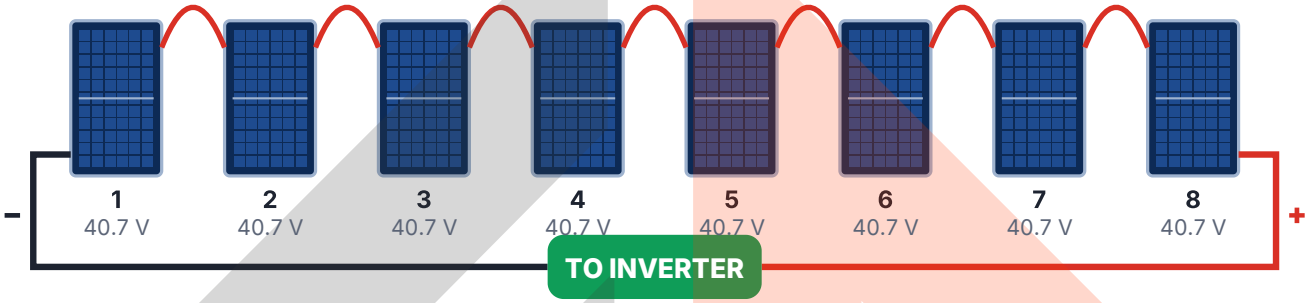
IN PLAIN WORDS · FOR THE SYSTEM OWNER

Connecting solar panels

How to build a solar array properly, calculate the voltage with a frost margin, fit the protection and choose the battery. One guide for all our inverters.



Example array	Array power	String voltage (Vmp)	Per year (London, south)
8 × 630 W	5.04 kW	≈ 326 V	≈ 5 140 kWh

Contents

1. What a panel, a string and an array are — p. 2
2. Series or parallel — p. 3
3. String voltage and the 20 % winter margin — p. 4
4. Shade, orientation and two arrays — p. 5
5. Protection: fuses, surge arrester, DC breaker — p. 6
6. Mounting and wiring step by step — p. 7
7. The battery must be three times larger — p. 8
8. 12, 24 or 48 V: which is best for solar — p. 9
9. 4, 6 or 8 panels: which to choose — p. 10
10. Monthly solar output in London — p. 11
11. South, east, west: the difference — p. 12
12. Table for your inverter — p. 13
13. Pre-start check and questions — p. 14

Three rules that save the inverter

- **String voltage with a 20 % margin** must stay below the inverter maximum (usually 500 V).
- **Between the panels and the inverter:** fuses, a surge arrester and a DC breaker.
- **Battery (kWh) ≥ 3 × panels (kW).** Otherwise the solar energy has nowhere to go.

Danger to life

A string of panels produces **over 300 V DC** as soon as light falls on it, even in cloudy weather. It cannot be switched off with a switch. Installation by a qualified person only.

Figures are for a 630 W panel (monocrystalline, bifacial). For other panels the method is the same: use their Voc and Vmp from the label.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved

+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

1 What a panel, a string and an array are

A solar panel is a "battery" that gives direct current when the sun shines on it. On its own one panel gives only ≈ 41 V, too little for an inverter. That is why panels are connected into a **string.**

String

Several panels connected **in series:** the "plus" of one to the "minus" of the next, like batteries in a torch. The panel voltages add up. The two end wires of the string go to the inverter.

Array

All panels that have the **same tilt and orientation** (for example, on the south-facing roof slope) and are connected to **one MPPT input** of the inverter. In our examples an array is one string of 8 panels.

What the panel label says (630 W)

Symbol	What it is	630 W
Pmax	Power under laboratory conditions (STC)	**630 W**
Vmp	Operating voltage when the panel gives its maximum	**40.7 V**
Imp	Operating current	**15.48 A**
Voc	Open-circuit voltage: no load, the highest	**48.9 V**
Isc	Short-circuit current	**16.18 A**
β Voc	How the voltage changes with temperature	**−0.275 %/ °C**
Size	Length × width × thickness	2383 × 1133 × 30 mm
Fuse	Max. series fuse	35 A

What MPPT is

The solar charge controller inside the inverter. It constantly "searches" for the string voltage at which the panels give the most energy and converts it into battery charge and power for the house. Each MPPT input works with its own array.

STC is a laboratory

1000 W/m² of sun and +25 °C on the panel itself. In summer a panel heats up to +60…70 °C and gives 10–15 % less; on a clear frosty day it is the opposite: the voltage rises. This matters for the calculation (p. 4).

Bifacial panel

Also collects reflected light on the back: +5…10 % over a light surface (snow, light roof, gravel). The current then reaches ≈ 17.9 A.

Units you will meet below

kW (kWp) — panel power. 8 × 630 W = 5 040 W = **5.04 kW.**

kWh — energy: how much is "stored" in the battery or produced per day / month. 1 kWh = a 2 kW kettle for 30 minutes.

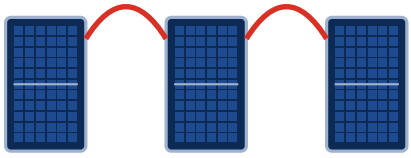
V / A — voltage and current. Power = voltage × current: 326 V × 15.48 A ≈ 5 040 W.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

2 Series or parallel

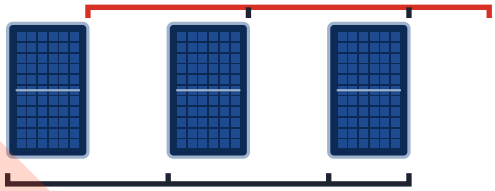
Panels can be connected in two ways. For our inverters and 630 W panels the right one is **in series.**

IN SERIES voltage adds up



40.7 + 40.7 + 40.7 = **122 V,** current 15.5 A

IN PARALLEL current adds up



voltage 40.7 V, current 15.5 × 3 = **46 A**

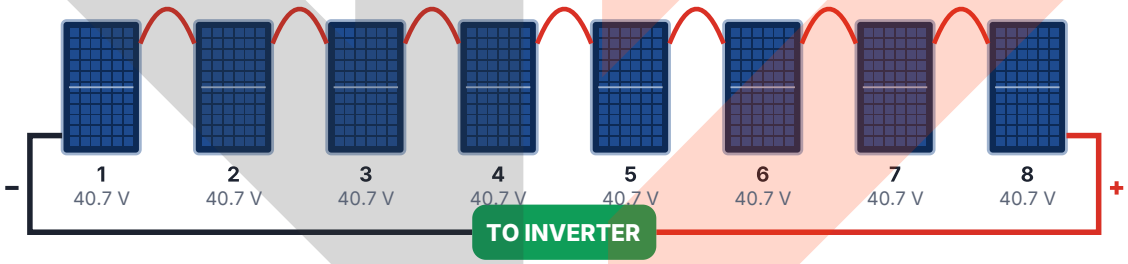
Why in series

- The inverter needs a high voltage: its solar input is rated for **60–450 V** (on some models 40–500 V).
- At high voltage the current is low (15.5 A), so a standard **6 mm²** solar cable will do; wire losses are under 1 %.
- Each panel adds ≈ 41 V: 8 panels = **≈ 326 V,** right in the "heart" of the MPPT range.

Why not in parallel

- One 630 W panel already gives 15.5 A. Two strings in parallel give 31 A, but the input of our inverters takes **15–27 A.** The inverter will not use the extra current, and the connectors heat up.
- The voltage of one panel (41 V) is below the MPPT start voltage (60 V).
- Parallel strings need a separate fuse on each string and exactly identical strings.

How to connect a string of 8 panels



1 **"+" of panel 1 → "–" of panel 2** and so on up to panel 8. MC4 connectors click: push until they click.

2 **Free ends: "–" of panel 1 and "+" of panel 8** — these are the string outputs. Run them to the DC box (p. 6).

3 **Identical panels in a string** One model, one power rating, one orientation and tilt. Do not mix: a string works like its weakest panel.

4 **Check with a multimeter** Voltage between the ends in sunlight ≈ 8 × 48.9 = 391 V (Voc). If it is ≈ 342 V, one panel is connected the wrong way round or not connected.

Run the string plus and minus side by side, without a large loop: a loop picks up induced voltage from lightning.

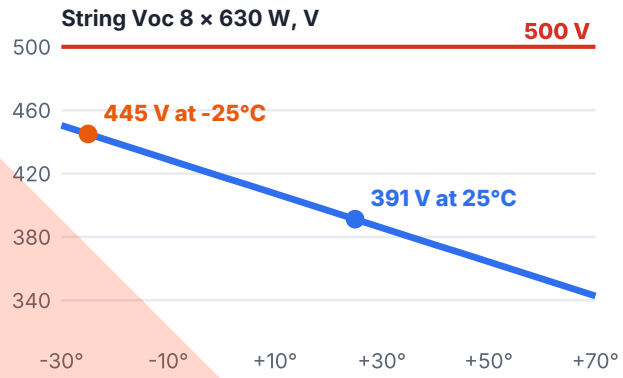
minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

3 String voltage and the 20 % winter margin

The most important rule: **the open-circuit voltage of the string (Voc) must never exceed the inverter's maximum input voltage;** for most of our models it is **500 V.**

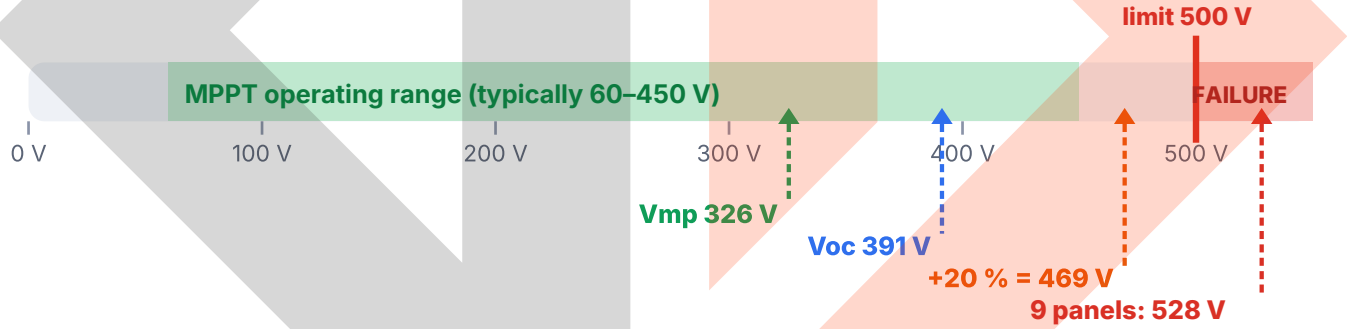
String of 8 panels 630 W:
operating voltage 8 × 40.7 = 326 V
open circuit 8 × 48.9 = 391 V
frost −25 °C 391 × 1.137 = 445 V
our margin +20 % 391 × 1.2 = 469 V
inverter limit 500 V ✔ OK

String of 9 panels: 9 × 48.9 × 1.2 = 528 V × not allowed



Why the voltage is higher in winter

The voltage of a solar cell rises when it is cold: for every degree below +25 °C a 630 W panel adds ≈ 0.275 % voltage. At −25 °C that is already +**14 %.** The worst moment is a **clear frosty morning:** the sun has just risen, the panels are cold, the battery does not need charging yet or the inverter is just switching on, so the input sees the full Voc, with no load.



Why exactly 20 %

14 % comes from a −25 °C frost. London is much milder (the coldest hour in 2005–2023 was −9.5 °C, ERA5), so the rest of the margin covers the spread in panel production, light reflected from snow and meter error. 20 % is a simple margin that needs no recalculation.

What happens if it is higher

Exceeding 500 V even for a few seconds breaks down the MPPT input transistors. The inverter fails, and this is **not covered by the warranty:** the manufacturer sees a PV overvoltage error in the log.

And if it is too low

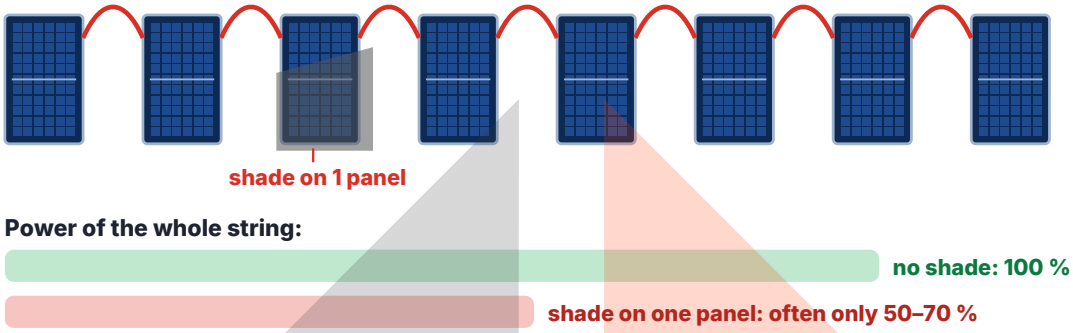
The lower limit is the MPPT start voltage (40–80 V depending on the model). A string of 2 panels already works, but 6–8 panels are best: 240–330 V, the highest efficiency and lower cable losses.

Simple check for any panel: Voc from the label × number of panels × 1.2 < inverter maximum. For 630 W: **58.7 V per panel →** no more than 8 in a string for 500 V, 7 for 450 V, 1 for 115 V.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

4 Shade, orientation and two arrays

In a string the same current flows through all the panels, like water in one hose. A shaded panel "pinches the hose" for all of them.



Why shade even on one panel is bad

- A shaded panel gives less current, and a series string cannot pass more than its weakest link.
- Bypass diodes in the panel junction box switch off the shaded part so it does not overheat, but its voltage disappears with it, and the MPPT "gets lost" between several peaks.
- Shade from a chimney, a tree, a neighbouring row or snow on the edge, and the string loses **30–50 %.**

How to avoid it

- Place the panels where there is no shade at all from **9:00 to 16:00,** even in winter (the sun is low then).
- Between rows of panels on the ground or a flat roof leave a gap so the front row does not shade the back one (p. 12).
- Do not mix panels facing different ways in one string.

Which way the panels should face

Best of all is **facing south** at ≈ 36° (in London the year-round optimum is 40°, and 36° gives practically the same). South-east or south-west gives ≈ 6 % less, east or west ≈ 22 % less over the year, and in winter less than half (p. 12).

Note: if the inverter has two solar inputs (2 MPPT)



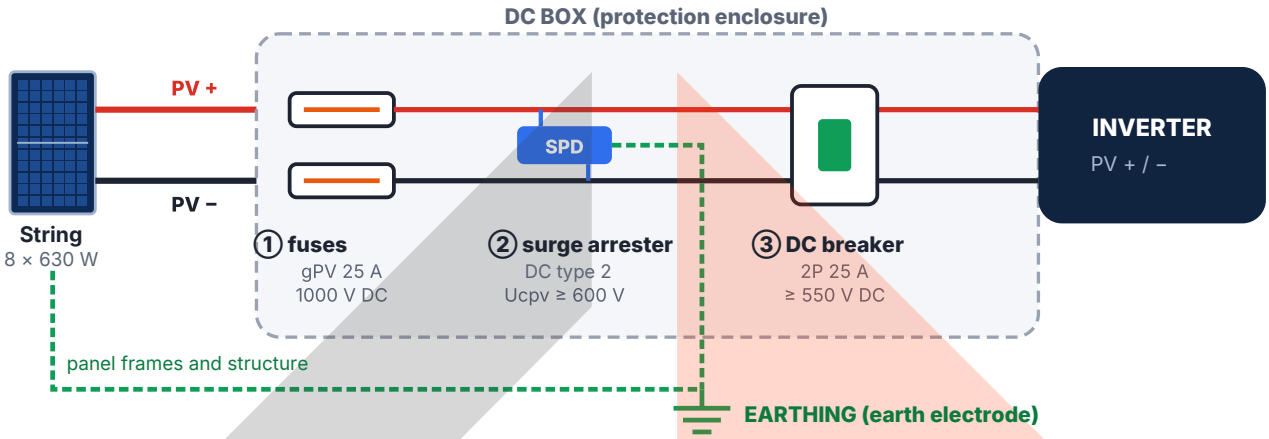
For example, **GSIKE 11 kW** and **POWLAND SMS-12KW 12 kW** have PV1 and PV2 inputs. Each input "searches" for its own maximum separately, so you can install **two arrays of 8 panels** facing different directions: east + west, south + west, two roof slopes.

East in the morning, west in the evening: the output is more even through the day, and the house runs longer without the grid. Each array has its own DC box and its own breaker. For inverters with one input: one array, one orientation.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

5 Protection: fuses, surge arrester, DC breaker

A **DC box** must be installed between the panels and the inverter: a small enclosure with three protective devices. It protects the inverter from lightning and short circuits, and lets you switch the panels off safely.



Device	Why	What to buy for 8 × 630 W
① **Fuses** on "+" and "–"	They blow on a short circuit in the cable or on reverse current. Mandatory for several strings; for one string they give protection and a handy isolator for repairs.	DIN-rail holders + **gPV 10×38, 25 A, 1000 V DC** fuse links (at least 1.25 × Isc and no more than 35 A from the label).
② **Surge arrester** (SPD)	Lightning nearby induces thousands of volts on long wires. The surge arrester dumps the pulse to earth within microseconds, bypassing the inverter. It does not work without earthing.	**DC SPD type 2** (or 1+2 for a house with a lightning rod), **Ucpv ≥ 600 V** (with a margin over 469 V), Imax ≥ 20–40 kA. Earth wire 6–16 mm², as short as possible.
③ **DC breaker** in the PV line	Switches the panels off under load. Direct current at 300+ V creates an arc that an ordinary household breaker cannot extinguish, so it must be a polarised DC breaker.	**2-pole DC breaker 25 A, ≥ 550 V DC** (preferably 1000 V DC), wired as shown on the housing (input "+" / "–").

Grounding

- Frames of all panels and the metal structure: yellow-green 6 mm² wire to the earth electrode.
- The surge arrester goes to the same electrode (up to 10 Ω). An AC surge arrester in the house panel is separate and recommended.
- **PV "+" and PV "–" are not earthed!** Our inverters are transformerless: this would break them.

Cable and connectors

- Solar cable only, **6 mm² (PV1-F, H1Z2Z2-K):** resistant to UV, frost and +90 °C. 4 mm² only up to 15 m.
- MC4 connectors of the same brand at both ends, crimped with a dedicated tool.
- Outdoors in UV-resistant conduit, without sagging or sharp edges.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

6 Mounting and wiring step by step

This order protects people and equipment. Remember: the panels are live all day long.

1 Planning
Choose a place without shade, calculate the string (p. 4 and 13), check that the battery is three times larger than the array (p. 8).

2 Mounting the structure
Mounts for 2383 × 1133 mm panels, tilt ≈ 36° facing south. Clamp at the frame edges in the zones given by the manufacturer; do not drill the frame.

3 Installing the panels
Leave a ventilation gap underneath. Do not connect the panel connectors yet. You can cover the panels with opaque film.

4 Earthing
Frames and structure to the earth electrode. Check the electrode resistance.

5 Mounting the DC box
Next to the inverter, indoors or in an IP65 enclosure. Fuses removed, breaker off.

6 Running the cable
From the panels to the DC box and from the DC box to the inverter: 6 mm², red "+" and black "−", labelled.

7 Assembling the string
Connect the panels in series. Check Voc and polarity at the ends with a multimeter; do not connect to the inverter yet!

8 Connecting the inverter
First the battery and inverter start-up (per its manual), then the wires from the DC box to the PV + / − terminals. Check polarity with a multimeter.

9 Switching on
Insert the fuses, switch on the DC breaker. The PV voltage appears on the inverter screen, and the power within a minute.

10 Checking
PV voltage ≈ 280–340 V under load. Power at a clear noon of 3.5–4.5 kW for 8 × 630 W is normal.

Never disconnect MC4 connectors under load. Switch off the DC breaker first. A connector carrying 15 A at 300 V draws an arc that burns hands and melts the connector.

Switching off: PV DC breaker → inverter output → inverter → battery. Switching on in reverse order: battery → inverter → PV.

Why the power is lower than 5 040 W, and that is normal

630 W is a laboratory figure. On the roof the panel heats up, the sun is not always at a right angle, and the cable and conversion take their share. At a clear noon in May–August expect 3.7–4.4 kW from 8 panels in London; at noon in December, 1.2–2.0 kW. If the battery is full and the house uses little, the inverter itself reduces what it takes from the panels: it takes only as much as is needed.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

7 The battery must be three times larger

The battery capacity in kWh must be at least 3 times the panel power in kW. 8 panels = 5.04 kW → battery from ≈ 15 kWh.

Why exactly this

During the day the sun gives up to 4.5 kW. If consumption in the house is low, all of it goes into the battery. A LiFePO4 lithium battery lives longest when charged at up to ≈ 0.3 of its capacity (0.3 C). The "× 3" rule ensures exactly this: even when all the solar goes into the battery, the current is comfortable for it.

Besides, on a summer day in London 8 panels give 18–21 kWh. A small battery is full by midday, and after that the sun simply **has nowhere to go:** you paid for panels that stand idle half the day.

What happens with a small battery

- A high charge current heats the battery and wears the cells faster; the BMS may cut off charging, and errors appear.
- You have to limit the charge current in the inverter menu, and then the panels still work at only a quarter.
- The result: money spent on panels, and no evening energy reserve.

So panels **are not worth fitting** to a small system (1–2.5 kWh): either buy a bigger battery straight away or do without solar.

How much battery for 4, 6 and 8 panels

Array	Power	Min. battery	at 24 V	at 48 V
4 panels	2.52 kW	**from 7.6 kWh**	295 Ah	148 Ah
6 panels	3.78 kW	**from 11.3 kWh**	443 Ah	221 Ah
8 panels	5.04 kW	**from 15.1 kWh**	591 Ah	295 Ah

And the other way round: how many panels your battery can take

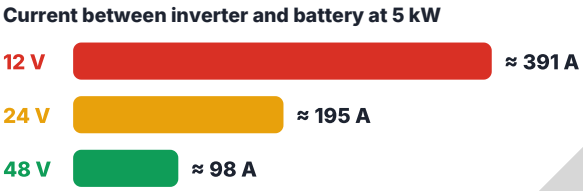
Battery	kWh	Panels up to (÷ 3)	630 W panels
12 V 100 Ah	1.28	427 W	**panels not worth it**
24 V 100 Ah	2.56	853 W	**up to 1** (630 W)
24 V 150 Ah	3.84	1 280 W	**up to 2** (1 260 W)
48 V 100 Ah	5.12	1 707 W	**up to 2** (1 260 W)
24 V 314 Ah	8.04	2 680 W	**up to 4** (2 520 W)
48 V 314 Ah	16.07	5 357 W	**up to 8** (5 040 W)
48 V 628 Ah	32.20	10 733 W	**up to 17** (10 710 W), several arrays

Several identical batteries in parallel add capacity: 3 × 48 V 100 Ah = 15.4 kWh, enough for 8 panels. The battery charge current is also set in the inverter menu, per the manual of your inverter and battery.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

8 12, 24 or 48 V: which is best for solar

Short answer: **for solar panels a 48 V system is best.** 24 V is fine for a small array (up to 4–6 panels). 12 V means only 1–3 panels: a system "for lights and the router".



It makes no difference to the panels: the voltage at the MPPT input is the same (hundreds of volts). The difference is **after** the MPPT, between the inverter and the battery. At 12 V the same power needs four times the current as at 48 V.

Power = voltage × current. Half the voltage means twice the current and four times the heating of wires and terminals with the same cable.

	12 V	24 V	48 V
How much solar the charger takes	40–100 A × 13 V ≈ **0.5–1.4 kW**	100–120 A × 27 V ≈ **2.7–3.2 kW**	120–160 A × 54 V ≈ **6.5–8.6 kW**
Max. panels (our inverters)	1–3 panels	6–8 panels	8, or 16 with 2 MPPT
Battery current at 3 kW	≈ 235 A	≈ 120 A	≈ 60 A
Battery cable (1–2 m)	50–70 mm², very thick	25–35 mm²	16–35 mm²
Losses and heating	highest	medium	lowest, higher efficiency
Inverter power	1–2 kW	3.3–5 kW	6.2–12 kW, parallel, 3 phases
Who it is for	lights, router, boiler, laptop	flat, small house, 4–6 panels	house, full array of 8+ panels, room to expand

12 V

The solar charge controller is small (up to 0.6–2 kW), so one 630 W panel is already at or near the maximum. High currents, thick wires. For solar it is **poor.**

24 V

8 panels can be connected, but on a clear day charging is limited to ≈ 3 kW; the rest of the solar is used only by the house. **4–6 panels** is the best balance.

48 V

A 120–160 A controller takes the whole 8 × 630 W array without limits, lower losses, easy to add a battery or a second inverter. If you plan solar, **choose 48 V.**

Tip: if solar is planned for "some time later", buy a 48 V inverter and battery right away. Switching from 24 to 48 V later means replacing both the inverter and the battery.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

9 4, 6 or 8 panels: which to choose

We recommend three array options. Each is one string, so there is nothing to calculate: all are safe for inverters with a 500 V limit.

4 panels · Economy

2.52 kW

When you want to save on the battery and do not need much. Covers the fridge, lights, router, boiler during the day and partly charges the battery.

Per year, kWh	**2 570**
July day, kWh	**10.0**
December day, kWh	**3.0**
String, V*	163 / 235

Battery: from 7.6 kWh (24 V 314 Ah or 2 × 48 V 100 Ah)

System: 24 or 48 V

6 panels · Compromise

3.78 kW

You want to save, but by your calculations the power is enough: during the day it powers the house and charges the battery for the evening.

Per year, kWh	**3 855**
July day, kWh	**15.0**
December day, kWh	**4.5**
String, V*	244 / 352

Battery: from 11.3 kWh (3 × 48 V 100 Ah or 48 V 314 Ah)

System: 24 V (limit ≈ 3 kW) or 48 V

8 panels · Standard

5.04 kW

Full array: in summer it covers most of the house's needs, in spring and autumn a large part, in winter it helps.

Per year, kWh	**5 140**
July day, kWh	**20.0**
December day, kWh	**6.0**
String, V*	326 / 469

Battery: from 15.1 kWh (48 V 314 Ah or 3 × 48 V 100 Ah)

System: 48 V (best)

How to choose

Choose 8 if

- 48 V inverter from 6 kW;
- battery from 15 kWh;
- you want to live on solar from April to September.

Choose 6 if

- 24 V inverter 4–5 kW;
- battery 11–15 kWh;
- limited budget, moderate consumption.

Choose 4 if

- battery 7.5–11 kWh;
- you need support during the day, not autonomy;
- little roof space.

Do not fit panels if

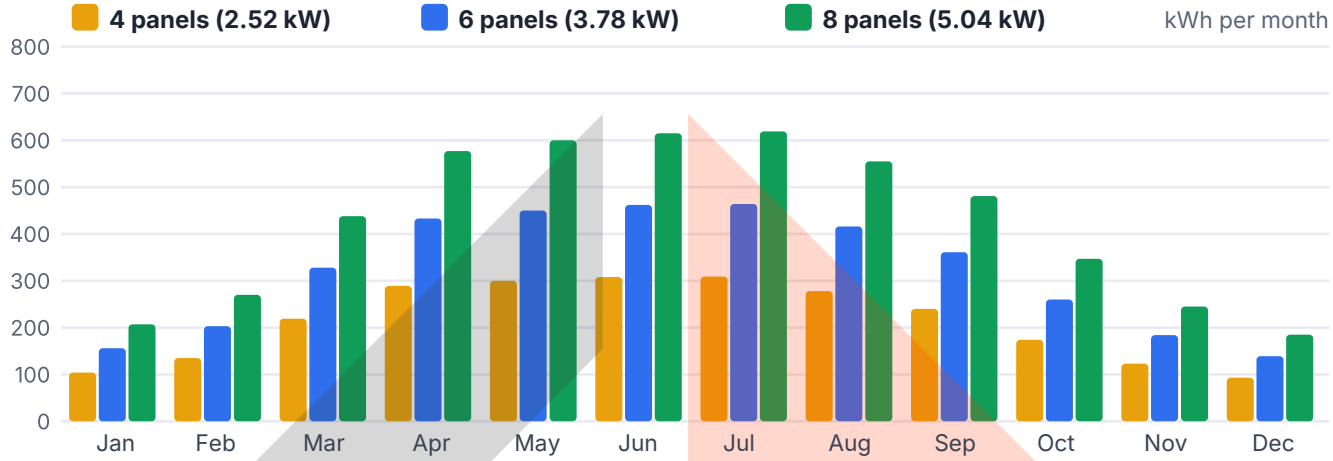
- battery smaller than 7.5 kWh (p. 8);
- the site is shaded most of the day;
- 12 V system: only 1–3 panels (p. 13).

South, 36°, London (PVGIS), kWh. *Operating voltage / Voc with a 20 % margin. Energy is useful when the house consumes it or there is room to charge the battery.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

10 Monthly solar output in London

Panels facing south, tilt 36°, no shade. Data from the European PVGIS database (average for 2005–2023) including panel heating, cables and conversion (losses 14 %).



Month	4 panels, kWh	per day	6 panels, kWh	per day	8 panels, kWh	per day
January	104	3.4	156	5.0	207	6.7
February	135	4.8	203	7.2	270	9.6
March	219	7.1	328	10.6	438	14.1
April	289	9.6	433	14.4	577	19.3
May	300	9.7	450	14.5	600	19.4
June	308	10.3	462	15.4	615	20.5
July	309	10.0	464	15.0	619	20.0
August	278	8.9	416	13.4	555	17.9
September	240	8.0	361	12.0	481	16.0
October	174	5.6	260	8.4	347	11.2
November	123	4.1	184	6.1	245	8.2
December	93	3.0	139	4.5	185	6.0
Per year	**2 570**	7.0	**3 855**	10.6	**5 140**	14.1

Summer and winter: a 3.3-fold difference

In July 8 panels give ≈ 20 kWh a day, in December ≈ 6.0. In winter the sun is low, the day is short and it is often cloudy. Panels are mainly a saving from March to October; in winter they help, but do not replace the grid or a generator.

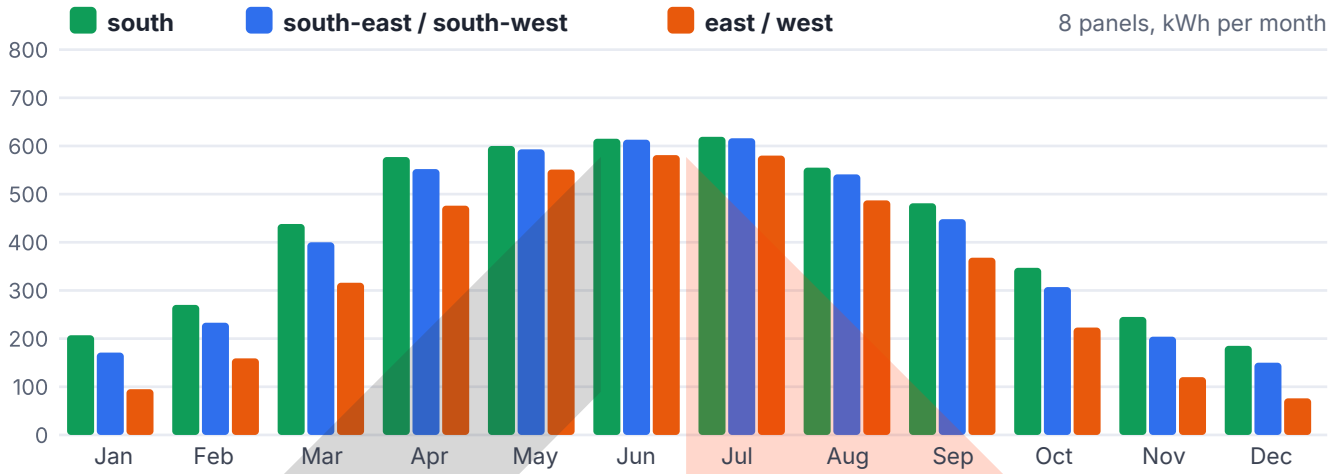
How to read the table

"Per day" is the monthly average: on a clear day it can be twice as much, on an overcast day 3–5 times less. How much of it you actually use depends on daytime consumption and battery capacity (p. 8).

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

11 South, east, west: the difference

The same 36° tilt, London. The further from south, the less energy, especially in winter.



Orientation	4 pan./yr	6 pan./yr	8 pan./yr	8 pan., Dec.	8 pan., July	vs south
South	2 570	3 855	5 140	185	619	**100 %**
South-east / south-west	2 414	3 621	4 827	150	616	**94 %**
East or west	2 016	3 024	4 033	76	580	**78 %**

kWh. South-east and south-west give almost the same (average of the two). East and west likewise.

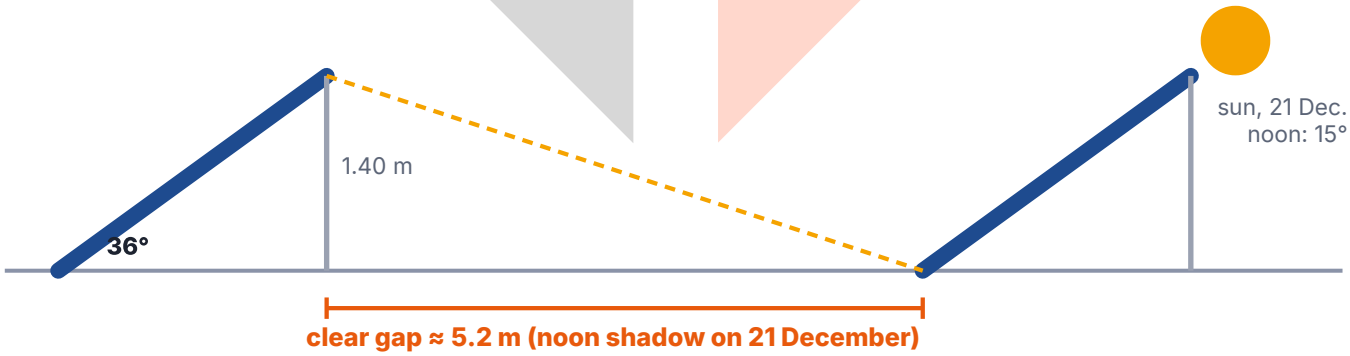
Tilt angle

For London the best year-round angle is **≈ 40°.** In winter steeper is better (60–70°, and snow slides off), in summer flatter (15–20°). Anywhere from 30° to 50° loses less than 2 % a year, so a 30–45° roof is excellent and needs no rework.

East + west on 2 MPPT

For GSIKE 11 kW and POWLAND SMS-12KW: 8 panels facing east (PV1) + 8 facing west (PV2) give ≈ 8 070 kWh a year in London and a smoother curve through the day: one array works in the morning, the other in the evening.

Row spacing on the ground or a flat roof



A 2.383 m panel at 36° rises 1.40 m. At noon on 21 December the sun in London is only 15° high, so the shadow is ≈ 5.2 m. A simpler rule: clear gap ≈ 3.7 × the height of the panel's top edge. Or put the panels in a single row.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

12 Table for your inverter

How many 630 W panels to put in one string for each model in the catalogue: with a 20 % frost margin and taking the input power into account.

Inverter	Battery	Inputs MPPT	Voc max, V	MPPT, V	PV max, W	PV current, A	Panels 630 W
EASUN SMS-6.5KP 6.5kW 48V WiFi	48 V	1	500	60–450	9000	27	**8**
POWGROW SMS-6.5KP 6.5kW 48V	48 V	1	500	60–450	9000	27	**8**
POWLAND SMS-6.5KP 6.5kW 48V WiFi	48 V	1	500	60–450	9000	27	**8**
JSDsolar J6500HC 6.5kW 48V	48 V	1	500	60–450	9000	27	**8**
GSIKE 6.2kW 48V WiFi	48 V	1	500	60–500	6500	27	**8**
EASUN SMT-6.2KW 6.2kW 48V	48 V	1	500	60–500	8500	27	**8**
GSIKE 11kW 48V WiFi · two arrays	48 V	2	500	60–500	2 × 5500	2 × 18	**2 × 8**
POWLAND SMS-12KW 12kW 48V WiFi · two arrays	48 V	2	500	60–450	15 000	2 × 22.5	**2 × 8**
POWGROW SMS-5kW 24V · *useful ≈ 4–5 kW	24 V	1	500	60–450	9000*	27	**8**
POWLAND SMS-5kW 24V WiFi · *useful ≈ 4–5 kW	24 V	1	500	60–450	9000*	27	**8**
Aninerel ANL-4200T 4.2kW 24V	24 V	1	500	60–500	5000	27	**8**
ANENJI ANJ-4000 4.2kW 24V WiFi · current up to 15 A	24 V	1	500	60–500	4500	15	**7**
JSDsolar J4000E 4kW 24V	24 V	1	500	40–450	5000	18	**8**
EASUN SMT-4KW 24V · 8 if the label says 5000 W	24 V	1	500	60–500	4000	15	**6**
ECGSOLAX HVM 3.6kW 24V	24 V	1	500	40–450	5000	18	**8**
POWGROW 3.6kW 24V · 8 if the label says 500 V	24 V	1	450–500	40–450	5000	18	**7**
DATOU BOSS 3.3kW 24V	24 V	1	500	40–450	5000	18	**8**
EASUN SMT-2KW 12V · 2 is better	12 V	1	500	30–500	2000	—	**3**
ECGSOLAX HVM 1.2kW 12V	12 V	1	115	17–115	800	18	**1**
ECGSOLAX 1kW 12V	12 V	1	150	20–150	600	—	**1**

If a string has 8 panels and "PV max" is 5000 W, that is fine: 5 040 W is a laboratory figure, in reality the panels give up to 4.5 kW, and the inverter limits the draw itself. A current of 15.5 A on inputs rated up to 15 A (ANENJI, EASUN SMT-4KW) is also limited by the inverter itself: the loss is only at a clear noon, 2–3 %.

Always check against the label on the housing of your inverter: manufacturers sometimes release revisions with different limits. If the label says Voc max 450 V, no more than 7 panels of 630 W; if 150 V, 2; if 115 V, 1.

12 V systems: ECGSOLAX 1kW and HVM 1.2kW take one 630 W panel (two already give 117 V with the frost margin, more than 115 V, or twice the allowed power). EASUN SMT-2KW: 2–3 panels (charging up to 100 A ≈ 1.4 kW). Three-phase kits of 3 inverters: each inverter has its own array.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com

13 Pre-start check and FAQ

Checklist before first switch-on

- All panels in the string are identical and face one way
- String Voc × 1.2 below the inverter Voc max (p. 13)
- No shade on the panels during the day
- Battery in kWh ≥ 3 × panels in kW
- DC box: gPV fuses, DC surge arrester, DC breaker
- Frames and structure earthed; PV "+" and "−" not earthed
- Solar cable 6 mm², MC4 of one brand, polarity checked
- Battery and inverter first, then PV

Write down for your system

Panels: _____

Voc / Vmp of one panel: _____

Number in the string: _____

String Voc × 1.2 = _____ V

Inverter Voc max (label): _____ V

Orientation / tilt: _____

Fuses / breaker / surge arrester: _____

Installation date, installer: _____

FAQ

Can I add more panels later?

In the same string only up to the limit from the table (for 500 V that is 8 panels of 630 W). More go on the second MPPT input, on a second inverter, or as a new string of the same panels in parallel if the inverter accepts that current (ours do not).

Can I mix panels of different power?

Not advisable. In a string all panels run at the current of the weakest one, so the stronger panel will give only as much as the weaker one.

Screen shows PV 0 W in sunshine: why?

The DC breaker is off or a fuse has blown; the battery is full and the house needs nothing; priority mode in the menu; the string voltage is outside the MPPT range.

Do the panels work in cloudy weather?

Yes, but they give 10–30 % of a clear day. The voltage, however, is almost full, so it is dangerous.

Do the panels need washing?

Rain cleans them. Once a year or after a dust storm: a soft brush and water without chemicals, early in the morning or in the evening when the glass is not hot.

Lightning struck nearby: what to do?

Inspect the surge arrester: if the window on the module is red, replace the plug-in module. Check the fuses.

Need help with the calculation?

Write or call us: we will calculate the string for your panels and inverter, and choose the battery and protection. Inverter settings are in the "Manual" of your inverter on the product page.

minertech.org · MinerTech® trademark · © 2017–2026, all rights reserved
+38 093 293 93 93 · +38 099 054 40 38 · Specialist Pavlo Leonidovych · strooks@gmail.com