / at 35 °C / at 50 °C)	570 to 950 V / 800 V / 800 V	638 V to 950 V / 800 V / 800 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	545 V / 645 V	614 V / 714 V
Max. input voltage $V_{DC, max}$	1100 V	1100 V
Max. input current $I_{DC, max}$ (at 25°C / at 50°C)	3960 A / 3600 A	3960 A / 3600 A
Max. short-circuit current $I_{DC, sc}$	6400 A	6400 A
Number of DC inputs	24 double pole fused (32 single pole fused)	
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	
Integrated zone monitoring	○	
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A	
Output (AC)		
Nominal AC power at cos φ =1 (at 35°C / at 50°C)	2200 kVA / 2000 kVA	2475 kVA / 2250 kVA
Nominal AC power at cos φ =0.8 (at 35°C / at 50°C)	1760 kW / 1600 kW	1980 kW / 1800 kW
Nominal AC current $I_{AC, nom}$ = Max. output current $I_{AC, max}$	3300 A	3300 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	385 V / 308 V to 462 V	434 V / 347 V bis 521 V
AC power frequency / range	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz	
Min. short-circuit ratio at the AC terminals[9)]	> 2	
Power factor at rated power / displacement power factor adjustable[8) 10)]	● 1 / 0.8 overexcited to 0.8 underexcited ○ 1 / 0.0 overexcited to 0.0 underexcited	
Efficiency		
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.6% / 98.4% / 98.0%	98.6% / 98.4% / 98.0%
Protective Devices		
Input-side disconnection point	DC load break switch	
Output-side disconnection point	AC circuit breaker	
DC overvoltage protection	Surge arrester, type I	
AC overvoltage protection (optional)	Surge arrester, class I	
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III	
Ground-fault monitoring / remote ground-fault monitoring	○ / ○	
Insulation monitoring	○	
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34	
General Data		
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)	
Weight	< 3400 kg / < 7496 lb	
Self-consumption (max.[4)] / partial load[5)] / average[6)])	< 8100 W / < 1800 W / < 2000 W	
Self-consumption (standby)	< 300 W	
Internal auxiliary power supply	Integrated 8.4 kVA transformer	
Operating temperature range[8)]	−25°C to 60°C / −13°F to 140°F	
Noise emission[7)]	67.0 dB(A)	
Temperature range (standby)	−40°C to 60°C / −40°F to 140°F	
Temperature range (storage)	−40°C to 70°C / −40°F to 158°F	
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%	
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m / 4000 m	● / ○ / ○ / ○ (earlier temperature-dependent derating)	
Fresh air consumption	6500 m³/h	
Features		
DC connection	Terminal lug on each input (without fuse)	
AC connection	With busbar system (three busbars, one per line conductor)	
Communication	Ethernet, Modbus Master, Modbus Slave	
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)	
Enclosure / roof color	RAL 9016 / RAL 7004	
Supply transformer for external loads	○ (2.5 kVA)	
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, UL 840 Cat. IV, Arrêté du 23/04/08	
EMC standards	IEC / EN 61000-6-4, IEC / EN 61000-6-2, EN 55022, IEC 62920, FCC Part 15 Class A, Cispr 11, DIN EN55011:2017	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001	
● Standard features ○ Optional * preliminary		
Type designation	SC-2200-10	SC-2475-10

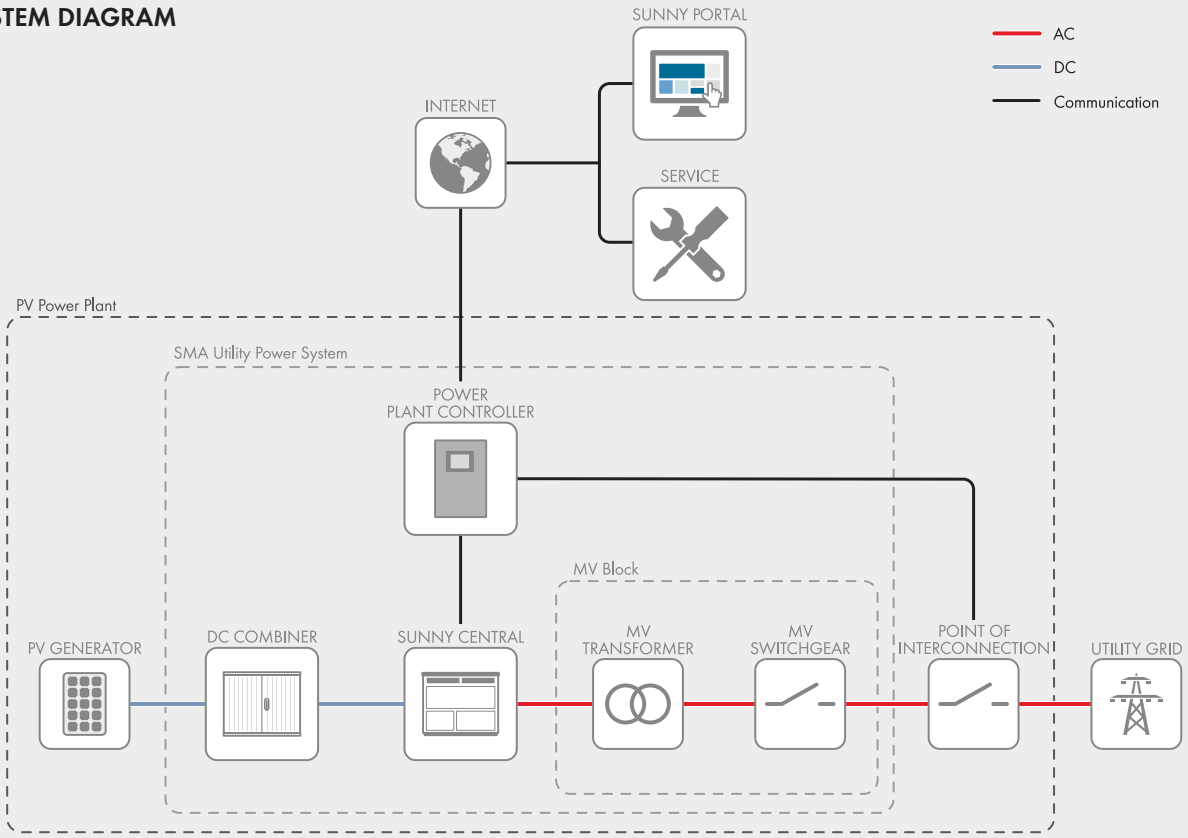
1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 25°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) A short-circuit ratio of < 2 requires a special approval from SMA
10) Depending on the DC voltage

SUNNY CENTRAL 1500 V

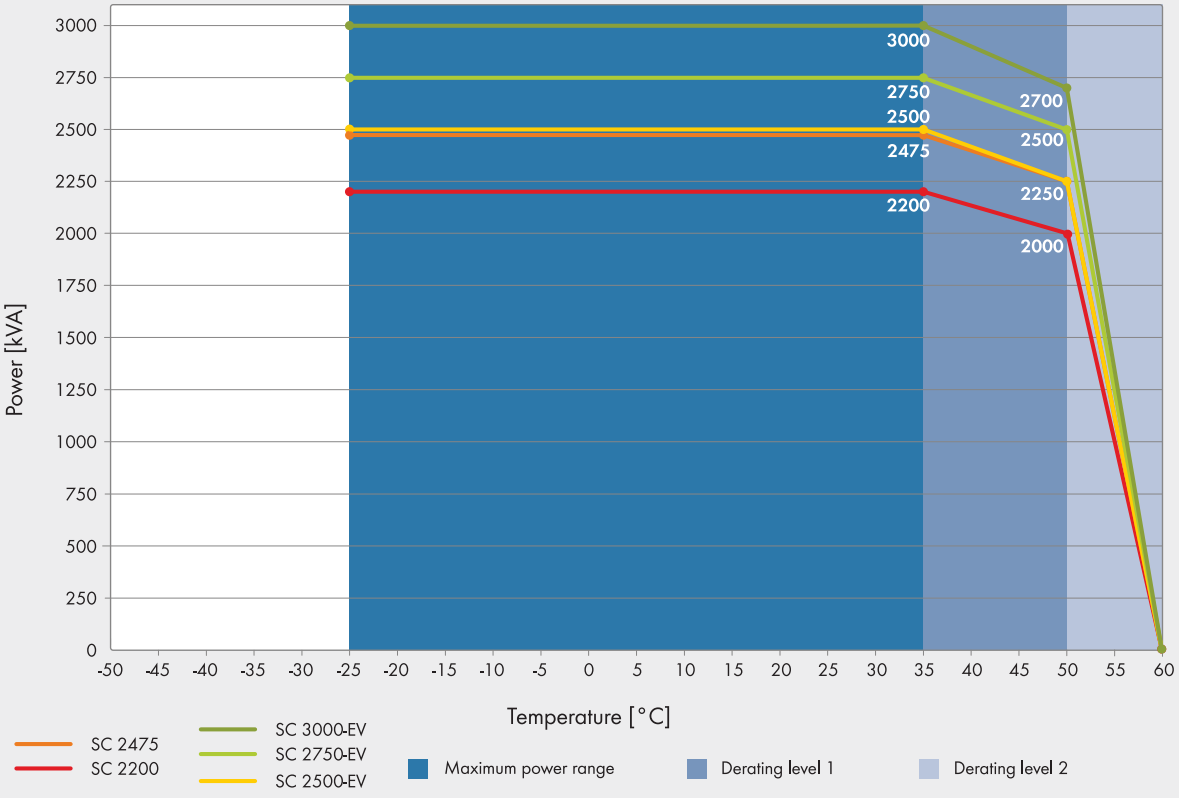
Technical Data	Sunny Central 2500-EV	Sunny Central 2750-EV	Sunny Central 3000-EV*
Input (DC)			
MPP voltage range V_{DC} (at 25°C / at 35°C / at 50°C)	850 V to 1425 V / 1200 V / 1200 V	875 V to 1425 V / 1200 V / 1200 V	956 V to 1425 V / 1200 V / 1200 V
Min. input voltage $V_{DC, min}$ / Start voltage $V_{DC, Start}$	778 V / 928 V	849 V / 999 V	927 V / 1077 V
Max. input voltage $V_{DC, max}$	1500 V	1500 V	1500 V
Max. input current $I_{DC, max}$ (at 25°C / at 50°C)	3200 A / 2956 A	3200 A / 2956 A	3200 A / 2970 A
Max. short-circuit current rating	6400 A	6400 A	6400 A
Number of DC inputs	32	32	32
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²
Integrated zone monitoring	○	○	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A		
Output (AC)			
Nominal AC power at cos φ =1 (at 35°C / at 50°C)	2500 kVA / 2250 kVA	2750 kVA / 2500 kVA	3000 kVA / 2700 kVA
Nominal AC power at cos φ =0.8 (at 35°C / at 50°C)	2000 kW / 1800 kW	2200 kW / 2000 kW	2400 kW / 2160 kW
Nominal AC current $I_{AC, nom}$ = Max. output current $I_{AC, max}$	2624 A	2646 A	2624 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range[1) 8)]	550 V / 440 V to 660 V	600 V / 480 V to 690 V	655 V / 524 V to 721 V[9)]
AC power frequency	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz		
Min. short-circuit ratio at the AC terminals[10)]	> 2		
Power factor at rated power / displacement power factor adjustable[8) 11)]	● 1 / 0.8 overexcited to 0.8 underexcited ○ 1 / 0.0 overexcited to 0.0 underexcited		
Efficiency			
Max. efficiency[2)] / European efficiency[2)] / CEC efficiency[3)]	98.6% / 98.3% / 98.0%	98.7% / 98.5% / 98.5%	98.7% / 98.6% / 98.5%
Protective Devices			
Input-side disconnection point	DC load-break switch		
Output-side disconnection point	AC circuit breaker		
DC overvoltage protection	Surge arrester, type I		
AC overvoltage protection (optional)	Surge arrester, class I		
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III		
Ground-fault monitoring / remote ground-fault monitoring	○ / ○		
Insulation monitoring	○		
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34		
General Data			
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)		
Weight	< 3400 kg / < 7496 lb		
Self-consumption (max.[4)] / partial load[5)] / average[6)])	< 8100 W / < 1800 W / < 2000 W		
Self-consumption (standby)	< 370 W		
Internal auxiliary power supply	Integrated 8.4 kVA transformer		
Operating temperature range[8)]	−25 to 60°C / −13 to 140°F		
Noise emission[7)]	67.8 dB(A)		
Temperature range (standby)	−40 to 60°C / −40 to 140°F		
Temperature range (storage)	−40 to 70°C / −40 to 158°F		
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month / year) / 0 % to 95%		
Maximum operating altitude above MSL[8)] 1000 m / 2000 m / 3000 m	● / ○ / ○ (earlier temperature-dependent derating)		
Fresh air consumption	6500 m³/h		
Features			
DC connection	Terminal lug on each input (without fuse)		
AC connection	With busbar system (three busbars, one per line conductor)		
Communication	Ethernet, Modbus Master, Modbus Slave		
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)		
Enclosure / roof color	RAL 9016 / RAL 7004		
Supply transformer for external loads	○ (2.5 kVA)		
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, Arrêté du 23/04/08		
EMC standards	CISPR 11, CISPR 22, EN55011:2017, EN 55022, IEC/EN 61000-6-4, IEC/EN 61000-6-2, IEC 62920, FCC Part 15 Class A	CISPR 11, CISPR 22, EN55011:2017, EN 55022, IEC 62920, FCC Part 15 Class A	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001		
● Standard features ○ Optional * preliminary			
Type designation	SC-2500-EV-10	SC-2750-EV-10	SC-3000-EV-10

1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25°C
6) Self-consumption averaged out from 5% to 100% Pn at 35°C
7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) AC voltage range can be extended to 753V for 50Hz grids only (option „Aux power supply: external" must be selected, option "housekeeping" not combinable).
10) A short-circuit ratio of < 2 requires a special approval from SMA
11) Depending on the DC voltage

SYSTEM DIAGRAM



TEMPERATURE BEHAVIOR (at 1000 m)



MV POWER STATION
2200 / 2475 / 2500 / 2750 / 3000

MVPS 2200-20 / MVPS 2475-20 / MVPS 2500-20 / MVPS 2750-20 / MVPS 3000-20

Robust
- Station and all individual components type-tested
- Optimally suited to extreme ambient conditions

Easy to Use
- Plug and play concept
- Walk-in control rooms
- Completely pre-assembled for easy set-up and commissioning

Cost-Effective
- Easy planning and installation
- Low transport costs due to 20-foot container

Flexible
- Global solution for international markets
- Numerous options
- Compatible with MVPS 4400 – MVPS 6000

MV POWER STATION 2200 / 2475 / 2500 / 2750 / 3000

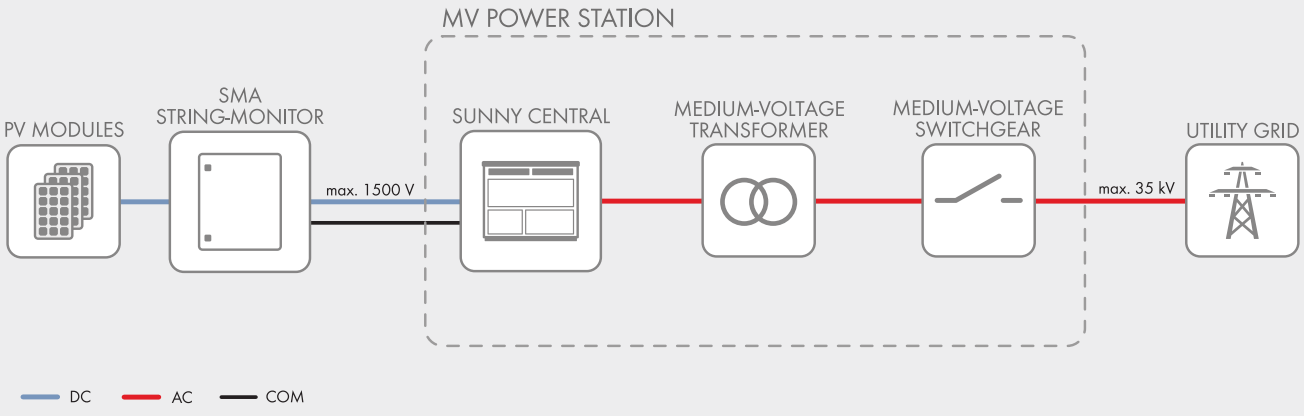
Turnkey Solution for PV Power Plants

With the power of the new robust central inverters, the Sunny Central or Sunny Central Storage, and with perfectly adapted medium-voltage components, the new MV Power Station offers even more power density and is a turnkey solution available worldwide. The solution is the ideal choice for new generation PV power plants operating at 1500 V_{DC}. Delivered pre-configured in a 20-foot container, the solution is easy to transport and quick to assemble and commission. The MVPS and all components are type-tested. The MV Power Station combines rigorous plant safety with maximum energy yield and minimized deployment and operating risk.

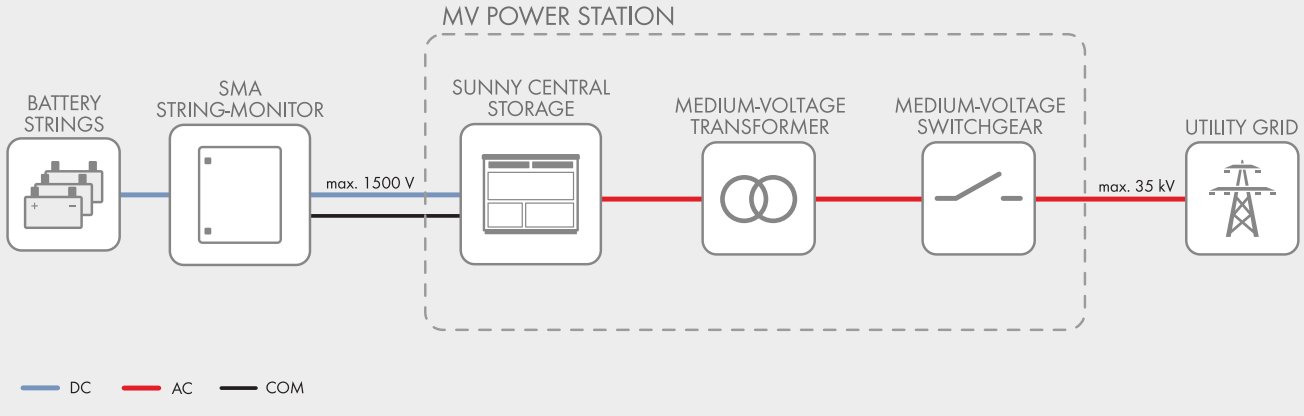
MV POWER STATION
2200 / 2475 / 2500 / 2750 / 3000

Technical Data	MV Power Station 2200
Input (DC)	
Available inverters	1 x SC 2200 or 1 x SCS 2200
Max. input voltage	1100 V
Max. input current	3960 A
Number of DC inputs	24 double pole fused (32 single pole fused)
Integrated zone monitoring	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A
Output (AC) on the medium-voltage side	
Standard power at 1000 m and cos φ = 1 (at 35°C / at 40°C / at 45°C)[1]	2200 kVA / 2000 kVA / 0 kVA
Optionale power at 1000 m and cos φ = 1 (at 35°C / at 50°C / at 55°C)[1]	2200 kVA / 2000 kVA / 0 kVA
Typical nominal AC voltages	6.6 kV to 35 kV
AC power frequency	50 Hz / 60 Hz
Transformer vector group Dy11 / YNd11	● / ○
Transformer cooling methods ONAN[2] / KNAN[2]	● / ○
Max. output current at 33 kV	39 A
Transformer no-load losses Standard / Ecodesign[3]	● / ○
Transformer short-circuit losses Standard / Ecodesign[3]	● / ○
Max. total harmonic distortion	< 3%
Reactive power feed-in	○ up to 60% of AC power
Power factor at rated power / displacement power factor adjustable	1 / 0.8 overexcited to 0.8 underexcited
Inverter efficiency	
Max. efficiency	98.6%
European efficiency	98.4%
CEC weighted efficiency[4]	98.0%
Protective devices	
Input-side disconnection point	DC load-break switch
Output-side disconnection point	Medium-voltage vacuum circuit breaker
DC overvoltage protection	Surge arrester type I
Galvanic isolation	●
Internal arc classification medium-voltage control room (according to IEC 62271-202)	IAC A 20 kA 1 s
General Data	
Dimensions of the 20-foot ISO container (W / H / D)[5]	6.058 m / 2.591 m / 2.438 m
Weight	< 16 t
Self-consumption (max. / partial load / average)[1]	< 8.1 kW / < 1.8 kW / < 2.0 kW
Self-consumption (stand-by)[1]	< 300 W
Degree of protection according to IEC 60529	Control rooms IP23D, inverter electronics IP65
Environment: standard / chemically active / dusty	● / ○ / ○
Degree of protection according to IEC 60721-3-4 (4C1, 4S2 / 4C2, 4S2 / 4C2, 4S4)	● / ○ / ○
Maximum permissible value for relative humidity	15% to 95%
Max. operating altitude above mean sea level 1000 m / 2000 m / 3000 m / 4000	● / ○ / ○ / ○ (earlier temperature-dependent de-rating)
Fresh air consumption of inverter and transformer	6500 m³/h
Features	
DC terminal	Terminal lug
AC connection	Outer-cone angle plug
Tap changer for MV-transformer: without / with	● / ○
Shield winding for MV-Transformer: without / with	● / ○
Communication package	○
Station enclosure color	RAL 7004
Transformer for external loads: without / 20 kVA / 30 kVA	● / ○ / ○
Medium-voltage switchgear: without / 2 feeders / 3 feeders 1 or 2 cable feeders with load-break switch, 1 transformer feeder with circuit breaker, internal arc classification IAC A FL 20 kA 1 s according to IEC 62271-200	● / ○ / ○
Accessories for medium-voltage switchgear: without / auxiliary contacts / motor for transformer feeder / cascade control / monitoring	● / ○ / ○ / ○ / ○
Oil containment	○
Industry standards (for other standards see the inverter datasheet)	IEC 62271-202, IEC 62271-200, IEC 60076 , CSC certificate, EN 50588-1
● Standard features ○ Optional features – Not available	
Type designation	MVPS-2200-20

System diagram with Sunny Central



System diagram with Sunny Central Storage



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To whom it may concern

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Date 28.01.2019

Medium Voltage Grid Connection in Italy
MVPS Compliance according to CEI 0-16

Hereby we confirm that our Medium Voltage Power Station (MVPS) is compliant to the Italian Standard CEI 0-16. According paragraph 8.5.13 of this standard there is a limit on 20 kV grid connection for Medium Voltage Transformers (MVT), defined with a transformer power of 2000 kVA and a short circuit voltage Vcc of 6 %. Higher power classes are allowed in case of using higher short circuit impedances, to reduce the short circuit power according to paragraph 8.5.13. SMA will deliver the following transformers for 20 kV grid connection:

MVPS	DC Voltage	MVT power	AC Voltage	Vcc
2200	1000 V	2000 kVA	20 kV	> 6.00 %
2475	1000 V	2250 kVA	20 kV	> 6.75 %
2500	1500 V	2250 kVA	20 kV	> 6.75 %
2750	1500 V	2500 kVA	20 kV	> 7.50 %
3000	1500 V	2700 kVA	20 kV	> 8.10 %

There is also a limit for the maximum power of 6000 kVA that can be energized at the same time according to paragraph 8.5.14 of the standard CEI 0-16. In this case SMA Solar Technology AG can offer the option Cascade Control for a delayed switching of the MV transformers, to reduce the inrush current

Yours sincerely,
SMA Solar Technology AG

i. A. Thomas Weiss
Technical Product Manager
Business Unit Utility

i. A. Bernhard Voll
Platform Product Manager
Business Unit Utility

DC-CMB-U10-16 / DC-CMB-U10-24 / DC-CMB-U10-32 /
DC-CMB-U15-16 / DC-CMB-U15-24 / DC-CMB-U15-32

Robust

- Stable housing made of glass-fiber-reinforced polyester
- Indoor and outdoor installation possible thanks to IP54 degree of protection

- Can be operated at ambient temperatures of –25°C to 60°C and at altitudes of up to 4000 m above MSL

Easy to Use

- Easy to install thanks to its compact structure and low weight
- Integrated DC load-break switch for ultra-high safety

Versatile

- For PV array voltages of 1000 V and 1500 V
- Collection and safeguarding of 16, 24 or 32 strings for flexibility during the system design phase

SMA STRING-COMBINER

For safe collection of all strings in the PV field

The boxes can be installed quickly, safely and easily both indoors and outdoors thanks to their compact dimensions, while their robust enclosure guarantees durability and reliable safety in the PV field. The SMA String-Combiners with 24 and 32 string inlets are fitted with two cable outlets per pole as standard and cover – just like the Combiner with 16 string inlets – a sealing range of 17 to 38.5 millimeters. Cables with cross-sections of 70 to 400 mm² can be inserted.

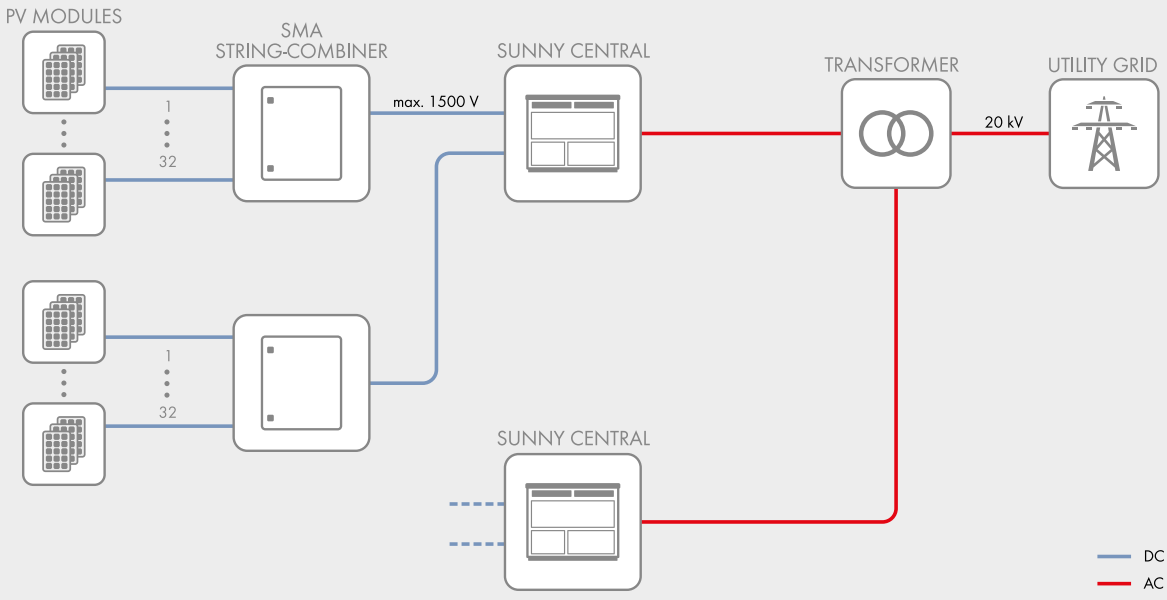
SMA STRING-COMBINER for 1000 V_{DC} systems

Technical Data	DC-CMB-U10-16	DC-CMB-U10-24	DC-CMB-U10-32
Input (DC)			
Rated voltage	1000 V	1000 V	1000 V
Altitude derating (rated voltage)	2001 m to 3000 m above MSL = reduction by 1.0% per 100 m 3001 m to 4000 m above MSL = reduction by 1.2% per 100 m		
Number of string inputs / fuse holders per pole	16	24	32
Rated current	13.75 A	12.5 A	12.5 A
Fuse type*	10.3 x 38 - 1000 VDC - gPV		
String connection	Connection to the fuse holder		
Sealing range of cable gland	5 mm to 8 mm		
Output (DC)			
Rated current	220 A	300 A	360 A
Temperature derating (rated current)	>50°C operating temperature = reduction by 1% per K		
DC switch (load-break switch)	250 A / 1000 V	400 A / 1000 V	400 A / 1000 V
Surge arrester	Type 2, In = 15 kA; Imax = 40 kA		
DC output	Busbar (ring terminal lug M12)		
Number of DC outputs	1	1 / 2	1 / 2
Conductor cross-section	Busbar 70 mm² to 400 mm²		
Sealing range of cable glands	17 mm to 38.5 mm	17 mm to 38.5 mm	17 mm to 38.5 mm
Enclosure / Ambient Parameters			
IP degree of protection according to IEC 60529	IP 54 / self-ventilated	IP 54 / self-ventilated	IP 54 / self-ventilated
Enclosure material	Glass-fiber reinforced plastic / UV-resistant		
Dimensions (W / H / D), wall mounting bracket and string cable harness included	550 / 650 / 260 mm (21.65 / 25.59 / 10.24 inch)		590 / 790 / 285 mm (23.23 / 31.10 / 11.22 inch)
Max. weight	24.2 kg (53.5 lb)	27.4 kg (60.5 lb)	34 kg (75 lb)
Protection class (according to IEC 61140)	II	II	II
Mounting type	Wall mounting		
Ambient temperature in operation / during storage	–25°C to +60°C / –40°C to +70°C		
Relative humidity	0% to 95%, non-condensing		
Max. altitude above MSL	4000 m	4000 m	4000 m
Standards			
Compliance	CE, IEC 61439-1, IEC 61439-2		
* accessory required			

SMA STRING-COMBINER for 1500 V_{DC} systems

Technical Data	DC-CMB-U15-16	DC-CMB-U15-24	DC-CMB-U15-32
Input (DC)			
Rated voltage	1500 V	1500 V	1500 V
Altitude derating (rated voltage)	2001 m to 3000 m above MSL = reduction by 1.0% per 100 m 3001 m to 4000 m above MSL = reduction by 1.2% per 100 m		
Number of string inputs / fuse holders per pole	16	24	32
Rated current	17.2 A	13.75 A	10.31 A
Fuse type*	10.3 x 85 - 1500 VDC - gPV		
String connection	Connection to the fuse holder		
Sealing range of cable gland	5 mm to 8 mm		
Output (DC)			
Rated current	275 A	330 A	330 A
Temperature derating (rated current)	>50°C operating temperature = reduction by 1% per K		
DC switch (load-break switch)	400 A / 1500 V	400 A / 1500 V	400 A / 1500 V
Surge arrester	Type 2, In = 15 kA; Imax = 40 kA		
DC output	Busbar (ring terminal lug M12)		
Number of DC outputs	1	1 / 2	1 / 2
Conductor cross-section	Busbar 70 mm² to 400 mm²		
Sealing range of cable glands	17 mm to 38.5 mm	17 mm to 38.5 mm	17 mm to 38.5 mm
Enclosure / Ambient Parameters			
IP degree of protection according to IEC 60529	IP 54 / self-ventilated	IP 54 / self-ventilated	IP 54 / self-ventilated
Enclosure material	Glass-fiber reinforced plastic / UV-resistant		
Dimensions (W / H / D), wall mounting bracket and string cable harness included	550 / 650 / 260 mm (21.65 / 25.59 / 10.24 inch)		590 / 790 / 285 mm (23.23 / 31.10 / 11.22 inch)
Max. weight	25 kg (55 lb)	28 kg (62 lb)	40 kg (88 lb)
Protection class (according to IEC 61140)	II	II	II
Mounting type	Wall mounting		
Ambient temperature in operation / during storage	-25°C to +60°C / -40°C to +70°C		
Relative humidity	0% to 95%, non-condensing		
Max. altitude above MSL	4000 m	4000 m	4000 m
Standards			
Compliance	CE, IEC 61439-1, IEC 61439-2		
* accessory required			

SYSTEM EXAMPLE



www.SMA-Solar.com

SMA Solar Technology

GE Power

RESERVOIR SOLUTIONS

Flexible, modular
Energy Storage Solutions
unlocking value across the electricity network

TODAY'S **ENVIRONMENT**

The electricity industry is facing new challenges that have not been seen for the past 100 years. As consumers become active power producers who demand clean, reliable, and affordable power, the transforming grid needs innovative technical solutions that can unlock new business models and revenue streams.

78% OF THE **9000GW+** OF NEW GENERATION FORECAST TO BE BUILT BY **2040** WILL BE **RENEWABLE**

TOTAL ENERGY STORAGE SOFTWARE REVENUE TO HIT **$3.3 BILLION** BY **2025**

Sources: *Bloomberg - New Energy Outlook Report*
Navigant Research - Energy Storage Software Report
Navigant Research - Global DER Deployment Forecast

ANNUAL INSTALLED CAPACITY OF DISTRIBUTED ENERGY RESOURCES IS EXPECTED TO REACH **530 GW** BY **2026**

This change to energy generation and consumption is being driven by three powerful trends: the arrival of increasingly affordable distributed power technologies, decarbonization of the world's electricity network through the introduction of more renewable energy sources, and the emergence of digital technologies.

Decarbonization

The rapid deployment of low-carbon technologies such as wind and solar is making it increasingly difficult to forecast variable generation, creating challenges around grid stability, congestion and market volatility.

Digitization

A rise in the number of connected devices and smart sensors enables fast decision-making on dynamic and nodal prices, while intelligent control systems and internet-enabled software optimize power plants and the grid.

Decentralization

The growing penetration of distributed energy resources, including renewables and storage, is creating more "prosumers" (end users who are active in the power system), greatly increasing distribution grid complexity.

INTEGRATING INTERMITTENT RENEWABLES INTO AN AGING GRID REQUIRES **FLEXIBLE AND RESILIENT TECHNOLOGIES**, ABLE TO **RAMP QUICKLY** AND **DYNAMICALLY ADJUST** TO REAL-TIME GRID SIGNALS

WHY ENERGY STORAGE?

A battery energy storage solution offers new application flexibility and unlocks new business value across the energy value chain, from conventional power generation, transmission & distribution, and renewable power, to industrial and commercial sectors. Energy storage supports diverse applications including firming renewable production, stabilizing the electrical grid, controlling energy flow, optimizing asset operation and creating new revenue by delivering:

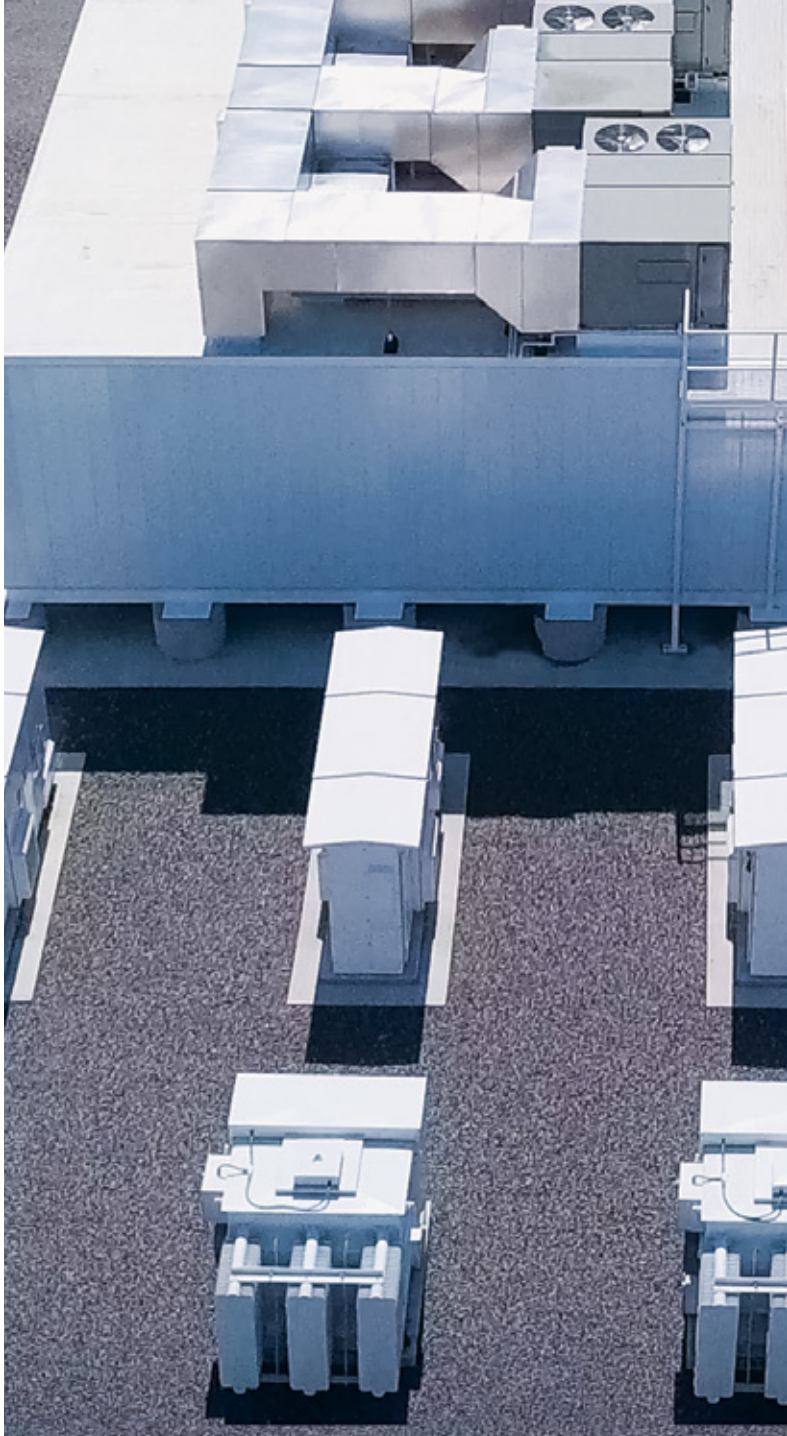
Active Power Services

- Frequency regulation
- Frequency response
- Peak shaving/firming
- Remote power commands
- Ramp rate control
- Curtailment avoidance
- Scheduled dispatch/shifting
- Scheduled power commands
- State of charge management
- Islanding
- Black start

Reactive Power Services

- Voltage control
- Voltage droop
- Power factor control
- VAR control

$103B INVESTMENT IN ENERGY STORAGE PROJECTS BY **2030**



Outcomes achieved with **GE'S RESERVOIR SOLUTION**

- **ENABLE UP TO 50% MORE SOLAR ENERGY SALES** WITH ENHANCED PV TO INVERTER LOADING RATIO
- **UP TO 50% REDUCED CONSTRUCTION TIME** WITH FACTORY BUILT & TESTED SOLUTION

Courtesy: Convergent Energy + Power

- **UP TO 15% EXTENDED BATTERY LIFE** UTILIZING PROPRIETARY BLADE PROTECTION UNITS
- **IMPROVE SAFETY** BY REDUCING FAULT CURRENT BY **UP TO 5X**

UNLOCKING NEW BUSINESS VALUE WITH GE'S RESERVOIR ENERGY STORAGE SOLUTION

Improve Financial Performance

Monetize assets through new revenue streams, increased asset utilization, improved yield, and reduced operating costs.

Increase Renewables Integration

Improve integration and maximize utilization of the energy generated from photovoltaics (PV) and wind turbines.

Optimize Electrical Grid

Defer upgrades, relieve congestion, control voltage, provide reserves and ancillary services, and improve reliability with backup power and black start functionality.

Reduce Energy Costs

Commercial and industrial end users can mitigate demand charges, optimize differential (Time of Day) energy prices, and benefit from additional onsite PV generation.

Develop Microgrids

Create a new and more flexible grid by locally integrating renewable generation and smart devices with energy storage and real-time communication.

GE'S RESERVOIR IS A FLEXIBLE ASSET THAT HELPS ENABLE **GRID OPTIMIZATION**

GE APPROACH

GE's broad portfolio of Reservoir Solutions can be tailored to your operational needs, enabling efficient, cost-effective storage distribution and utilization of energy where and when it's needed most. Our expert systems and applications teams utilize specialized techno-economic tools to help optimize the lifetime economics of a project. Our approach results in an investment grade business case that provides the basis of project planning and financing.

GE's System Approach

1	2	3	4	5
Consulting Services Customized Solutions Based on Needs Analysis	**Business Case** Cost-Benefit Analysis	**Project Planning & Financing** Value Engineering, Plan & Budgets, Financing	**Turnkey Service Project** Implementation & Production Roll Out	**Service Agreement** Training, Operations, Long Term Services

System Design Process & Optimization

Once the project scope, business objectives and services are established, GE's technical experts will define the energy sources, equipment and services required. Using advanced system planning and optimization tools, GE will deliver a tailored solution to meet the desired objectives.

GE INPUTS

ENERGY SOURCES

- Solar PV
- Wind Turbine
- Reciprocating Engines

PRODUCTS

- Inverters
- Batteries
- Reservoir Control Unit
- Substation
- PREDIX Analysis

SERVICES

- Regional Costs
- Local Policy
- Energy Markets
- Service Costs
- Financing

+

CUSTOMER INPUTS

BASICS

- Location
- Market
- Use Case

SPECIFICS

- Finance Details
- Project Life
- PPA Structure
- Grid Connection
- Services Required
- Constraints

+

GE OPTIMIZATION TOOL

=

ENHANCED RESERVOIR SOLUTION


MCC

GE SOLUTION

GE's Reservoir is a flexible, compact energy storage solution for AC or DC coupled systems. The Reservoir solution combines GE's advanced technologies and expertise in plant controls, power electronics, battery management systems and electrical balance of plant – all backed by GE's performance guarantees.

POWER CONVERSION

- Inverters are a bidirectional system converting AC to DC for battery charge and DC to AC for discharge
- 4 quadrant operation
- High efficiency

BATTERY MANAGEMENT

- Battery Protection Unit
- Long life Li-ion battery
- Integrated lockable disconnect
- Active string balancing
- Factory tested
- Field replacement

PURPOSE BUILT ENCLOSURES

- Ships with batteries installed
- Enhanced cooling and insulation
- Built in redundancy for 25 years of life
- Fast and flexible installation

RESERVOIR CONTROL UNIT

- Advanced functionalities to monitor batteries and help optimize asset operations
- Based on GE Mark™ VIe

FLEXIBLE SYSTEM DELIVERY

The solution can be delivered as Engineered Equipment Package (EEP), Engineering, Procurement, and Construction (EPC) turnkey solution or lease and financing arrangement.

MV TRANSFORMER

- Connects to any MV network up to 66kV through a step-up transformer
- Dry or oil-type transformer designed for both outdoor or e-house indoor environment

MV SWITCHGEAR

- MV switchgear and LV auxiliaries integrated into an ISO container for easy site installation

CONSULTING & SERVICES

- Technical and economic feasibility studies
- Network analysis
- Project management & design
- Real-time optimization services
- Long term service contracts
- Performance guarantees

SOFTWARE SUITE

- Asset performance management
- Fleet management
- Dispatch optimization

World's First Hybrid Electric Gas Turbine,
10 MW/4.3 MWh Energy Storage Solution

RESERVOIR STORAGE UNITS

The Reservoir Storage unit is a **modular** high density solution that is factory built and tested to reduce project risk, shorten timelines and cut installation costs. The Reservoir Storage unit is built with GE's Battery Blade design to achieve an industry leading energy density and minimized footprint. GE's proprietary Blade Protection Unit actively balances the safety, life and performance of each Battery Blade, extending battery life by up to 15% and reduce fault currents by up to 5X. The modular system has multiple installation and cabling options including pad or pier and is configured to minimize operation and maintenance (O&M) expenses over the life of the project with all weather capabilities and high efficiency cooling system.

ELECTRICAL INTEGRATION

- DC disconnect, service rated
- Auxiliary power equipment
- Optional combiner package for DC coupled PV
- Bottom and front entry cable option

ENCLOSURE

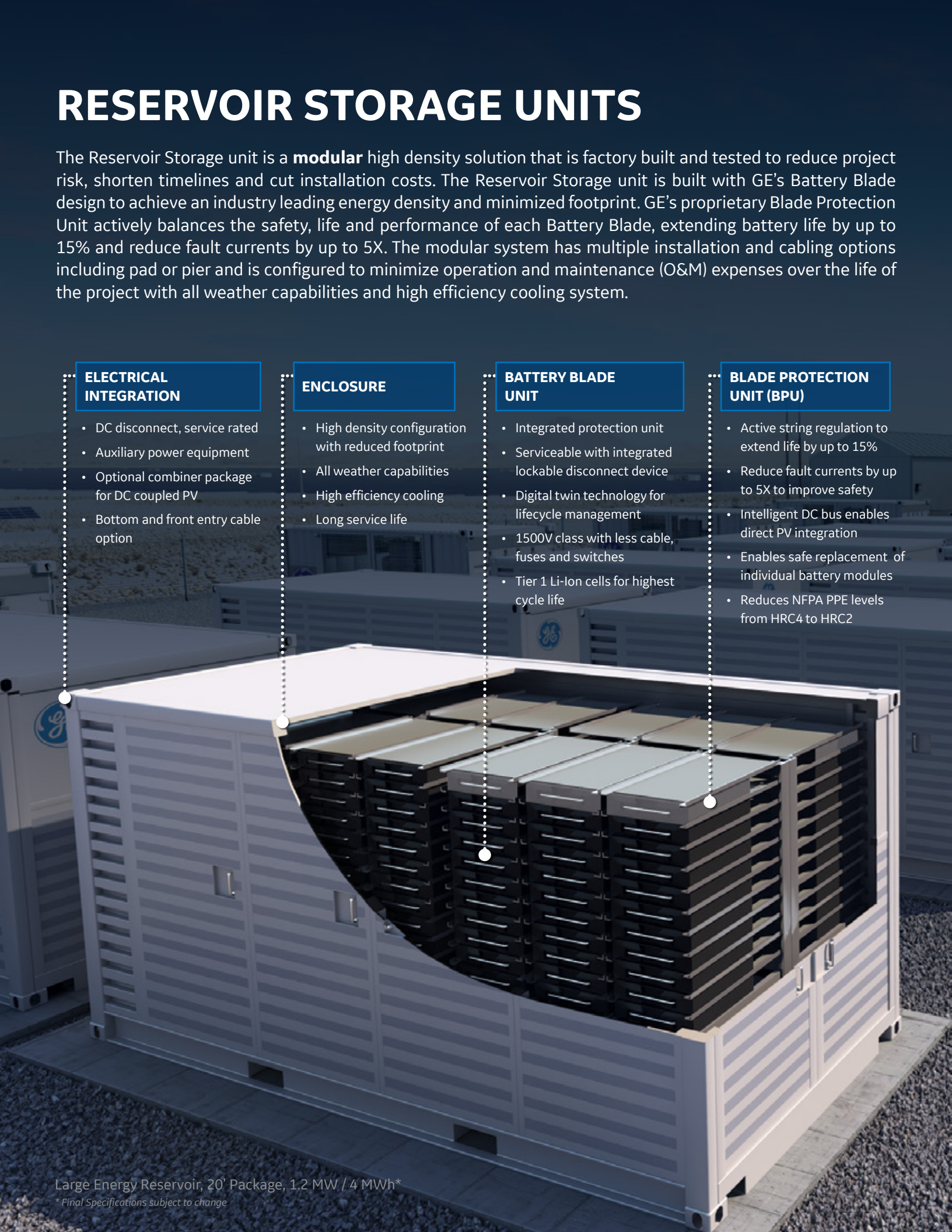
- High density configuration with reduced footprint
- All weather capabilities
- High efficiency cooling
- Long service life

BATTERY BLADE UNIT

- Integrated protection unit
- Serviceable with integrated lockable disconnect device
- Digital twin technology for lifecycle management
- 1500V class with less cable, fuses and switches
- Tier 1 Li-Ion cells for highest cycle life

BLADE PROTECTION UNIT (BPU)

- Active string regulation to extend life by up to 15%
- Reduce fault currents by up to 5X to improve safety
- Intelligent DC bus enables direct PV integration
- Enables safe replacement of individual battery modules
- Reduces NFPA PPE levels from HRC4 to HRC2



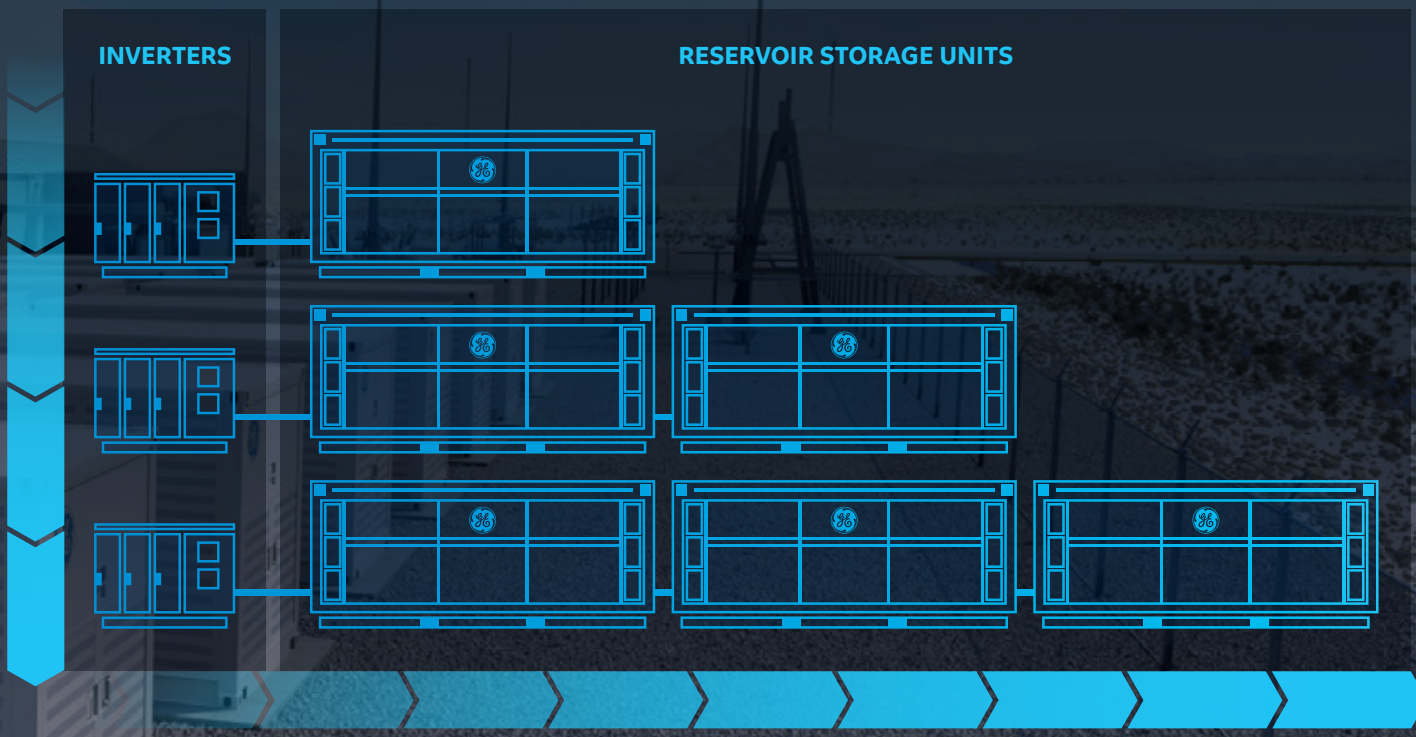
Large Energy Reservoir, 20' Package, 1.2 MW / 4 MWh*

** Final Specifications subject to change*

SYSTEM CONFIGURATIONS

The Reservoir Solution can be designed in a power or energy configuration depending on the required application. In an energy configuration, the batteries are used to inject a steady amount of power into the grid for an extended period of time. In a power configuration, the batteries are used to inject a large amount of power into the grid over a short period of time. The configuration of power or energy is determined by the ratio of inverters to batteries.

Modular and Scalable Solution



MORE POWER
Additional inverters are added to achieve desired power level.

MORE ENERGY
Additional reservoir storage units are added to achieve desire energy output.

GE'S **DC COUPLED RESERVOIR SOLUTION** ENABLES **ENHANCED PV TO INVERTER LOADING RATIO** RESULTING IN UP TO **50%** **INCREASE IN ANNUAL SOLAR ENERGY SALES** PER SITE

TYPICAL **RESERVOIR APPLICATIONS**

Standalone Applications

POWER

ENERGY

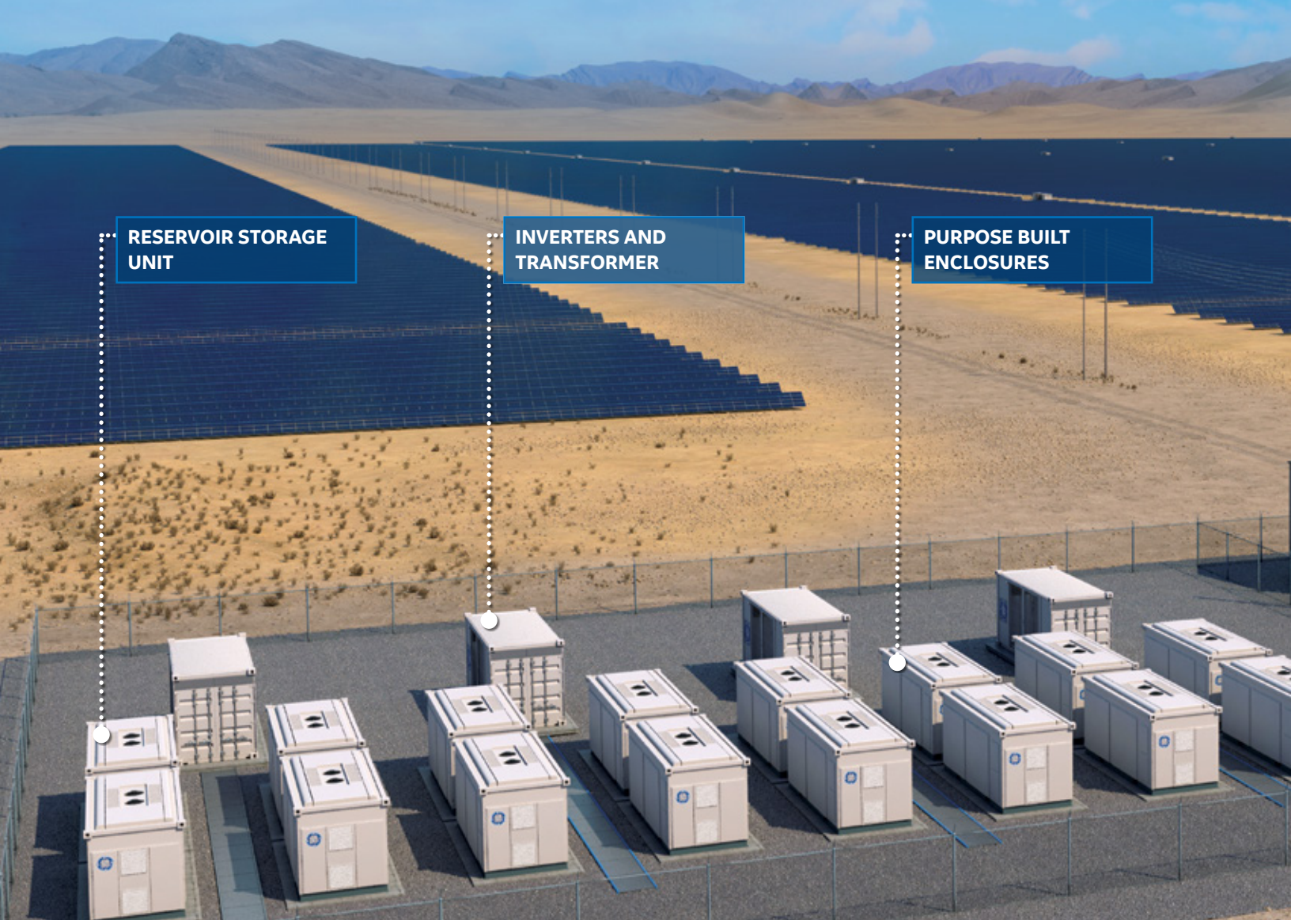
	Generation	Transmission	Distribution
Voltage Regulation Compensate anomalies or disturbances (e.g., voltage magnitude, harmonics, etc.) by sending reactive energy into system.			✓
Frequency Response Provide fast regulation of grid frequency to balance supply and demand.		✓	
Frequency Regulation Provide regulation of grid frequency to balance supply and demand based on signals sent by the grid operator.	✓		
Renewable Integration Balance the local excesses or deficits of renewable generation caused by rapid weather fluctuations.			✓
Black Start Energize part of the generation asset without outside assistance after a blackout.	✓	✓	
Back-Up Store energy to maintain service continuity and grid resilience in the event of an outage.			✓
Peak Management Reduce grid capacity needs during peak periods with local storage.		✓	✓
Shifting Buy or produce electricity at low price (off-peak) to store and sell at peak price.	✓		
Capacity Store renewable energy production for peak and base load consumption.	✓	✓	

Integrated Hybrid Solution Applications

POWER

ENERGY

	Solar	Wind	Thermal
Synthetic Inertia Compensate losses of grid inertia caused by high renewable penetration.			✓
Frequency Regulation Provide fast regulation of grid frequency to balance supply and demand.	✓	✓	✓
Firming Prevent undesirable short-duration effects from rapid fluctuations in solar generation due to intermittency and weather conditions.	✓	✓	
Improved Operations Help optimize generation fleet operations and costs.			✓
Contingency Reserve Provide fast ramp-rate to meet grid requirement for online dispatch within a short delay of operating reserve.			✓
Curtailment Avoidance Avoid output curtailment at certain times, preventing loss of energy production.	✓	✓	
Dispatchable Control solar generation at request of power grid operators or according to market needs.	✓	✓	



KEY COMPONENTS

Reservoir Control Unit (RCU)

GE's integrated Reservoir Control Unit is a supervisory control and data acquisition system for energy storage plants.

At the heart of the system is GE's field proven Mark™ Vle control system used to monitor and control gas turbines, wind and solar energy fleets.

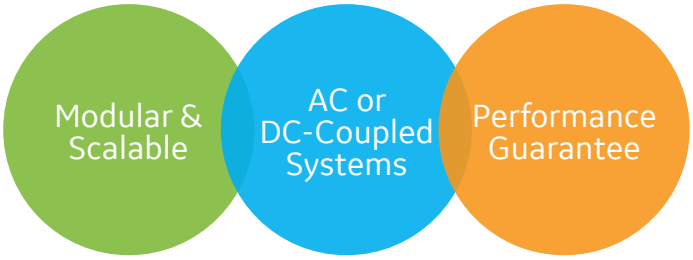
Inverters

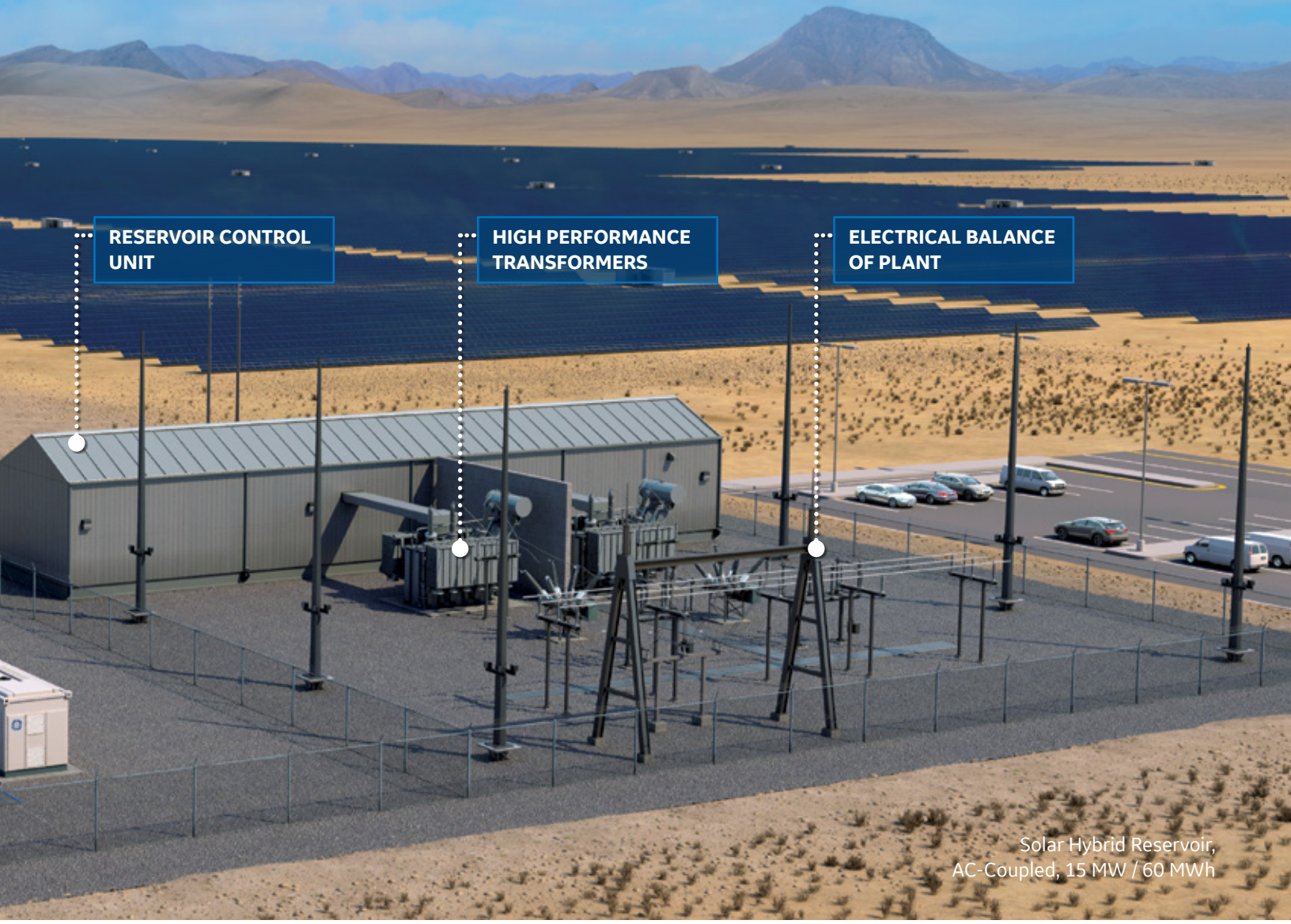
GE's inverters are designed specifically for dynamic operation and high performance lithium ion batteries.

Built with enhanced technology including integral ground fault detector/interrupter low voltage, zero voltage and high voltage ride through capability (LVRT, ZVRT, HVRT).

Reservoir Storage Unit

GE utilizes proven Li-Ion technology for battery storage solutions; each solution is tailored based on the customer's application. GE's battery solution exceeds industry standards for protecting against common industrial battery failure and reduces environmental impact with restricted use of substances controlled by US EPA, Global REACH and RoHS regulations.





Solar Hybrid Reservoir,
AC-Coupled, 15 MW / 60 MWh

High Performance Transformers

GE provides comprehensive portfolio of HV and MV transformers. Each transformer is made for performance, efficiency and immunity to withstand electronic noise.

Electrical Balance of Plant

GE offers a comprehensive portfolio of high voltage and medium voltage substation equipment and technical expertise to ensure efficient and reliable interconnection of power generation.

Purpose Built Enclosures

GE's enclosures are prefabricated with redundant HVAC and optional fire suppression systems, and provide the following benefits:

- Low maintenance, configured with enhanced cooling and insulation with built-in redundancy for 25 years of life.
- Easy transportation, minimal installation effort on site and better battery insulation

FROM ADVANCED TECHNOLOGIES AND PLANT CONTROLS TO BATTERY MANAGEMENT SYSTEMS, **GE DELIVERS COMPREHENSIVE STORAGE SOLUTIONS**

RESERVOIR SOFTWARE SUITE

The reservoir software suite includes edge to cloud infrastructure that's scalable, adaptable and easy to use. The software suite includes:

FLEET MANAGEMENT

Fleet aggregation software designed for asset monitoring, alerts, trends and forecasting.

COMPONENT LIFE ANALYTICS

Manages battery life based on history and expected future use profiles to minimize downtime and unplanned outages.

DISPATCH OPTIMIZATION

Charges and discharges batteries based on equipment status and market conditions to maximize customer outcomes.

Reservoir Services

GE's service agreements are customized based on the customers' requirements and can lower operating costs and mitigate operational and financial risks. GE's services include:

Planned Maintenance

Routinely service equipment and keep the energy storage system online, resulting in superior fleet performance.

Unplanned Maintenance

Monitor, troubleshoot and inspect equipment, boosting uptime and lifecycle production.

Parts Plans

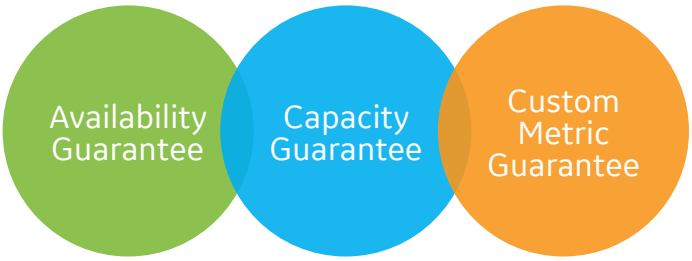
Provide full range of offerings to support preferred levels of service. Our forecasting capability, driven by fleet-wide parts consumption data configuration and management knowledge, can even help to predict what you may need.

Remote Operations Center

Provides continuous monitoring and diagnostics services 24 hours a day, 365 days a year. An on-site SCADA system enables continuous tracking of key operating parameters and detects abnormal conditions. GE technicians can then troubleshoot or reset the equipment remotely, in real-time.

Performance Guarantee

The specific performance criteria and duration of the performance guarantee will vary depending on your application, economic incentives, and requirements. Performance guarantees are only available to customers who maintain a contractual services agreement with GE and include:



Availability Guarantee

This guarantees that the battery energy storage solution will be available to charge or discharge electric energy at the nameplate power output and at the agreed-upon percentage of time.

Capacity Guarantee

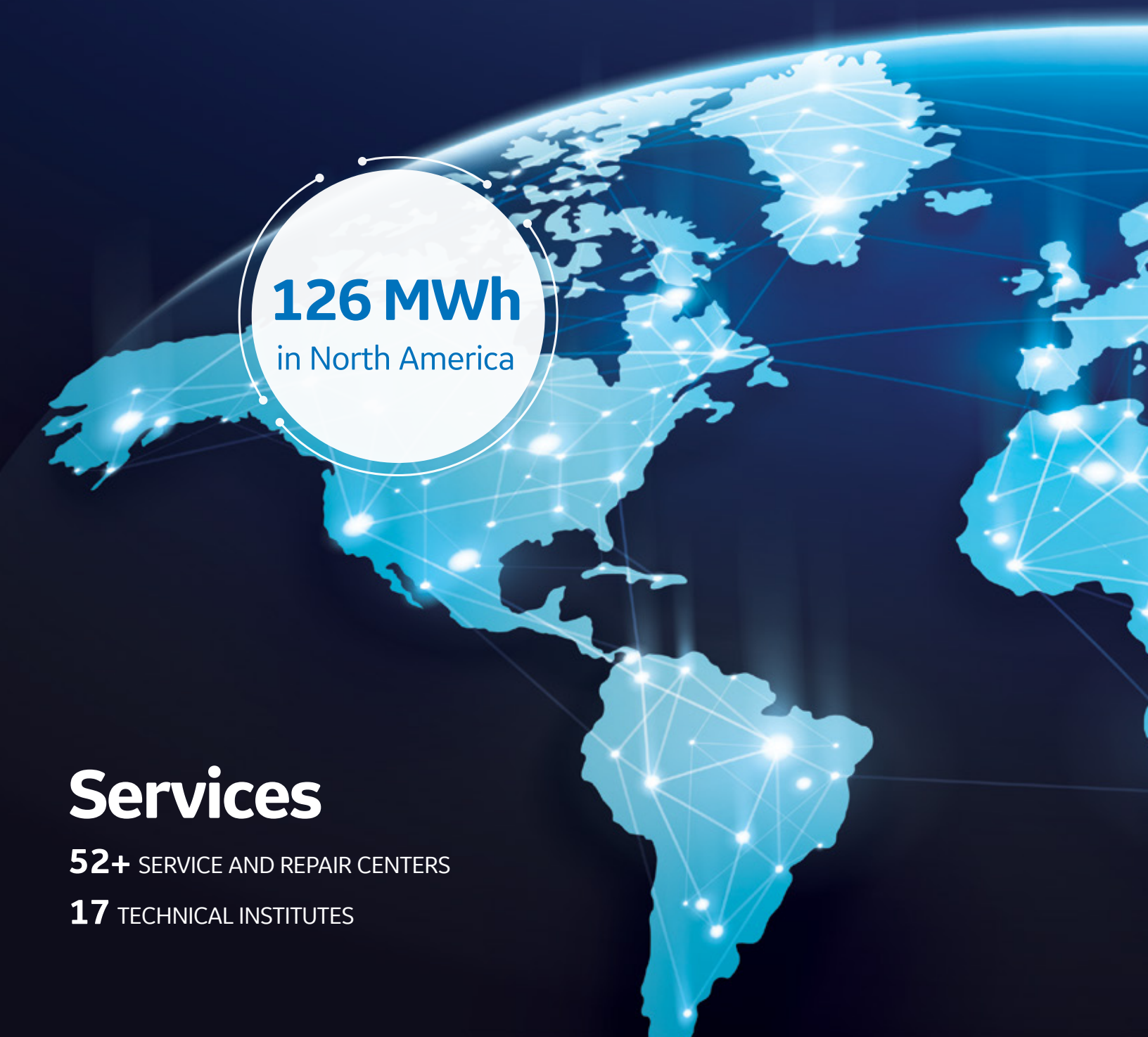
The amount of energy that the battery is able to extract from and discharge to the grid can be guaranteed.

Custom Metric Guarantee

Some owners have unique measurements or metrics, such as the PJM fast response frequency regulation score. In such cases, GE works with you to assess the risks involved and define a guarantee structure that aligns the interests of both parties throughout the life of the asset.

SERVING **GLOBAL CUSTOMERS** WITH **LOCAL EXPERTISE**

GE is globally recognized for designing and delivering customized energy storage solutions for diverse applications. With regionally located technical experts, our teams work directly with customers during the lifetime of the project. To date GE has more than **207 MWh of energy storage** in operation or in construction globally.



Services

52+ SERVICE AND REPAIR CENTERS

17 TECHNICAL INSTITUTES

INDUSTRY EXCELLENCE

10 years
of storage experience

20 year
performance guarantee

PIONEERING

1st Hybrid EGT
storage + gas turbine peaker in operation

Black Start
first proven emergency start of CCGT

LOCAL EXPERTISE

40+ Countries
providing comprehensive consulting & services

CUSTOMER APPLICATIONS

CUSTOMER ENERGY STORAGE DEVELOPER

CHALLENGE
Local grid support

GE SOLUTION
41MW / 41MWh BESS

APPLICATION
Standalone - Generation
Capacity; demand charge management

LOCATION
United Kingdom

STATUS
Under construction

This project will relieve pressure on the host country's energy system and provide flexibility when it is most needed to deliver a more balanced, secure energy system and help reduce consumer energy cost. The focus is on building long term commercially sustainable battery storage systems that are not reliant on subsidies and incentives.

CUSTOMER INVESTOR-OWNED ENERGY COMPANY

CHALLENGE
Meeting resource adequacy requirement

GE SOLUTION
2MW / 8MWH BESS

APPLICATION
Hybrid - Solar
Solar integration

LOCATION
Southern California (US)

STATUS
In operation

"We have a history of working with GE in thermal and wind, and we are pleased to continue our long-standing collaboration into the evolving world of energy storage. GE brings a strong technical solution, along with performance guarantees."

CUSTOMER PUBLIC POWER UTILITY

CHALLENGE
Addressing local grid reliability concerns

GE SOLUTION
10MW / 4.3MWh BESS, integrated controls

APPLICATION
Hybrid - Thermal (EGT)
Spinning reserve

LOCATION
Southern California (US)

STATUS
In operation

This project consists of two 10 MW of battery energy storage systems, each paired with GE's proven 50 MW LM6000 aeroderivative gas turbines, capable of providing instantaneous response during a spinning reserve event.

CUSTOMER DISTRIBUTION NETWORK OPERATOR

CHALLENGE
Local grid reliability

GE SOLUTION
1MW / 560 kWh BESS, EMS

APPLICATION
Standalone - Distribution
Load shifting, frequency & voltage regulation

LOCATION
Nice, France

STATUS
In operation

Smart-solar energy demonstration project. First application of large storage integrated at microgrid level, combined with a solar PV farm.

CUSTOMER APPLICATIONS

CUSTOMER ENERGY STORAGE ASSET DEVELOPER

CHALLENGE
Balance long duration voltage and frequency irregularities

GE SOLUTION
7MW / 7MWh BESS

APPLICATION
Standalone - Transmission
Voltage control, reactive power support, frequency regulation, ramp rate control, peak shaving, load shifting

LOCATION
Ontario, Canada

STATUS
In operation

"GE worked with us to create a fully integrated energy storage solution that helps meet the growing needs of the local transmission system. The project utilizes reliable GE equipment and products ranging from enclosures through the point of utility interconnection — a strategy that is cost-efficient, simplifies system warrantees and guarantees, and provides a financeable solution to our customers."

CUSTOMER LARGE INDUSTRIAL COMPANY

CHALLENGE
Grid support; pilot program

GE SOLUTION
2MW / 2MWh BESS

APPLICATION
Standalone - Transmission
Frequency regulation

LOCATION
Belgium

STATUS
Under construction

This project will repurpose their facility in order to develop a large scale storage park. The goal of the storage park is to further develop know-how on large scale storage. In the first stage, 6 MW of li-ion battery energy storage systems will be installed to deliver primary frequency regulation for the Transmission System Operator as a first application.

CUSTOMER PUBLIC POWER UTILITY

CHALLENGE
Providing grid stability & smoothing renewable output

GE SOLUTION
33MW / 20MWh BESS

APPLICATION
Standalone - Transmission
Emergency power / black start capability, distribution management system integration, ramp rate control, frequency response, spinning reserve

LOCATION
Southern California (US)

STATUS
In operation

Located in California, which has some of the most aggressive renewable portfolio requirements in the US, this 33MW / 20MWh battery system complements the integration of renewable resources, such as solar and wind, by adding stability and improving power quality.

CUSTOMER UTILITY

CHALLENGE
Local grid reliability

GE SOLUTION
1MW / 560 kWh BESS

APPLICATION
Standalone - Transmission
Frequency regulation

LOCATION
France

STATUS
In operation

The project is part of a larger initiative to test battery storage in real conditions for the purpose of frequency regulation, stabilizing the grid and preventing blackouts.

Courtesy: Convergent Energy + Power

For more information about
GE's Energy Storage Solutions visit
www.GEPower.com/**EnergyStorage**

GEA-32054-(E)
English
180320

GE Power

Reservoir Storage Unit

Modular, Scalable Solutions For Utility Scale Applications

RSU-4000 Series

Overview	RSU-4000/20	RSU-4000/16	RSU-4000/12
	RSU-4000/20	RSU-4000/16	RSU-4000/12
Overview			
Nameplate Energy Capacity (KWh.dc, usable)	4184	3347.2	2510.4
Individual Battery Blades - Factory Installed	20 of 20	16 of 20	12 of 20
Maximum Power - Factory Installed (KW.dc)	1200	960	720
Maximum DC Current - Factory Installed (A)	1600	1280	960
Available Augmentation Capacity (% BOL)	0%	25%	67%
Available Augmentation Capacity (kWh.dc)	N/A	836.8	1673.6
Key Features			
Batery Management System		GE Blade Protection Unit (BPU)	
Compatible Inverters		GE RIU-2750MV	
Remote Management		Reservoir Suite	
Solar DC Coupling		Yes (DC:AC Ratio <2.8)	
Integrated PV Combiner		Yes	
Integrated Lockable Disconnect		Module & Rack Level	
Augmentation Options for Lifecyle Management		Yes	
DC Bus Control		DC-IQ Intelligent Bus	
Battery LifeCycle Management		Digital Twin Life Optimization - Optional	
Unit Validation		Factory Built & Tested	
Design life (years)		25	
Battery Information			
Battery Chemistry		Lithium-Ion, NCM	
Battery Module Design		Energy	
Continuous C-Rate		<C/3	
Pulse C-Rate		<C/3	
Voltage Class		1500V	
Nominal DC Voltage (V)		1300	
Minimum DC Voltage (V)		770	
Mechanical Information			
Package Format		20' ISO w/Exterior Acces	
Dimensions (mm) (L X W X H)		6058 x 2438 x 2890 mm	
Weight (kg)	37k	31k	25k
Fully Integrated HVAC		Dual Self-Contained 3 Ton Units (High Efficiency 10. EER)	
- Hot Climate Upgrade		+33% Cooling Capacity	
- Cold Climate Upgrade		+ Electric Heating Package	
Fire Suppression - Aerosol		Optional	
Installation		Pad/Pier	
Cable Entry		Bottom	
Weatherization		NEMA 3R, IP54	
Design Conditions			
Min Operating Temperature (C)		-40°C	
Max operating Temperature (C)		50°C (55°C w/ hot climate upgrade)	
Maximum Altitude (m)		2000	
Maximum Relative Humidity (%)		95%, non-condensing	
Seismic Zone		UBC Zone-4	
Audible Noise		<60 dB at 3M	
Certifications & Compliance			
Certifications		UN38.3, UL 1973, UL 508C, CE	
Compliance		UL1642, UNDOT 38.3, IEC 62477-1, NFPA 70E, IEC 50110, ASTM4169, IEEE 605, IEEE C37.32	

GEPower.com/**EnergyStorage**

GEA-33122-(E)
English
180802

REV2.2 – 02/2019

iTracker™

intelligent tracking by soltigua

Technical specifications

Tracker version: ST

Summary

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R.I., Codice Fiscale e Partita I.V.A.: 00139220404Codice Id. Intra: IT 00139220404 - R.E.A. Forlì-Cesena: n. 26786 Capitale Sociale: Euro 119'520 i.v.

1. Overview

With iTracker™, the intelligent solar tracker, Soltigua bring to the PV market their many years of sun tracking experience in the highly demanding concentrating solar thermal industry.

iTracker™ has many innovative features:

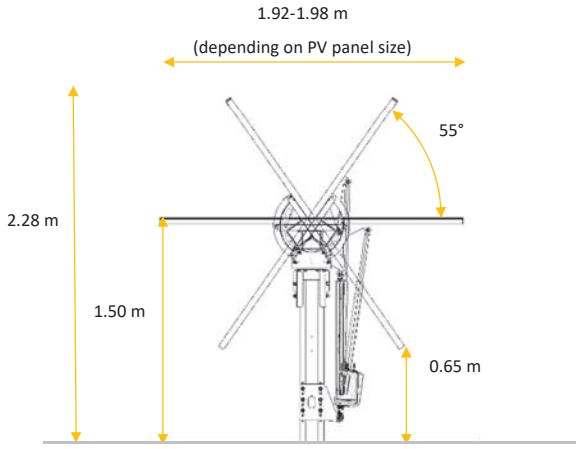
- **Single-row tracking**: no mechanical components in the corridors between tables;
- **Long tracker structure**: up to 100 pv panels per tracker (e.g. 5 strings of 20 modules, 5 strings of 18 modules, etc.) to optimize drive costs;
- **User friendly size**: 1-module-portrait/2-module-landscape configuration to simplify installation and O&M vs. larger tables such as 2-module in portrait;
- **Maintenance free components:** minimized O&M costs;
- **Balanced design:** improved mechanical accuracy and reduced stress on the drive.

2. Tracking features

iTracker is a horizontal single axis, single row tracker.

It can accommodate 1 PV module in portrait or 2 modules in landscape configuration.

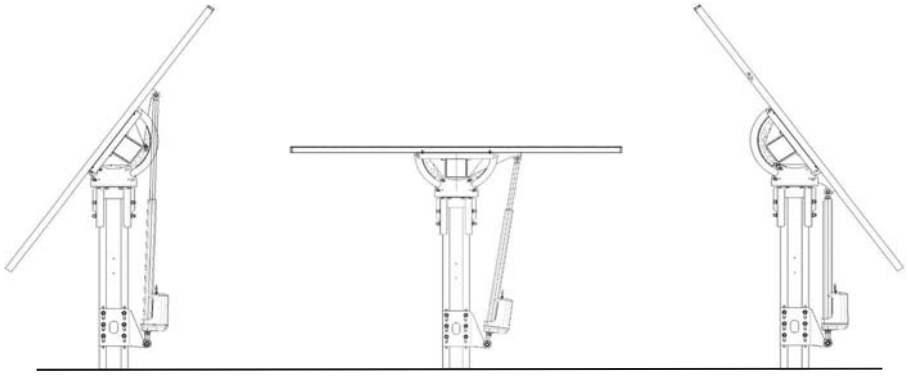
The following drawing shows iTracker's dimensions.



iTracker's main dimensions

In single row tracking each tracker moves independently from the others, guided by its own drive system.

The following drawings show the extreme positions and the position assumed at solar noon.

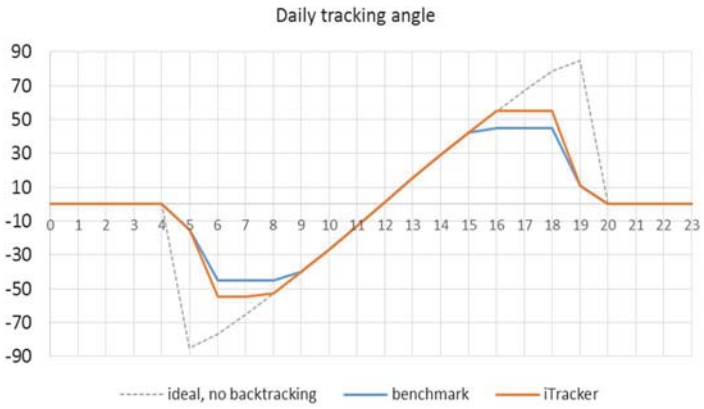


West Extreme position:	Horizontal position:	East Extreme position:
+55°	0°	-55°

iTracker rotation range

iTracker's **extended rotation range** is 110° (-55°; +55°) and it allows for higher energy yields than industry benchmark of (-45°; +45°).

As shown in the following graph, the broader rotation allows iTracker to follow the ideal tracking pattern for a longer period of time.



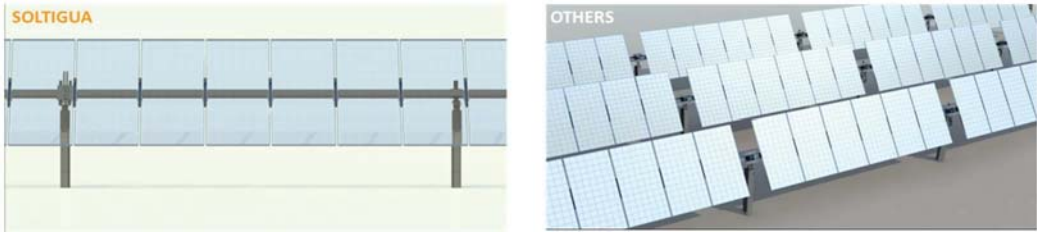
iTracker tracking angle compared to a benchmark solution

When Ground Cover Ratio is lower than 0.5, iTracker's broader rotation translates into an increase in annual yield which can be up to 1%.

Thanks to the **"continuous beam" concept** and a virtual rotation axis, iTracker™ maximizes the power density on the available ground area, increasing the installable peak capacity by up to 14% compared to other trackers. The continuous beam concept generates the following benefits:

- Land savings;
- Capex reduction;
- Higher peak power in limited size plots;

- No shadows from the structure.



Soltigua's continuous beam (left), compared to a benchmark solution which interrupts the structure every 6 modules

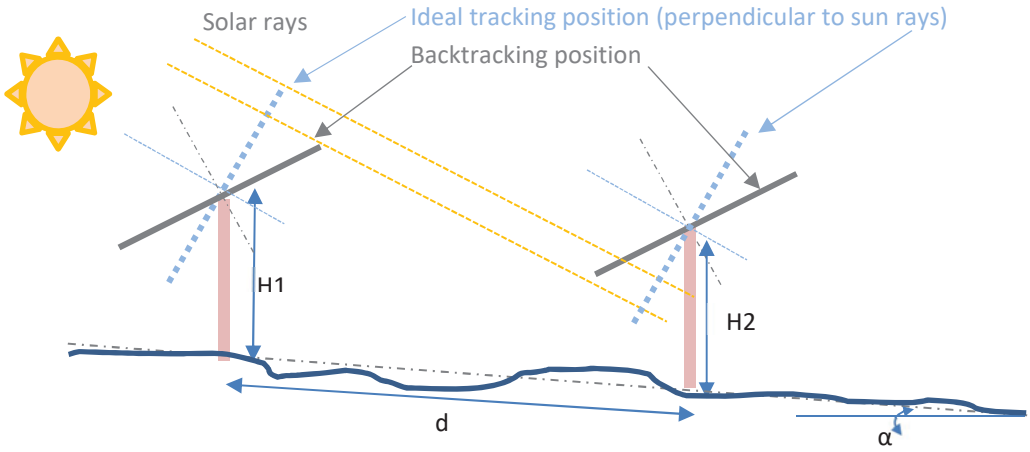
Soltigua's **bearing solution**, with a center-of-mass virtual rotation axis, has the following advantages:

- The structure is balanced, avoiding large tracking errors at the ends of long trackers and also reduces internal mechanical stress in the structure;
- The connection with the piles is stiff, greatly reducing trampoline associated vibrations;
- Torsional vibrations are reduced, avoiding need for dampers and reducing risk of galloping.

2.1 Backtracking

iTracker™ control software includes a **backtracking algorithm** to prevent mutual shadows between adjacent rows. When sun elevation is low, the PV panels rotate off their ideal tracking position to avoid the mutual shadowing, which would reduce the electrical output of the strings. The less-than-ideal inclination reduces the solar radiation available to the PV panels, but increases the overall array output, as PV cells and strings are more evenly exposed to sun irradiance over the entire PV array.

Thanks to individual tracking, Soltigua's backtracking algorithm can optimize the tracking angles of each single tracker, which is particularly helpful in case of uneven or undulated terrains where adjacent trackers are not at the same height.



Individual backtracking concept

Based on the interaxis between trackers, sun inclination and ground slope (typically along East-West), the algorithm evaluates if the adjacent tracker generates shadows (the one on the East side in the morning; the tracker on the West in the afternoon). If this is the case, the tracking angle is reduced by the minimum amount that avoids such shadows.

3. Structural characteristics

iTracker™ **support structure** is made of construction steel, and designed according to **Eurocodes standards**. Most tracker metallic components (torque tube, piles, …) are hot dip galvanized according to ISO 1461 (batch bath) or ISO 3575 (continuous bath) standards. Module rails can be either hot dip galvanized according to ISO 1461, or made in Magnelis, a Zinc-Aluminum-Magnesium coating, applied as well via hot dip bath, which has an even superior resistance in harsh outdoor environments.

Standard module rails are 440 mm long. Different lengths can be priced as an option.

As a standard, all iTracker™ structures are guaranteed 30 years in ISO 14713-1 atmospheric corrosion category up to C2. Different guarantee durations can be agreed as an option.

Mechanical components have been designed with FEM simulations and 3D CAD software, and extensively tested for more than 50 years equivalent service life.

Thermal expansion of the structure is included in the design.

Different tracker lengths are available, accounting for a different number of strings.

3.1 Wind resistance and safety position

iTracker™ design is also the result of **wind tunnel test studies**.

The trackers start the safety procedure when the gust wind speed is higher than 50 km/h, and resist up to 55 km/h during operations.

Based on wind tunnel studies, the safety position assumed in case of excessive wind is not horizontal, but at 35°, so that **wind galloping is avoided**, which otherwise could damage both the PV modules and the tracker structure.

Illustrative stow position of the various rows within the PV array

In safety position, iTracker™ can withstand a gust wind speed of 120 km/h. Higher values are available as an option for dedicated tracker versions.

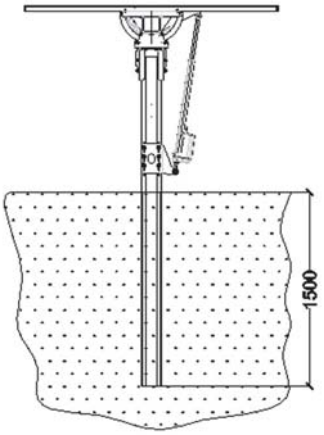
Gust wind speed is the 3 sec mean. Wind speeds are defined as wind velocity at 10 m above ground level in open country terrain, as per Eurocodes definition.

Wind tunnel test studies of PV array allow optimizing the tracker structure

During stowing procedures, trackers are managed in a sequence of 2 groups, in order to optimize the electrical architecture and power consumption. The total stowing time for the array is on average 3 minutes.

3.2 Foundations

iTracker™ can be installed on **different foundations**: concrete blocks, driven piles, screw piles. Piles are C-shaped, and in case of driven piles, they are rammed directly inside the ground. Standard pile embedment length is 1.500 mm ± 150 mm tolerance. Different lengths are available as an option.
A practical pull-test in the field is recommended to verify the actual required pile embedment.



Tracker pile rammed in the ground

4. Ease of use

4.1 Installation

Building on its experience, Soltigua developed iTracker™ to optimize **ease of installation** and minimize installation errors, also when personnel lacks previous experience with trackers and/or specific skills.
Maximum ground slope along the longitudinal axis of rotation of each tracker: 15% (i.e. 8°).
Maximum ground slope along perpendicular to the longitudinal axis of rotation: 100% (i.e. 45°).
The ground level at the basis of each intermediate pile of a given tracker should be within 150 mm from the height of the ideal line connecting the basis of the first pile and of the last pile of that tracker.
No welding nor drilling is required during erection and installation tolerances allowed by iTracker™ rank the highest in the market.

Feature	iTracker	Benchmark
Vertical tolerance (Z)	±45 mm	±20 mm
Transversal tolerance (X)	±25 mm	±20 mm
Longitudinal tolerance (Y)	±50 mm	±35 mm
Tilt	8°	2°
Twist	15°	5°

iTracker installation tolerances compared to a benchmark solution

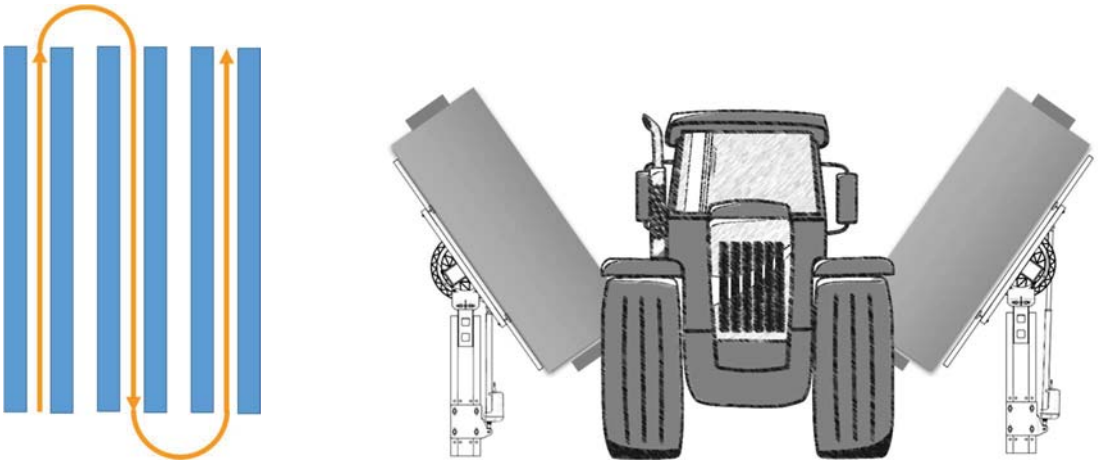
These large installation tolerances help at minimizing site repairs/modifications and ground works and at achieving:

- lower installation costs;
- no delays in project timeline;
- easier project management.

4.2 Maintenance

All components are **maintenance free**, including the linear actuator and its motor, which has an IP66 dynamic rating. The rotation bearings are made of stainless steel rollers with self-lubricating washers.

Single row tracking **simplifies cleaning and vegetation management** because there are no obstacles between rows. Adjacent trackers can be rotated to face each other in order to enable their simultaneous cleaning.



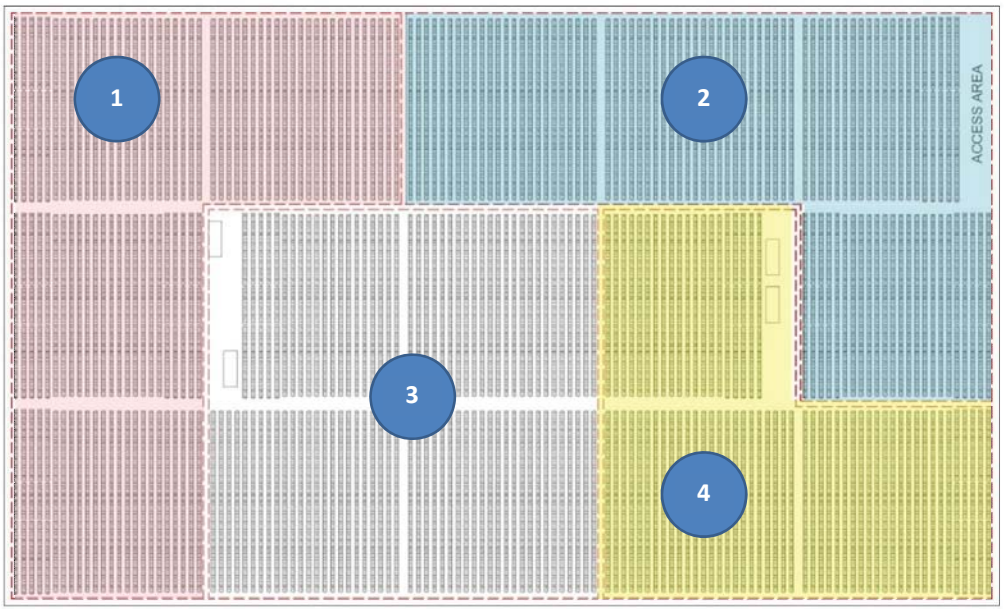
Single row trackers allow cleaning 2 tables at once

Continuous tables are already optimized for autonomous robot cleaning.

SolControl intelligent **monitoring system** enables the operators to evaluate the tracking system status at a glance, even remotely, in an intuitive manner.
If necessary, details down to single tracker level can be checked.

5. Tracking system architecture

The whole tracking system of a PV power plant is usually divided into some sub arrays, each of which coincides with the part of the plant related to a transformer station or to a centralized inverter.



Illustrative PV plant divided into sub-arrays

Each sub-array is provided with a distribution panel (DP) and a back-up UPS (available as an option), which is used to perform the safety procedure in case of lack of electricity.

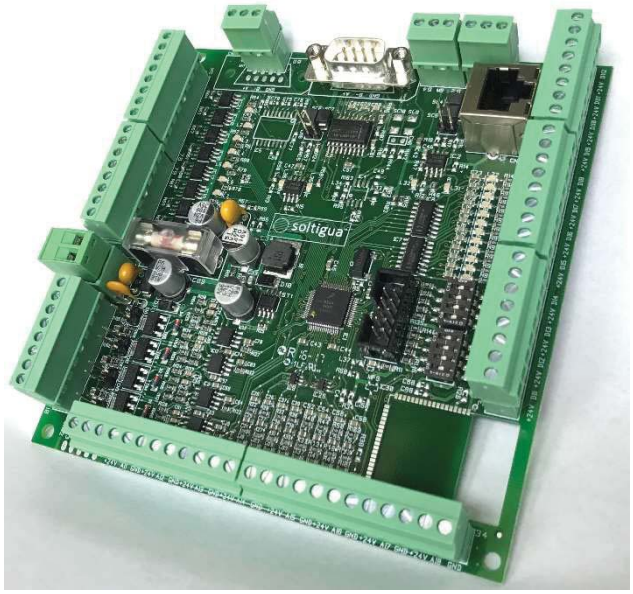
The DP distributes the power to the tracker field panels (FP) of the sub-array, each of which in turns supplies up to 4 tracker motors.

A central Tracker Control Panel (TCP) contains the industrial controller, which manages all the trackers in the PV array. The TCP communicates with the DP and with the FPs, where Soltigua's proprietary printed control boards (PCB) acquire trackers data.

The codification is the following:

CODE	DESCRIPTION
TCP	Tracking system control panel. There is one per PV power plant
xx	Sub-array. there can be several, typically one every 3-5 MWp
xx.DP	Sub- array distribution panel. There is one per sub-array
xx.FPyy	Tracker field panel; yy= 01 … 40
xx.TRzzz	Tracker in the sub-array xx; zzz = 001 … 160

Each PCB acquires data of up to 4 trackers, and communicates them to the central controller via Modbus RTU protocol over an RS-485 network.

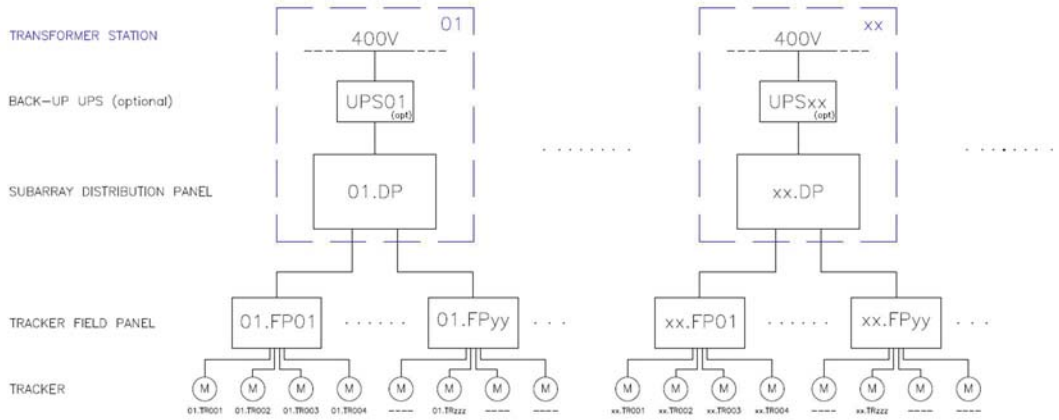


Soltigua's custom Printed Control Board (PCB)

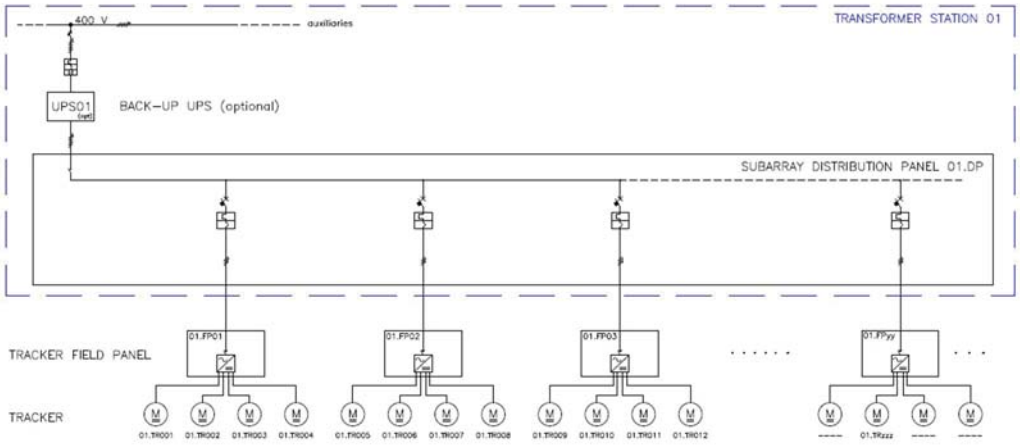
5.1 Power supply

The UPS and distribution panel DP are fed with electricity by the grid/PV plant (400 V AC 50/60 Hz), and supply the field panels FP at 230 V. Each FP supplies the tracker motors at 24V DC.

The following diagrams illustrate the typical power supply architecture, which is highly modular, flexible and scalable.



Example of general power supply architecture



Example of sub-array detailed power supply

Working conditions are as follows:

- distribution panels (DP) and optional UPS: indoor installation, 5°C ÷ 35°C;
- Field panels (FP): outdoor installation; IP 66; -10° ÷ 50°C, with max 90% humidity.

Each tracker has the following power requirements:

- Standby (between one tracking step and the following): 5 W;
- Tracking (with a wind speed of 15 km/h): 77 W.

The average tracking time is less than 1.0% of daylight hours, therefore iTracker™ control software dynamically manages the assembly of trackers in the field by operating them in a sequence of 2 groups, in order to limit peak power consumption and optimize the UPS battery usage. Moreover, at night, all

trackers can be switched off, so that power consumption is further reduced, unless it is advisable to keep them on when ambient temperature falls below 5°C.

Each sub array can include a maximum of 160 iTrackers for an equivalent power capacity of 5 MWp, for a maximum total power consumption of 22 kVA and a maximum inrush current of 45 A @400V. Typically a sub-array will include less trackers, hence will require lower values.

The maximum power consumption is only obtained if the wind blows at the maximum operational wind speed and the trackers are at their maximum working angle.

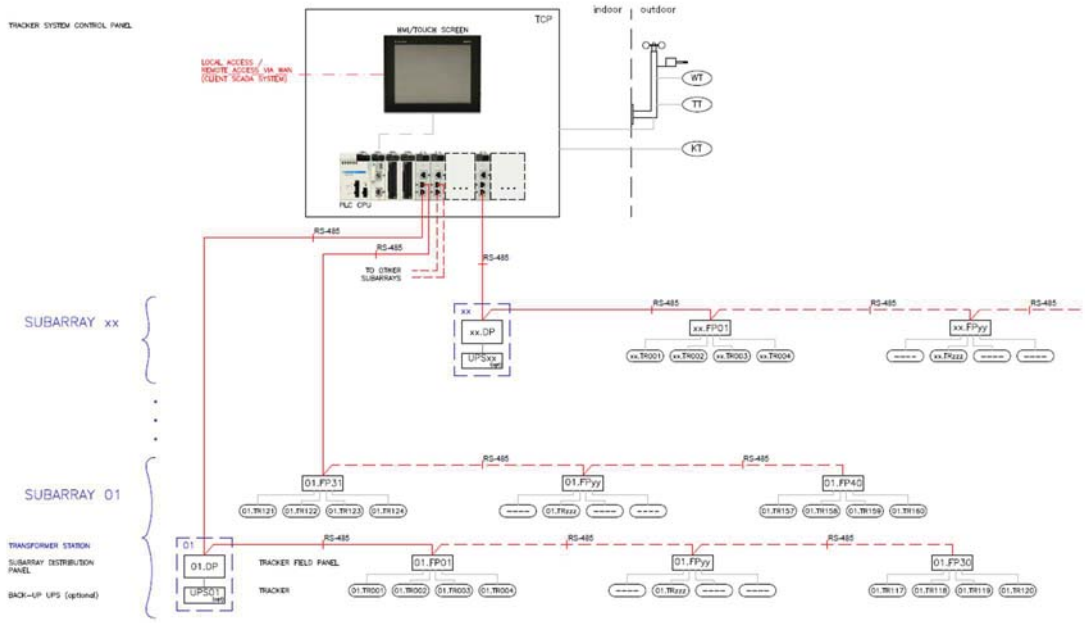
Average power consumption is 0.13 kW/MWp during daytime and 0.01 kW/MWp during nighttime.

5.2 Control and Monitoring

The central controller takes care of the automatic tracking cycle, including the backtracking function and the safety procedure in case of warnings such as high wind. The controller reads the following sensors:

- Wind speed sensor: to check the working conditions;
- Ambient temperature probe: to check for extreme operating temperatures;
- GPS receiver: to communicate with satellites for time update;
- Back-up UPS (optional): to verify its operational functionality.

The following diagram shows the typical I&C architecture.



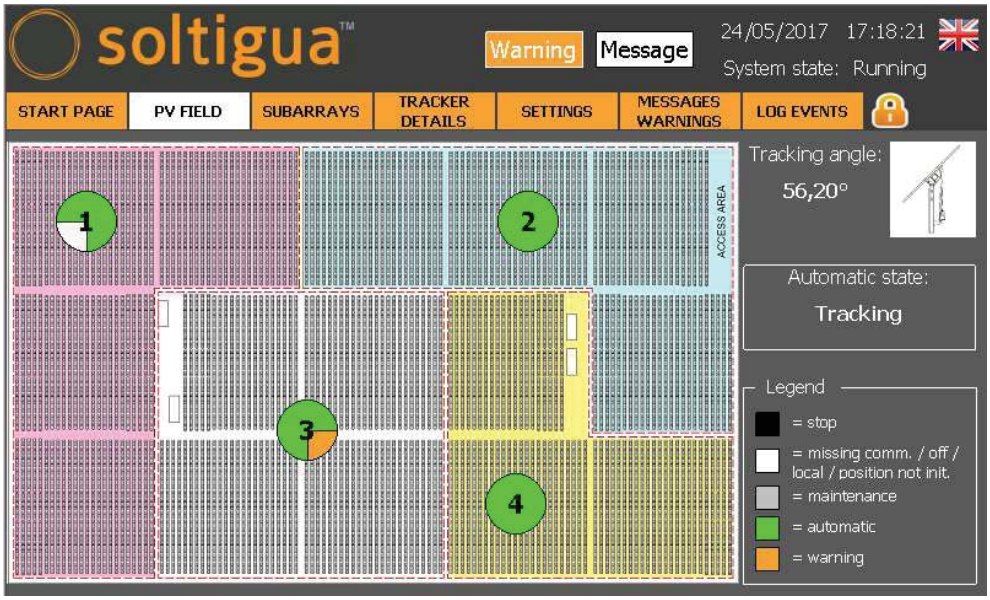
Example of typical communication architecture

Thanks to **Soltigua's SolControl supervision software**, three different interfaces can be used for checking operating data in real time and setting specific functions:

- Local touchscreen monitor on the tracker control panel;
- Locally connected pc (to customer's care);
- Remotely connected pc, via GSM or WAN, thanks to the integrated router.

SolControl specific functions include:

- Rotation to maintenance position of a sub array (for cleaning or other purposes);
- Individual rotation of single trackers to a desired position (special activities on given strings;
- Datalogging;
- Alarms log.



Soltigua's SolControl supervision software

The controller monitors and makes available operational data via Modbus TCP/IP protocol to any other monitoring system. Data are updated every second for continuous communication, whereas a given amount of historical data are stored locally for non-continuous extraction.
In addition, Soltigua can provide remote assistance and monitoring via the integrated WAN/GSM router.

For data extraction possibilities, the following parameters are available in the log file:

- For the whole PV array:
  - Date and time;
  - Sun elevation and sun azimuth;
  - Wind speed;
  - Power plant state;
  - Ideal tracking angle;
- For each sub-array:

- Global working state;
- Active warnings (e.g.: high wind);
- N° of trackers in automatic mode;
- N° of trackers in manual mode;
- N° of trackers in maintenance mode;
- N° of trackers in local alarm;

- For each tracker:
  - Tracking angle;
  - Active alarms.

6. Earthing

iTracker™ rotating structure is connected to earth through its drive pile. In cases where the earthing requirements are not satisfied because of the ground features or because of local code requirements, more piles can be connected to the structure to reduce the resistance to earth by means of optional additional grounding braids.

Modules earthing is not included as a standard, but it can be provided, as an option, via the iTracker™ metallic structure by means of earthing washers or similar items.

iTracker: catching all the sun

iTracker – the intelligent tracker –
maximizes the output of your PV power plant,
thanks to its all-around performance
and Soltigua's customer-tailored solutions

soltigua™

Track and field: iTracker's decathlon

"The decathlon includes ten separate events and they all matter. You can't work on just one of them."

Dan O'Brien
Olympic gold medal

Track

Horizontal single-axis trackers increase the performance of PV power plants by up to 30% with alimited increase of the investment. By following the sun throughout the day PV trackers maximise power generation.
They also better match the grid demand profile, which peeks in the afternoon, and contribute to a smarter and more sustainable energy system.

Field

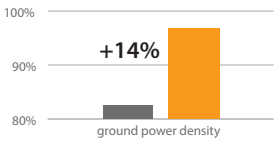
To maximize the actual PV output in the field, trackers must deliver on several dimensions during the different phases of the PV project life: design, installation, operation and maintenance.
Challenges are numerous and diversified, ranging from field configuration to need for local content, from local labour skills to weather conditions, from budgetary constraints all the way down to asset management for a long lifespan.

iTracker's decathlon

Effective tracker performance requires all-around achievements and attention to detail, like a decathlete, who prepares for multiple challenges at the same time.
This is iTracker's intelligence: delivering everywhere it matters!

01 Power Density

Smallest footprint for each installed PV module



- Up to 14% additional capacity for a given area
- Continuous table with no interruptions thanks to virtual axis of rotation
- Length up to 96 meters
- Single row 3D backtracking maximises annual output

02 Site Adaptability

The most flexible tracker on the market

- Optional universal joint for undulating sites avoids ground works
- North South slopes up to 15% - no East West slope limitation
- Independent row tracking enables more flexible layouts
- Alignment is possible in any direction to adapt to site constraints

iTracker™
intelligent tracking by soltigua

03 Wind Management

Holistic approach to wind loads

- Wind tunnel tested, including dynamic analysis
- Intelligent stowing position along the array avoids wind galloping
- Soltigua's patented bearing concept includes a torsional limiter
- An embedded damping factor avoids the addition of external dampers

04 Outdoor Resistance

Ready for the harshest environment

- Linear actuator with IP 66 dynamic rating and IP69K static rating
- IP 65 electric box against moisture, dust and sand
- Broad range of working temperatures from -10°C to +50°C
- HDG metal structure and components with advanced coatings (Zn-Al-Mg)

05 Endurance & Reliability

Designed and field tested for 50-year service

- Patented balanced design reduces mechanical stress on structure and actuator
- Proprietary rugged printed control board can resist temperatures from -20° to +80°C
- Drive and bearing components tested on the field for an equivalent 50-year service
- Technical due diligence available on request

06 Advanced Design

Integrated mechanical engineering

- Tracking precision, balanced design and broad rotation range increase yield by up to 1,5%
- Engineering platform leverages Soltigua's experience in complex CSP collectors
- 3D CAD modelling enables rapid virtual prototyping and in depth analysis
- FEM (Finite Elements) analysis performed for various load cases on critical components

iTracker™
intelligent tracking by soltigua

07 Intelligent Monitoring

Monitoring tailored to specific customer needs

- Individual monitoring and control of each tracker
- Soltigua's cloud-based SCADA shows solar array status at a glance, in an intuitive manner
- Single tracker status can also be detected, including warnings and alerts
- Real time and historical data available

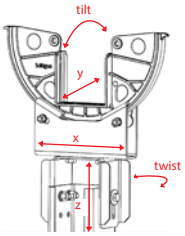
08 Minimized O&M

Minimized operating cost for the pv array

- Simplified cleaning and vegetation management: no obstacles between rows
- Adjacent rows can face each other to allow their simultaneous cleaning
- Continuous table is already optimized for autonomous robot cleaning
- All moving parts are maintenance free, as they are sealed and self lubricated

09 Ease of installation

Fast, simple and user friendly installation



- Highest installation tolerances on the market avoid repair work at construction site
- No specialized tool is required during installation: no welding, no drilling
- Installation manual available to partners and clients
- Installation courses in Soltigua's headquarters and on project sites

10 Certified Quality

100% compliant to state-of-the-art standards

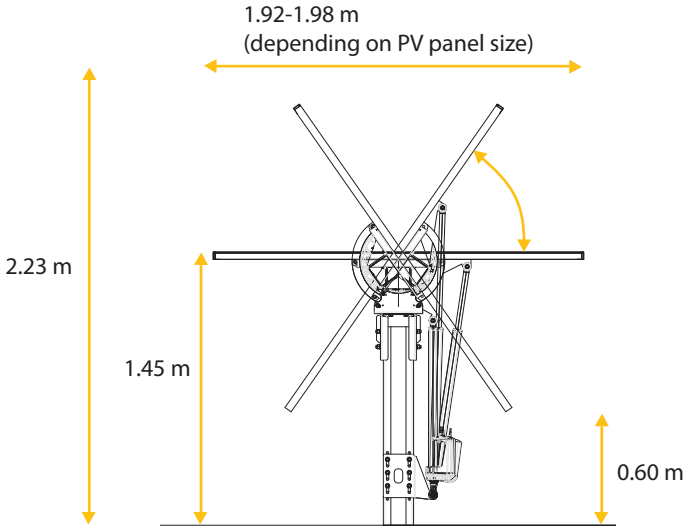
- CE marked according to the Machinery Directive 2006/42/UE
- Structural design compliant with Eurocodes EN 1991-1-1, EN 1991-1-3, EN 1991-1-4
- Electrical design as per EU Directives 2014/35/UE (LV) and 2014/30/UE (EMC)
- Quality system certified by TUV Sud according to ISO 9001:2015

iTracker™
intelligent tracking by soltigua

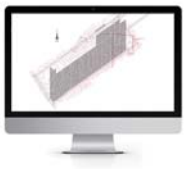
iTracker™
intelligent tracking by soltigua

Technical features

Tracking type	Independent single axis horizontal tracker; Any tracker alignment possible (ideally along North-South direction); Individual 3D backtracking
Tracking algorithm	Accurate astronomical formulas; tracking precision = 0.5°
Rotation range	±55°
Ground cover ratio	Freely configurable by customer (between 34% and 50%)
PV Module compatibility	Framed modules; All major brands
Module mount	1 module portrait; 2 modules landscape
Drive system	1 Independent linear actuator per tracker
Peak power per tracker	Up to 32.64 kWp per tracker (with 340Wp panels)
N° of Module per tracker	Up to 100 72-cell modules (1000 V) or 90 72-cell modules (1500 V)
PV array voltage	1000 V or 1500 V
Power supply	400 V AC (50/60 Hz) / Self powered
Communication	Private wired network / wireless with star topology
Monitoring	Local control via SCADA; Remote control available
Power consumption	≈ 600 kWh/MWp/year
Foundation type	standard: driven pile; compatible also with: cement block; ground screw
Wind resistance (Eurocodes)	In operation: up to 80 km/h in any position, depending on tracker version; Stow position: up to 200+ km/h in stow position, depending on tracker version.
Snow resistance	Up to 1'050 N/m2; depending on tracker version
Tracker stowing time	≤ 3 min
Installation tolerances	North South: ±45 mm; East-West: ±25 mm; Height tolerance: ±40 mm; Tilt: 8°; Twist: 15°
Ground slope	Max 15% slope in longitudinal direction (North- South); Any slope in transversal direction (East-West) [max 70% local slope for rotation clearance]
Installation method	Engineered for fast and easy assembly; no welding nor drilling required on site
Materials	HDG construction steel; Maintenance free drive components (actuator and bearings)
Certifications/Compliance	CE 2006/42/UE; Eurocodes EN1991-1-1/3/4; LV 2014/35/UE; EMC 2014/30/UE; ISO 9001-2015
Warranty	Structure: 10 years; Drive and electronics: 5 years; Warranty extension available



Dedicated global service



Project engineering - Tailored to the needs of each individual plant

- Choice of optimal trackers based on project features (PV modules, land, wind etc.)
- Detailed layout development already during proposal
- Optimization during basic engineering

Scope of supply - Flexible battery limits for goods and services

- On-site presence adapted to customer preference: from simple supervision to full turn-key
- If wished, selected structural components can be sourced locally by the client

Project management - Reliable network across 4 continents

- 100+ year of cumulative experience in project management
- Extensive network of local partners for seamless client service
- Projects successfully delivered and commissioned across 4 continents

Post sale assistance - Guaranteed support - online and onsite

- 99% availability guarantee included as sales contract standard
- Suitable stock of spare parts supplied and maintained available on site
- Remote monitoring service available upon request

Training - Supporting continuous learning during the entire life of the plant

- Dedicated courses at Soltigua's headquarters for construction partners
- On-site sessions during erection and commissioning phase
- Comprehensive manuals for detailed reference during O&M

A unique product portfolio

Soltigua is the only PV tracker supplier with a 10-year experience in engineering and manufacturing concentrating collectors for solar heat up to 320°C.
By manufacturing both parabolic troughs and Fresnel collectors, Soltigua can offer the most suitable solution to any solar thermal installation.

For more information and quotes write to sales@soltigua.com

This leaflet is part of the Re-Deploy project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 711935

soltigua™
solar tracking since 2007

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H1Z2Z2-K

CPR (UE) n° 305/11
E_{ca}

Regolamento Prodotti da Costruzione/*Construction Products Regulation*
Classe conforme norme EN 50575:2014 + A1:2016 e EN 13501-6:2014
Class according to standards EN 50575:2014 + A1:2016 and EN 13501-6:2014

DoP n° 1036/17

EN 50618	Costruzione e requisiti/*Construction and specifications*
CEI EN 60332-1-2	Propagazione fiamma/*Flame propagation*
CEI EN 50525	Emissione gas/*Gas emission*
CEI EN 50289-4-17 A	Resistenza raggi UV/*UV resistance test*
CEI EN 50396	Resistenza ozono/*Ozone resistance*
2014/35/UE	Direttiva Bassa Tensione/*Low Voltage Directive*
2011/65/CE	Direttiva RoHS/*RoHS Directive*
CA01.00546	Certificato IMQ/*IMQ Certificate*

◁HAR▷ CE NB 0051

DESCRIZIONE

Cavo unipolare flessibile stagnato per collegamenti di impianti fotovoltaici. Isolamento e guaina realizzati con mescola elastomerica senza alogeni non propagante la fiamma.

Conduttore
Corda flessibile di rame stagnato, classe 5

Isolante
Mescola LS0H di gomma reticolata speciale di qualità conforme alla norma EN 50618
LS0H = Low Smoke Zero Halogen

Guaina esterna
Mescola LS0H di gomma reticolata speciale di qualità conforme alla norma EN 50618

Colore anime
Nero

Colore guaina
Blu, rosso, nero

Marcatura a inchiostro
BALDASSARI CAVI IEMMEQU <HAR> H1Z2Z2-K 1/1 kV
(sez) (anno) (m) (tracciabilità)

CARATTERISTICHE TECNICHE

Tensione massima: 1800 V c.c. - 1200 V c.a.

Temperatura massima di esercizio: 90°C

Temperatura minima di esercizio: -40°C

Temperatura minima di posa: -40°C

Temperatura massima di corto circuito: 250°C

Sforzo massimo di trazione: 15 N/mm^2

Raggio minimo di curvatura: 4 volte il diametro esterno massimo

Condizioni di impiego
Per l'interconnessione di elementi di impianti fotovoltaici. Adatti per l'installazione fissa all'esterno e all'interno, entro tubazioni in vista o incassate o in sistemi chiusi similari.
Adatti per la posa direttamente interrata o entro tubo interrato e per essere utilizzati con apparecchiature di classe II.

DESCRIPTION

Flexible single-core cable for connection in photovoltaic installations. Insulation and sheath made of elastomeric compound, halogen free and flame retardant.

Conductor
Tinned copper flexible wire, class 5

Insulation
Special LS0H cross-linked rubber compound according to EN 50618 quality
LS0H = Low Smoke Zero Halogen

Outer sheath
Special LS0H cross-linked rubber compound according to EN 50618 quality

Cores colour
Black

Sheath colour
Blue, red or black

Inkjet marking
BALDASSARI CAVI IEMMEQU <HAR> H1Z2Z2-K 1/1 kV
(section) (year) (m) (traceability)

TECHNICAL CHARACTERISTICS

Maximum voltage Uo/U: *1800 V d.c. - 1200 V a.c.*

Maximum operating temperature: *90°C*

Minimum operating temperature: *-40°C*

Minimum installation temperature: *-40°C*

Maximum short circuit temperature: *250°C*

Maximum tensile stress: *15 N/mm^2*

Minimum bending radius: *4 x maximum external diameter*

Use and installation
For interconnection of photovoltaic elements. Suitable for fixed installation indoor and outdoor, in pipes exposed or embedded or in similar closed systems.
Suitable for laying directly underground or in pipe underground and to be used for class II equipment.

BALDASSARI CAVI

H1Z2Z2-K

Formazione *Formation*	Ø indicativo conduttore *Approx. conductor Ø*	Spessore medio isolante *Average insulation thickness*	Spessore medio guaina *Average sheath thickness*	Ø indicativo produzione *Approx. production Ø*	Peso indicativo cavo *Approx. cable weight*	Resistenza elettrica max a 20°C *Max. electrical resistance at 20°C*	Portata di corrente in aria libera *Current rating free in air*	
							Singolo cavo *Single cable* 60°C	2 cavi adiacenti *2 adjacent cables* 60°C
n° x mm²	mm	mm	mm	mm	kg/km	ohm/km	A	A
1 x 1,5	1,5	0,7	0,8	4,7	34	13,7	30	24
1 x 2,5	2,1	0,7	0,8	5,2	47	8,21	40	33
1 x 4	2,5	0,7	0,8	5,8	58	5,09	55	44
1 x 6	3,0	0,7	0,8	6,5	80	3,39	70	70
1 x 10	4,0	0,7	0,8	7,9	127	1,95	95	95
1 x 16	5,0	0,7	0,9	8,8	180	1,24	130	107
1 x 25	6,2	0,9	1,0	10,6	270	0,795	180	142
1 x 35	7,6	0,9	1,1	12,0	360	0,565	220	176
1 x 50	8,9	1,0	1,2	14,1	515	0,393	280	221
1 x 70	10,5	1,1	1,2	15,9	720	0,277	350	278
1 x 95	12,5	1,1	1,3	17,7	915	0,210	410	333
1 x 120	13,7	1,2	1,3	19,8	1160	0,164	480	390
1 x 150	16,1	1,4	1,4	21,7	1460	0,132	566	453
1 x 185	17,7	1,6	1,6	24,1	1780	0,108	644	515
1 x 240	19,9	1,7	1,7	26,7	2310	0,082	775	620

ARG16R16 0,6/1 kV Repero® unipolare

CPR (UE) n°305/11
C_{ca} - s3, d1, a3

Regolamento Prodotti da Costruzione/*Construction Products Regulation*
Classe conforme norme EN 50575:2014 + A1:2016 e EN 13501-6:2014
Class according to standards EN 50575:2014 + A1:2016 and EN 13501-6:2014

DoP n°1043/17

CEI 20-13
CEI EN 60332-1-2
2014/35/UE
2011/65/CE

Costruzione e requisiti/*Construction and specifications*
Propagazione fiamma/*Flame propagation*
Direttiva Bassa Tensione/*Low Voltage Directive*
Direttiva RoHS/*RoHS Directive*

NB 0051

DESCRIZIONE

Cavo unipolare per energia con conduttore in alluminio, isolato in gomma etilenpropilenica ad alto modulo di qualità G16, sotto guaina di PVC, con particolari caratteristiche di reazione al fuoco e rispondente al Regolamento Prodotti da Costruzione (CPR).

Conduttore
Corda di alluminio rigida, classe 2

Isolante
Mescola di gomma etilpropilenica ad alto modulo di qualità G16

Guaina esterna
Mescola di PVC di qualità R16

Colore anime
Normativa HD 308

Colore guaina
Grigio

Marcatura a inchiostro
BALDASSARI CAVI REPERO® ARG16R16 0,6/1 kV (sez)
Cca-s3,d1,a3 IEMMEQU EFP (anno) (m) (tracciabilità)

DESCRIPTION

Single-core power cable with aluminum conductor, HEPR insulated (G16 quality), PVC sheathed, with special fire reaction characteristics according to Construction Products Regulation (CPR).

Conductor
Aluminium stranded wire, class 2

Insulation
Rubber HEPR compound G16 quality

Outer sheath
PVC compound, R16 quality

Cores colour
HD 308 Standard

Sheath colour
Grey

Inkjet marking
BALDASSARI CAVI REPERO® ARG16R16 0,6/1 kV (section)
Cca-s3,d1,a3 IEMMEQU EFP (year) (m) (traceability)

CARATTERISTICHE TECNICHE

Tensione nominale Uo/U: 0,6/1 kV

Temperatura massima di esercizio: 90°C

Temperatura minima di esercizio: -15°C
(in assenza di sollecitazioni meccaniche)

Temperatura minima di posa: 0°C

Temperatura massima di corto circuito:
250°C fino alla sezione 240 mm², oltre 220°C

Sforzo massimo di trazione: 50 N/mm²

Raggio minimo di curvatura: 6 volte il diametro esterno massimo

Condizioni di impiego
Per trasporto energia nell'edilizia industriale e/o residenziale. Adatto per impiego all'interno in locali anche bagnati o all'esterno; posa fissa su murature e strutture metalliche. Ammessa anche la posa interrata.

TECHNICAL CHARACTERISTICS

Nominal voltage Uo/U: *0,6/1 kV*

Maximum operating temperature: *90°C*

Minimum operating temperature: *-15°C*
(without mechanical stress)

Minimum installation temperature: *0°C*

Maximum short circuit temperature:
250°C up to 240 mm² section, over 220°C

Maximum tensile stress: *50 N/mm²*

Minimum bending radius: *6 x maximum external diameter*

Use and installation
Power cable for industrial and/or residential uses. Suitable to be used indoor and outdoor, even in wet environments; it can be fixed on walls and/or metal structures. Suitable also for laying underground.

ARG16R16 0,6/1 kV Repero® unipolare

Formazione *Formation*	Ø indicativo conduttore *Approx. conductor Ø*	Spessore medio isolante *Average insulation thickness*	Spessore medio guaina *Average sheath thickness*	Ø indicativo produzione *Approx. production Ø*	Peso indicativo cavo *Approx. cable weight*	Resistenza elettrica max a 20°C *Max. electrical resistance at 20°C*	Portata di corrente *Current rating*			
							In aria libera *Free in air 30°C*	In tubo in aria *In pipe in air 30°C*	Interrato *Underground 20°C*	In tubo interrato *Underground in pipe 20°C*
n° x mm²	mm	mm	mm	mm	kg/km	ohm/km	A	A	A	A
1 x 16	4,9	0,7	1,4	9,1	109	1,91	70	64	98	75
1 x 25	6,1	0,9	1,4	10,7	151	1,20	102	88	119	95
1 x 35	7,1	0,9	1,4	11,7	185	0,868	136	110	141	115
1 x 50	8,2	1,0	1,4	13,0	230	0,641	164	131	167	134
1 x 70	9,9	1,1	1,4	14,9	315	0,443	218	175	204	173
1 x 95	11,4	1,1	1,5	16,6	405	0,320	261	209	245	196
1 x 120	13,1	1,2	1,5	18,5	510	0,253	310	250	277	238
1 x 150	14,4	1,4	1,6	20,4	620	0,206	350	280	313	250
1 x 185	16,2	1,6	1,6	22,6	750	0,164	415	334	350	300
1 x 240	18,4	1,7	1,7	25,2	955	0,125	490	392	413	331
1 x 300	20,7	1,8	1,8	27,9	1150	0,100	567	-	454	400
1 x 400	23,6	2,0	1,9	31,4	1520	0,0778	665	-	512	450
1 x 500	26,5	2,2	2,0	34,9	1850	0,0605	765	-	578	505
1 x 630	30,2	2,4	2,2	39,8	2415	0,0469	880	-	646	580

N.B. Il coefficiente di resistività termica del terreno preso a riferimento per il calcolo della portata dei cavi interrati è di 1° C.m/W, profondità di posa 0,8 m. Calcolo della portata di corrente eseguito considerando quattro cavi a contatto con temperatura dei conduttori di 90°C.

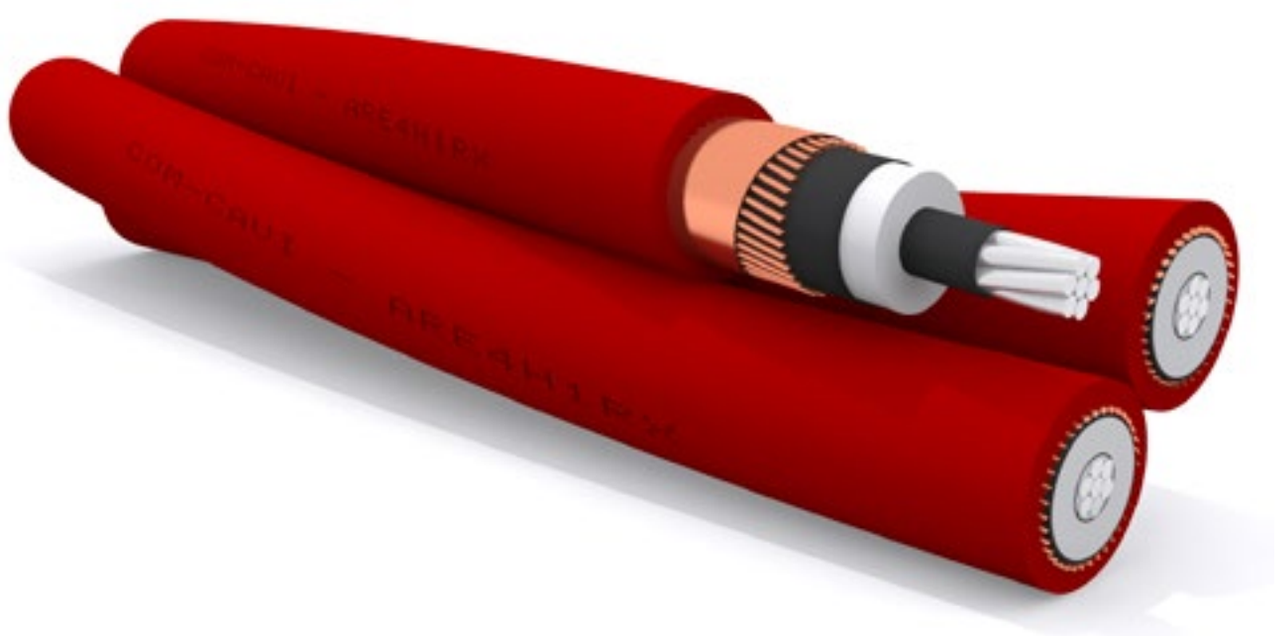
N.B. The thermal resistivity coefficient used as a reference for the calculation of the underground cables current rating is 1° C.m/W, 0,8 m installation depth. Calculation of current rating performed considering four cables in contact with conductor temperature of 90°C.

ARE4H1RX - Elica visibile 12/20 kV - 18/30 kV

MEDIA TENSIONE - ENERGIA
MEDIUM VOLTAGE - ENERGY

RoHS 2002/95/EC CE

RIFERIMENTO NORMATIVO/*STANDARD REFERENCE*	
Costruzione e requisiti/*Construction and specifications*	EC 60502-2
Propagazione fiamma/*Flame propagation*	CEI 20-35
Direttiva RoHS/*RoHS Directive*	2011/65/CE



CARATTERISTICHE FUNZIONALI:
- Tensione nominale Uo/U: : 12/20 kV - 18/30 kV
- Temperatura massima di esercizio: 90°C
- Temperatura minima di posa: 0°C
- Temperatura massima di corto circuito: 250°C

CARATTERISTICHE PARTICOLARI:
Cavi media tensione non propaganti la fiamma. Adatti per impianti eolici.

CONDIZIONI DI IMPIEGO:
Adatti per installazioni in canale interrato; tubo interrato; interro diretto; aria libera; interrato con protezione.

FUNCTIONAL CHARACTERISTICS
- *Nominal voltage Uo/U: 12/20 kV - 18/30 kV*
- *Maximum operating temperature: 90°C*
- *Minimum installation temperature: 0°C*
- *Maximum short circuit temperature: 250°C*

SPECIAL FEATURES
Medium voltage cable, not propagating flame. Suitable for wind power plants.

USE AND INSTALLATION
Suitable for installations in buried trough; buried duct; directly buried; open air; buried with protection.

ARE4H1RX - Elica visibile 12/20 kV - 18/30 kV

COSTRUZIONE DEL CAVO / ***CABLE CONSTRUCTION***

	**CONDUTTORE** **Materiale:** Conduttore a corda rotonda compatta di alluminio	***CONDUCTOR*** ***Material:*** *stranded wire alluminium*
	**SEMICONDUTTIVO INTERNO** **Materiale:** Mescola estrusa **Colore:** Nero	***INNER SEMICONDUCTIVE*** ***Material:*** *extruded compound* ***Colour:*** *Black*
	**ISOLANTE** **Materiale:** Mescola di politene reticolato **Colore:** Naturale	***INSULATION*** ***Material:*** *polyethylene compound* ***Colour****: Natural*
	**SEMICONDUTTIVO ESTERNO** **Materiale:** Mescola estrusa **Colore:** Nero	***OUTER SEMICONDUCTIVE*** ***Material:*** *extruded compound* ***Colour:*** *Black*
	**SCHERMO** **Tipo:** Fili di rame rosso e controspirale **Materiale:** Rame rosso (R max 3 Ω/km)	***SCREEN*** ***Type:*** *Copper wire* ***Colour:*** *Copper (R max 3 Ω/km)*
	**GUAINA ESTERNA** **Materiale:** PVC di qualità Rz/ST2 **Colore:** Rosso	***OUTER SHEATH*** ***Material:*** *PVC compound, Rz quality* ***Colour:*** *grey*

MARCATURE:

- COM-CAVI - ARE4H1RX 12/20 kV - <N° COND. X SEZIONE> <ANNO> <MARCATURA METRICA>

MARKINGS

- *CCOM-CAVI - ARE4H1RX 12/20 kV - <N° CONDUCT. S SECTION> <YEAR> <METRIC MARKING>*

ARE4H1RX - Elica visibile 12/20 kV

12/20 kV Dati dimensionali - size characteristics

Formazione *Size*	Ø nominale conduttore *Nominal conduct. Ø*	Spessore isolante *Insulation thickness*	Spessore guaina *Sheath thickness*	Ø nominale cavo *Nominal cable Ø*	Peso nominale cavo *Nominal cable weight*	Raggio minimo di curvatura *Minimum bending radius*
n° x mm²	mm	mm	mm	mm	kg/km	mm
25	6,0	5,5	1,8	29,6	610	350
35	7,0	5,5	1,8	30,7	670	360
50	8,1	5,5	1,8	31,7	720	380
70	9,9	5,5	1,8	33,3	840	400
95	11,5	5,5	1,9	35,4	955	430
120	12,9	5,5	1,9	37,0	1060	450
150	14,2	5,5	2,0	38,5	1210	470
185	15,9	5,5	2,0	40,0	1345	490
240	18,3	5,5	2,1	43,2	1590	530
300	20,7	5,5	2,2	45,8	1845	570
400	23,5	5,5	2,3	49,0	2175	610
500	26,5	5,5	2,4	52,0	2620	650
630	30,1	5,5	2,5	56,2	3110	710
3x1x25	6,0	5,5	1,8	63,9	1834	350
3x1x35	7,0	5,5	1,8	66,3	2014	360
3x1x50	8,1	5,5	1,8	68,5	2164	380
3x1x70	9,9	5,5	1,8	71,9	2525	400
3x1x95	11,5	5,5	1,9	76,5	2871	430
3x1x120	12,9	5,5	1,9	79,9	3186	450
3x1x150	14,2	5,5	2,0	83,2	3637	470
3x1x185	15,9	5,5	2,9	86,4	4043	490
3x1x240	18,3	5,5	2,1	93,3	4780	530
3x1x300	20,7	5,5	2,2	98,9	5546	570
3x1x400	23,5	5,5	2,3	105,8	6538	610
3x1x500	26,5	5,5	2,4	112,3	7876	650

Per i cavi con isolamento in G7 i dati dimensionali sono da ritenersi identici.
For cables with insulation G7 dimensional data are to be considered identical.

ARE4H1RX - Elica visibile 12/20 kV

12/20 kV Caratterisitche elettriche - electrical characteristics

Formazione *Size*	Capacità nominale *Nominal capacity*	Corrente capacitiva nominale a tensione U_0 *Nominal capacitive current at voltage U_0*	Reattanza di fase a 50 HZ *Reactance phase 50HZ*	Resistenza massima in CC del conduttore a 20°C *Conductor max electrical resist. CC at 20°C*	Resistenza massima in CC dello schermo a 20°C *Screen max electrical resist. CC at 20°C*	Resistenza massima in CA del conduttore a 90°C *Conductor max electrical resist. CA at 90°C*	Portata di corrente *Current rating* A		Corrente di corto circuito del conduttore *Short circuit current conductor* (1s)
							in aria a *in air at* *30° C*	interrato a 20° C *Underground at 20° C* Rt=1m°C/W	
n° x mm²	mm	A/Km	Ω/Km	Ω/Km	Ω/Km	Ω/Km			kA
25	0,15	0,56	0,155	1,200	3,0	1,540	136	133	2,3
35	0,16	0,65	0,147	0,868	3,0	1,115	160	156	3,2
50	0,17	0,71	0,141	0,641	3,0	0,852	198	181	4,6
70	0,20	0,80	0,132	0,443	3,0	0,570	243	222	6,5
95	0,22	0,89	0,125	0,320	3,0	0,412	296	263	8,8
120	0,24	0,96	0,120	0,253	3,0	0,328	338	296	11,1
150	0,25	1,03	0,117	0,206	3,0	0,268	387	337	13,8
185	0,28	1,12	0,112	0,164	3,0	0,213	441	378	17,0
240	0,30	1,23	0,108	0,125	3,0	0,163	517	436	22,1
300	0,33	1,34	0,105	0,100	3,0	0,132	586	493	27,6
400	0,37	1,48	0,101	0,0778	3,0	0,103	677	567	36,8
500	0,40	1,62	0,098	0,0605	3,0	0,081	775	626	46,0
630	0,44	1,80	0,095	0,0469	3,0	0,064	882	700	58,0
3x1x25	0,15	0,56	0,155	1,200	3,0	1,540	136	133	2,3
3x1x35	0,16	0,65	0,147	0,868	3,0	1,115	160	156	3,2
3x1x50	0,17	0,71	0,141	0,641	3,0	0,825	198	181	4,6
3x1x70	0,20	0,80	0,132	0,443	3,0	0,570	243	222	6,5
3x1x95	0,22	0,89	0,125	0,320	3,0	0,412	296	263	8,8
3x1x120	0,24	0,96	0,120	0,253	3,0	0,328	338	296	11,1
3x1x150	0,25	1,03	0,117	0,206	3,0	0,268	387	337	13,8
3x1x185	0,28	1,12	0,112	0,164	3,0	0,213	441	378	17,0
3x1x240	0,30	1,23	0,108	0,125	3,0	0,163	517	436	22,1
3x1x300	0,33	1,34	0,105	0,100	3,0	0,132	586	493	27,6
3x1x400	0,37	1,48	0,101	0,0778	3,0	0,103	677	567	36,8
3x1x500	0,40	1,62	0,098	0,0605	3,0	0,081	775	626	46,0

Per i cavi con isolamento in G7 le portate di corrente sono da ritenersi più basse di 4-6 A.
For cables with insulation G7 current rating are to be considered more low 4-6 A.

Accessori Consigliati/*Recommended accessories*

Accessori per cavi con tensione di esercizio/Cables accessories with voltage 12/20 kV

Sezione nominale conduttore *Nominal section conductor*	Terminazione termorestringente da interno unipolare *Xxxxxxx*	Terminazione termorestringente da esterno unipolare *Xxxxxx*	Giunto termorestringente unipolare *Xxxxxxx*
35	24TTMI1-50C12	24TTME1-50C12	24GTS1-50C
50	24TTMI1-50C12	24TTME1-50C12	24GTS1-50C
70	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
95	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
120	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
150	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
185	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
240	24TTMI1-300C16	24TTME1-300C16	24GTS1-185E2AC
300	24TTMI1-300C16	24TTME1-300C16	24GTS1-300C
400	24TTMI1-630C16	24TTME1-630C16	24GTS1-630C
500	24TTMI1-630C16	24TTME1-630C16	24GTS1-630C
630	24TTMI1-630C16	24TTME1-630C16	24GTS1-630C

N.B. Per i cavi tripolari utilizzare tre confezioni unipolari della sezione corrispondente.

ARE4H1RX - Elica visibile - 18/30 kV

18/30 kV Dati dimensionali - size characteristics

Formazione *Size*	Ø nominale conduttore *Nominal conduct. Ø*	Spessore isolante *Insulation thickness*	Spessore guaina *Sheath thickness*	Ø nominale cavo *Nominal cable Ø*	Peso nominale cavo *Nominal cable weight*	Raggio minimo di curvatura *Minimum bending radius*
n° x mm²	mm	mm	mm	mm	kg/km	mm
35	7,0	8,0	1,9	36,0	920	430
50	8,1	8,0	2,0	37,5	990	460
70	9,9	8,0	2,0	39,5	1140	480
95	11,5	8,0	2,1	41,1	1265	500
120	12,9	8,0	2,1	42,5	1380	530
150	14,2	8,0	2,2	44,2	1510	550
185	15,9	8,0	2,2	45,8	1665	570
240	18,3	8,0	2,3	49,0	1940	610
300	20,7	8,0	2,4	51,5	2245	640
400	23,5	8,0	2,5	57,6	2625	690
500	26,5	8,0	2,6	57,7	3065	730
630	30,1	8,0	2,7	63,4	3860	810
3x1x35	7,0	8,0	1,9	77,8	2766	430
3x1x50	8,1	8,0	2,0	81,0	2976	560
3x1x70	9,9	8,0	2,0	85,3	3427	480
3x1x95	11,5	8,0	2,1	88,8	3803	500
3x1x120	12,9	8,0	2,1	91,8	4148	530
3x1x150	14,2	8,0	2,2	95,5	4539	550
3x1x185	15,9	8,0	2,2	98,9	5005	570
3x1x240	18,3	8,0	2,3	105,8	5832	610
3x1x300	20,7	8,0	2,4	111,2	6748	640

Per i cavi con isolamento in G7 i dati dimensionali sono da ritenersi identici.
For cables with insulation G7 dimensional data are to be considered identical.

ARE4H1RX - Elica visibile - 18/30 kV

18/30 kV Caratterisitche elettriche - electrical characteristics

Formazione *Size*	Capacità nominale *Nominal capacity*	Corrente capacitiva nominale a tensione U_0 *Nominal capacitive current at voltage U_0*	Reattanza di fase a 50 HZ *Reactance phase 50HZ*	Resistenza massima in CC del conduttore a 20°C *Conductor max electrical resist. CC at 20°C*	Resistenza massima in CC dello schermo a 20°C *Screen max electrical resist. CC at 20°C*	Resistenza massima in CA del conduttore a 90°C *Conductor max electrical resist. CA at 20°C*	Portata di corrente *Current rating* A		Corrente di corto circuito del conduttore *Short circuit current conductor* (1s)
							in aria a 30° C *in air at 30° C*	interrato a 20° C *Underground at 20° C*	
n° x mm²	mm	A/Km	Ω/Km	Ω/Km	Ω/Km	Ω/Km		Rt=1m°C/W	kA
35	0,13	0,74	0,153	0,868	3,0	1,115	160	156	3,2
50	0,13	0,83	0,149	0,641	3,0	0,825	198	181	4,6
70	0,15	0,92	0,140	0,443	3,0	0,570	243	222	6,5
95	0,16	1,01	0,132	0,320	3,0	0,412	289	263	8,8
120	0,18	1,10	0,127	0,253	3,0	0,328	334	296	11,1
150	0,19	1,16	0,123	0,206	3,0	0,268	373	337	13,8
185	0,21	1,22	0,119	0,164	3,0	0,213	426	371	17,0
240	0,22	1,37	0,115	0,125	3,0	0,163	494	419	22,1
300	0,24	1,49	0,111	0,100	3,0	0,132	555	469	27,6
400	0,27	1,64	0,107	0,0778	3,0	0,103	630	526	36,8
500	0,29	1,79	0,103	0,0605	3,0	0,081	714	581	46,0
630	0,32	1,96	0,100	0,0469	3,0	0,064	793	625	58,0
3x1x35	0,13	0,74	0,153	0,868	3,0	1,115	160	156	3,2
3x1x50	0,13	0,83	0,149	0,641	3,0	0,825	198	181	4,6
3x1x70	0,15	0,92	0,140	0,443	3,0	0,570	243	222	6,5
3x1x95	0,16	1,01	0,132	0,320	3,0	0,412	289	263	8,8
3x1x120	0,18	1,10	0,127	0,253	3,0	0,328	334	296	11,1
3x1x150	0,19	1,16	0,123	0,206	3,0	0,268	373	337	13,8
3x1x185	0,21	1,22	0,119	0,164	3,0	0,213	426	371	17,0
3x1x240	0,22	1,37	0,115	0,125	3,0	0,163	494	419	22,1
3x1x300	0,24	1,49	0,111	0,100	3,0	0,132	555	469	27,6

Per i cavi con isolamento in G7 le portate di corrente sono da ritenersi più basse di 4-6 A.
For cables with insulation G7 current rating are to be considered more low 4-6 A.

Accessori Consigliati/Recommended accessories

Accessori per cavi con tensione di esercizio/Cables accessories with voltage 18/30 kV

Sezione nominale conduttore *Nominal section conductor*	Terminazione termorestringente da interno unipolare *Xxxxxxx*	Terminazione termorestringente da esterno unipolare *Xxxxxx*	Giunto termorestringente unipolare *Xxxxxxx*
35	36TTMI1-70C12	36TTME1-70C12	36GTS1-95C
50	36TTMI1-70C12	36TTME1-70C12	36GTS1-95C
70	36TTMI1-70C12	36TTME1-70C12	36GTS1-95C
95	36TTMI1-240C12	36TTME1-240C12	36GTS1-95C
120	36TTMI1-240C12	36TTME1-240C12	36GTS1-240C
150	36TTMI1-240C12	36TTME1-240C12	36GTS1-240C
185	36TTMI1-240C12	36TTME1-240C12	36GTS1-240C
240	36TTMI1-240C16	36TTME1-240C12	36GTS1-240C
300	36TTMI1-300C16	36TTME1-300C16	36GTS1-300C
400	36TTMI1-630C16	36TTME1-630C16	36GTS1-630C
500	36TTMI1-630C16	36TTME1-630C16	36GTS1-630C
630	36TTMI1-630C16	36TTME1-630C16	36GTS1-630C

N.B. Per i cavi tripolari utilizzare tre confezioni unipolari della sezione corrispondente.