



Solar Design: From Bill to Battery

A solar quote is a chain of dependent choices. Start with annual use, then make the panels, strings, inverter, wire, and battery agree.

Solar is not a panel-count decision. A useful early design makes every downstream component fit the energy target and the electrical limits.

Worked example from the live calculator

At 12,000 kWh a year, 4.5 peak sun hours, and 400 W panels, the live solar calculator recommends 9.1 kW, about 23 panels, for a 100% offset using its 0.80 derate.

Start with the bill, not the roof photograph

Annual kWh and peak sun hours set the array target. The system-size engine turns those inputs into kW and panel count for 80%, 100%, or 120% offset. A 100% target can be sensible, but future EV or heat-pump load and utility caps can move it.

Make strings and inverter agree before buying hardware

Panel count alone does not prove a design works. The string-sizing engine checks cold open-circuit voltage and operating voltage against the inverter window. The inverter-ratio engine then checks whether DC array size is sensible against AC capacity. Use manufacturer data, especially the cold-temperature voltage coefficient.

Treat wire and storage as separate constraints

A string that fits electrically can still lose too much voltage over a long DC run. Check conductor size at the actual distance. Battery reserve is a different decision: it follows critical daily kWh, autonomy days, chemistry, and usable depth of discharge, not the panel count.

Key takeaway. A credible solar concept is a compatible chain, not a panel total. Size energy first, then verify voltage, inverter ratio, conductor loss, and reserve.

Assumptions

- A planning design uses a full year of kWh, site-specific sun hours, equipment data sheets, and utility interconnection rules.

Sources

- NREL PVWatts sizing concepts
- NEC Article 690, verify local requirements

Frequently asked questions

Can I choose panels before an inverter?

You can shortlist panels, but do not finalize a quantity or string layout until the inverter voltage window and current limits are known.

Does a larger battery make a small array work?

No. Storage shifts energy in time. It does not create annual production, so the array still has to cover the intended load.

Is this a permit-ready design?

No. It is a planning sequence. Final design needs site conditions, equipment listings, utility rules, and local code review.

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