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

Webinar PV Magazine
Bernhard Beck, BELECTRIC
PIONEERING 1,500V ARCHITECTURE

Longest Innovation track record in PV power plant business:

→ Developing high voltage DC cabling system:
  • $1^{\text{st}}$ 700+$V_{\text{DC}}$ in 2003 $\rightarrow$ 1,100+$V_{\text{DC}}$ in 2010
  • $1^{\text{st}}$ 1,500$V_{\text{DC}}$ PV power plant in 2012
  • $1^{\text{st}}$ 1,500$V_{\text{DC}}$ rooftop system in 2015

→ Reducing raw materials:
  • $1^{\text{st}}$ generation central inverter (2004) = 40tons/MVA
  • $2^{\text{nd}}$ generation central inverter (2008) = 11tons/MVA
  • $3^{\text{rd}}$ generation SKID inverter (2012) = 7tons/MVA
1,500 VOLT IS THE NEW STANDARD

BELECTRIC’S HIGH EFFICIENT 1,500\text{V}_{\text{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)
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

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

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

BELECTRIC®
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\textsubscript{DC} - IT’S REALITY SINCE 2012

**Fact #1:**
Since 2012 BELECTRIC has commissioned over 150MWp of 1,500V\textsubscript{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\textsubscript{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
<table>
<thead>
<tr>
<th><strong>Location:</strong></th>
<th>Barcaldine, Australia</th>
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<tbody>
<tr>
<td><strong>Nominal Power:</strong></td>
<td>11MWp</td>
</tr>
<tr>
<td><strong>Commissioned:</strong></td>
<td>2017</td>
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<tr>
<td><strong>Power Plant:</strong></td>
<td>Solar PV based on PEG System</td>
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<tr>
<td><strong>DC System type:</strong></td>
<td>1,500V Float Control System</td>
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<tr>
<td><strong>DC Voltage Range:</strong></td>
<td>-500...+1000V</td>
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More information at [www.belectric.com](http://www.belectric.com) ➔ Solar Power Plants ➔ PEG
<table>
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<tr>
<th><strong>Location:</strong></th>
<th>Suhlendorf, Germany</th>
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<tbody>
<tr>
<td><strong>Nominal Power:</strong></td>
<td>750kWp</td>
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<td><strong>Commissioned:</strong></td>
<td>2017</td>
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<td><strong>Power Plant:</strong></td>
<td>Solar PV based on PEG System</td>
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<tr>
<td><strong>DC System type:</strong></td>
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<td><strong>DC Voltage Range:</strong></td>
<td>-500...+1000V</td>
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More information at [www.belectric.com](http://www.belectric.com) → Solar Power Plants → PEG
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<thead>
<tr>
<th><strong>REFERENCE: SOLAR POWER PLANT</strong></th>
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<tr>
<td><strong>Location:</strong> Berlin Marienfelde, Germany</td>
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<tr>
<td><strong>Nominal Power:</strong> 621kWp</td>
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<td><strong>Commissioned:</strong> 2015</td>
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<td><strong>Power Plant:</strong> Solar PV - CHP Hybrid² power</td>
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<tr>
<td><strong>DC System Type:</strong> 1,500V Float Control</td>
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<tr>
<td><strong>DC Voltage Range:</strong> -500...+1000V</td>
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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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More information at www.belectric.com