

EFASOLAR PVStation Solutions

EFASOLAR PVStation Solutions

Efacec is a century-long experienced company in providing power conversion products and solutions, we develop advanced fully integrated photovoltaic converter stations, covering the entire electric conversion chain for photovoltaic power plants.

EFASOLAR PVStation solution is highly competitive for large photovoltaic plants. A complete solution with in-house developed products, according to the highest efficiency and reliability standards, achieved through solar inverters, medium voltage switchgear, step-up transformer, enclosure and the energy automation solutions.

In order to support our customers in their projects we have several PVStation solutions. These can have different enclosures and/or different inverters configurations for the same output power. Other configurations can be modified in factory upon request.

With an entirely integrated approach, we are also able to provide photovoltaic grid-connection substations and interface solutions to the grid operator dispatch through its energy automation solutions.

Seeking for the highest performance during the EFASOLAR PVStation lifetime, optionally support services are available from base maintenance to a 24/7 protection approach and a multiple after sales packages assuring high availability and performance of our products.

Rated Power	1 MW	2 MW	3 MW	4,66 MW	6 MW
EFASOLAR Inverter	2 x 500M	2 x 1000	2 x 1500 HV	4 x 1165	4 x 1500 HV
Maximum PV power	2 x 575 kW	2 x 1200 kW	2 x 1915 kW	4 x 1400 kW	4 x 1915 kW
MPPT Range	480 V - 820 V	625 V - 900 V	940 V - 1250 V	630 V - 890 V	940 V - 1250 V
Maximum DC current	2 x 1084 A	2 x 1600 A	4 x 1600 A	4 x 1950 A	4 x 1600 A
Number of independent MPP inputs	4	2	2	4	4
Number of DC fused inputs ⁽¹⁾	16	12	12	24	24
Transformer	Oil Immersed / Dry Type				
Power	1000 kVA	2000 kVA	1 x 3000 kVA	2 x 2330 kVA	2 x 3000 kVA
Number of LV Windings	2	2	2	2	2
Switchgear⁽²⁾	2x IS + CIS / IS + CIS		2x IS + 2x CIS		
Voltage	≤ 36 kV				
Insulation	Air / SF6				
Enclosure	Concrete / Container / Modular / Padmount UL				
Dimensions (WxDxH)	7500 x 2730 x 3200 mm / 20 ft -40 ft Container / 9000 x 2980 x 2950 mm				
Weight	≤ 35 tons Concrete / ≤ 24 tons Container				
Cooling	Air forced cooling				
Protection Degree	IP 23D				

(1) - Other configurations can be used.
 (2) - Different configurations available upon request.

EFASOLAR PVStation

0,25 MW	1x EFASOLAR 250
1 MW	2x EFASOLAR 500 / 500M
1,46 MW	2x EFASOLAR 730
2 MW	2x EFASOLAR 1000
2 MW	1x EFASOLAR 2000
2,33 MW	2x EFASOLAR 1165
3 MW	3x EFASOLAR 1000
3,49 MW	3x EFASOLAR 1165
4 MW	4x EFASOLAR 1000
4 MW	2x EFASOLAR 2000
4,66 MW	4x EFASOLAR 1165
5,20 MW	4x EFASOLAR 1300HV
6 MW	4x EFASOLAR 1500HV

Efacec Inverter

- Up to 1500 V DC input voltage
- Multiple MPPTs with wide MPPT range
- Multiple DC inputs & integrated fuses with individual current measurement
- Power control & grid support features

Efacec MV Transformer

- Oil
- Dry

Outdoor

- Single Winding
- Double Winding

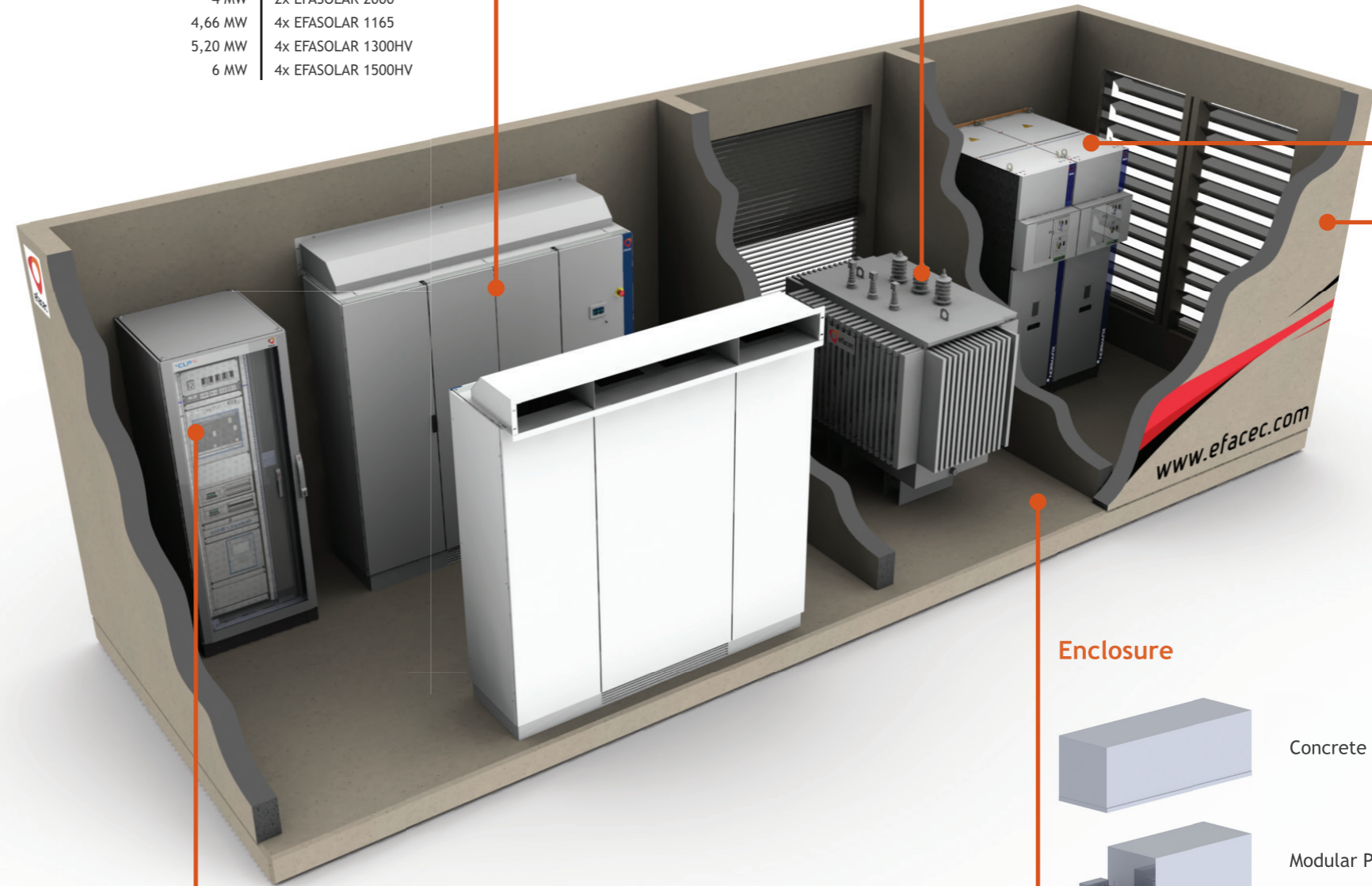
Efacec MV Switchgear ≤ 36 kV

Configurable Blocks

- Metering
- Compact
- Modular

After Sales

- Hotline
- Maintenance
- Life Cycle Warranty Options



Enclosure

- Concrete | Metal
- Modular Padmount UL
- Container 20ft. / 40ft.

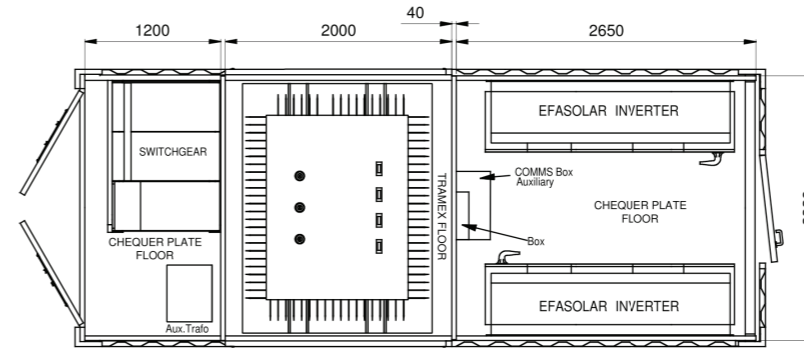
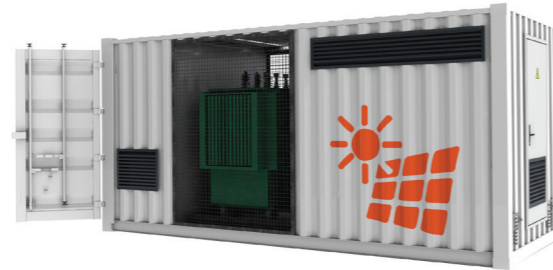
Efacec SCADA Monitoring System

- Power Plant Controller
- String Monitoring Integration
- Dispatch / DNO / ISO Interface
- High Reliability System (Hot-standby Redundancy)
- User Friendly Web based HMI

EFASOLAR PVStation 20ft Container

Efacec worldwide transportable and compact PVStation solution.

The best solution for large scale PV power plant where the transportation is a key point. With his standard container size is a plug & play solution for any kind of installation in any local conditions type.

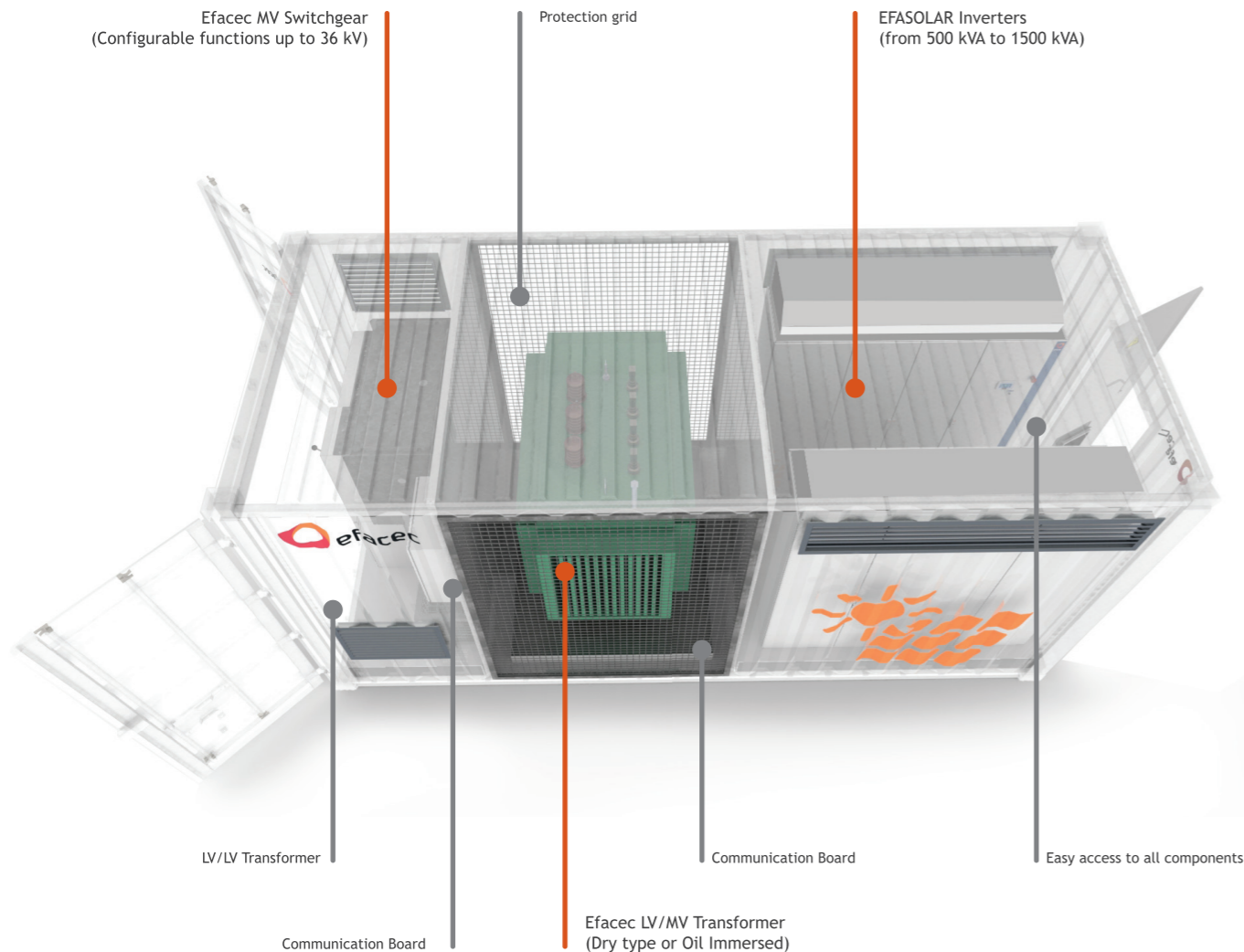


Customer Benefits

- 20ft solutions up to 2,33 MVA
- Reduced transportation and installation cost
- Plug & play solution
- Configurable MV switchgear functions
- High efficiency cooling system

Key Benefits

- All Efacec equipment are manufactured in-house
- Efacec single source of technology
- One single warranty for entire PVStation
- One service support for all products
- Robust and high quality container



Electrical

DC input	
Number of independent MPP inputs	2
Number of DC fused inputs ⁽¹⁾	up to 12
AC output	
Rated power	up to 2,33 MVA
Grid frequency	50 / 60 Hz
Grid rated voltage	from 6,6 kV up to 36 kV
Power factor ⁽²⁾ / Displacement power factor ⁽³⁾	1,0 / 0,8 inductive to 0,8 capacitive
Equipment	
Inverter	EFASOLAR Inverters
LV/MV Transformer	Efacec Dry type / Efacec Oil immersed
Transformer standards	IEC 60076 standard (Ecodesing normative optional)
MV Switchgear	Efacec Fluofix / Efacec Normafix (up to 36 kV)
MV Switchgear functions ⁽⁴⁾	Star topology / Ring topology
	IS + CIS (fuse) / IS+DC (breaker) + Protection Relay panel
	2x IS + CIS (fuse) / 2x IS+DC (breaker) + Protection Relay panel

Protective devices

DC disconnect device	Motor-drive switch disconnecter
DC overvoltage protection	Type II surge arrester
AC disconnect device	Fuse / Circuit breaker
AC overvoltage protection	from 75 kV to 180 kV
Other protective devices and protective functions included	Auxiliaries overvoltage protection, Ground fault monitoring, Overvoltage, Undervoltage, Overfrequency, Underfrequency, Anti-islanding, Reverse polarization, Short circuit on the output, Overtemperature, Asymmetrical current, DC unbalance strings, and others

General data

Enclosure type	20ft HC Container
Dimensions (WxLxH)	2438 x 6058 x 2896 mm
Weight	≤ 22 ton
Standard temperature range ⁽⁵⁾	-20 °C ... +60 °C / -4 °F ... +140 °F
Max. permissible value for relative humidity (noncondensing)	≤ 95%
Cooling concept	Energy efficient air forced cooling system
Altitude for rated conditions / Maximum operating altitude above sea level ⁽⁶⁾	1000 m / 3000 m
Protection degree	Inverter and MV switchgear compartments: IP 54 / Transformer compartment: IP21

Features

Auxiliary circuit transformer ⁽⁷⁾	230 V, 50/60 Hz
Auxiliary circuit board	included
LV / MV Transformer	Transformer oil containment
Communication protocols	Modbus TCP / RTU
Enclosure isolation	Walls, roof and doors isolated with thermal isolation panels (except transformer room)
Others	Earth circuit, illumination, power outlets, safety equipment, transportation parts, anti-corrosion treatment

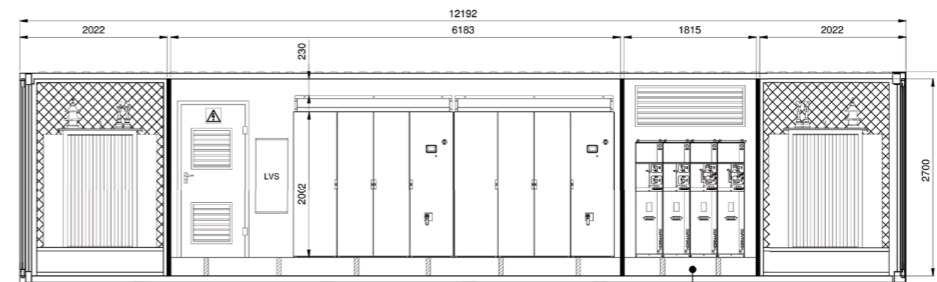
Optional

Inverters	DC fused inputs configurable, Optical-Fiber communication ports
LV/MV Transformer	Transformer alarm contacts (thermometer, DGPT or others)
MV Switchgear	MV circuit breaker (DC function), CTs and VTs in MV modules, MV protection relay with progressive auto-recloser
Others	UPS, Communications board, Air conditioning, Auxiliary transformer for trackers supply, dust protection filter levels, Meteorological Station, Efacec Monitoring systems, Efacec Management solutions, intrusion and fire detection system, external lighting system and others

(1) Other configurations can be used.
 (2) Power factor > 0,98 at rated output voltage and power load > 15%.
 (3) The adjustable range can be extended and other values can be configured.
 (4) Other configurations can be used.
 (5) Please consult the EFASOLAR inverter technical information about the power derate with temperature within the indicated operating range.
 (6) Please consult Efacec with the specific operating conditions in order to characterize an eventual derate with altitude.
 (7) Several rated power are available up to 30 kVA.

EFASOLAR PVStation 40ft Container

The right solution for utility scale PV power plant for overseas projects. This Efacec PVStation standard container size is a plug & play solution for all kind of projects, with several cooling options, covering all environmental conditions.

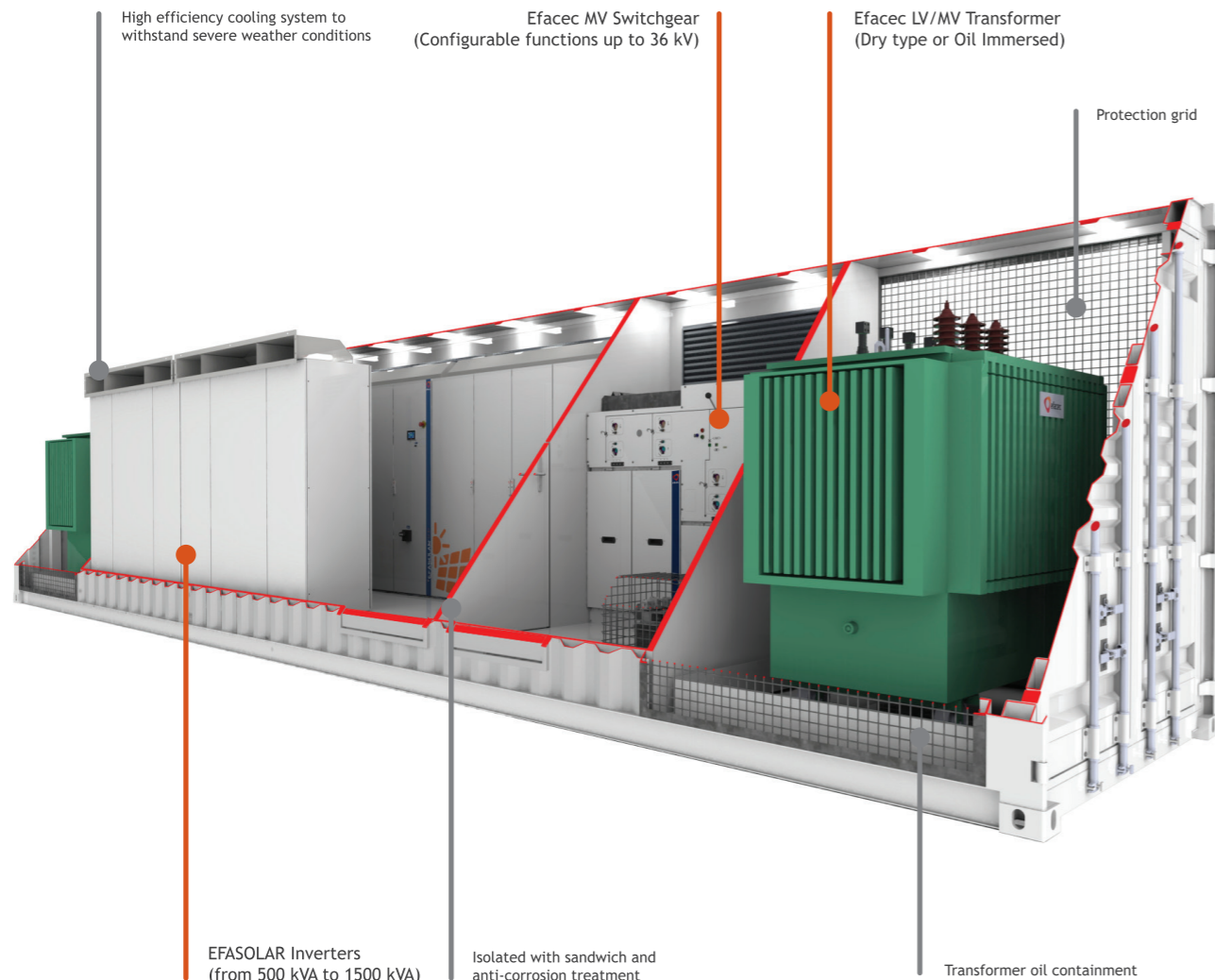


Customer Benefits

- 40ft solutions up to 4,66 MVA
- Standard transportation
- Plug & play solution
- Configurable MV switchgear functions
- High efficiency cooling system

Key Benefits

- All Efacec equipment are manufactured in-house
- Efacec single source of technology
- One single warranty for entire PVStation
- One service support for all products
- Robust and high quality container



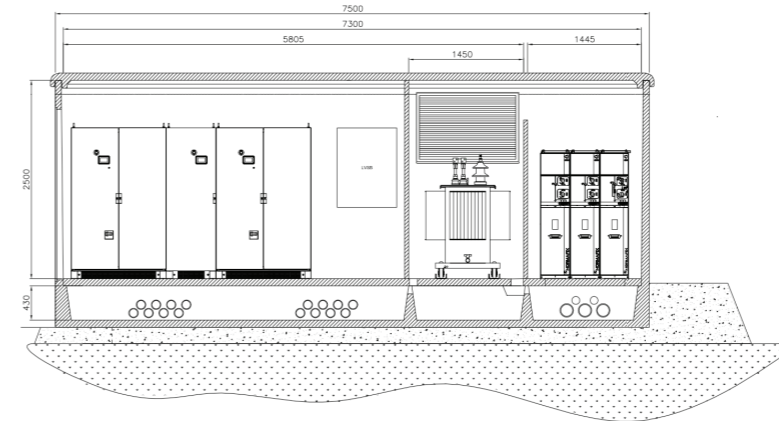
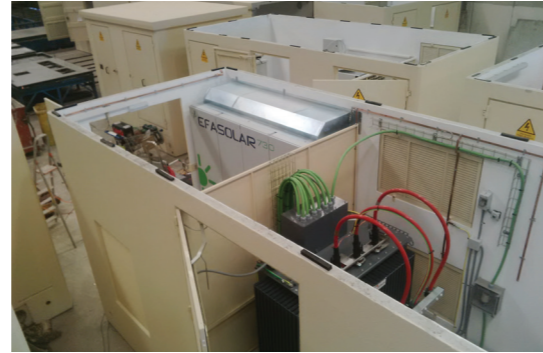
Electrical	
DC input	
Number of independent MPP inputs	4
Number of DC fused inputs ⁽¹⁾	up to 24
AC output	
Rated power	up to 4,66 MVA
Grid frequency	50 / 60 Hz
Grid rated voltage	from 6,6 kV up to 36 kV
Power factor ⁽²⁾ / Displacement power factor ⁽³⁾	1,0 / 0,8 inductive to 0,8 capacitive
Equipment	
Inverter	EFASOLAR Inverters
LV/MV Transformer	Efacec Dry type / Efacec Oil immersed
Transformer standards	IEC 60076 standard (Ecodesing normative optional)
MV Switchgear	Efacec Fluofix / Efacec Normafix (up to 36 kV)
MV Switchgear functions ⁽⁴⁾	Star topology IS + CIS (fuse) / IS + 2x CIS (fuse) / IS+DC (breaker) / IS+ 2x DC (breaker) + Protection Relay panel Ring topology 2x IS + CIS (fuse) / 2x IS + 2x CIS (fuse) / 2x IS+DC (breaker) / 2x IS+ 2x DC (breaker) + Protection Relay panel
Protective devices	
DC disconnect device	Motor-drive switch disconnecter
DC overvoltage protection	Type II surge arrester
AC disconnect device	Fuse / Circuit breaker
AC overvoltage protection	from 75 kV to 180 kV
Other protective devices and protective functions included	Auxiliaries overvoltage protection, Ground fault monitoring, Overvoltage, Undervoltage, Overfrequency, Underfrequency, Anti-islanding, Reverse polarization, Short circuit on the output, Overtemperature, Asymmetrical current, DC unbalance strings, and others
General data	
Enclosure type	40ft HC Container
Dimensions (WxLxH)	2438 x 12116 x 2896 mm
Weight	≤ 28 ton
Standard temperature range ⁽⁵⁾	-20 °C ... +60 °C / -4 °F ... +140 °F
Max. permissible value for relative humidity (noncondensing)	≤ 95%
Cooling concept	Energy efficient air forced cooling system
Altitude for rated conditions / Maximum operating altitude above sea level ⁽⁶⁾	1000 m / 3000 m
Protection degree	Inverter and MV switchgear compartments: IP 54 / Transformer compartment: IP21
Features	
Auxiliary circuit transformer ⁽⁷⁾	230 V, 50/60 Hz
Auxiliary circuit board	included
LV / MV Transformer	Transformer oil containment
Communication protocols	Modbus TCP / RTU
Enclosure isolation	Walls, roof and doors isolated with thermal isolation panels (except transformer room)
Others	Earth circuit, illumination, power outlets, safety equipment, transportation parts, anti-corrosion treatment.
Optional	
Inverters	DC fused inputs configurable, Optical-Fiber communication ports
LV/MV Transformer	Transformer alarm contacts (thermometer, DGPT or others)
MV Switchgear	MV circuit breaker (DC function), CTs and VTs in MV modules, MV protection relay with progressive auto-recloser
Others	UPS, Communications board, Air conditioning, Auxiliary transformer for trackers supply, dust protection filter levels, Meteorological Station, Efacec Monitoring systems, Efacec Management solutions, intrusion and fire detection system, external lighting system and others

(1) Other configurations can be used.
 (2) Power factor > 0,98 at rated output voltage and power load > 15%.
 (3) The adjustable range can be extended and other values can be configured.
 (4) Other configurations can be used.
 (5) Please consult the EFASOLAR inverter technical information about the power derate with temperature within the indicated operating range.
 (6) Please consult Efacec with the specific operating conditions in order to characterize an eventual derate with altitude.
 (7) Several rated power are available up to 30 kVA.

EFASOLAR PVStation Concrete

PVStation with improved robustness with all Efacec equipment in a plug & play mode.

Full solution designed to support the most severe weather conditions to ensure the highest performance. It is a robust solution with fast installation, easy maintenance allowing to minimized the OPEX and maximize the energy generation.



Customer Benefits

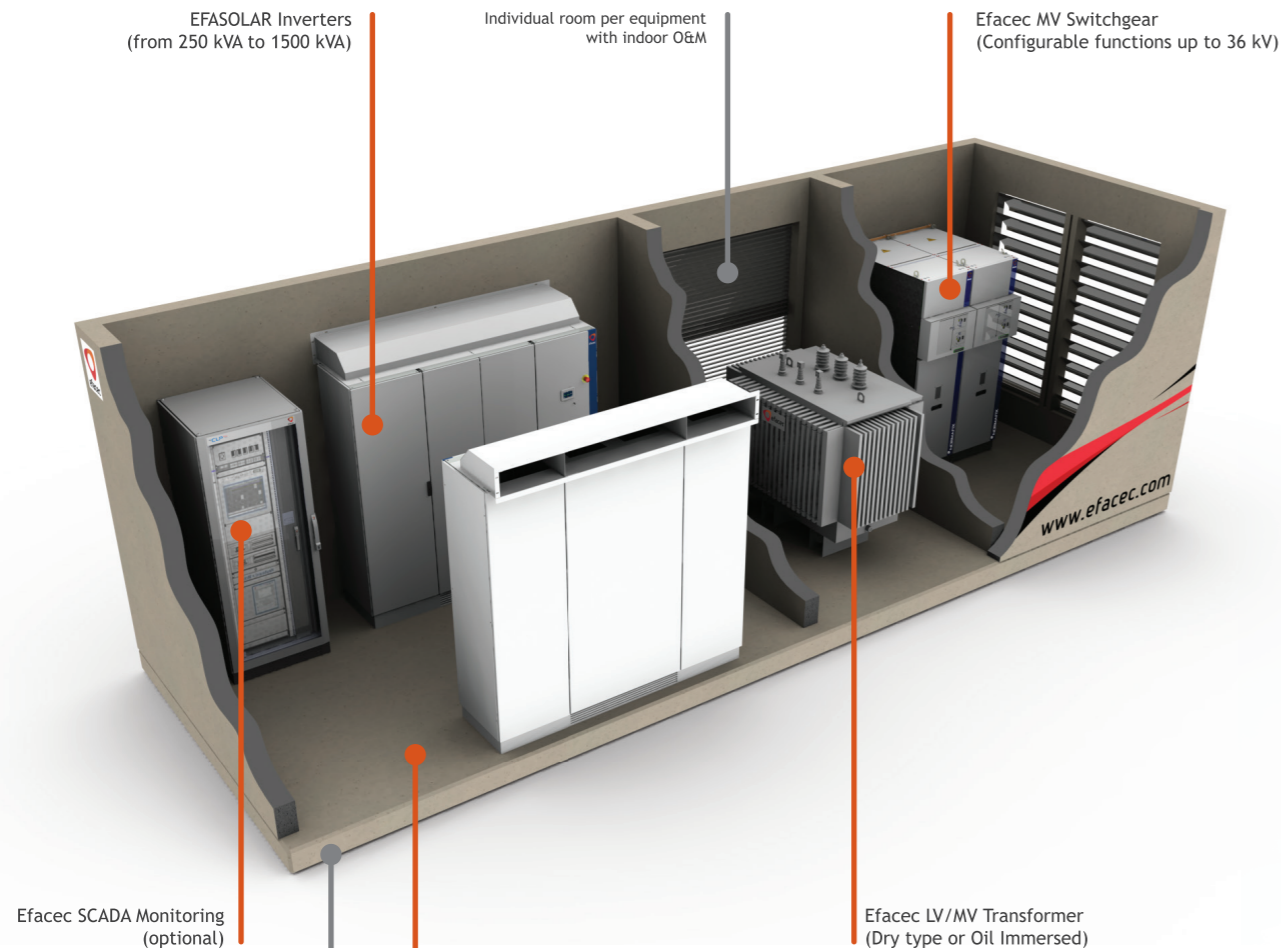
- Solutions up to 3 MVA
- Reliability and Robustness solution
- Low temperature variation inside PVStation
- Plug & play solution
- Configurable MV switchgear functions

Key Benefits

- All Efacec equipment are manufactured in-house
- Efacec single source of technology
- One single warranty for entire PVStation
- One service support for all products
- Ready to integrate more Efacec products

Electrical	
DC input	
Number of independent MPP inputs	4
Number of DC fused inputs ⁽¹⁾	up to 12
AC output	
Rated power	up to 3 MVA
Grid frequency	50 / 60 Hz
Grid rated voltage	from 6,6 kV up to 36 kV
Power factor ⁽²⁾ / Displacement power factor ⁽³⁾	1,0 / 0,8 inductive to 0,8 capacitive
Equipment	
Inverter	EFASOLAR Inverters
LV/MV Transformer	Efacec Dry type / Efacec Oil immersed
Transformer standards	IEC 60076 standard (Ecodesing normative optional)
MV Switchgear	Efacec Fluofix / Efacec Normafix (up to 36 kV)
MV Switchgear functions ⁽⁴⁾	Star topology IS + CIS (fuse) / IS+DC (breaker) + Protection Relay panel Ring topology 2x IS + CIS (fuse) / 2x IS+DC (breaker) + Protection Relay panel
Protective devices	
DC disconnect device	Motor-drive switch disconnecter
DC overvoltage protection	Type II surge arrester
AC disconnect device	Fuse / Circuit breaker
AC overvoltage protection	from 75 kV to 180 kV
Other protective devices and protective functions included	Auxiliaries overvoltage protection, Ground fault monitoring, Overvoltage, Undervoltage, Overfrequency, Underfrequency, Anti-islanding, Reverse polarization, Short circuit on the output, Overtemperature, Asymmetrical current, DC unbalance strings, and others
General data	
Enclosure type	Concrete
Dimensions (WxLxH)	4500 / 5500 / 6500 / 7500 / 8500 x 2520 x 2600 mm
Weight	≤ 35 ton
Standard temperature range ⁽⁵⁾	-20 °C ... +60 °C / -4 °F ... +140 °F
Max. permissible value for relative humidity (noncondensing)	≤ 95%
Cooling concept	Energy efficient air forced cooling system
Altitude for rated conditions / Maximum operating altitude above sea level ⁽⁶⁾	1000 m / 3000 m
Protection degree	Inverter, Transformer and MV switchgear compartments: IP 54
Features	
Auxiliary circuit transformer ⁽⁷⁾	230 V, 50/60 Hz
Auxiliary circuit board	included
LV / MV Transformer	Transformer oil containment
Communication protocols	Modbus TCP / RTU
Enclosure isolation	resistance higher than 300 kg/cm ² and full impermeability
Others	Earth circuit, illumination, power outlets, safety equipment, transportation parts, anti-corrosion treatment
Optional	
Inverters	DC fused inputs configurable, Optical-Fiber communication ports
LV/MV Transformer	Transformer alarm contacts (thermometer, DGPT or others)
MV Switchgear	MV circuit breaker (DC function), CTs and VTs in MV modules, MV protection relay with progressive auto-recloser
Others	UPS, Communications board, Air conditioning, Auxiliary transformer for trackers supply, dust protection filter levels, Meteorological Station, Efacec Monitoring systems, Efacec Management solutions, intrusion and fire detection system, external lighting system and others

(1) Other configurations can be used.
 (2) Power factor > 0,98 at rated output voltage and power load > 15%.
 (3) The adjustable range can be extended and other values can be configured.
 (4) Other configurations can be used.
 (5) Please consult the EFASOLAR inverter technical information about the power derate with temperature within the indicated operating range.
 (6) Please consult Efacec with the specific operating conditions in order to characterize an eventual derate with altitude.
 (7) Several rated power are available up to 30 kVA.



Technical floor for cable connections and high efficiency cooling system

Efacec Concrete enclosure highly resistant to the most extreme weather conditions and tested for seismic environments for seismic environments

EFASOLAR PVStation Modular

With concrete or metallic solution these PVStation are designed to simplify the transport operation in projects with difficult access, or correspondance with particular requirements. The local integration of the outdoor transformer and the inverters and MV switchgear enclosure(s), ensures the necessary flexibility in terms of logistics and compliance with local requirements, while maintaining the high level of performance and reliability.

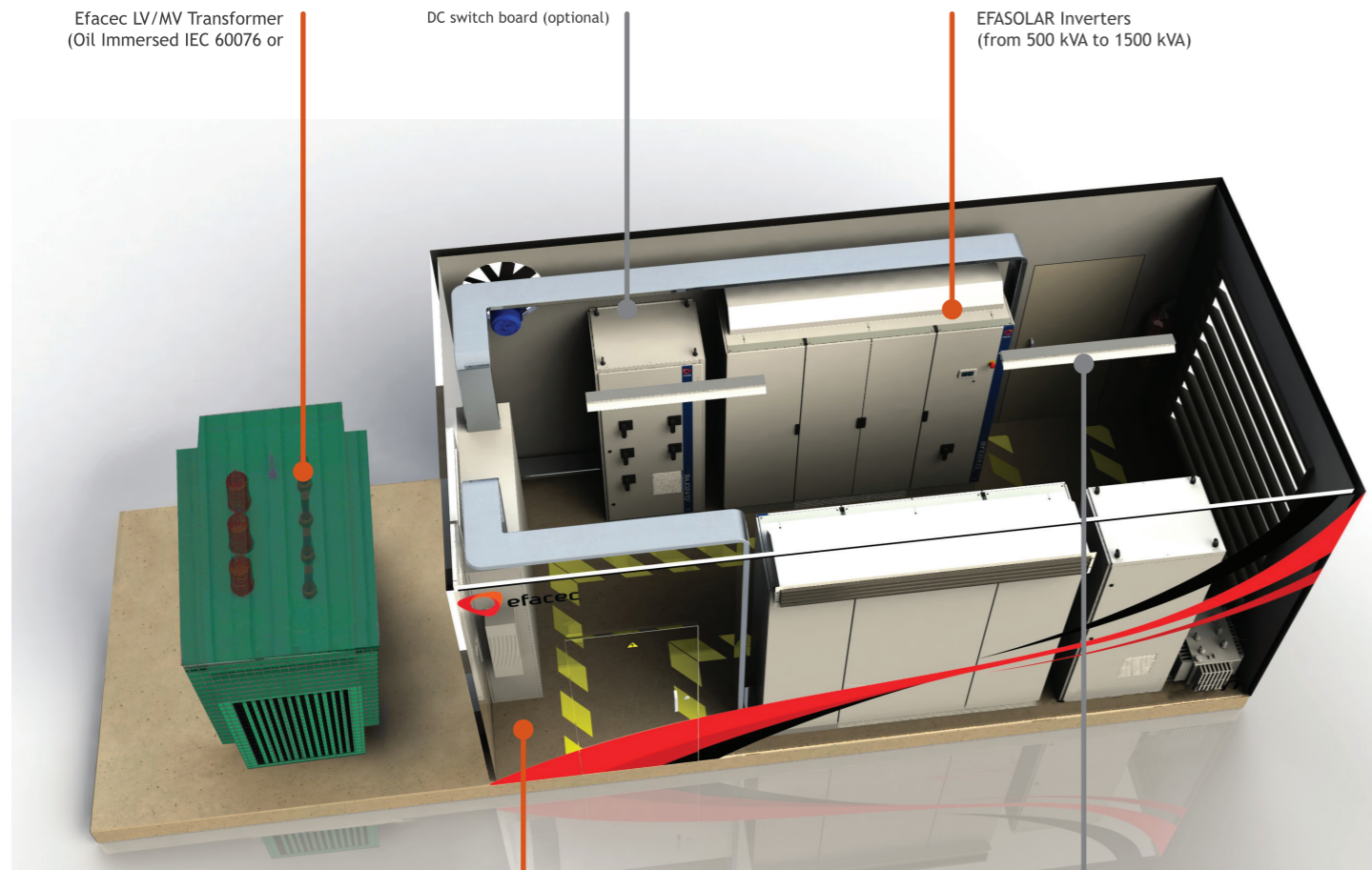


Customer Benefits

- Solutions up to 6 MVA
- Flexible solution
- Reliability and Robustness solution
- Customization available to each project
- Configurable MV switchgear functions

Key Benefits

- All Efacec equipment are manufactured in-house
- Efacec single source of technology
- One single warranty for entire PVStation
- One service support for all products
- Modular blocks to simplify the transportation



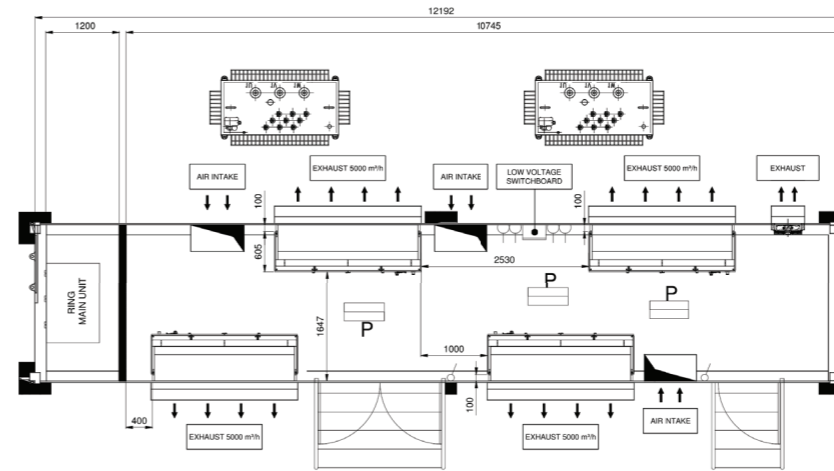
Efacec LV/MV Transformer (Oil Immersed IEC 60076 or

DC switch board (optional)

EFASOLAR Inverters (from 500 kVA to 1500 kVA)

Efacec Concrete or 20ft / 40ft Container enclosure

Illumination and other features included



Electrical

DC input	
Number of independent MPP inputs	4
Number of DC fused inputs ⁽¹⁾	up to 24
AC output	
Rated power	up to 6 MVA
Grid frequency	50 / 60 Hz
Grid rated voltage	from 6,6 kV up to 36 kV
Power factor ⁽²⁾ / Displacement power factor ⁽³⁾	1,0 / 0,8 inductive to 0,8 capacitive

Equipment

Inverter	EFASOLAR Inverters	
LV/MV Transformer	Efacec Oil immersed	
Transformer standards	IEC 60076 standard (Ecodesing normative optional)	
MV Switchgear	Efacec Fluofix / Efacec Normafix (up to 36 kV)	
MV Switchgear functions ⁽⁴⁾	Star topology	IS + CIS (fuse) / IS + 2x CIS (fuse) / IS+DC (breaker) / IS+ 2x DC (breaker) + Protection Relay panel
	Ring topology	2x IS + CIS (fuse) / 2x IS + 2x CIS (fuse) / 2x IS+DC (breaker) / 2x IS+ 2x DC (breaker) + Protection Relay panel

Protective devices

DC disconnect device	Motor-drive switch disconnecter
DC overvoltage protection	Type II surge arrester
AC disconnect device	Fuse / Circuit breaker
AC overvoltage protection	from 75 kV to 180 kV
Other protective devices and protective functions included	Auxiliaries overvoltage protection, Ground fault monitoring, Overvoltage, Undervoltage, Overfrequency, Underfrequency, Anti-islanding, Reverse polarization, Short circuit on the output, Overtemperature, Asymmetrical current, DC unbalance strings, and others

General data

Enclosure type	Concrete or 20ft / 40ft Container
Dimensions (WxLxH)	4500 / 5500 / 6500 / 7500 / 8500 x 2520 x 2600 mm or 20ft / 40ft container size
Weight	≤ 35 ton
Standard temperature range ⁽⁵⁾	-20 °C ... +60 °C / -4 °F ... +140 °F
Max. permissible value for relative humidity (noncondensing)	≤ 95%
Cooling concept	Energy efficient air forced cooling system
Altitude for rated conditions / Maximum operating altitude above sea level ⁽⁶⁾	1000 m / 3000 m
Protection degree	Inverter and MV switchgear compartments: IP 54 / Transformer: IP65

Features

Auxiliary circuit transformer ⁽⁷⁾	230 V, 50/60 Hz
Auxiliary circuit board	included
LV / MV Transformer	Transformer oil containment
Communication protocols	Modbus TCP / RTU
Enclosure isolation	Concrete 20ft/40ft Container
	resistance higher than 300 kg/cm ² and full impermeability Walls, roof and doors isolated with thermal isolation panels (except transformer room)
Others	Earth circuit, illumination, power outlets, safety equipment, transportation parts, anti-corrosion treatment

Optional

Inverters	DC fused inputs configurable, Optical-Fiber communication ports
LV/MV Transformer	Transformer alarm contacts (thermometer, DGPT or others)
MV Switchgear	MV circuit breaker (DC function), CTs and VTs in MV modules, MV protection relay with progressive auto-recloser
Others	UPS, Communications board, Air conditioning, Auxiliary transformer for trackers supply, dust protection filter levels, Meteorological Station, Efacec Monitoring systems, Efacec Management solutions, intrusion and fire detection system, external lighting system and others

(1) Other configurations can be used.

(2) Power factor > 0,98 at rated output voltage and power load > 15%.

(3) The adjustable range can be extended and other values can be configured.

(4) Other configurations can be used.

(5) Please consult the EFASOLAR inverter technical information about the power derate with temperature within the indicated operating range.

(6) Please consult Efacec with the specific operating conditions in order to characterize an eventual derate with altitude.

(7) Several rated power are available up to 30 kVA.



Efacec Energia, Máquinas e Equipamentos Eléctricos, S.A.

High and Medium Voltage Switchgear

Electronic Power Systems

Apart. 1018 4466-952
S. Mamede de Infesta
Portugal

Rua Eng. Frederico Ulrich - Ap. 3078
4471-907 Moreira Maia
Portugal

Tel.: + 351 229 562 300
Fax: + 351 229 562 961

Tel.: + 351 229 402 000
Fax: + 351 229 403 209

efacecamt@efacec.com
www.efacec.com
www.efacec.com/switchgear/

inverters@efacec.com
www.efacec.com
solarinverters.efacec.com