Huawei launches next-generation FusionSolar residential smart PV solution
Continuously Creating Values for Customers Achieving Sustainable Business Growth

Sustainable business growth with large operation scale & diversified business groups

- **170+** Countries and regions
- **49 In** Fortune Global 500
- **96,000+** R&D employees
- **14** Research institutes/labs/centers
- **194,000** Employees
- **74 In** Interbrand’s Top 100 Best Global Brands

**2020H1 Sales Revenue** US$65.7 Billion
YoY increased by **13.1%**

<table>
<thead>
<tr>
<th>Year</th>
<th>US$ billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>39.3</td>
</tr>
<tr>
<td>2014</td>
<td>46.7</td>
</tr>
<tr>
<td>2015</td>
<td>63.1</td>
</tr>
<tr>
<td>2016</td>
<td>75.1</td>
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<tr>
<td>2017</td>
<td>92.5</td>
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<tr>
<td>2018</td>
<td>105.2</td>
</tr>
<tr>
<td>2019</td>
<td>120.9</td>
</tr>
<tr>
<td>2020H1</td>
<td>65.7</td>
</tr>
</tbody>
</table>
Cumulative 130GW+ Global Shipments, Leading String Solution to become the Mainstream

No. 1 Global Inverter Shipment for Consecutive 5 Years

String Solution Becomes the MAINSTREAM in PV Industry

String inverters grows rapidly worldwide

Data Source: Third Parity Consultant Company
Leading Smart String Solution for All PV Scenarios

**Residential**
2~6kW  3~10kW

**Commercial & Industrial**
12~20kW  30~40kW
50/60kW  100kW

**Utility-scale**
185kW  100kW

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Smart & String for All PV Scenarios
FusionSolar Residential Smart PV Solution

Residential
(<=10kW)

- Full Optimizer
  1. Module level optimization
  2. High voltage rapid shutdown
  3. Module level monitoring
  4. Flexible long string design

Smart Energy Center
- SUN2000-2/3/3.6/4/4.6/5KTL-M1
  Single Phase

- SUN2000-3/4/5/6/8/10KTL-M1
  Three Phase

Smart PV Optimizer
- SUN2000-450W-P

Smart Dongle
- Smart Dongle-WLAN-FE
- Smart Dongle-4G

Smart String ESS

Smart Power Sensor
- DDSU666-H (Single Phase)
- DTSU666-H 250A (Three Phase)

Backup Box
- Backup Box-B0/B1

Monitoring Portal
- FusionSolar Cloud & APP

FusionSolar Smart PV Management system

- WLAN/Ethernet/4G/3G/2G

FusionSolar Cloud & APP

- FusionSolar Smart PV Solution

Support 2 ESS operating in parallel, up to 30kWh

LUNA2000-5/10/15-S0

DDSU666-H (Single Phase)
DTSU666-H 250A (Three Phase)
FusionSolar Smart PV Residential Inverter Portfolio

**SUN2000-2/3/3.68/4.6/5/6KTL-L1**  
(Single phase inverter)

**MPPT/Inputs:** 2/2  
**Local commissioning:** Built-in WLAN  
**Communication:**  
- Built-in WLAN (Standard)  
- Smart Dongle-WLAN-FE (Optional)  
- Smart Dongle-4G (Optional)  
**AFCI:** Yes  
**Compatible Optimizer:** SUN2000-450W-P

* Test result shows nominal DC voltage of SUN2000-2-6KTL-L1 inverter does not induce significant PID of connected PV module.

**SUN2000-3/4/5/6/8/10KTL-M1**  
(Three phase inverter)

**MPPT/Inputs:** 2/2  
**Local commissioning:** Built-in WLAN  
**Communication:**  
- Built-in WLAN (Standard)  
- Smart Dongle-WLAN-FE (Standard)  
- Smart Dongle-4G (Optional)  
**AFCI:** Yes  
**PID Recovery:** Yes  
**Ripple Control Interface:** Yes  
**Compatible Optimizer:** SUN2000-450W-P
HUAWEI Smart String ESS Basic Specification

**Power Module**

- Up to three 5kWh Battery Module in one system
- High voltage DC couple Solution
- Up to 2 ESS operates in parallel, 5-30kWh
- Compatible with both SUN2000-2-6KTL-L1 & SUN2000-3-10KTL-M0/M1

**Battery Module**

- Power Module: 5kW
- Battery Module: 5kWh
- Max 5KW charge/discharge power
- 100% DoD
- 10 years warranty
- ≥4,500 cycles

**Smart Energy Storage System**

LUNA2000 5-30kWh

- Standard floor stand / Optional wall mount installation
- IP65, outdoor / indoor install
- Lithium-iron phosphate (LiFePO4) cell

**Graph**

- Capacity (kWh)
- Power (kw)
Optimizer and Smart Power Sensor

Smart PV Optimizer
SUN2000-450W-P

- DC MBUS communication to Inverter
- Maximum power harvesting from each module
- Module-level monitoring
- Open circuit impedance 1K Ohms for installation verification
- Reduces PV wires to a safe voltage when inverter is shut down (Compliant to NEC2017)

Compatible to SUN2000-2-6KTL-L1, SUN2000-3-10KTL-M1 inverter

Smart Power Sensor
DDSU666-H (Single Phase)
DTSU666-H 250A/50mA (Three Phase)

- RS485 connected to inverter
- Class 1 high accuracy meter readings for production/consumption monitoring
- Import/export meter readings for export limitation functionality
- Current transformer included
External Communication Modules

**Smart Dongle-WLAN-FE**
- Max. 10 device communication connected
- Plug & play USB interface connected to inverter for monitoring through WLAN or fast Ethernet

Compatible to SUN2000-2-6KTL-L1, SUN2000-3-10KTL-M1 inverter

**Smart Dongle-4G**
- Max. 10 device communication connected
- Plug & play USB interface connected to inverter for monitoring through 4G

Compatible to SUN2000-2-6KTL-L1, SUN2000-3-10KTL-M1 inverter
FusionSolar APP & Smart PV Management System

FusionSolar APP

• Support local system commissioning and plant registration on management system
• Auto-detection of system equipment
• Registering plant by scanning any equipment in the system

FusionSolar Smart PV Management System

• Unified address: https://intl.fusionsolar.huawei.com
• Real-time energy flow and energy balance
• Module-level performance management
• Demo site for all guests to experience system
SUN2000 APP & 3rd Party Management System

**SUN2000 APP**
- Local commissioning APP
- Support WLAN connection

**3rd Party Management system**
- Data can be transferred to 3rd party server via API
Residential Single Phase Inverter System
SUN2000-2/3/3.68/4/4.6/5/6KTL-L1

Communication:
- Local Commissioning: Inverter built-in WLAN communication to FusionSolar App
- Remote Monitoring:
  - Inverter built-in WLAN (Standard)
  - WLAN-FE Dongle (Optional)
  - 4G Dongle (Optional)
  - communicating to FusionSolar smart PV management system for site creation and monitoring

Compatible Battery:
- HUAWEI Smart ESS LUNA2000 5-30kWh
- LG Chem RESU7H/10H
  - High voltage DC coupled battery plug & play integration to inverter. Battery is managed by inverter via RS485 communication.
  - Support 5KW battery charging while 5KW AC power output for 5KTL inverter;
  - Support reverse battery charging from grid;
  - Fix charge/discharge, self-consumption maximization & time of use control mode can be selected

Backup Power Supply (Not available to SUN2000L-2-5KTL):
- Inverter automatically supplies power to backed-up loads in the event of grid outages

Smart Power Sensor (necessary with battery installed):
- DDSU666-H (single phase)
- DTSU666-H 250A/50mA (three phase)
  - connects to inverter via RS485 for power output monitoring or export control.
Residential Three Phase Inverter System
SUN2000-3/4/5/6/8/10KTL-M1

Communication:
- Local Commissioning: Inverter built-in WLAN communication to FusionSolar App
- Remote Monitoring:
  - WLAN-FE Dongle (Standard)
  - 4G Dongle (Optional) communicating to FusionSolar smart PV management system for site creation and monitoring

Compatible Battery:
- HUAWEI Smart ESS LUNA2000 5-30kWh
  High voltage DC coupled battery plug & play integration to inverter. Battery is managed by inverter via RS485 communication.
  Fix charge/discharge, self-consumption maximization & time of use control mode can be selected

Backup Power Supply (Not available to SUN2000-3-10KTL-M0):
- Only support one phase backup load Inverter,
- Automatically supplies power to backed-up loads in the event of grid outages

Smart Power Sensor (necessary with battery installed):
- DTSU666-H 250A/50mA (three phase) connects to inverter via RS485 for power output monitoring or export control.
More Modules
with Long & Flexible String Design

Comparison Case

Other Solution

25

HUawei

• Max. 200% DC/AC oversizing for SUN2000-5KTL-L1 & 10KTL-M1

<table>
<thead>
<tr>
<th></th>
<th>SUN2000-2-6KTL-L1 (2 strings)</th>
<th>SUN2000-3-10KTL-M1 (2 strings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum DC power per string</td>
<td>5,000 W</td>
<td>10,000 W</td>
</tr>
</tbody>
</table>
PV + ESS connects to Single/Three Phase Grid

- Both LG Chem RESU 7H_R & 10_R and HUAWEI LUNA2000-5/10/15-S0 string battery is compatible with SUN2000-2-6KTL-L1 smart energy center;
- Battery communicates to smart energy center via RS485 at RS485-2 port.
- Smart power sensor DDSU666-H is connected at the grid connection point for exported power measurement to calculate self-consumption rate and power export control.

When connecting smart energy center to one phase of three phase grid, DTSU666 smart power sensor shall be used.

- Single phase backup box Backup Box-B0 can be connected to smart energy center. User can determine critical household load to connect to backup box.

**On-grid mode:** Smart energy center connects directly to the grid. Both critical load and non-critical load are connected to the grid and can be powered up.

**Backup mode:** When grid is outage, non-critical load is powered off. Switch in backup box automatically turns off and smart energy center turns into backup operating mode to output stable voltage and frequency to critical load until battery energy is exhausted and there is no stable PV power input.

During daytime, both PV and battery supply power to critical load while during nighttime only battery discharges power to critical load.

- Both self-consumption maximization control mode and TOU control mode can be applied for system operating.
**SUN2000-3-10KTL-M1**

**PV + ESS connects to Three Phase Grid**

- Only HUAWEI LUNA2000-5/10/15-S0 string battery is compatible with SUN2000-3-10KTL-M1 smart energy center;
- Battery communicates to smart energy center via RS485 at RS485-2 port.
- Smart power sensor DTSU666-H 250A/50mA is connected at the grid connection point for exported power measurement to calculate self-consumption rate and power export control.
- Three phase backup box Backup Box-B1 can be connected to smart energy center. User can determine critical single phase household load to connect to backup box.

**On-grid mode:** Smart energy center connects directly to the grid. Both critical load and non-critical load are connected to the grid and can be powered up.

**Backup mode:** When grid is outage, non-critical load is powered off. Switch in backup box automatically turns off and smart energy center turns into backup operating mode to output stable voltage and frequency to critical load until battery energy is exhausted and there is no stable PV power input.

During daytime, both PV and battery supply power to critical load while during nighttime only battery discharges power to critical load.

- Both self-consumption maximization control mode and TOU control mode can be applied for system operating.
System Quick Commissioning
Auto Detection of All System Devices

All inverter connected devices can be automatically detected in FusionSolar app.

<table>
<thead>
<tr>
<th>System Setting up Duration</th>
<th>HUAWEI Solution</th>
<th>Other Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Device Auto Detected in App)</td>
<td>1.5-3 mins</td>
<td>15-20 mins (Separated Apps or web tools to add devices manually)</td>
</tr>
</tbody>
</table>

Diagram showing the setup duration for different devices:
- Inverter: 1.5-3 mins
- App: 5-8 mins
- Optimizer: 10-15 mins
- ESS: 5-8 mins
- Smart Power Sensor: 5-8 mins
- Dongle: 5-8 mins
<5sec
Module Auto-Mapping

<table>
<thead>
<tr>
<th>Operating Steps</th>
<th>HUAWEI Solution</th>
<th>Other Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2D barcode paste on template</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td>Physical layout creation</td>
<td>&lt;5sec (AI powered)</td>
<td>6.5min (manual)</td>
</tr>
<tr>
<td>Total configuration time</td>
<td>&lt;1min</td>
<td>6.5min</td>
</tr>
</tbody>
</table>

@15KW system with 40 pcs of PV modules

Saving 86% configuration time compared with other solutions
Control Mode Setting Option

**Maximum self-consumption**
Using PV energy is prioritized over using grid energy, Storing PV energy is prioritized over feeding excess PV energy into grid.

**Fully fed to grid**
Smart energy center feeds as much power as possible to the grid either with excessive PV power or ESS power.

**TOU (Time-of-use)**
If electricity is more expensive at times of high demand (peak rate) than at times of low demand (off-peak rate), customers will automatically consume more when it is cheaper and save when it is expensive.
System Operating Control Mode - Maximization Self Consumption

1. Early Morning
2. Morning
3. Noon
4. Evening

Load Power Curve
PV Power Curve

ESS Discharge
ESS Charge

Purchase power from grid
Excessive PV power -> ESS
Excessive PV power -> Grid
PV power self consumption

State of ESS

ESS Discharge
Stand by
ESS Charge
Stand by
ESS Discharge

SOC:0%
SOC:100%
TOU (Time of Use) Control Mode Setting

Specify day and period of ESS charge and discharge

Excessive PV power fed to grid prior to charge ESS
PV power utilization priority: Self-consumption > Export to grid > ESS charge
Load is supplied with power in the priority of PV, ESS discharge and Grid. ESS charge power to grid is prohibited.

Excessive PV power charges ESS prior to being fed to grid
PV power utilization priority: Self-consumption > ESS charge > Export to grid
Load is supplied with power in the priority of PV, ESS discharge and Grid. ESS charge power to grid is prohibited.
**System Operating Control Mode – Time of Use, No PV**

**Time-Of-Use (AC coupling system applied most):**

Time of use storage operation mode enables you to store electricity in the battery at a cheap off-peak rate, and then to use this stored electricity to supply the household appliances at times of the expensive peak rate.
System Operating Control Mode – Fully Feed In

When PV power > smart energy center output rated power, smart energy center output max power while excessive PV power charges ESS;
When PV power < smart energy center output rated power, smart energy center output max power with ESS charged power and PV power;
PV power utilization priority: Self consumption > Export to grid > ESS charge
System Operating Control Mode – Off Grid Operating Mode (No AC Grid)

Smart energy center operates in voltage source mode to supply stable voltage and frequency to the load. Excessive PV power is to charge ESS.
Pinpoint
Arc Fault Positioning for Easier Troubleshooting

Saving 80% onsite troubleshooting time and cost with accurate arc fault positioning

* Manually detection of DC arc fault in a 10Kwp residential system usually costs 5hrs. Pinpoint arc fault position report lead to resolve the problem within 30 mins.

Less power loss because of shorter system tripping
Safe House with Smart PV Optimizer

Without optimizer: High DC voltage when system shuts down

With optimizer: Each optimizer outputting 0V when system shuts down
No Fuse or Other Quick-wear Parts, Inverter Touch Free

TÜV verified: annual failure rate < 0.5%
Inverter availability up to 99.996%

Natural Cooling Verified by Telecom & Solar Application*

* For 3–10KTL inverter models

Station Phase II, 200 units, 963 running days
Failure Rate: 0.189%

Station Phase III, 4939 units, 583 running days
Failure Rate: 0.252%

Station Phase IV, 1790 units, 207 running days
Failure Rate: 0.390%

High efficient thermal design to ensure low temperature within enclosure
01 Company Introduction

02 FusionSolar 24h Green Power Home Solution

03 Summary
One-Fits-All
Solution, Easier Business

1. One Optimizer
2. One Battery
3. One Inverter
4. One APP
5. One Service Window

Easier Selection
One optimizer fits most poly & mono PV module in the market

Easier management
One optimizer model simplifies PO, stock and spare part management

Easier Compatibility
One ESS fits both single & three phase residential inverters

Easier Support
One supplier provides all product marketing and training support

Easier Commissioning
One App auto detects & configures all system components

Easier Operating
One inverter fits both on grid and off grid operating (via backup box).

Easier Service
One Service window for all system components on pre & after sales.

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Thank you.