

MOST EFFICIENT PV DESIGN

Huawei SUN2000-50K-MC0 with LONGi LR8-66HVD-650M Anti-Glare, based on both manufacturers' datasheets

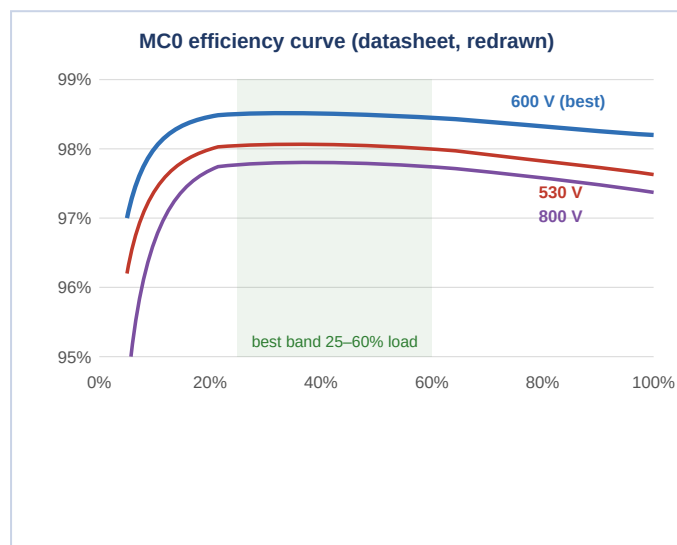
Result. The most efficient pairing is **6 strings × 16 panels = 96 panels, 62.4 kWp (DC/AC 1.25)**, wired **1 / 2 / 2 / 1** on MPPT 1 to 4. It keeps the MPPT voltage at about **600 V**, the inverter's best point, for most of the day. It runs the inverter mainly in its 25–60% high-efficiency load band, stays inside every current limit, and has no AC clipping. Estimated output is about **89,300 kWh/year (≈1,430 kWh per kWp)**, the highest yield per panel of all layouts tested.

1. Datasheet values used

Huawei SUN2000-50K-MC0	Value	LONGi LR8-66HVD-650M	Value
Max. / European efficiency	98.5% (400 V) / 98.2%	Pmax / efficiency (STC)	650 W / 24.06%
Rated input voltage	600 V	Voc / Vmp	49.72 V / 40.98 V
MPPT range / start voltage	180–1,000 V / 180 V	Isc / Imp	16.54 A / 15.86 A
Max. input voltage	1,100 V	With 10% rear gain: Isc / Imp	18.11 A / 17.36 A
MPPTs / inputs	4 / 8 (2 per MPPT)	With 20% rear gain: Isc / Imp	19.75 A / 18.94 A
Max. current per input	23 A	Temp. coeff. Voc / Isc / Pmax	−0.20 / +0.05 / −0.26 %/°C
Max. current per MPPT (1/2/3/4)	30 / 33 / 33 / 30 A	Nominal operating cell temp.	45 ± 2 °C
Max. short-circuit current per MPPT	40 / 44 / 44 / 40 A	Max. system voltage / series fuse	1,500 V / 35 A
Rated / max. AC power	50 kW / 55 kW	Size / mounting-hole pitch	2382 × 1134 mm / 1,400 mm

Design conditions (Chiang Rai): coldest cell temperature 0 °C; cell temperature about 52 °C in typical operation and about 61 °C at clear-sky noon (from the 45 °C nominal operating temperature with 30 °C air); Vmp temperature coefficient taken as −0.30 %/°C (Pmax −0.26 %/°C less the current gain); rear-side gain 10% for a roof or normal ground.

2. The inverter's best operating point



Read from the MC0 datasheet curve:

- **600 V** gives the highest efficiency, about 98.5%.
- 530 V is about 0.4% lower and 800 V about 0.6–0.7% lower.
- Efficiency is flat from about 25% to 60% load and falls quickly below 10%.

Design targets:

- MPPT voltage close to 600 V in normal daytime operation.
- Array size that keeps the inverter in the 25–60% band for most hours, without pushing it into clipping at noon.
- Currents inside each MPPT's rating, so the inverter never has to move off the maximum power point.

3. String length: matching the panel to 600 V

Panels per string	Voc at 0 °C (limit 1,100 V)	Vmp at 61 °C (clear noon)	Vmp at 52 °C (typical operation)	Vmp at 25 °C	Year-average Vmp (irradiance-weighted)	Fit to 600 V
15	783 V	548 V	565 V	615 V	579 V	Very good (−3%)
16	835 V	585 V	603 V	656 V	618 V	Best (+3%)
17	888 V	621 V	640 V	697 V	656 V	Good (+9%)
18	940 V	658 V	678 V	738 V	695 V	Good (+16%)
20	1,044 V	731 V	753 V	820 V	772 V	Far from 600 V; little voltage margin

A 16-panel string runs at about 603 V at the typical 52 °C cell temperature, almost exactly the inverter's 600 V rated and best-efficiency point, and its Voc of 835 V at 0 °C leaves a 24% margin below 1,100 V.

4. Current check per MPPT (datasheet rear-gain values)

Strings on the MPPT	I _{mp} , 10% rear gain	I _{sc} at 70 °C, 10% / 20% rear gain	MPPT 1 and 4 (30 A / 40 A)	MPPT 2 and 3 (33 A / 44 A)
1 string	17.4 A	18.5 A / 20.2 A	OK, full headroom	OK
2 strings	34.7 A	37.0 A / 40.4 A	Current-limited above about 865 W/m ² ; 40.4 A over limit with 20% gain	OK; only touches 33 A above about 950 W/m ² (negligible)

Two strings belong on MPPT 2 and 3, whose 33 A / 44 A ratings fit this panel. On MPPT 1 and 4, one string is the efficient choice. Every input carries at most one string (≤ 20.2 A, inside the 23 A input limit). With at most two strings per MPPT the reverse current into a faulty string stays below the panel's 35 A series-fuse rating, so no string fuses are needed.

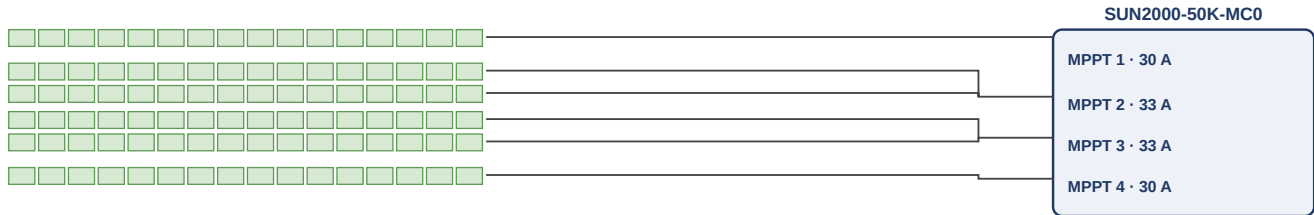
5. Layouts compared

Layout (strings on MPPT 1/2/3/4)	Panels	kWp	DC/AC	Avg. Vmp	Est. kWh / year	kWh per kWp	Current limit	AC clipping
4 × 20 (1/1/1/1)	80	52.0	1.04	772 V	74,000	1,425	0%	0%
6 × 15 (1/2/2/1)	90	58.5	1.17	579 V	83,700	1,430	0.02%	0%
6 × 16 (1/2/2/1) — most efficient	96	62.4	1.25	618 V	89,300	1,430	0.02%	0%
6 × 17 (1/2/2/1)	102	66.3	1.33	656 V	94,700	1,428	0.02%	0%
6 × 18 (1/2/2/1)	108	70.2	1.40	695 V	100,100	1,426	0.02%	0.1%
8 × 15 (2/2/2/2)	120	78.0	1.56	579 V	110,300	1,414	0.2%	0.8%
8 × 16 (2/2/2/2)	128	83.2	1.66	618 V	116,200	1,397	0.2%	2.0%
8 × 20 (2/2/2/2)	160	104.0	2.08	772 V	134,400	1,292	0.2%	8.8%

Estimated with a simplified model of a Chiang Rai year (calibrated to about 1,430 kWh per kWp), the datasheet efficiency curve (voltage and load), the panel's temperature behaviour and rear-gain currents, each MPPT's current limit and the 55 kW AC limit. Not based on site weather data; use the figures to compare layouts. The figures refine the earlier maximum-input note using the two datasheets.

6. Recommended design

Most efficient: 6 strings × 16 panels = 96 panels = 62.4 kWp (MPPT 1/2/2/1)



Each string: Voc 835 V at 0 °C · Vmp about 603 V in typical operation (585–705 V over the year) · Imp 15.9 A (17.4 A with rear gain) · 10.4 kWp

Free inputs: one on MPPT 1 and one on MPPT 4, for a later 16-panel string each (up to 128 panels)

Figure 2 — Most-efficient string layout. Each pair of strings joins at the inverter's own two inputs on MPPT 2 and 3.

7. Recommendation

- **Most efficient: 6 strings × 16 panels = 96 panels (62.4 kWp), MPPT 1/2/2/1.** About 603 V operating voltage at the inverter's best point, high-efficiency load band most of the day, no current limiting worth counting and no clipping. Works on a roof, on the ground and on a carport.
- **If you need more energy** while staying almost as efficient: 6 × 18 = 108 panels (70.2 kWp, 1,426 kWh per kWp, clipping 0.1%) uses the same wiring with longer strings.
- **Higher ratios** (8 strings, 120–160 panels) produce more energy in total, but each panel works less efficiently because of clipping and the 30 A limit on MPPT 1 and 4. Choose them only when panels are cheap compared with the value of the energy.
- Keep all strings on one MPPT the same length, orientation and tilt. Mount panels on the 1,400 mm hole pitch shown in the LONGi datasheet.
- Ask our supplier to confirm that Huawei's warranty covers the chosen DC/AC ratio; for a grid-connected system, also check PEA's requirements (the MC0 lists PEA among its grid standards).

Sources: Huawei SUN2000-50K-MC0 datasheet (specification and efficiency curve); LONGi Hi-MO X10 Anti-Glare LR8-66HVD 640–665M datasheet. Energy figures are model estimates; confirm the final design against site conditions.