



Fusionsolar

**Huawei next generation solar
inverter**

SUN2000 150K-MG0

SUN5000 150K-MG0



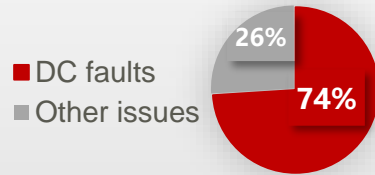
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Trends and Challenges

Challenges: Challenges in C&I PV Construction

DC high-voltage safety risks

Root causes of inverter failures: 74% faults are on the DC side



Complex environment



- The rooftop environment is complex, and the rooftop usage is low due to shading.

Complex O&M



- C&I PV plants are geographically dispersed and difficult to manage in a unified manner.
- Onsite O&M is required, resulting in high costs.

Safety challenges

DC arcing DC short circuit DC high voltage Terminal overtemperature

Benefit challenges

Shading Less area for PV installation Lower yield

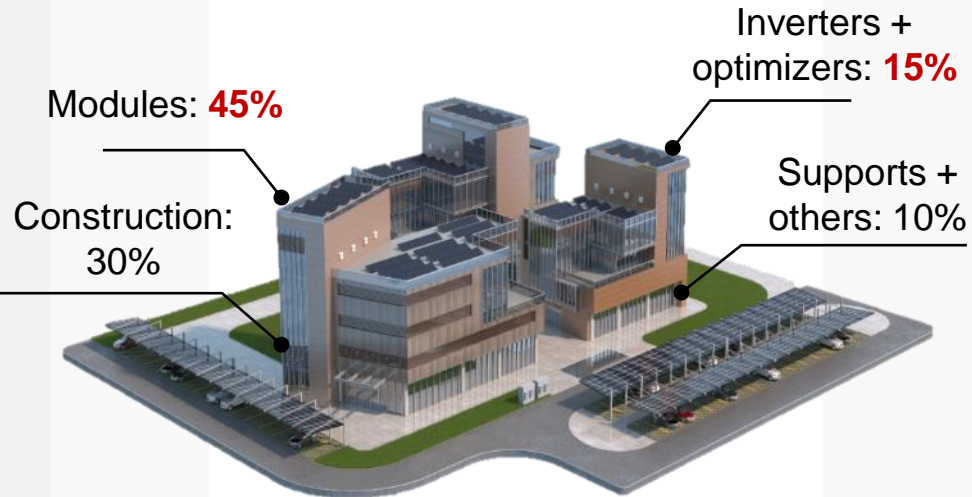
Operation challenges

Unable to achieve unified and visualized management
Difficult and inefficient fault locating

Solution: Inverter is the Core of PV System. Small Investment Brings Huge Benefits

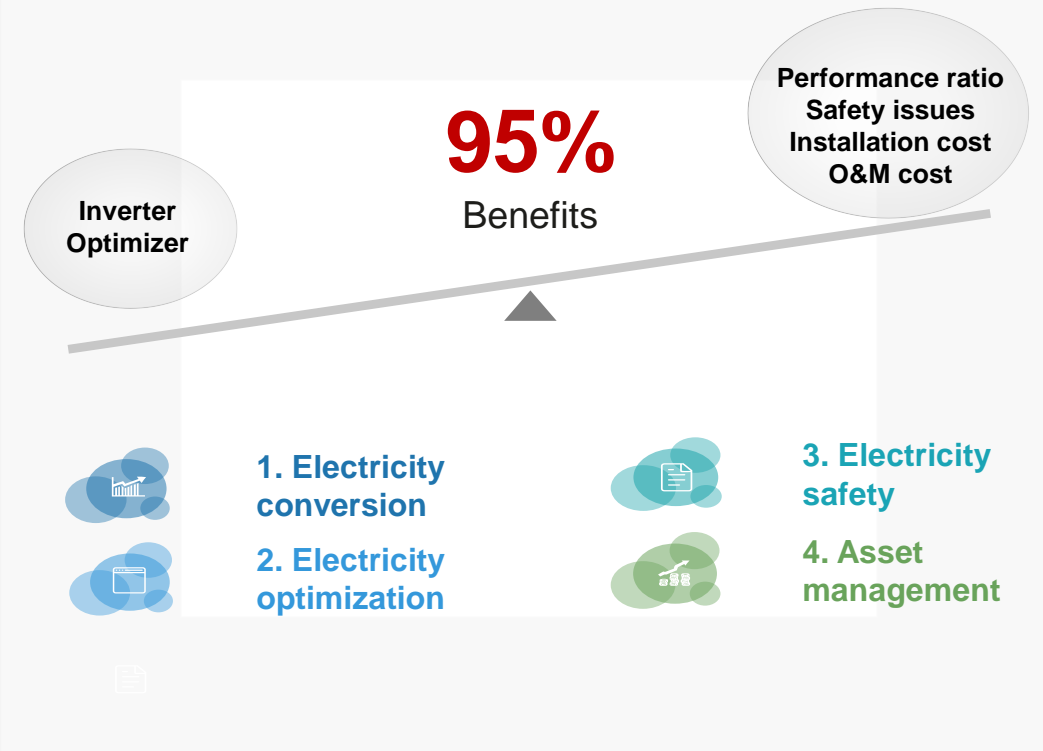
Optimizers and Inverters Account for Only a Small Portion of the Investment

Optimizers and inverters account for only 15% of the investment.



Inverters and optimizers are the **core of a PV system**.

Determining factors in terms of current conversion, system benefits, and reliability





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Huawei Fusionsolar
SUN2000 150K-MG0
SUN5000 150K-MG0

Leading the Way in Power Electronics Innovation Throughout Decade

- **First** 20KTL inverter
- Max Efficiency: 98.6%
- Power Density: 0.23 KW/L

20KTL



2014

- Max Efficiency: 98.6% / 98.7%
- Power Density: 0.24 KW/L, 0.33 KW/L

33/36KTL



2015 - 2017

60KTL



- Max Efficiency: 98.7%
- Power Density: 0.43 KW/L

30/36/40KTL



2018 - 2019

- **First** 100KTL inverter
- Max Efficiency: 98.6%
- Power Density: 0.37 KW/L

100KTL



2020

- Max Efficiency: 98.5%
- Power Density: 0.54 KW/L

50KTL



2022

- **First** 150KTL inverter
- Max Efficiency: 98.8%
- Power Density: **0.54 KW/L**

150KTL



2024

SUN2000-150K-MG0 Series



Efficiency: **98.8%**

Rated output power: **150 kW**

Maximum apparent power: **165 kVA**

Maximum DC input voltage: **1100 V DC**

Max. Current per MPPT/per String: **48A / 16A**

Number of MPPT/Inputs : **7 / 21**

Maximum String per MPPT : **3**

Weight: **98 kg**

Dimensions: **1000 mm x 710 mm x 395 mm**

Keep Innovating to Create More Values

Higher Density & Efficiency

Material upgrading

The 3rd. generation semiconductor application



Technological innovation

Key of digital power technologies fusion

Heat
Dissipation

Integrated
driven

High Speed
Computing Chips

Advanced
Packaging

Higher Energy Density in Same Volume

50%+

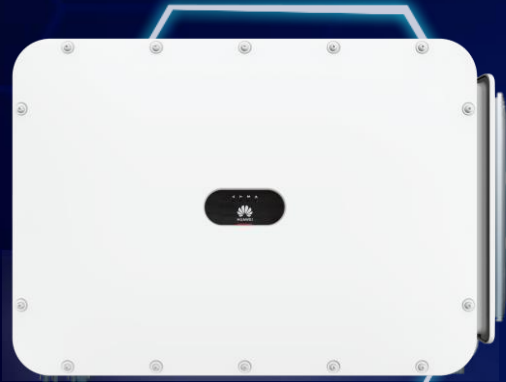
- 100 -> 150kw, same volume but higher density
- Reach to the largest power in C&I voltage

Higher Inverter Efficiency and better yield

98.8%

- Worry-free Conversion Losses
- Make each inverter more efficient

C&I All-Rounder



SUN2000-150K-MG0

Grid Friendly

Intelligent harmonic algorithm
Intelligent reactive power compensation

Higher Yield

Maximum efficiency: 98.8%
PID repair improves yield by 3%.

Optimal BOS

Better BOS for 1 MW
PV plants

Active Safety

Device safety
Asset safety
Personal safety

Simplified O&M

Module-level
insulation resistance
detection

High Reliability

Product availability:
99.999%



Value 1: Increase energy yield and achieve optimal energy efficiency

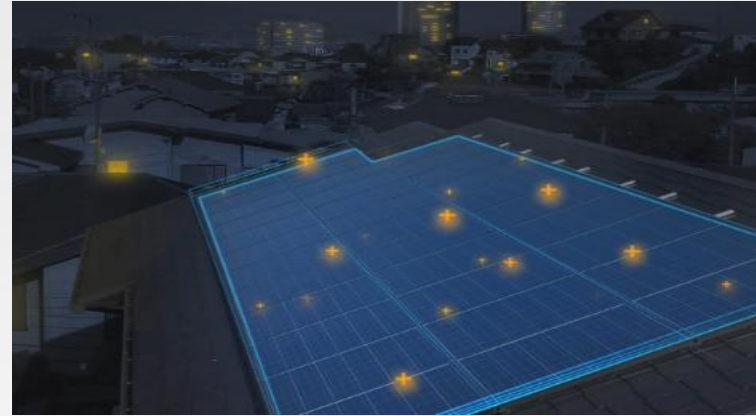
No worries about conversion loss
Optimal energy performance ratio



Unique inverter tracking algorithm

Industry higher inverter maximum efficiency: **98.8%**
Industry highest dynamic MPPT efficiency: **99.8%**

No worries about PID
Support PV installation in extreme environments



Leading PID recovery technology

3% higher system yield
0.1% higher efficiency for the same configuration

98.8% Efficiency + Intelligent MPPT Tracking Algorithm, Improving Yield by 1.5%

98.8% Max. efficiency

Focus on the three core elements of inverter efficiency
Improve inverter efficiency with three steps

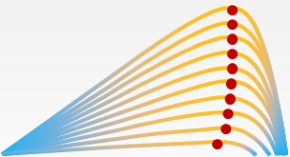


- Circuit design
- Cooling design
- Software algorithm

- Three steps: Simulation in the early stage, test and verification, and long-term optimization
- **0.2%** higher efficiency than industry average

High dynamic MPPT efficiency

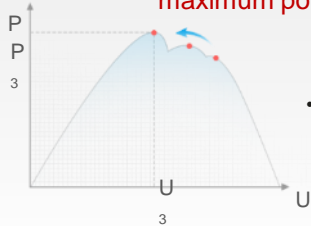
With Huawei's intelligent algorithm, the MPPT tracking efficiency reaches 99.839%.



- Dynamic MPPT efficiency: **99.839%**
- **Faster tracking of MPPT when irradiance changes**

MPPT multi-peak scanning

Conventional algorithms cannot accurately track the maximum power point.
Huawei multi-peak MPPT scanning accurately **locates the maximum power point.**



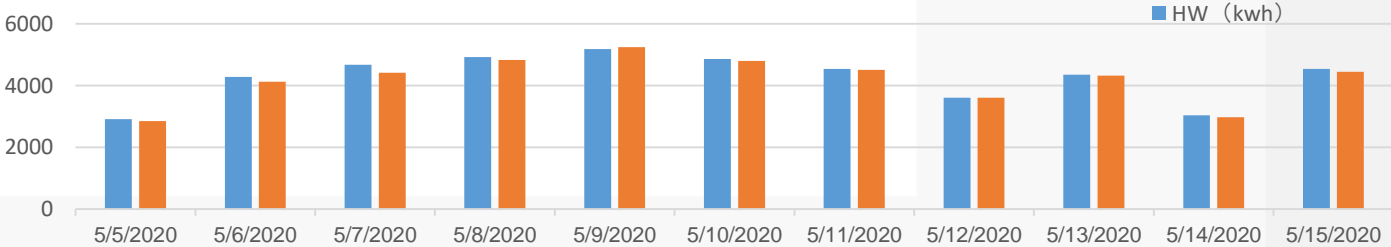
- Full-range MPP scanning < 200ms

Rooftop PV Plant of a factory in Vietnam: Huawei's 100 kVA inverters outperform those of the competitor by 1.71%.



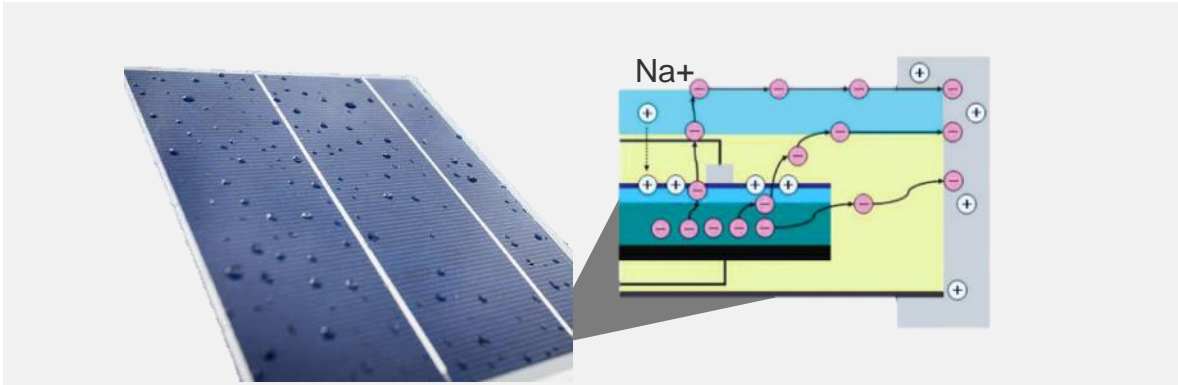
- Location: Vietnam
- Huawei: 9 x SUN2000-100KTL-M0
- Competitor: 9 x XX-100-CX
- Comparison test duration: 1 month

Huawei's intelligent MPPT tracking vs **Competitor's MPPT tracking**
In the 900 kW comparison test, the monthly energy yield of Huawei inverters is **1.71%** higher than that of the competitor.



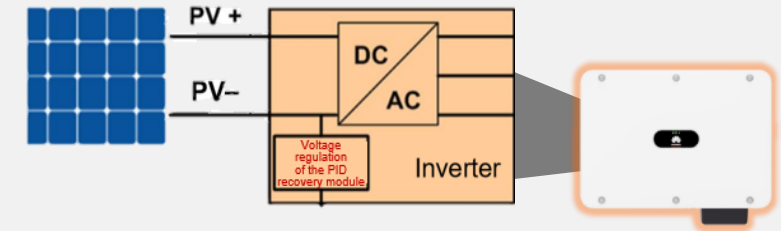
Industry-leading PID recovery improves the energy yield by 3%

Industry: PID effect is one of the most frequent problems in PV systems
PID reduces the energy yield by more than 5% throughout the lifecycle.



Huawei PID recovery solution effectively avoids the PID effect and ensures energy yield.

Built-in PID recovery function of Huawei inverters



A rooftop project in Zhongshan City, Guangdong Province
TÜV's empirical tests prove that Huawei's PID recovery function can improve energy yield by 3%.

PID is more severe in high-temperature and high-humidity areas.



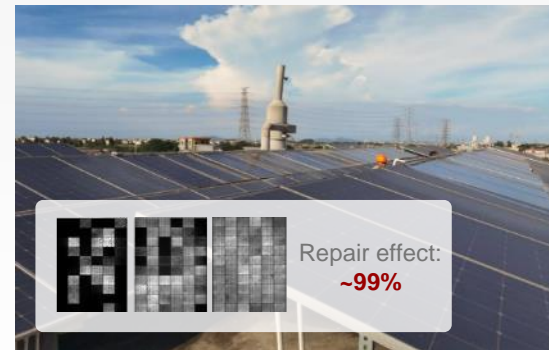
High temperature



High humidity



Damaged module



Value 2: System-Level Safety Solution, Ensuring Device and Asset Safety

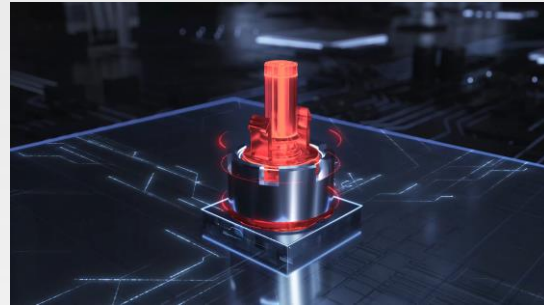
Device Safety PV Ground-Fault Protection



Industry's First

cutting off ground faults within 15 ms during grid connection, ensuring inverter safety

Device Safety Smart Connector Temperature Detection



DC & AC Side

Real-time Detection of Connector Temperature

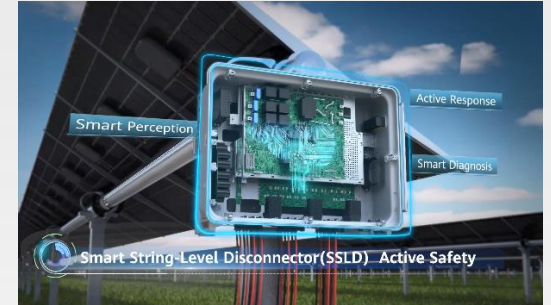
Asset Safety Active arc extinguishing for fire prevention



Industry Highest L4 AFCI

Arc protection covering the entire roof
Active arc extinguishing for fire prevention

Device Safety Active disconnection for device protection



Industry-unique Smart String-Level Disconnect

Intelligent and fast disconnection
Ensure the safety of the DC side

Industry's first **PV Ground-Fault Protection**, cutting off ground faults within 15ms during grid connection, ensuring inverter safety

Industry First

PV Ground-Fault Caused Highest Failures



Cable damaged



Cables not firm connected



Long-term stress cause by disordered cabling

75%

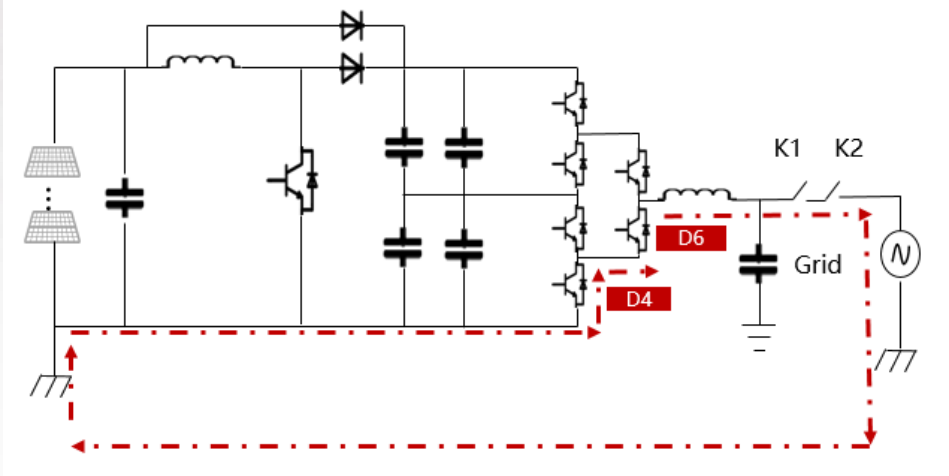
PV Ground Fault @ PV Side Problem

Inverter damage

Fire risk

Rapid Shutdown and Protect Inverters Effectively

15ms Overcurrent Automatic Protection and shutdown



Smart Connector Temperature Detection

Unique

Conventional: loose connection of terminals may cause over temperature and fire

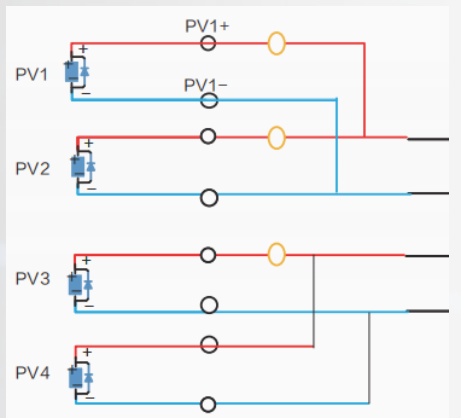


Frequent terminal burning faults

The terminal connection is not good

Poor contact caused by external forces

Improper crimping of metal core

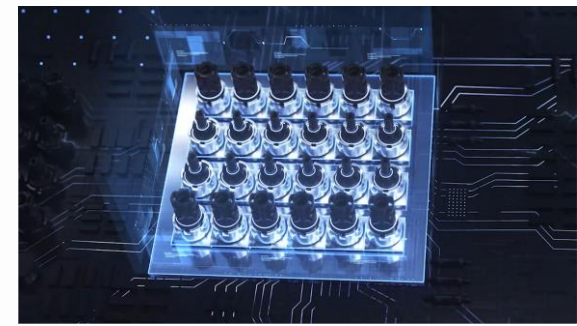


No terminal over temperature detection

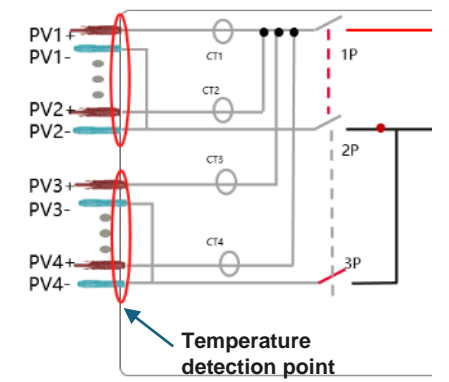
Over temperature, terminal burning

VS

Accurate Over Temperature Detection



PV terminal on-board design



Terminal over temperature detection

Both DC connector and temperature sensor onboard
0.5s shutdown when over temperature happens

Leading **AFCI Solution**, Larger Detection Range, Ensuring Asset Safety

Industry Leading



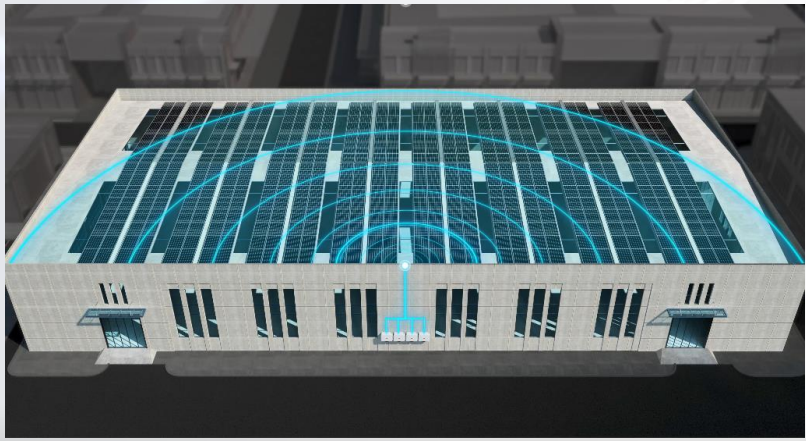
TUV certification
IEC 63027 standard

200m Detection Range Only fit Small/Middle Scale Rooftop
Unable to Detect Longer range Arc fault



200m

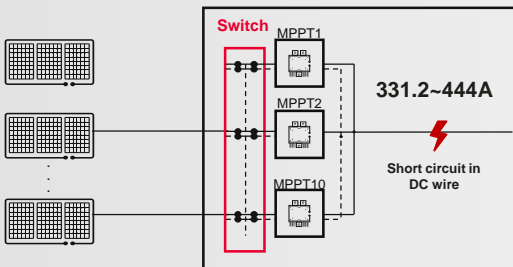
450m Can Cover Larger Scale of C&I Application
Especially for MW rooftop



450m

C&I's 1st **Smart String Disconnection** Function, rapid disconnection of DC-side faults within 15ms ensures DC-side safety

Traditional: DC short circuit



- **Manually enabled**, causing high safety risks
- **Equipment damage**: inverter, MCCB& transformer
- **Secondary damage**: fire hazard etc

VS

Huawei: **Smart String Disconnection Function**



- **Intelligent enabled**, free of site visit
- **15ms rapid shutdown**, ensuring device safety
- **Real-time monitoring**, quickly cut off the fault current circuit



Reverse connection of PV strings



DC input back feed



Internal short circuit



HW Industry-leading SSLD

Passed CGC's first intelligent segmentation certification

Value 3: Long-Term High Reliability Assurance, With 99.999% Product Availability

Unique

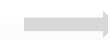
Reliability design



High-standard components



Rigorous tests



Meticulous inspection



- Joint design by aesthetic research centers globally
- Simulation design for **high-power** inverters



- **Mature components:** Components are carefully selected and have been proven in large shipments.
- **Customized components:** Components are customized for **high-power** inverters to reduce the size and loss.



- **Rigorous tests** on high-power inverters:
 - Low-temperature freezing test
 - High-temperature and high-humidity test
 - Salt spray corrosion test
 - Dust test
 - **Lightning test**
 - **Limit test**



- **100% aging test** before delivery
- Huawei-unique **ongoing reliability testing (ORT)**

Value 4: The First High-Precision **Module-Level Insulation Detection**

Ensure Safety and Reduce O&M Cost

Isolation Fault is a Very Common Problem and Hard to Locate



More MPPTs and longer cables

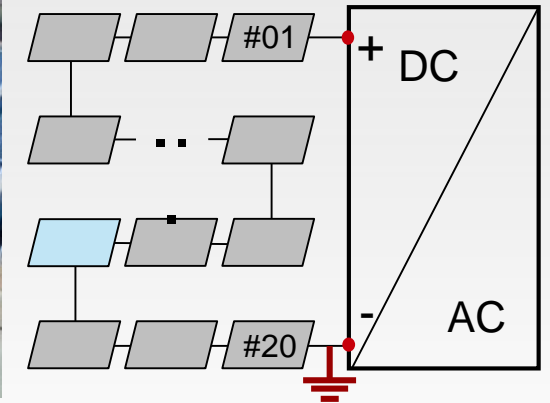


Small or tiny fault points



More false alarm in rainy seasons

Module-level insulation detection: high precision avoids false positives and quickly narrow down the fault location



Locating an insulation fault to the corresponding module (± 1)

Module-level insulation detection

High
positioning
accuracy

Outstanding
safety
performance

Value 5: Optimal BOS, SmartDesign Brings Simplified Design Experience

Optimal BOS

Lower cable costs
Lower installation costs



- The output power is increased by 50% (compared with 100K products).
- Reduce the required number of inverters and AC&DC cables.

Simplified design

PV design tool (SmartDesign)



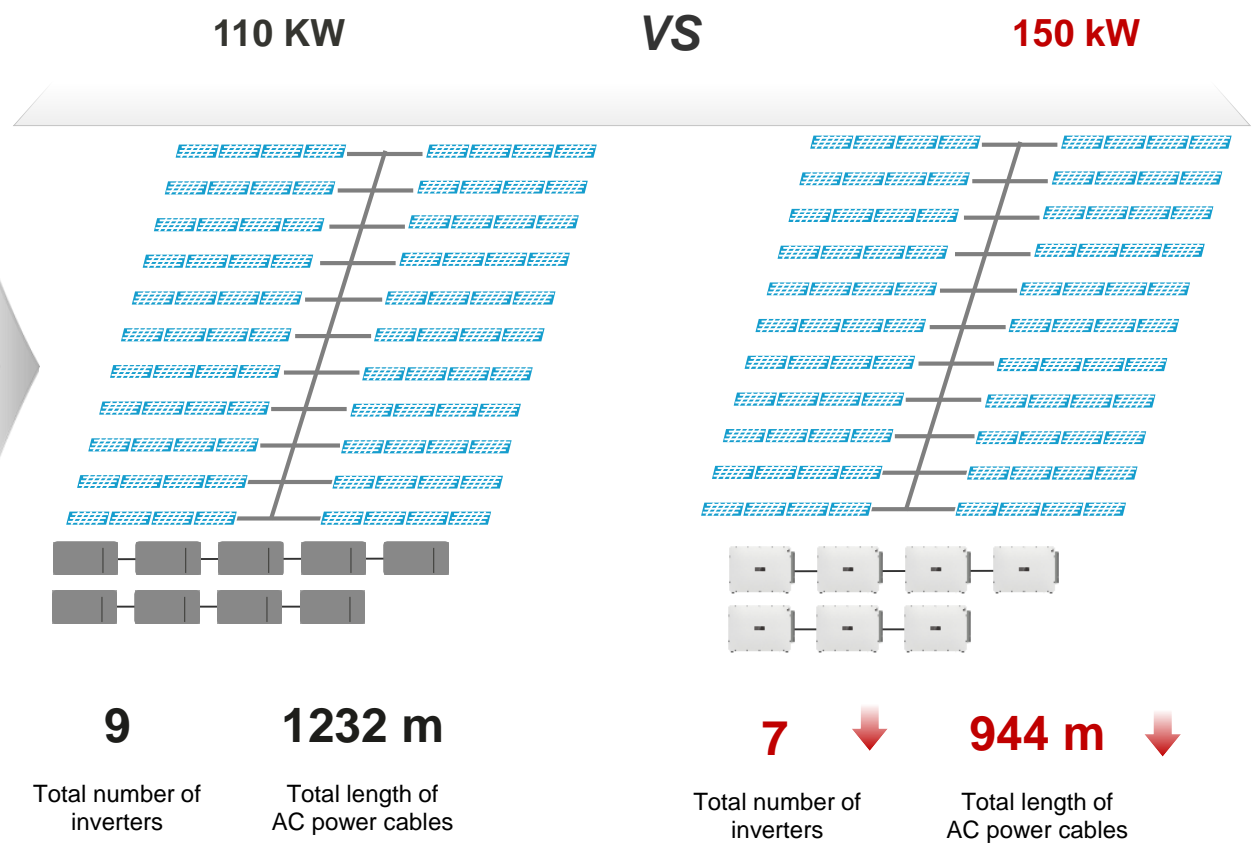
- Satellite positioning, automatic layout, and one-click connection
- Comprehensive analysis and comparison for optimal design

C&I Projects With Higher Power, BOS reduced to provide better ROI



Rooftop picture of an industrial park in Guangdong + Emulated module layout

Ex : 1 MW typical PV plant with only 7 inverters



- The BOS calculation is based on 575 W modules, with a ratio of 1

Value 6: Adapting to Customer Requirements in Different Industries

Friendly to various grids

Grid Adaptation



- Intelligent reactive power compensation to prevent energy yield loss
- Intelligent harmonic algorithm, THDi < 1%, grid-friendly

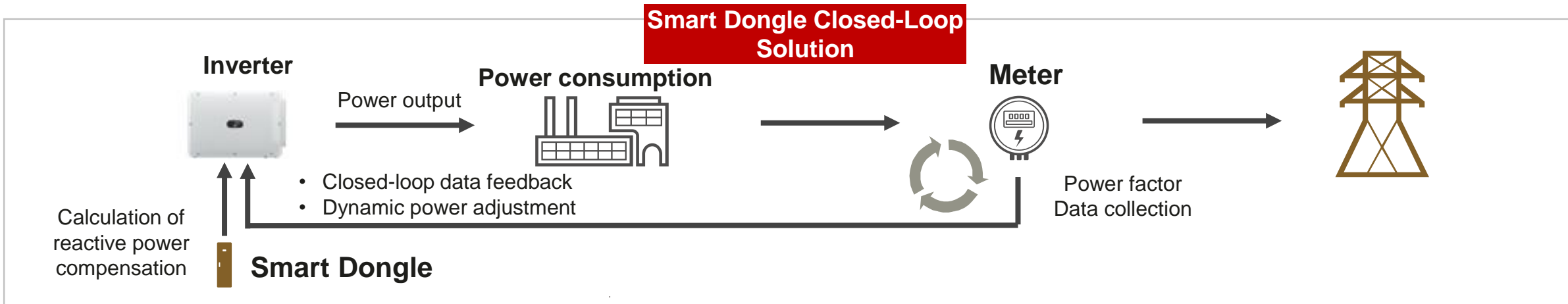
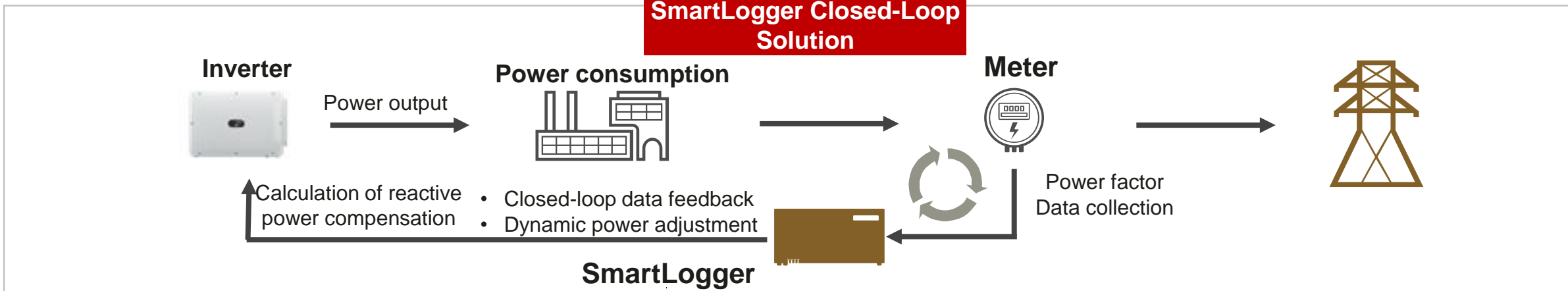
Friendly to different business models

PV+ESS solution



- PV+ESS collaboration to support more business models
- Electricity price settings for more accurate benefit calculation

Closed-Loop Control and Precise Control of Reactive Power Output



Technical implementation

The power factor control precision is 0.01.
 The reactive power control precision of the system is 1% or 1.5 kVar, whichever is larger.

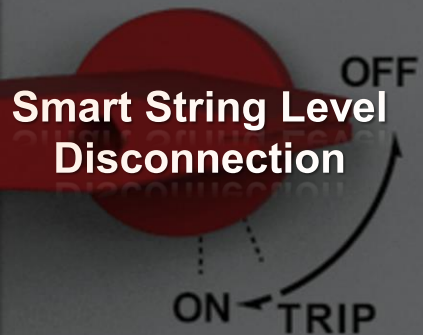
System reactive power response time < 10s
 The reactive power control precision of the inverter is 1% or 0.2 kVar, whichever is larger.

Upgrade



AFCI

DC SWITCH 1



Smart String Level Disconnection

SUN2000-150K-MG0



150 KW

Upgrade

98.8%
Max. efficiency

New

150K
Higher Power

New

PV Ground-Fault Protection

New

Smart Connector Temperature Detection

New

Module-level Isolation Fault Detection

PID Recovery



Huawei Fusionsolar C&I SUN5000 Series Solution

Module SafeLink

Construction

Release the Potential of Rooftop

Operation

Resolves Component Mismatch

Problems

Cable SafeLink

SafeLink

ProfiLink

Maintenance

Module-level fault locating

Device SafeLink

MERC-1100/1300W-P

SmartDesign

SmartLink

Module-level Management

Long-term Reliability

Industry-leading Rapid Shutdown, Adapts to High-safety Scenarios

Traditional: Rooftop high voltage



- **Fire safety risks,** Firefighters are in danger of electric shock
- **O&M safety risks:** O&M personnel may easily get injured by high voltage

VS

Huawei: Module-level rapid shutdown



- **30s rapid shutdown,** Ensuring personal safety
- **Rooftop 30V voltage,** No risk of electric shock

Rapid Shutdown Becomes an Important Standard



EU: VDE-AR-E 2100-712



US: NEC 2020



Thailand: EIT



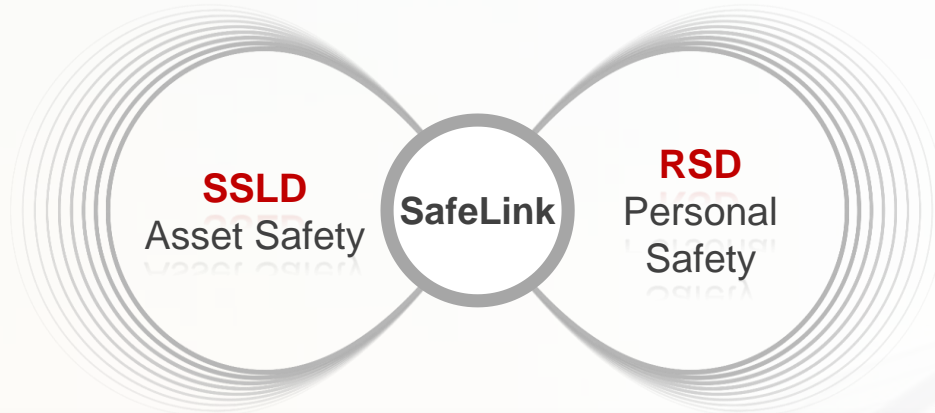
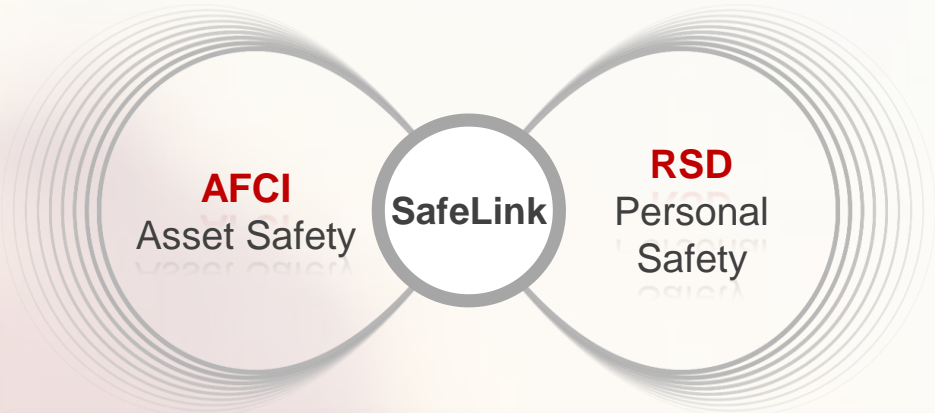
Brazil: Inmetro RSD



HW: Meets the most advanced safety standards, NEC 2017 & 2020



Linkage between features ensure the safety of both asset and personal safety



Fifth AFCI Triggers Rapid Shutdown

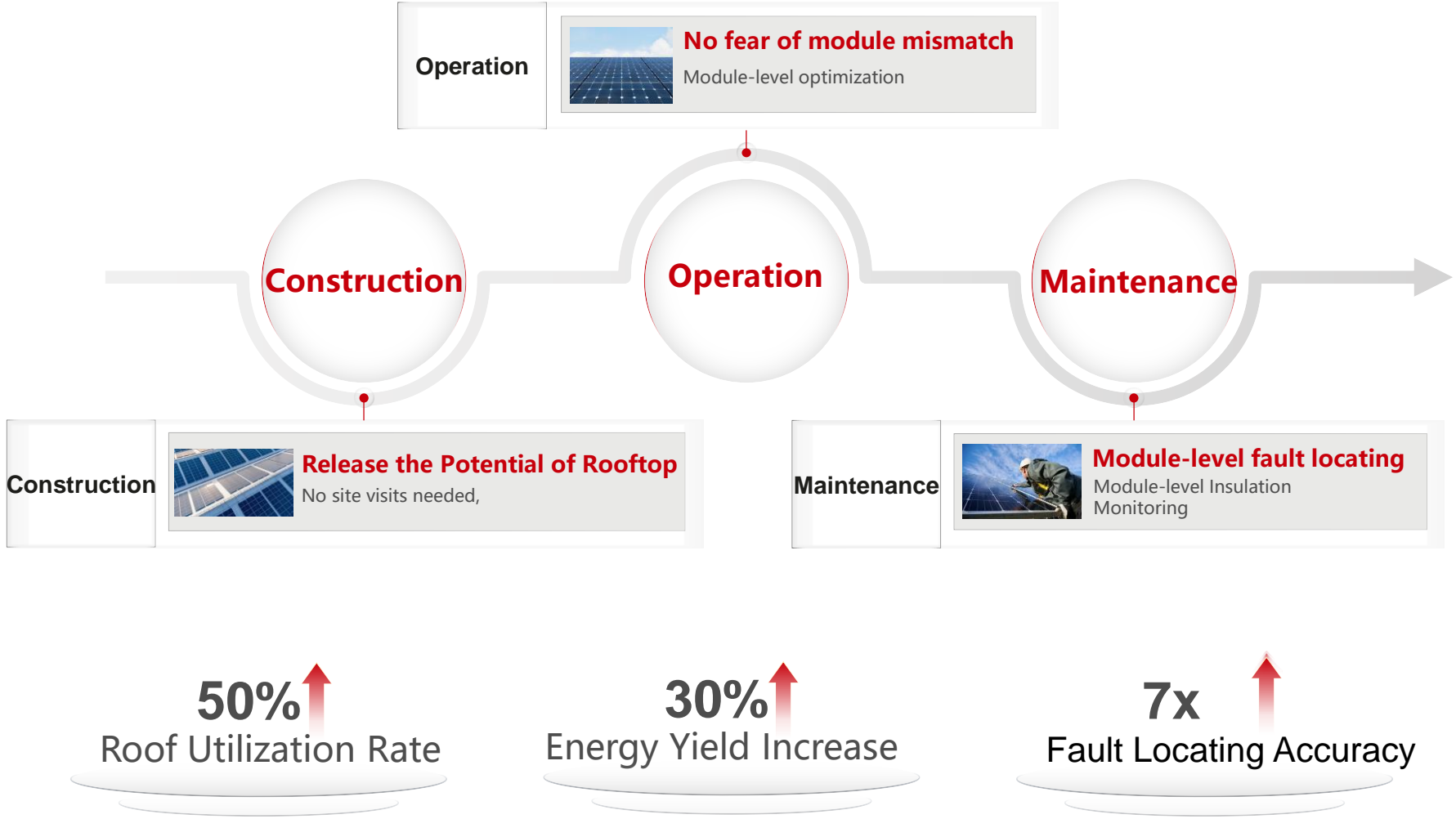
1 Shut Down Arc Fault within 0.5s → 2 Real-Time Active Alarm → 3 Reduce Voltage within 30s

Active alarm	
Historical alarms	
Total: 4	
DC arc fault	The "N" string power cable arc or is in poor contact.
Occurrence Time	10-Apr-2024 10:27:52
Clearance Time	10-Apr-2024 10:27:58
DC arc fault	The "N" string power cable arc or is in poor contact.
Occurrence Time	10-Apr-2024 10:34:03
Clearance Time	10-Apr-2024 10:34:05
DC arc fault	The "N" string power cable arc or is in poor contact.
Occurrence Time	10-Apr-2024 10:20:47
Clearance Time	10-Apr-2024 10:20:52
DC arc fault	The "N" string power cable arc or is in poor contact.
Occurrence Time	10-Apr-2024 10:28:34
Clearance Time	10-Apr-2024 10:28:38

Trigger RSD

1 Real-Time Active Alarm → 2 Smart String-Level Disconnect → 3 Linkage-triggered Rapid Shutdown

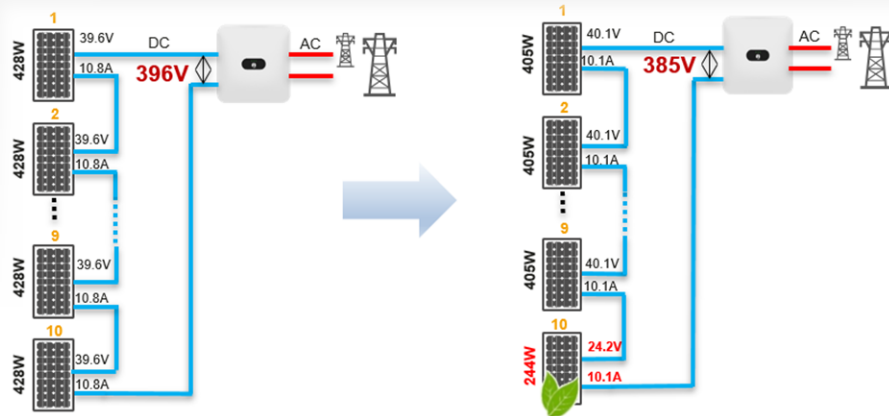
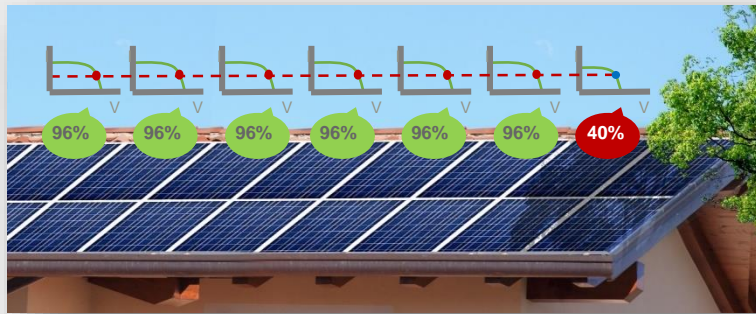
Unleashing PV Modules' Power Generation Potential, Eliminating O&M Management Blind Spots, and Achieving Better Revenue and Expenditure



“Module-level” Asset Management, Real-time Detection Reducing O&M Cost

Targeting PV module mismatch, increasing energy yield by 5% to 30%.

MPPT at the PV module level



Identifying inefficient module

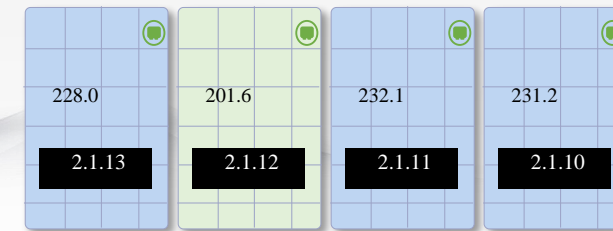
Detects low-efficiency PV modules in timely manner



Blocking of foreign objects



module damage

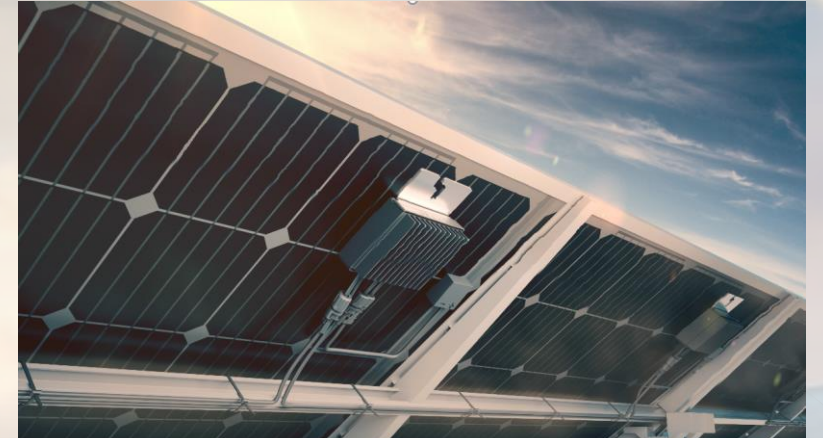


Long-term Reliability: 30% Less Component for Utmost Reliability & Guaranteed 24 Hours Reconnection If Any Failure

Unique architecture with
30% Less Components

Utmost performance with rigorous testing
Under extreme weather conditions

**Failure Rate
< 300 ppm**



**Guaranteed
24 Hours Response**



Faster Recovery:
Authorized service provider
for replacement **within 24 hours***



Quicker Response:
7*24 Hotline & Online support:
Multi Language Covering **20+** Countries



Higher Reimbursement:
Optimizer Replacement
300-700€/ time**

SafeLink

AFCI

Smart String
Level
Disconnection

Unique



SUN5000-150K-MG0

ProfiLink

98.8%
Max. efficiency

150K
Higher Power

50%
Rooftop Usage

DC-to-ground
Protection

Smart
Connector
Temperature
Detection

Unique



Module-level
insulation
impedance
location

PID Recovery

30%
Energy Yields

Smart Link

Smartdesign



Module-level
management

Long-term Reliability

Thank you.

把数字世界带入每个人、每个家庭、
每个组织，构建万物互联的智能世界。

Bring digital to every person, home and
organization for a fully connected,
intelligent world.

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