



Factory Built, Field Ready

How engineered EBOS saves on cost and reduces project risk

Today's Speaker



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Director of Engineering

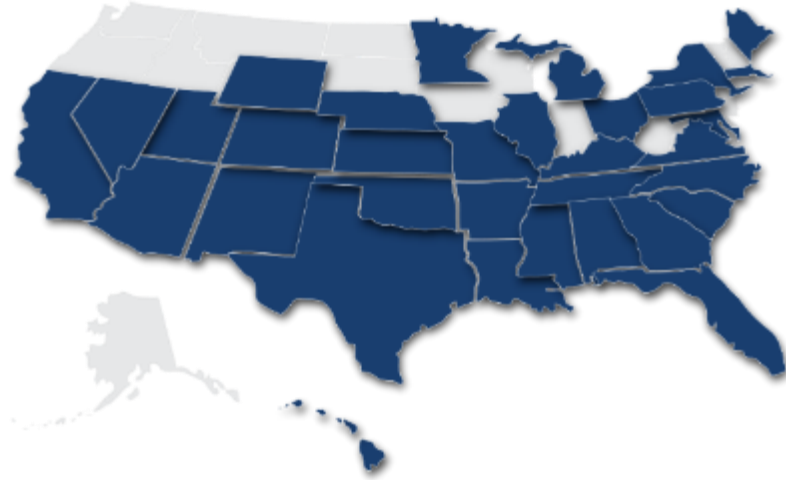
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About Voltage

Starting as a small team in Chapel Hill, NC, Voltage Energy has grown quickly.

To date, we've delivered over **68 GW** of solar EBOS solutions, powering projects with reliable, high-performance systems.

We cover more than **33 states**, from the Southwest and Southeast, up to the Midwest and Great Plains. Voltage is proud to contribute to the renewable energy infrastructure across key regions in North America, helping to drive clean energy solutions coast to coast.



68 gigawatts **33** states **430** projects
EBOS Solutions Delivered Covered in North America Connected by Voltage products



New US Facility!
Timberlake, NC



Contents

01

Risk

Wire Cabling Quality Concerns

02

Plug an' Play

A Factory Built Solution

03

Design

Design Options to Optimize Every Site

04

Solutions

Quality Control Techniques

Project Management – Core Principles

01

COSTS

Projects must be cost-effective to be able to be built successfully

02

SCHEDULE

Schedules and timelines must be adhered to meet important project deadlines

**03**

ENGINEERING

Proper engineering to ensure the site is viable and will work

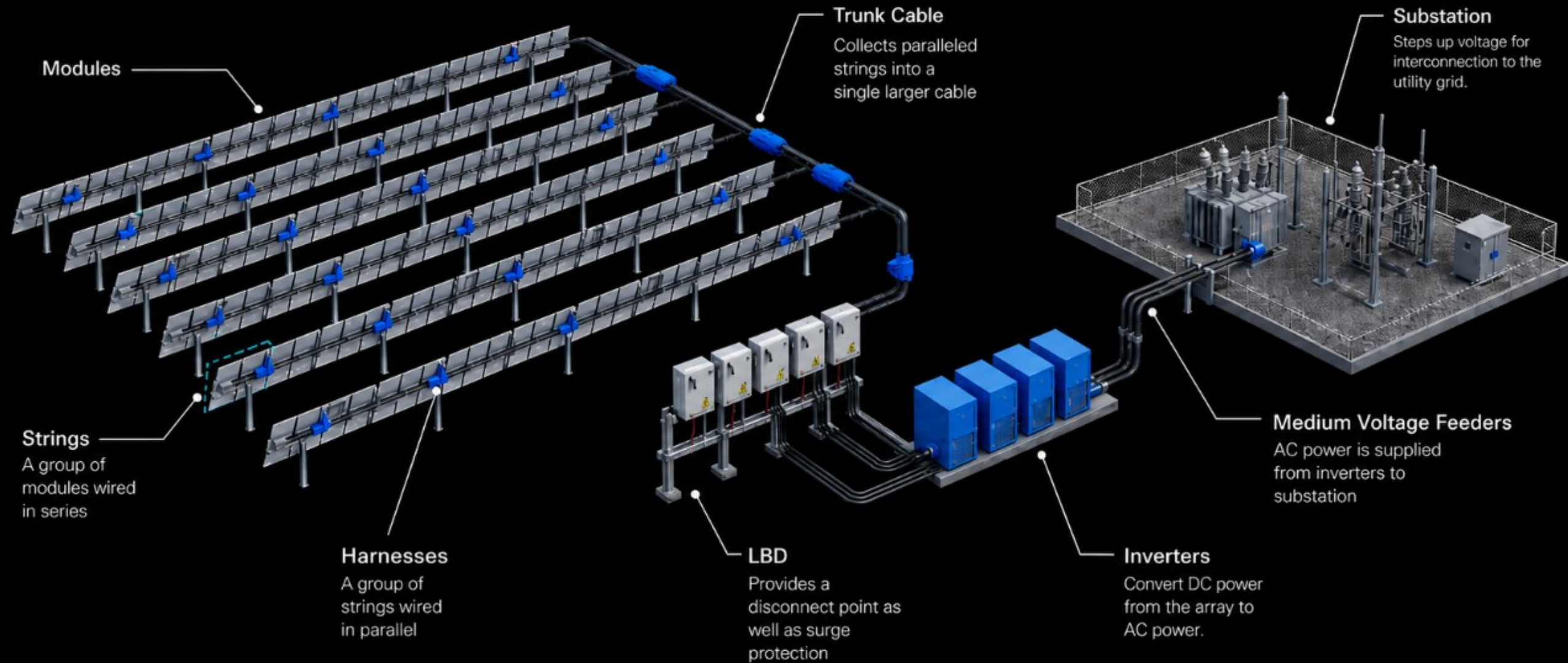
04

QUALITY

Installation quality is important to reduce risk of early O&M needs

Basic Solar Site – EBOS POV

VOLTAGE*

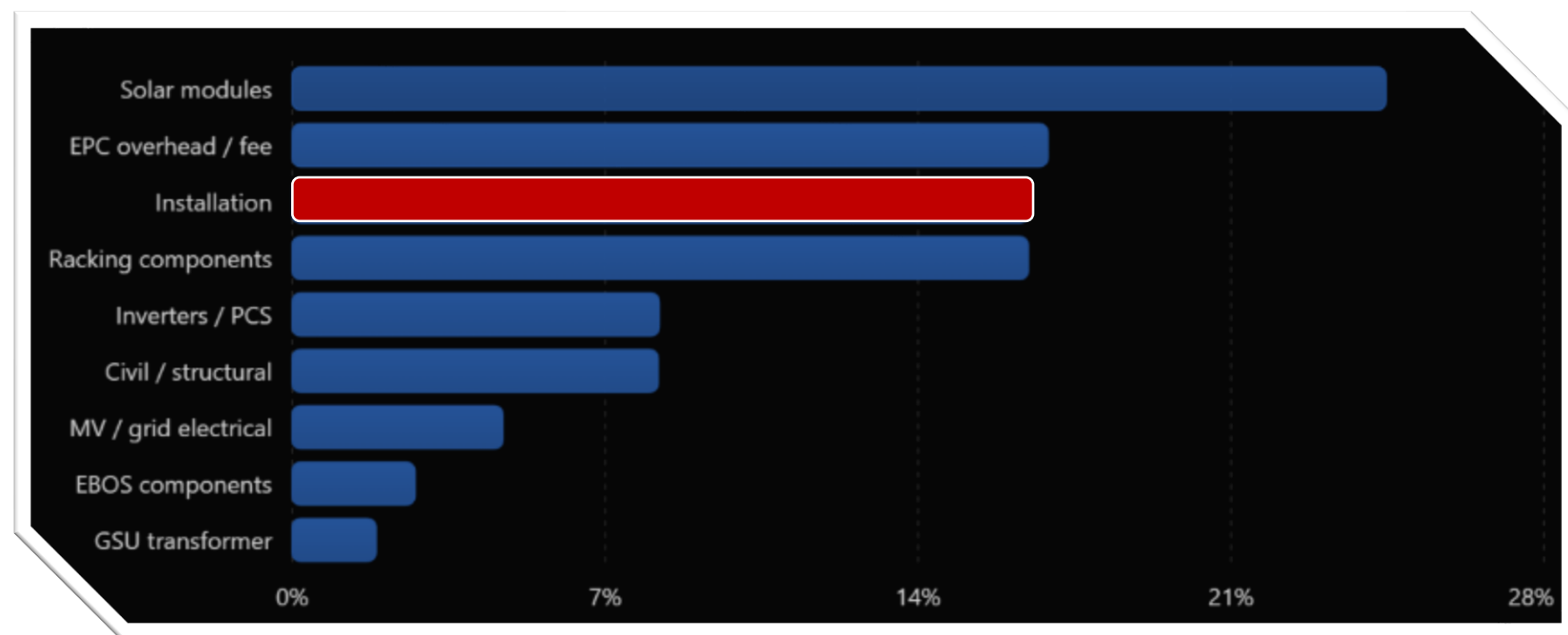


Project Costs

Fixed vs Variable Impacts

Cost Breakdown of Sample Project

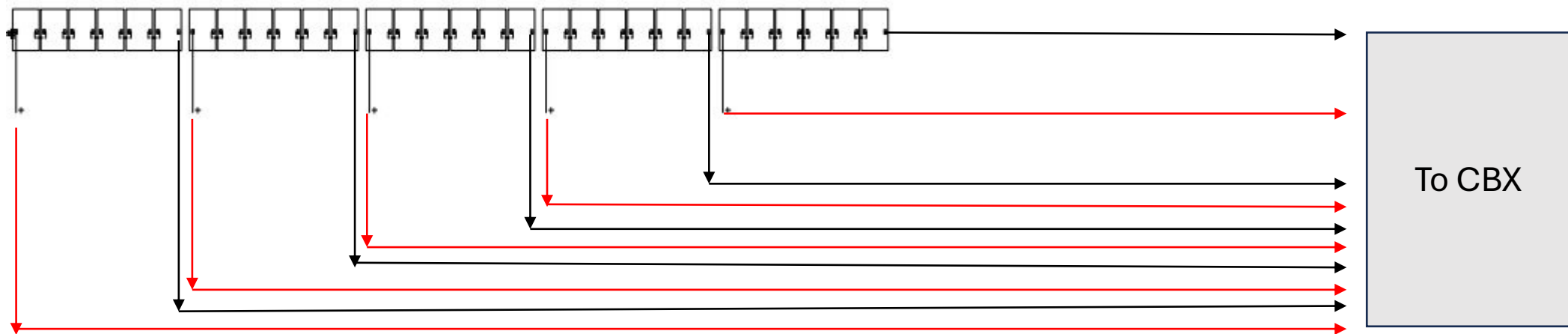
- Labor is the one the largest CAPEX costs of the project and is one of, if not the highest variable cost on the project
- Labor alone can count for up to 15-20% of the TOTAL project costs



Traditional Installation Techniques



- **Standard site construction involves:**
 - Running lines from every string of panels back to the combiner box
 - Adding connectors to cable on site



Ordinary Errors Repeat

Connector mismatch

Different manufacturers, dirty/wet bodies, incomplete engagement, cross-mating assumptions.

Polarity and labels

Handed rows, start/end confusion, wrong circuit labels, unclear positive/negative landing.

Mechanical damage

Abrasion, unsupported spans, tension at overmolds, bend-radius violations, wind whip.

Water and debris

Connectors at low points, standing water, sagging positions, contamination before mating.



How Issues Compound

You may feel confident in your electrician doing a termination, do you feel confident in them doing it 10 thousand times?



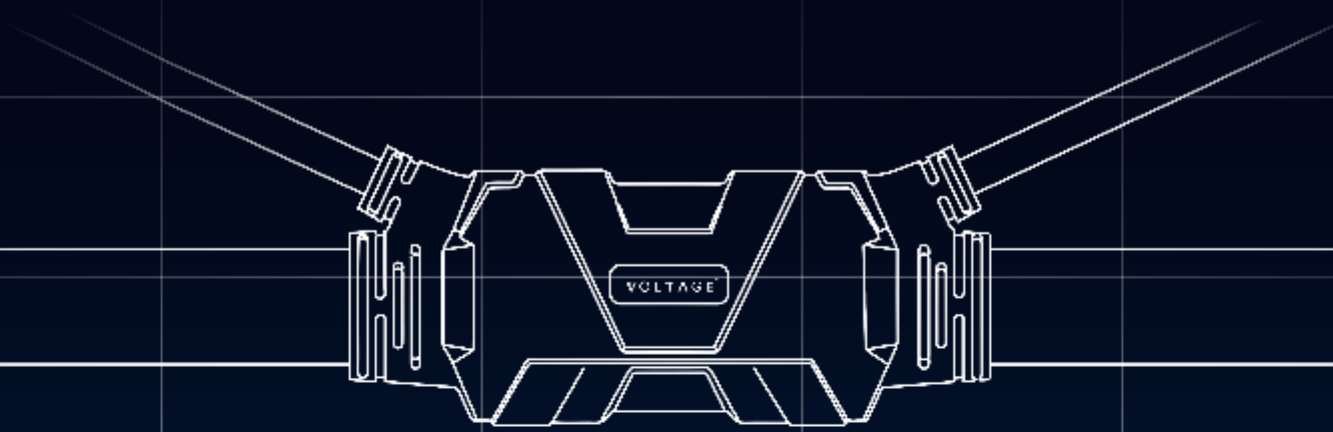
Small Sites



Risks around weather, material intrusions and worker error multiply quickly at these huge scales.



Utility Scale



02

Plug and Play

So how do we reduce site errors?



The Plug and Play Solution

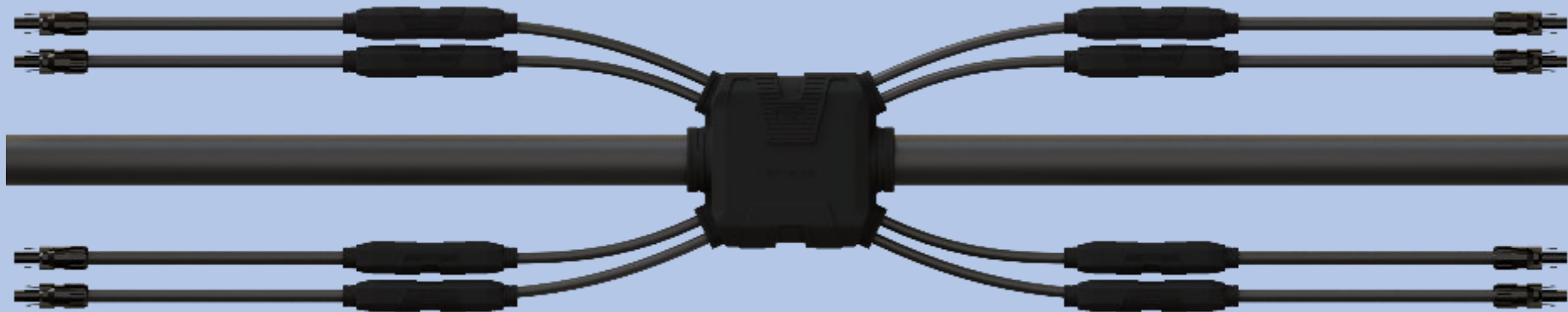
Fully
Customized...
NEC
Compliant...
Ready to Roll Out
and Plug In!



Better Connections

Connections Built in the Factory

- Clean environment
- Fully tested
- Quality Assurance, Quality Control



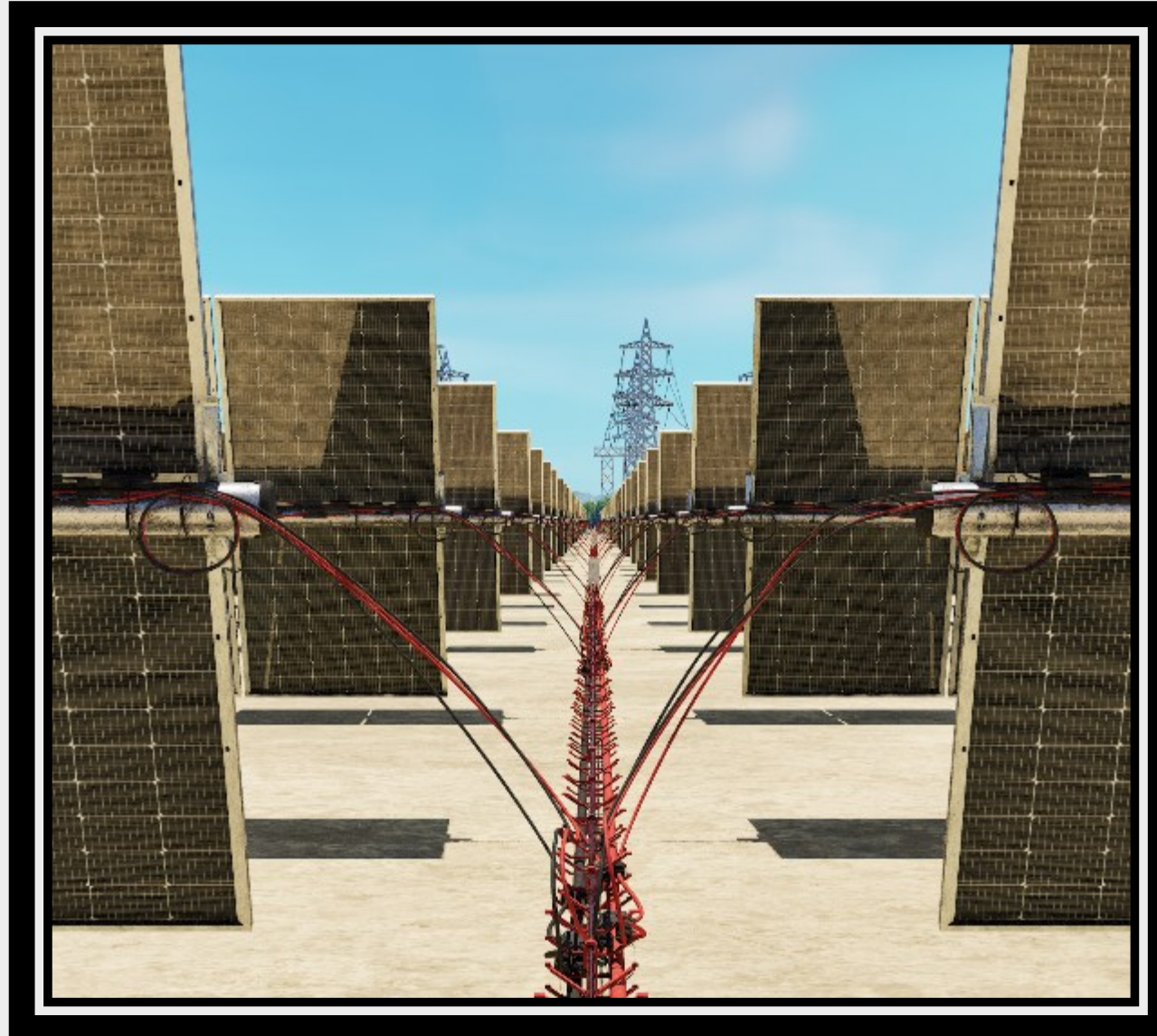


03

Design

Better Design

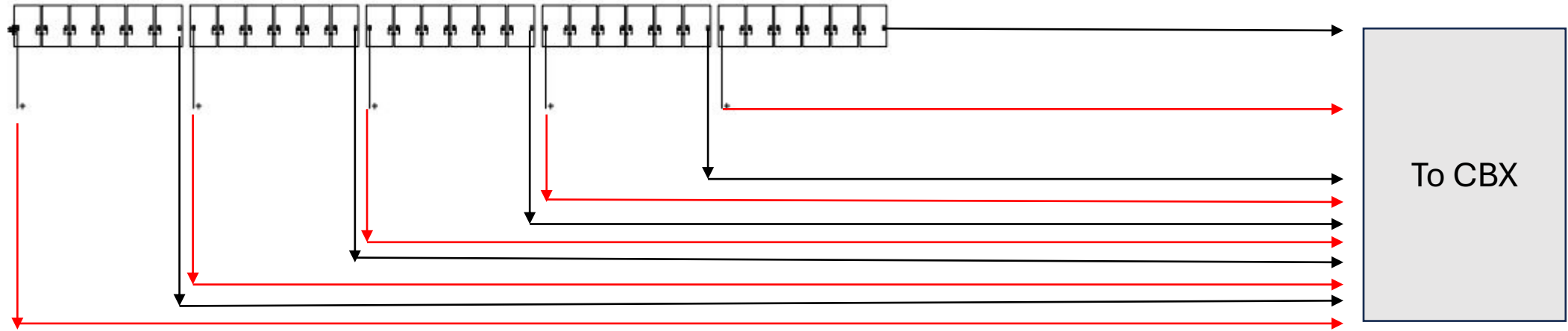
Every
Connection
Planned



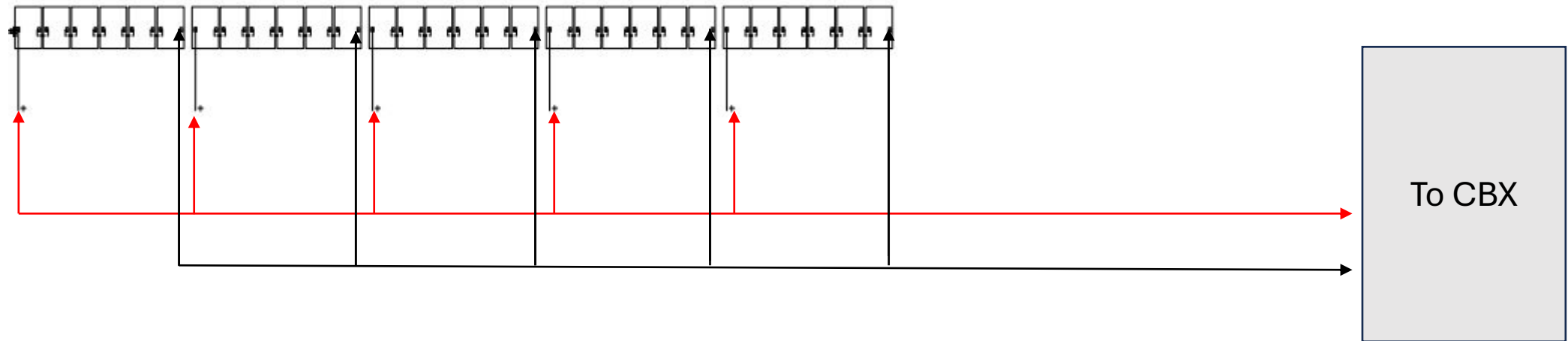
Every Route
Optimized

Traditional Stringing Vs. Harness Stringing

Traditional Stringing

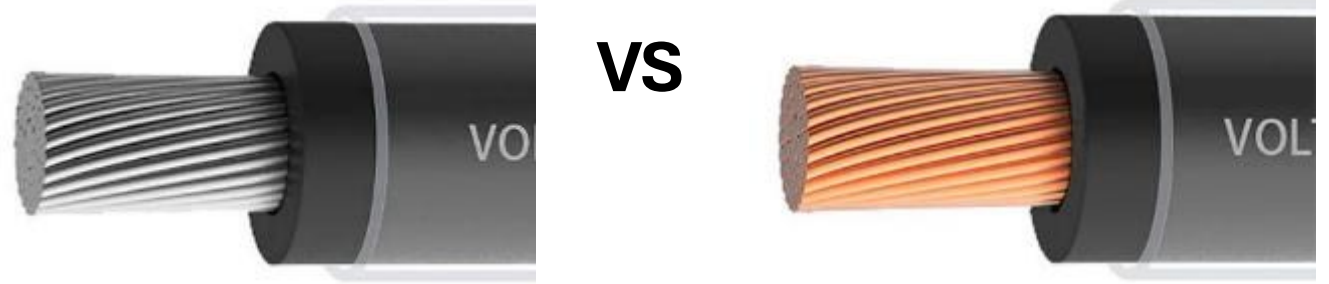


String Harness



The Metal Matters

Copper where it Counts.
Aluminum when Advantageous.



- Factory injection / overmolded transitions enable the use of Aluminum cable
- Aluminum can reduce weight and costs, and gain the same performance results by using larger, high strand sizes technology.



Evolution of Multi-String Solution

Cu String Harness

- 4 * T-kits
- Copper as main conductor



IBEX

- 4 * T-kits
- Aluminum as main conductor



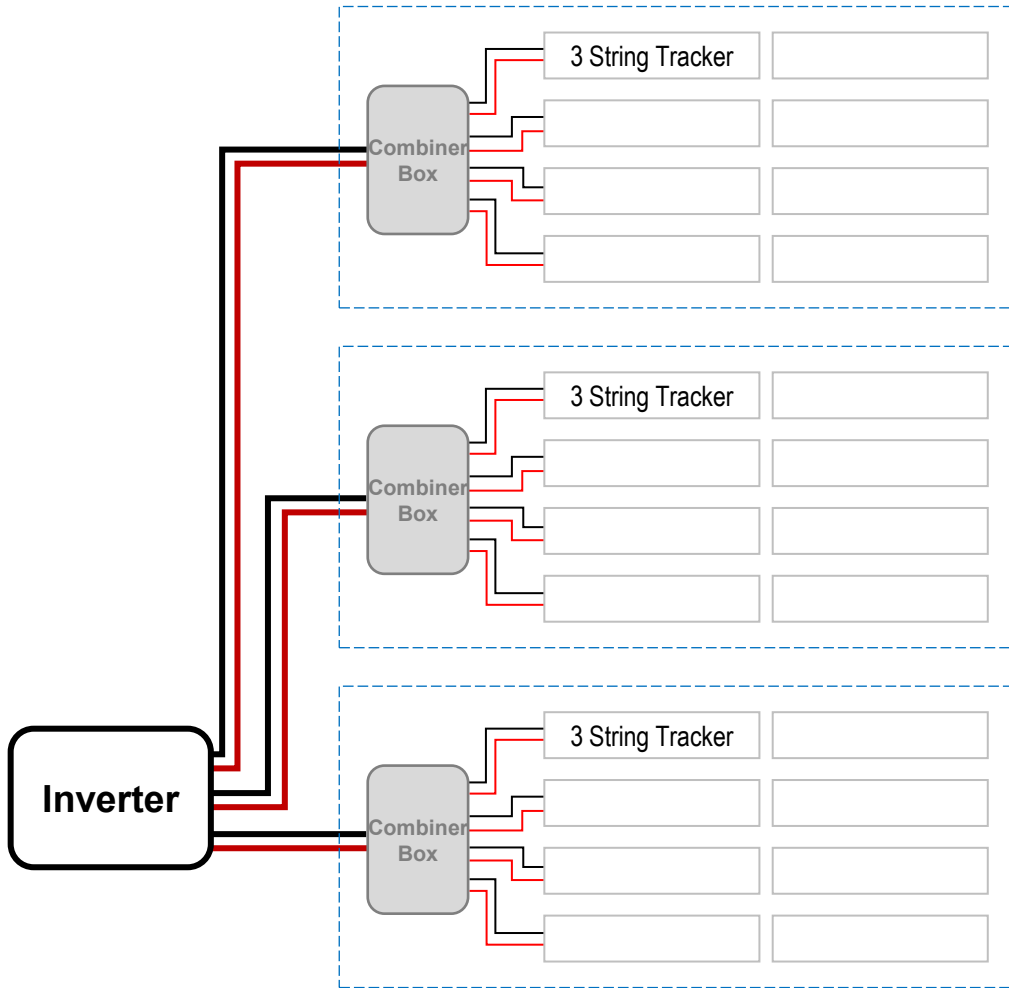
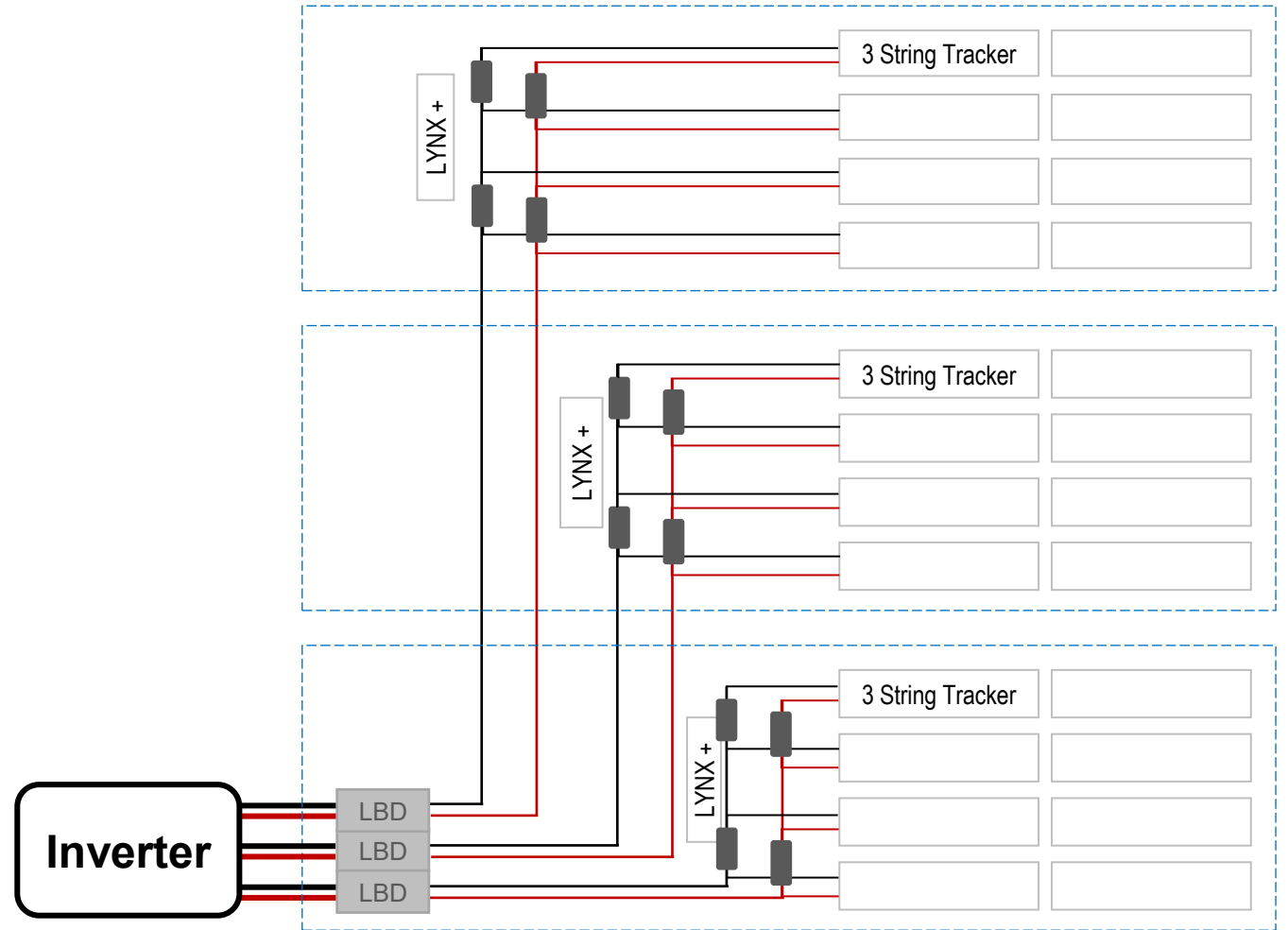
IBEX PLUS

Opt. 1: Overmold-Optimized Design

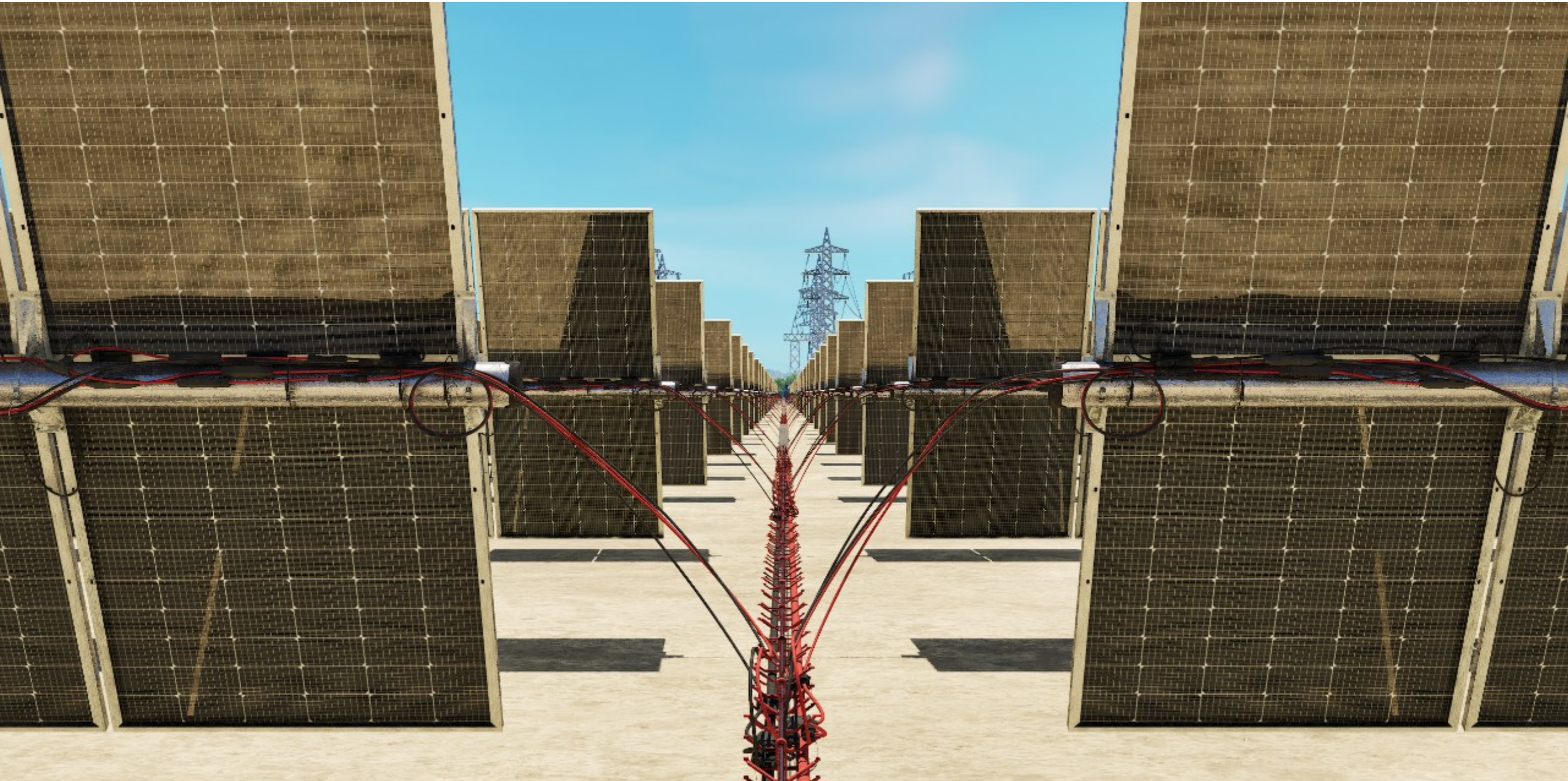
- 3 * IBEX Plus
- Full Flexible aluminum trunk
- Direct-to-CBX with copper wire



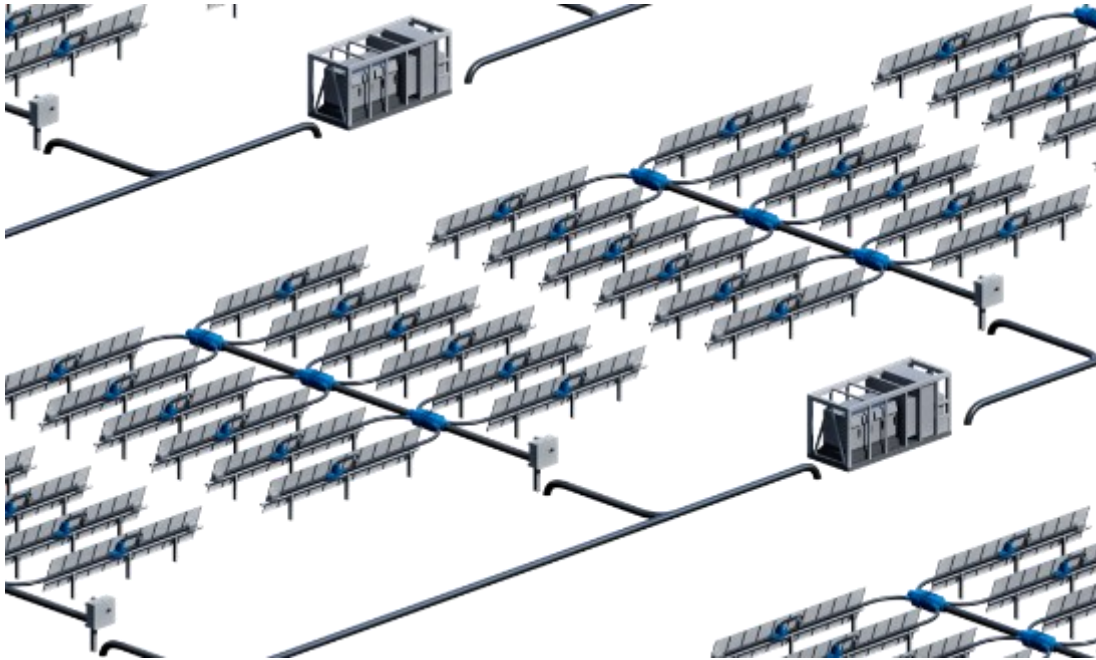
Trunk Bus Solution - Diagram



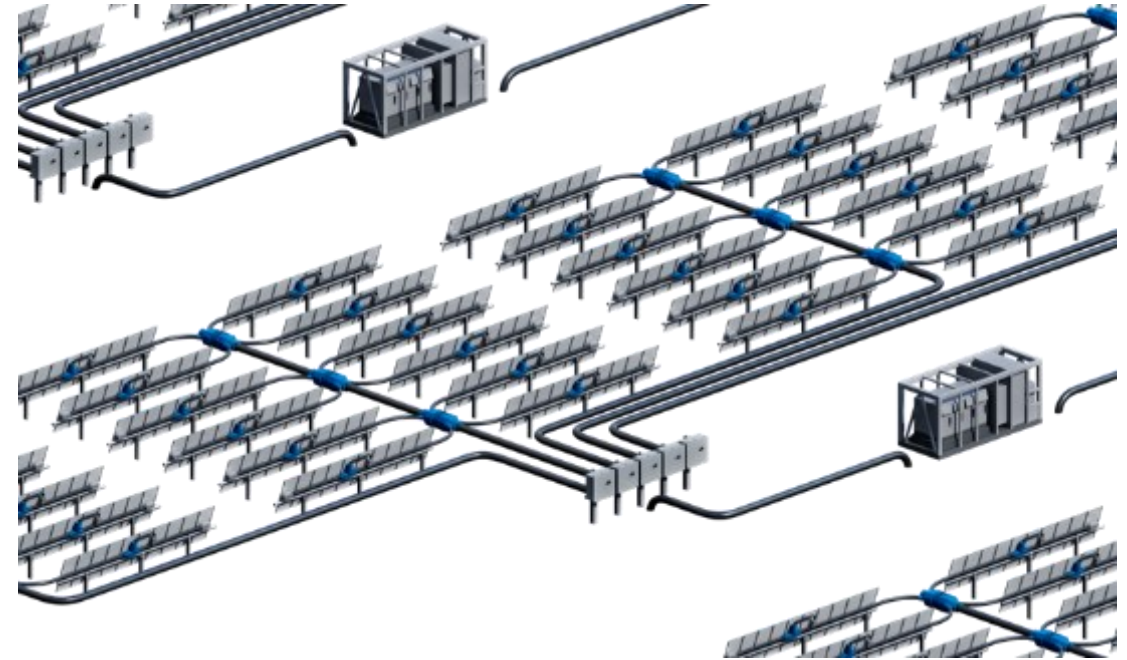
The Trunk Bus



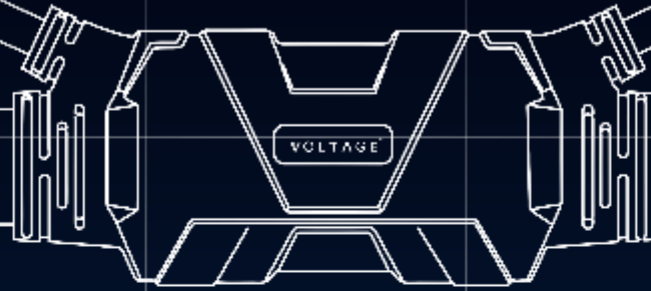
LBD Placement



Distributed LBD Solution



Clustered LBD Solution



04

Solutions

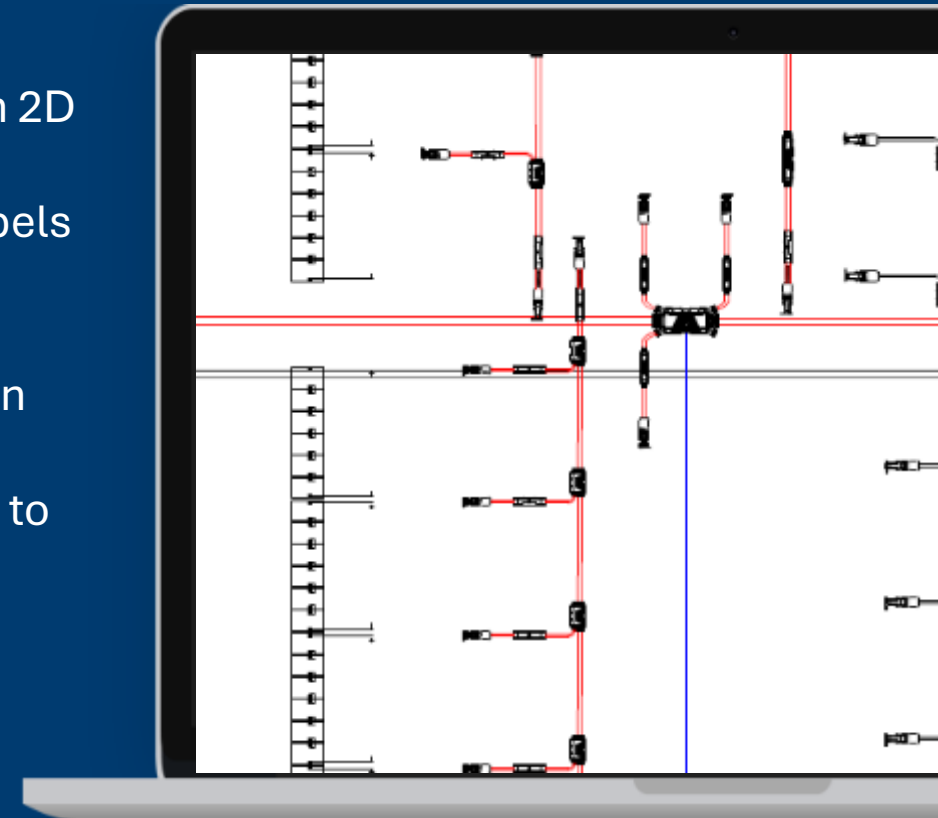


What About the Complexity? VOLTAGE[®]

What happens when every block of rows is unique?

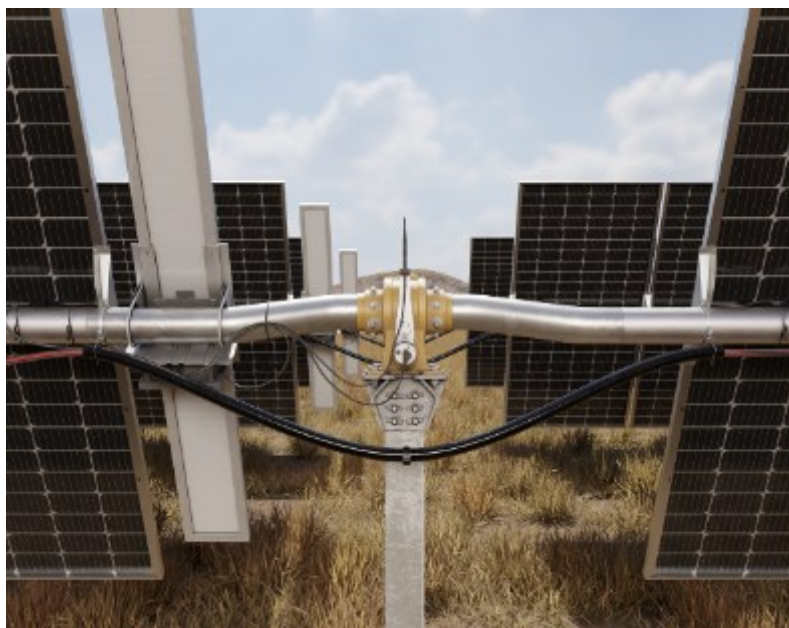
In order to make the process seamless:

- Every row is customized
- All lengths are checked in 2D and 3D
- Specialized maps and labels are created for every site
- Engineers work with site teams to verify installation sequence
- Virtual trainings are given to the team
- Golden rows visits are provided for every job



Turn 2D Plans into a 3D Visual

Get Details Right Before Building



/// Bridging The Gap: Clear Communication, Clear Results

The 3D service ensures all stakeholders share the same understanding of the project's scope. The models simplify complex designs into visuals that speak to everyone.

/// Virtual “Golden Row”

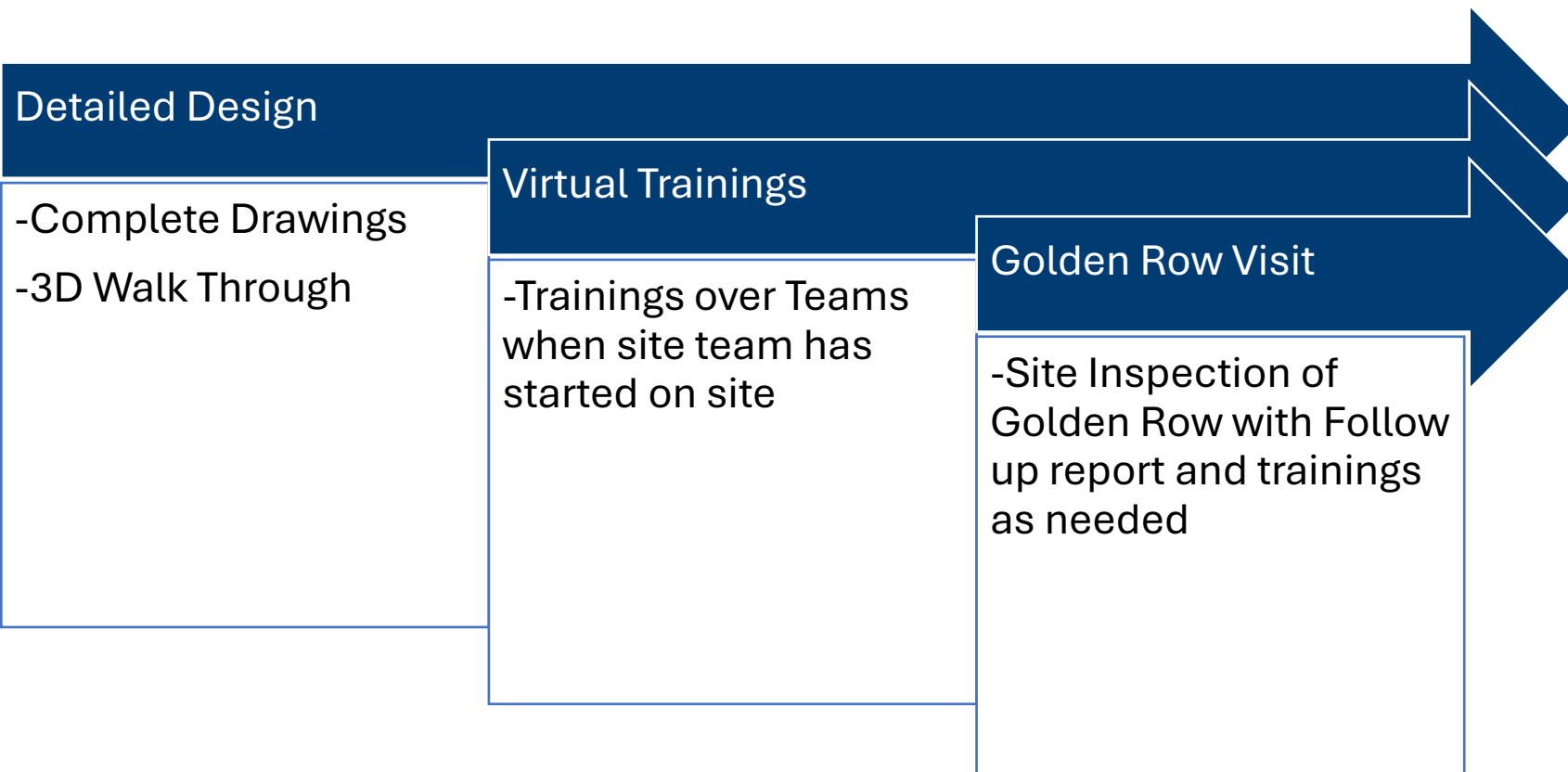
Avoid surprises and costly delays by visualizing every aspect of your site, helping your team make the right decisions long before construction starts.

/// Picture-Perfect Precision: Accurate Visuals That Deliver

Voltage 3D models offer clear representations of your entire project.

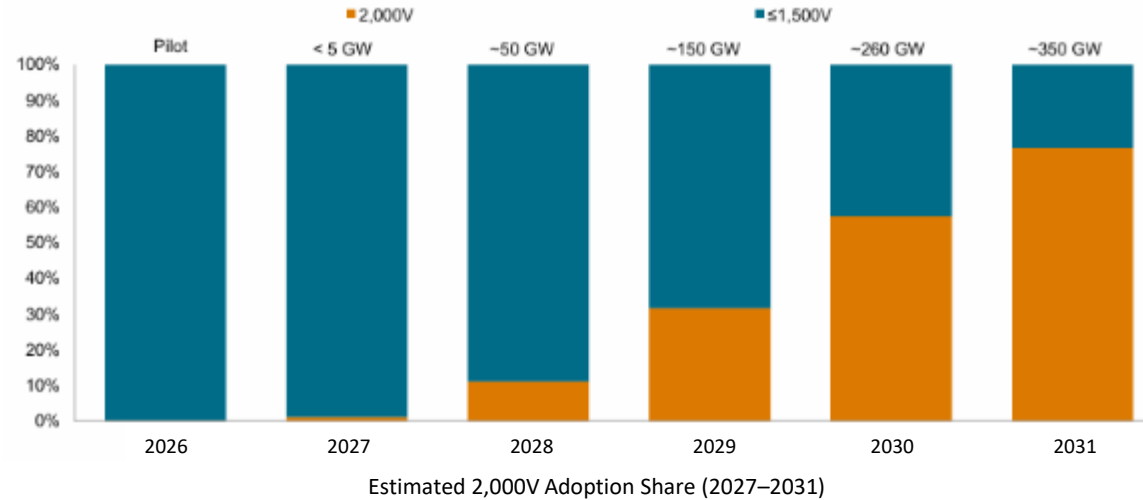
Connecting with Site Teams

Where the Work Gets Done



2,000V Is Coming

Why the industry is moving beyond 1,500V



// The Shift Has Begun

// Industry is transitioning from 1,500V to 2,000V in utility-scale PV systems

// Major suppliers (e.g., Jinko, GE Vernova) have released 2,000V-compatible modules and inverters

// Commercial adoption forecasted from **2027 onward**

// Why 2,000V Makes Sense

// Higher voltage systems enable a 0.5%–0.8% increase in energy yield

// Longer strings reduce the number of connections, combiner boxes, and cabling

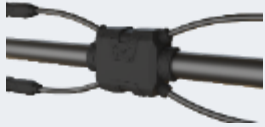
// Fewer inverters result in lower system complexity and improved reliability

A Solution for Every Problem

Empowering Energy Solutions with Voltage Products and Services

- Our favored 2kV ready solutions such as ALEX, IBEX, IBEX PLUS and LYNX PLUS are renowned for their reliability and efficiency.
- Our cutting-edge innovations like 3D-Modeling, Voltage Reality, and Voltage Connect are revolutionizing the way our customers approach project planning and execution. These tools offer unparalleled insights and precision, reducing risks and enhancing outcomes.

LYNX PLUS



An all-in-one trunk bus system that consolidates power transmission from multiple strings to the utility collection system.

IBEX & IBEX PLUS



A fully customizable wire harness that enables various configurations of combining module strings.

ALEX



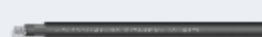
Advanced aluminum extension solution ensuring reliable and cost-effective connections.

CUEX



Single-string extensions for homeruns, jumpers, or whips.

PV Cables



PV, MV, and LV cables engineered for maximum efficiency and long-term reliability in utility-scale solar.

Reel PnP

Plug-and-play reel system designed to simplify and accelerate solar wiring installation with minimal effort.

3D-Modeling

Innovative 3D modeling services that visualize solar designs with precision and clarity, ensuring project accuracy.

Voltage Reality

Immersive walkthroughs provide an interactive and highly accurate visualization from within the project.

Voltage Connect

A centralized platform enabling seamless access to all project-related information for better communication and management.

Why Voltage?

The advantage is not one part number. It is the combined workflow.



Design Controls

- Configuration review
- Quantity reconciliation
- Polarity
- Fuse sizing, ampacity, voltage drop, and product limits.

01



Factory Controls

Pre-assembled terminations, overmolds, labels, connector selection, and conductivity testing before shipment.

02



Field Controls

Circuit maps, reel IDs, row/CBX packaging, unspooling order, 3D references, and installation recommendations.

03

Typical EBOS leaves labor, routing, terminations, labeling, and troubleshooting in the field. Engineered EBOS moves those decisions into design, factory assembly, QA, packaging, and installation planning.

Q & A