



# MAXIMISE PROFITABILITY

With Pre-assembled Wiring

## Ensuring Bankability through Maximised Profitability

Whitepaper

The demand for safe, clean, and reliable renewable energy is rapidly growing. Today, PV technology is both an environmentally and economically viable power generation option. For large-scale PV plants to remain competitive, they must outperform both conventional energy sources and other PV projects. With declining government subsidies, the focus has shifted to maximising overall efficiency.

### Reducing CapEx and OpEx

A low **Levelised Cost of Energy (LCOE)** is the primary determinant of profitability and return on investment. Expressed in cents per kWh, LCOE accounts for capital, operational, and maintenance costs, making it the key metric for comparing solar energy with other power sources and determining the long-term profitability of the plant.

Cost pressures across industries have made minimising expenses crucial for all components of a PV system. **The key to long-term success lies in both capital and operational efficiency.** A project's profitability during operation, supported by reliable partners, components, and maintenance, is essential for securing favourable investment terms.

#### Calculating the Levelized Cost of Energy

$$\text{LCOE} = \frac{\text{CapEx} + \text{OpEx}}{\text{Energy Yield}}$$

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### CapEx

Capital Expenditure



The upfront investment required to build and install a solar PV plant, including costs for land, equipment, construction, and grid connection.

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### OpEx

Operational Expenditure



The ongoing costs of running and maintaining a solar PV plant, including operations, maintenance, repairs, insurance, and administrative expenses.

# Reliability - Key to Bankability

During PV system operation, the Cost Priority Number (CPN) framework introduced by the *Solar Bankability Project* helps assess and rank risks according to their economic impact. Based on failure data collected from owner reports and on-site inspections, the economic impact of failures falls into two main categories:

- 1 Power loss and associated financial impact (in kWh calculated into lost income in Euros)
- 2 Repair and replacement costs (in Euros)

Among the top 20 technical failures, improper installation and cabling/connectors failures pose the highest risks and have the greatest financial impact, second only to improper module installation.

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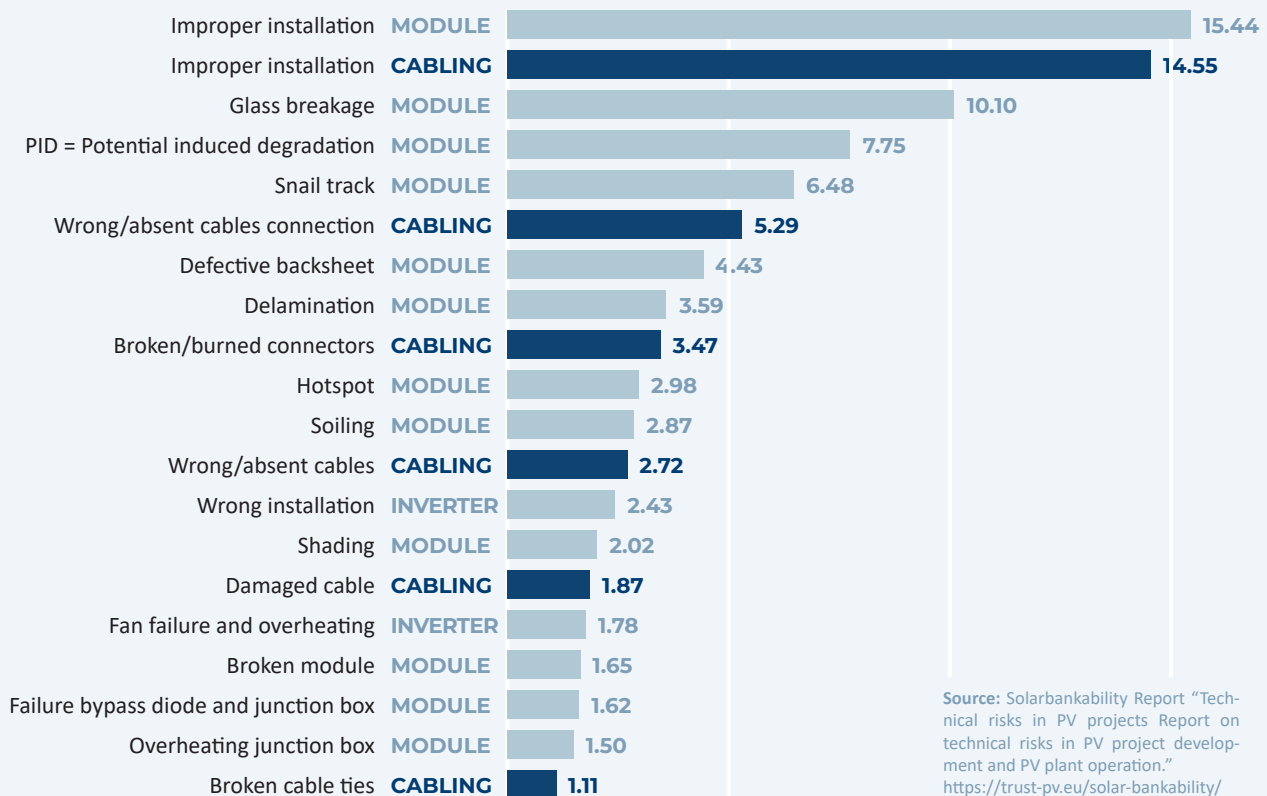
## Bankability

In the Solar Industry

Refers to the financial risk associated with a project, technology, or supplier, impacting capital availability and costs. Investors assess risk through technical, legal, and economic evaluations, balancing initial costs, operating expenses, and Levelised Cost of Energy (LCOE).

Selecting bankable components and partners is crucial for securing financing and ensuring long-term profitability. The key to bankability lies in minimising risk while maximising returns through reliable, efficient systems.

### Top 20 financial risks related to modules, inverters, and cabling (€/kWp/yr)



Source: Solarbankability Report "Technical risks in PV projects Report on technical risks in PV project development and PV plant operation."  
<https://trust-pv.eu/solar-bankability/>

40+

GW Installed  
Worldwide

10 yrs

Experience in  
Solar Wiring

25

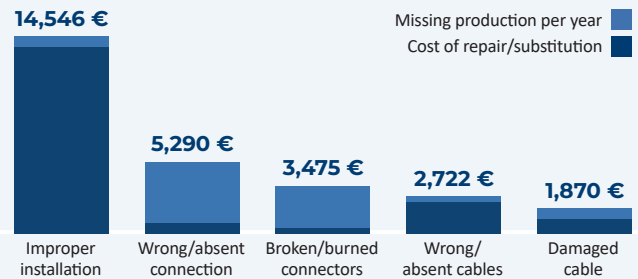
GW Annual  
Capacity

# The Large Impact of Cabling on Profitability

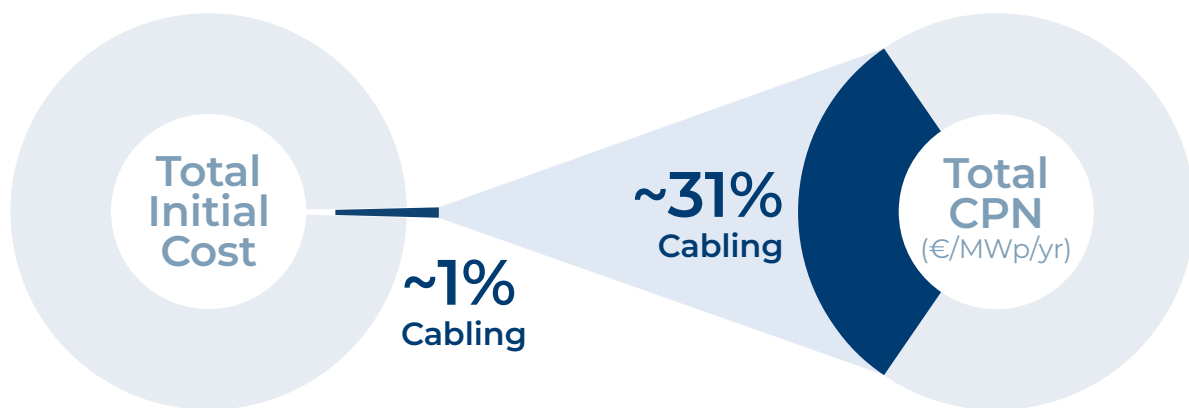
## Economic Impact per MW

Top 5 Cabling Risks (€/MWp/yr)

A closer look at cabling risks reveals that, despite its small share in CapEx, its impact on OpEx is significant. Proper installation is crucial for stable power transmission, with **faulty connections causing the highest losses of all failure risks.**



## Small share in CapEx – big impact on OpEx and LCOE



## Boost Efficiency With Pre-assembled Wiring

Although cabling materials represent only a small share of CapEx, their impact increases when wiring assembly and installation are considered. In large-scale solar parks, wiring can account for up to 5% of construction costs, offering significant savings potential. Voltage's custom plug-and-play wiring solutions, pre-assembled in our production facility and delivered on reels, **streamline installation, optimise project timelines, and enhance profitability.**

## Maximise Reliability with Factory Assembly and Quality Control



The high risk ratings and CPN values associated with installation errors highlight the critical need to mitigate these risks in large-scale solar projects. For solar wiring, the solution is to opt for **pre-assembled systems, produced in a controlled factory environment** rather than being assembled on-site. These solutions undergo rigorous quality control, effectively eliminating the risks of faulty crimps, connections, and other installation-related issues.

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### Voltage's Comprehensive Testing Program

Before your order leaves our factory, all cables and harnesses undergo a rigorous, end-to-end testing process on our automated testing line, including:

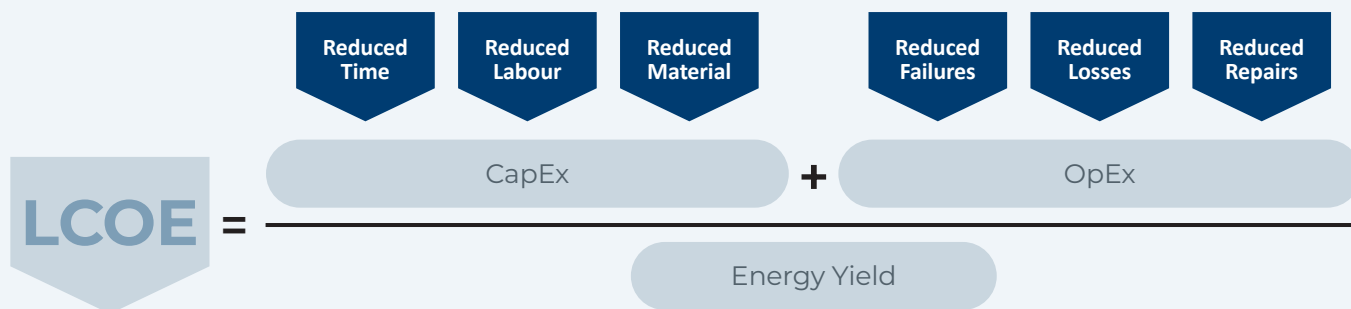
- » **Exclusive Wet Insulation Test:** Instead of sample-based testing, all cables and harnesses are immersed in liquid for 60 seconds under 1500V DC.
- » **Post-Overmolding Continuity Test:** Although not required for conformity, we carry out a 100% inspection to verify complete and correct electrical pathways.
- » **Waterproof Test:** We adopt an enhanced waterproofing standard of IP68, ensuring our products withstand prolonged submersion and pressure in harsh environments.
- » **Dielectric Withstand Test:** This high-voltage safety test uses a 19.7 kV impulse voltage – exceeding the industry standard by 23%.
- » **Automated Visual Inspection:** We measure the crimp cross-section's fullness, uniformity, and voids without contact, ensuring reliable crimping.

# Lower LCOE – Optimize Bankability and Profit

Voltage's pre-assembled wiring solutions help lower the Levelized Cost of Energy (LCOE) – a key factor in solar project profitability and bankability. By reducing time, labour, and material costs, CapEx is minimised while failure rates are significantly decreased, preventing costly losses and repairs. Plus, Voltage provides a **5-year warranty** – well above the 2-year industry practice for field-assembled wiring.



## Optimised LCOE with Voltage



## Quantitative Savings: A Practical Example

An exemplary **100 MW solar PV plant** is typically divided into 22 blocks, each comprising 250 strings with 28 modules per string. This results in approximately **22,000 connectors** that must be installed on the DC cables throughout the site. These connectors can either be assembled on-site – often under variable and uncontrolled conditions – or pre-assembled under controlled factory conditions to enable a plug-and-play approach.

The latter significantly reduces installation time, improves quality

assurance, and minimizes the risk of errors or performance losses due to improper field terminations. Defective components, poor installation, and maintenance challenges result in substantial energy losses, high service costs, and – in extreme cases – complete system breakdowns.

Based on the CPN value of only the top cabling risk from the *Solar Bankability Project* – improper installation – these losses can be quantified as follows:  $100,000 \text{ kWp} \times 14.55 \text{ €} = 1,455,000 \text{ €}$ .

A photograph of a solar farm with rows of photovoltaic panels in a desert landscape with red rock hills in the background.

**1.455 M€**  
potential savings  
per year

This emphasizes the critical role of reliable wiring in large-scale solar farms to enhance project bankability and safeguard plant profitability.