



BELECTRIC Next Gen Utility-scale PV Power 1,500V DC Technology



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PIONEERING 1,500V ARCHITECTURE

Longest Innovation track record in PV power plant business:

→ Developing high voltage DC cabling system:

- 1st 700+V_{DC} in 2003 → 1,100+V_{DC} in 2010
- 1st 1,500V_{DC} PV power plant in 2012
- 1st 1,500V_{DC} rooftop system in 2015

→ Reducing raw materials:

- 1st generation central inverter (2004) = 40tons/MVA
- 2nd generation central inverter (2008) = 11tons/MVA
- 3rd generation SKID inverter (2012) = 7tons/MVA



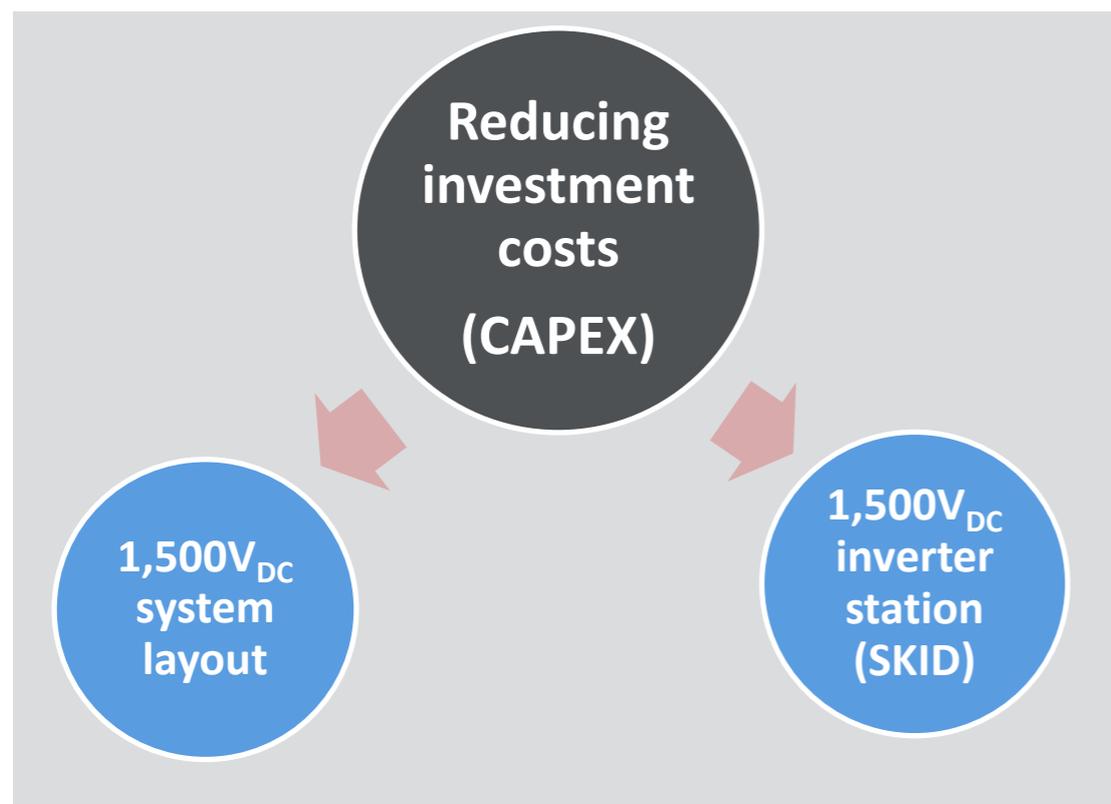
1,500 VOLT IS THE NEW STANDARD

BELECTRIC'S HIGH EFFICIENT 1,500V_{DC}
ARCHITECTURE ENABLES A REDUCTION OF 30%
OF eBOS COMPONENTS

- 30% lower logistics cost for eBOS transport
- 30% lower labor cost for eBOS installation
- 30% lower maintenance cost related to eBOS



COST REDUCTIONS AND SCALE EFFICIENCIES



BELECTRIC's high efficient DC system

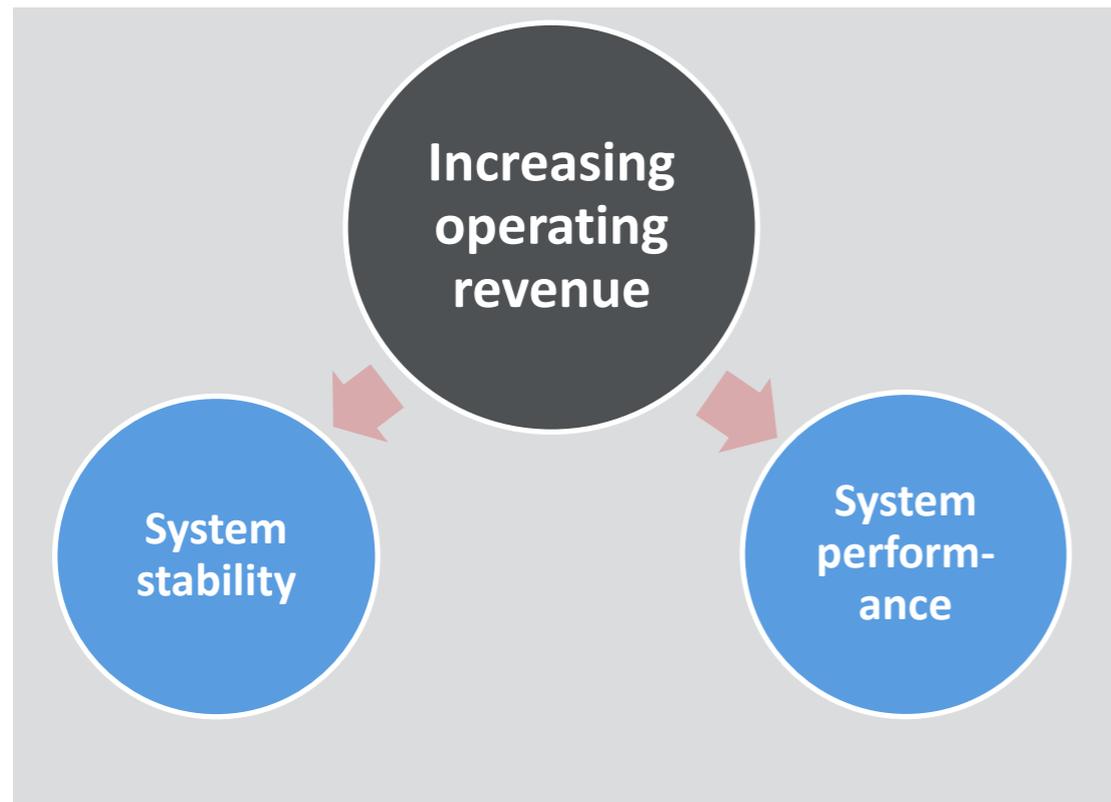
- Longer string length = up to 50% more panels can be interconnected
- Less DC eBoS (wiring, connections, combiner boxes)
- Less labor costs and faster project realization



Inverter stations

- Reducing amount of inverter stations
- Lightweight, easy to handle on site
- Less AC system costs

INCREASING OPERATION ELECTRICITY YIELD



Better long-time system stability:

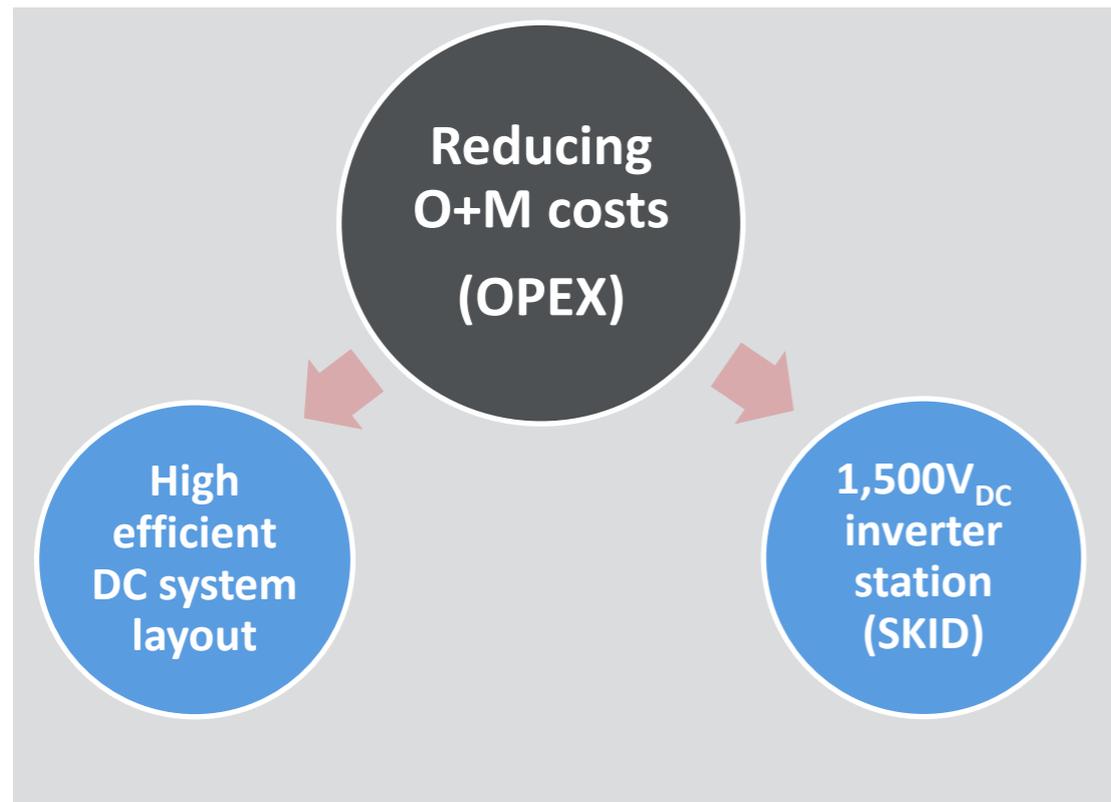
- Less DC components
→ less risk for system faults
- Proved 1,500V_{DC} wiring harness
- Optional 1,500V_{DC} Anti PID device reduces PV panel degradation

Higher system performance:

- High voltage enables higher inverter power
- Less electrical power loss due to high voltage level and less junction points



REDUCING OPERATION AND MAINTENANCE COSTS



DC system:

Compared to typical PV power plants, less DC cabling and inverters have to be controlled

→ Reduced maintenance time

→ Less downtimes → Higher energy yield

→ BELECTRIC's standardized inverter SKID setup safes long-term operation



THE TECHNOLOGY CHALLENGE

- Lack of experience
- New requirements for power plant engineering and construction
- Availability of reliable 1,500V_{DC} components (product engineering, mass production, quality conformance)
- Staff training for construction and service teams

The solution is provided by good partnerships:

- Module supplier in general and technical collaboration
- Inverter stations (e.g. GE, SMA)
- DC cabling and substructure (Jurchen Technology)
- DC combiner boxes and float controller (PADCON)



BELECTRIC COMPONENTS – 1,500V CERTIFIED

From PV panel to inverter, all components are approved to operate at 1,500V voltage level (DC):

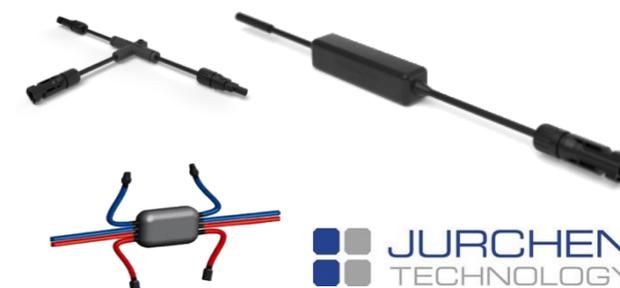
Modules: Latest generation, restricted to a maximum system voltage of 1,500V

✓ 1,500V
APPROVED



BoS Electrical System:
BELECTRIC has developed all components for a maximum system voltage of 1,500V

✓ 1,500V
APPROVED



Inverter: Latest generation, restricted to a maximum system voltage of 1,500V

✓ 1,500V
APPROVED



BELECTRIC COMPONENTS - 1500V CERTIFIED

The DC cables are the „life veins“ of every PV system. They have to defy wind and weather conditions for many years and reliably safeguard the electricity yields.

- ✓ Wiring harness solutions reduce / eliminate the use of DC combiner boxes
- ✓ Wiring harness cabling system saves up to 50% solar cable than typical single array solutions
- ✓ High quality connection points, 1,500V DC capability and less plug connections reduce DC power loss
- ✓ Rock solid quality ensures decades long operation independent to climatic conditions
- ✓ Efficient and easy to integrate modular system with extensive accessories like 1,500V inline fuses and diodes



1,500V_{DC} - IT'S REALITY SINCE 2012

Fact #1:

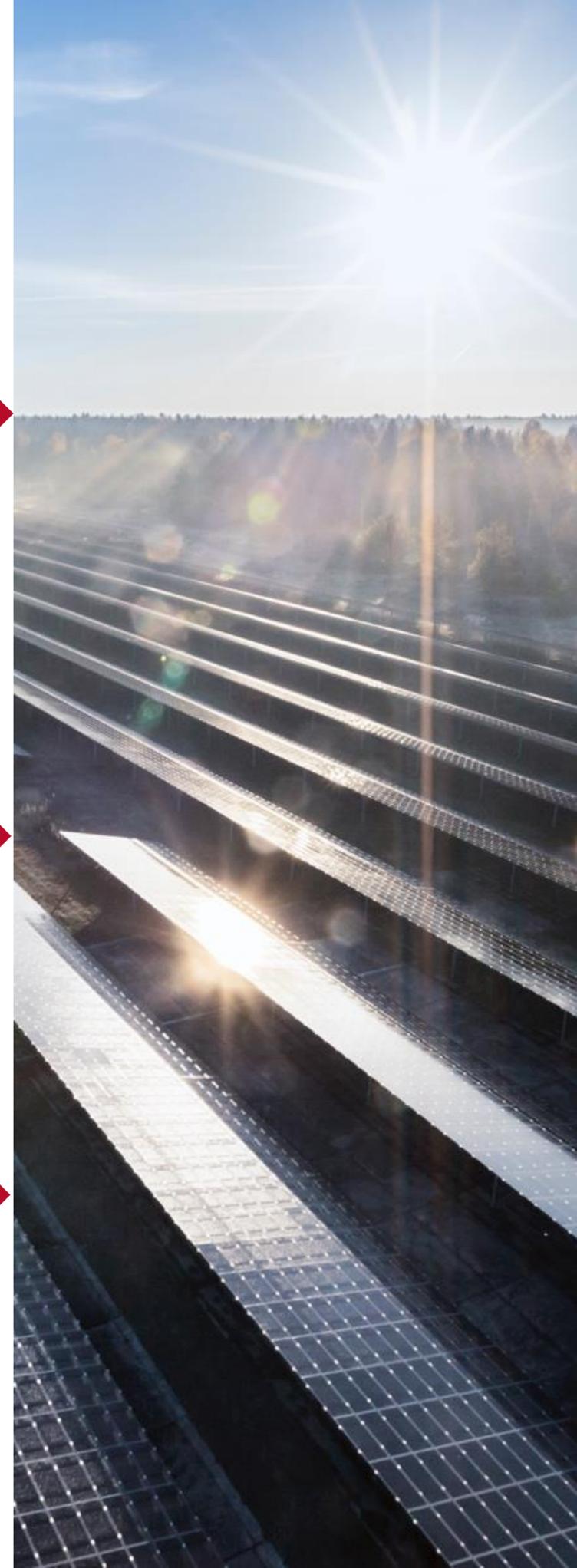
Since 2012 BELECTRIC has commissioned over 150MWp of 1,500V_{DC} utility-grade PV power plants AND numerous multi-megawatt projects in different countries are in pipeline.

Fact #2:

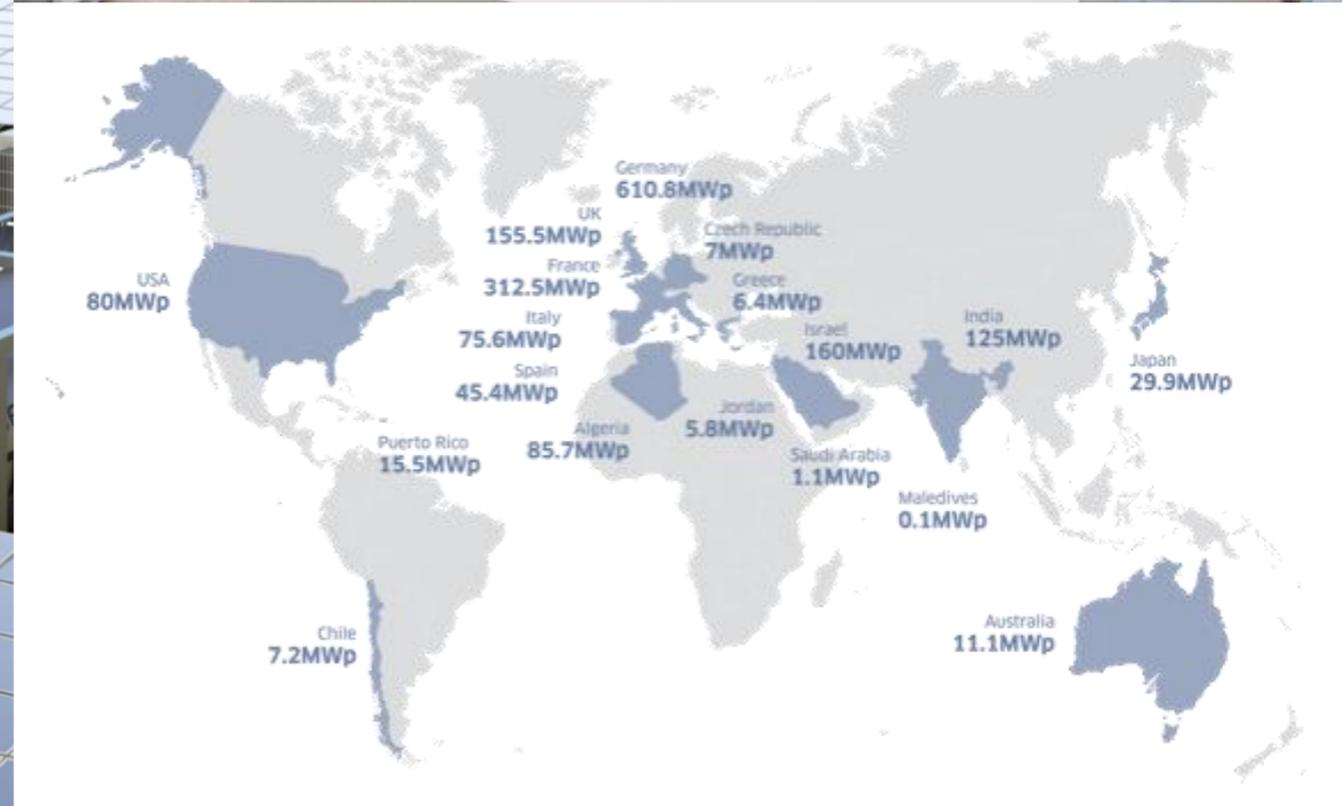
From module to substructure to inverter, all components are available and approved to operate at 1,500V_{DC}.

Fact #3:

The availability of 1,500V approved PV modules is constantly rising.



BELECTRIC References: Solar Power Plants and Energy Storage



REFERENCES: SOLAR POWER PLANT

Location:	Landmead, UK
Nominal Power:	45.8MWp
Commissioned:	2014
Power Plant:	Solar PV (Double Base, First Solar)
DC System type:	1,500V Float Control
DC Voltage Range:	-500...+1000V



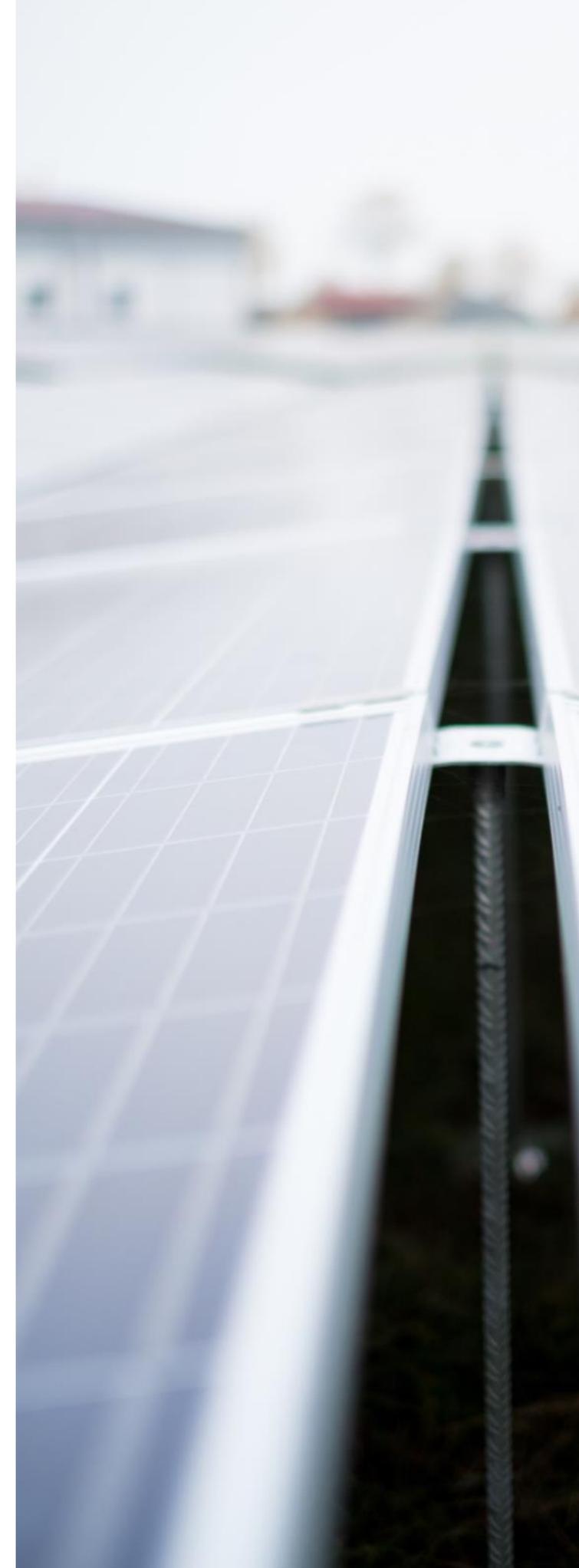
REFERENCES: SOLAR POWER PLANT

Location:	Barcaldine, Australia
Nominal Power:	11MWp
Commissioned:	2017
Power Plant:	Solar PV based on PEG System
DC System type:	1,500V Float Control System
DC Voltage Range:	-500...+1000V



REFERENCES: SOLAR POWER PLANT

Location:	Suhlendorf, Germany
Nominal Power:	750kWp
Commissioned:	2017
Power Plant:	Solar PV based on PEG System
DC System type:	1,500V Float Control
DC Voltage Range:	-500...+1000V



REFERENCES: SOLAR POWER PLANT

Location: Berlin Marienfelde, Germany
Nominal Power: 621kWp
Commissioned: 2015
Power Plant: Solar PV - CHP Hybrid² power
DC System Type: 1,500V Float Control
DC Voltage Range: -500...+1000V



REFERENCES: ENERGY BUFFER UNIT

Location: Alt Daber, Germany
Nominal Capacity: 2.0MWh
Primary Reserve: 1.3MW
Commissioned: 2014
DC System Type: 1,500V



REFERENCES: ENERGY BUFFER UNIT

Location: Kolitzheim, Germany
Nominal Capacity: 924kWh (C5)
Commissioned: 2016
DC System Type: 1,500V





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