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BELECTRIC Next Generation PV Power Plants: 1500V Systems

BELECTRIC - Powering the Future

2017-03-28

Pioneering the 1,500V Architecture

Longest INNOVATION track record in PV power plant business:

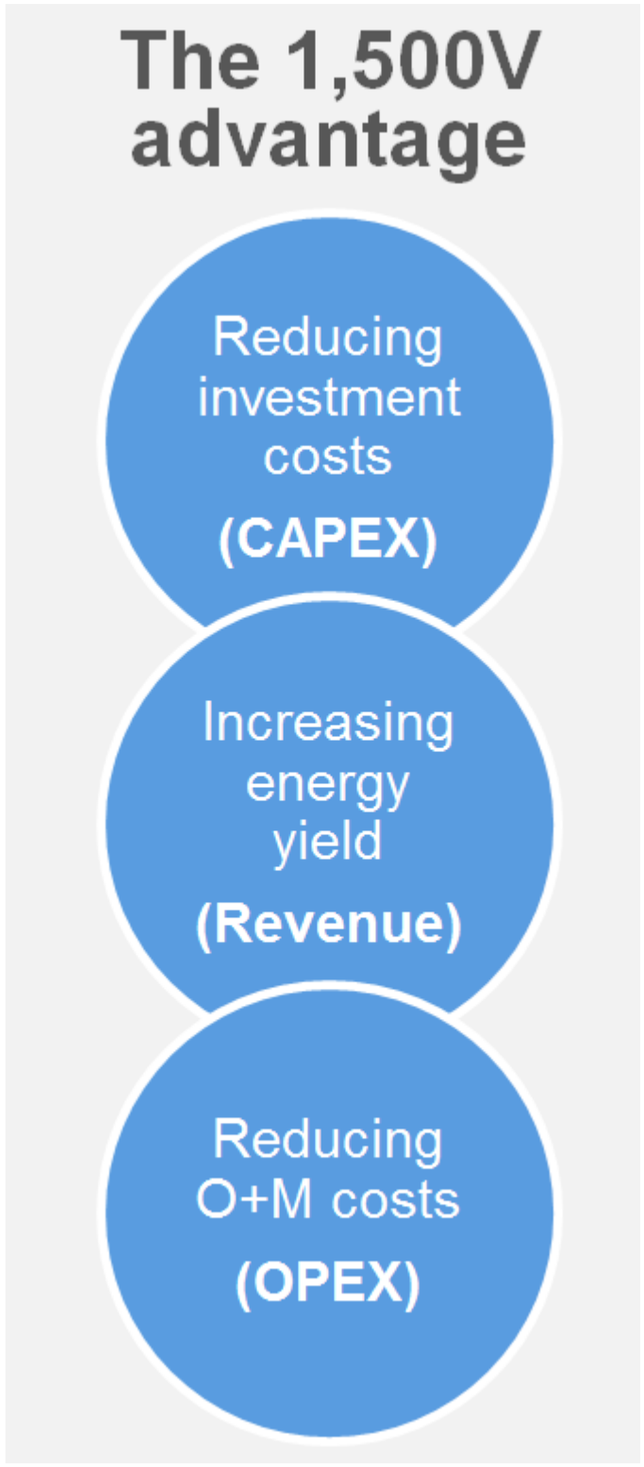
→ <u>Developing high voltage DC cabling system:</u>

- 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

→ <u>Reducing raw materials:</u>

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

New System – new requirements



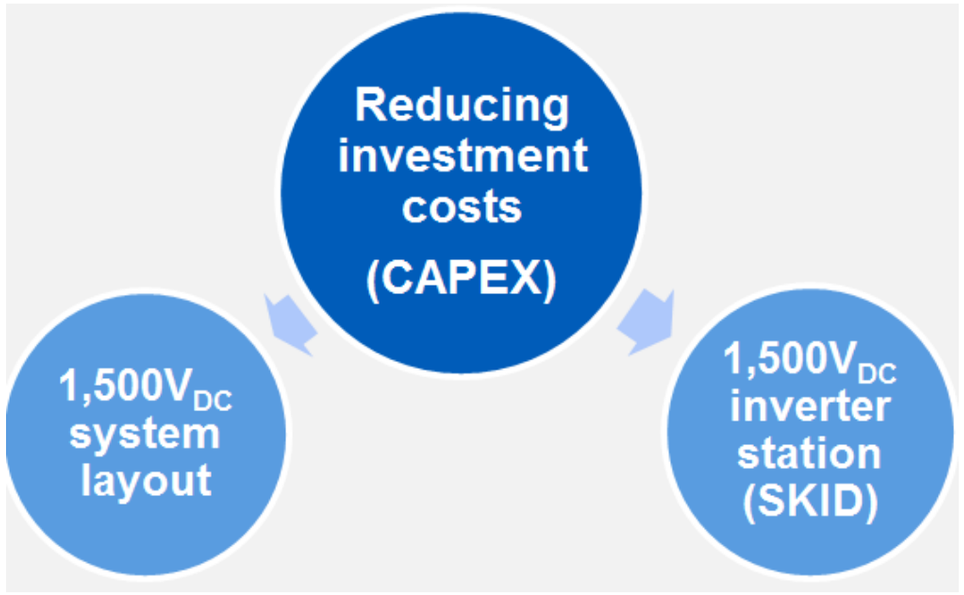
New System

- Higher system voltage
- More modules connected per string
- More strings per inverter
- Less DC components
- Reduced maintenance time

New requirements

- 1500V Certificates for all components
  - → Modules, BoS Components, Inverters, etc.
  - → Different standards and test requests
- Higher risk due to higher voltage
  - → Staff Training
  - → Adjusted distances and isolations

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

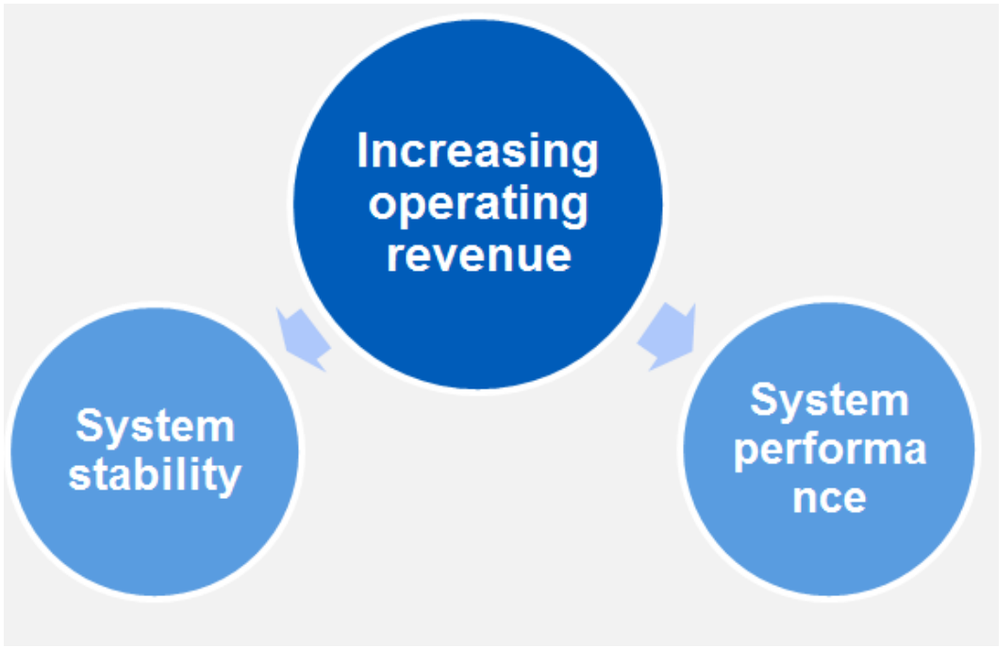
Inverter stations

→ 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

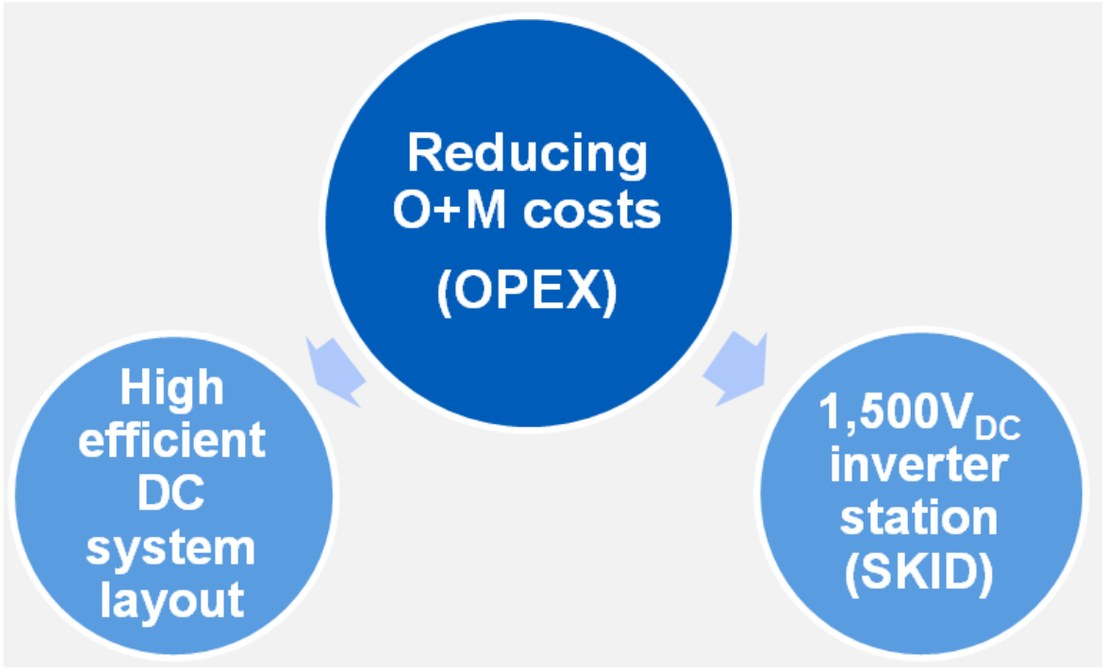
  → less risk for system faults

- 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

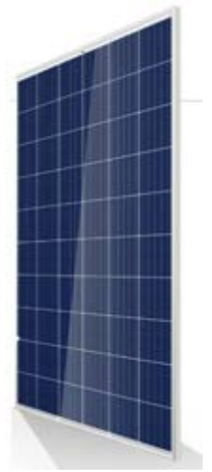
BELECTRIC Components - 1500V certified

From PV panel to inverter, all components are approved to operate at 1500V voltage level (DC):

- **Modules:**

  new generation, restricted to a maximum system voltage of 1500V

✓ **1500V APPROVED**



- **BoS Electrical System:**

  BELECTRIC has developed all components for a maximum system voltage of 1500V

✓ **1500V APPROVED**

- **Inverter:**

  new generation, restricted to a maximum system voltage of 1500V

✓ **1500V APPROVED**

BELECTRIC Components - 1500V certified

Benefits for established 1,500V DC cabling

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

It’s not a dream. It’s reality since 2012!

- **Fact #1:** Since 2012 BELECTRIC has commissioned >100MWp of 1,500V utility-scale PV power plants AND numerous multi-megawatt projects in different countries are in pipeline

- **Fact #2:** From PV panel to substructure to inverter, all components (Jurchen Technology, BELECTRIC) are proved to operate at 1,500V voltage level

- **Fact #3:** Availability of 1,500V PV panels is continuously rising

→ 1500V_{DC} is new standard in utility-scale Solar Power

BELECTRIC Reference:
Solar Power Plants and Energy Buffering Units

References: Solar Power Plants

Location:	Haidt, Germany
Nominal Power:	1,698 kWp
Commissioned:	2012
System Type:	1,500 V Float Control System
System Voltage Range:	-500…+1000V

References: Solar Power Plants

Location:	Berlin Marienfelde, Germany
Nominal Power:	621 kWp
Commissioned:	2015
System Type:	1,500 V Float Control System
System Voltage Range:	-500…+1000V

References: Energy Buffer Unit

Location:	Kolitzheim, Germany
Nominal Capacity:	924 kWh (C5)
Commissioned:	2016
System Type (DC):	1,500 V
System Voltage (DC):	1060 V

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