

AGRICULTURAL ENGINEERING GUIDE · 2026

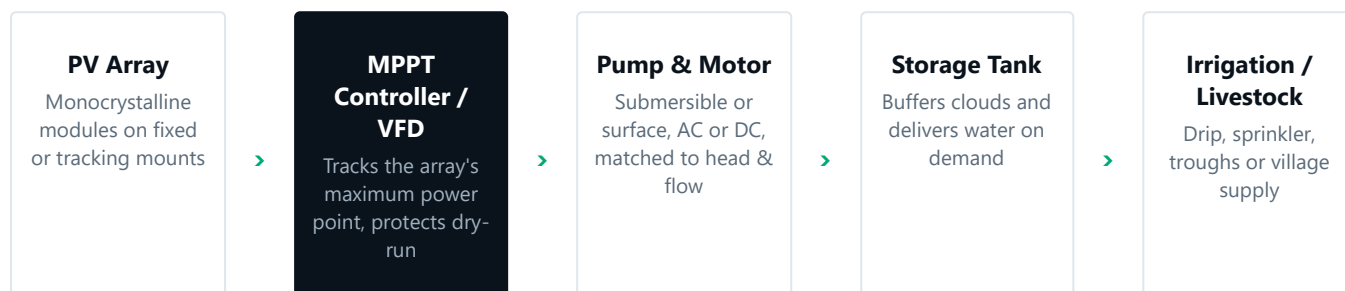
Farm Solar Pumping Solution Guide

How to size a reliable, low-maintenance solar water pumping system — from daily water demand and total dynamic head to PV array, controller and off-grid backup.

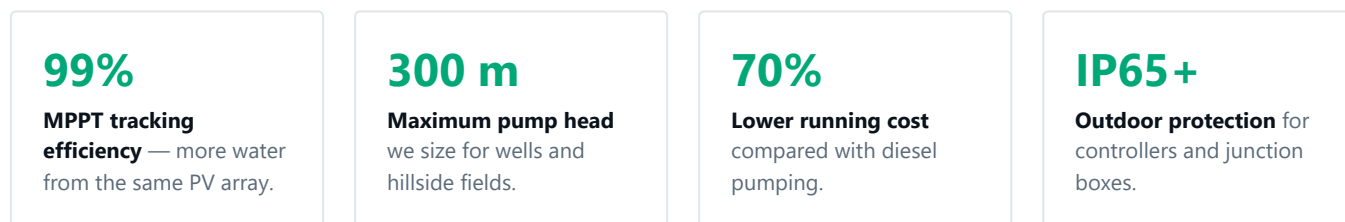
01 · UNDERSTANDING THE SYSTEM

Start with the water, not the wattage.

A solar pumping system is sized around three physical facts: how much water you need each day, how high and how far it must travel, and how much sun your site receives. Panels and pumps follow from those numbers — not the other way around.



Because water itself is the storage medium, most daytime irrigation systems need no battery at all. Batteries enter the design only when water must be pumped before sunrise, after sunset, or through consecutive cloudy days.



Solar pumping system — PV array, MPPT controller and submersible pump package.



Optional battery storage for night-time or cloudy-day pumping.

02 · SIZING WALKTHROUGH

Six steps from farm data to a bankable BOM.

1 Establish daily water demand

Irrigation: crop area × peak seasonal water requirement. Livestock: head count × daily consumption. Add 10–15% for evaporation, leaks and future expansion. Design for the **peak week**, not the annual average.

2 Calculate total dynamic head (TDH)

TDH = static lift + drawdown + pipe friction + discharge pressure head. Include fittings, valves, filters and the height of the tank inlet. Undersizing head is the most common cause of low flow.

$$\text{TDH (m)} = H_{\text{static}} + H_{\text{drawdown}} + H_{\text{friction}} + H_{\text{pressure}}$$

3 Convert water demand into hydraulic energy

Use the hydraulic power formula with Q in m³/h and H in metres, then divide by pump and controller efficiency to get electrical energy.

$$P_{\text{hydraulic}} \text{ (kW)} = Q \times H \div 367 \quad \cdot \quad E_{\text{day}} \text{ (kWh)} = Q_{\text{day}} \times \text{TDH} \div 367 \div \eta_{\text{system}}$$

4 Size the PV array against local sun hours

Divide daily electrical energy by peak sun hours (PSH) at the site, then add 20–30% for temperature, soiling and inverter losses.

$$\text{Array (kWp)} = E_{\text{day}} \div \text{PSH} \times 1.25$$

5 Match the pump, controller and well

Select a pump whose best-efficiency point sits at your duty flow and TDH. Confirm well diameter, casing depth, sand content and water quality. The MPPT controller must accept the array's open-circuit voltage and provide dry-run, over-voltage and lightning protection.

6 Decide on tank and backup autonomy

Size the tank for 1–2 days of demand where terrain allows. Add battery storage only for night-time or critical supply, and size it on critical load × autonomy days ÷ usable depth of discharge.

Worked example. 50 m³/day at 80 m TDH, 5 peak sun hours, 55% system efficiency → 19.8 kWh/day → about 4.0 kWp, specified as 4.8 kWp after losses. A 5 kW MPPT controller and a 4-inch submersible pump cover the duty point.

03 · TYPICAL CONFIGURATIONS

One platform, four ways to run your farm.

Application	Daily water	Typical TDH	Recommended package
Crop irrigation	20–200 m ³	20–150 m	3–30 kWp array + MPPT controller + 4–6" submersible pump + drip/sprinkler kit
Livestock watering	5–50 m ³	30–200 m	2–15 kWp array + controller + submersible pump + elevated or pressure tank
Village / community supply	10–100 m ³	30–250 m	3–20 kWp array + controller + pump + 10–50 m ³ storage + chlorination
Cold storage & processing	—	—	5–30 kW PV + hybrid inverter + 20–100 kWh battery + generator input

Daytime direct pumping

Simplest and lowest cost. Water is pumped while the sun shines and stored in a tank or reservoir. No battery, minimal maintenance.

Pump + tank buffer

Adds 1–2 days of tank capacity so irrigation continues through short cloudy periods without oversizing the array.

Battery-backed pumping

For night-time or critical supply: PV + MPPT + battery + hybrid inverter, with the pump fed from DC or AC bus.

Generator hybrid microgrid

PV and battery carry daytime loads; the generator starts only as backup. Ideal for remote farms with existing diesel sets.

What changes with an off-grid microgrid

When the same array also powers cold rooms, workshop tools or farm housing, size the inverter on simultaneous surge loads — motor starting can draw 3–6× rated current. Keep pumping and household circuits on separate feeds so a pump fault never darkens the farm.

Design rule of thumb. Every 10 m of additional head costs roughly the same pumping energy as 10% more flow. Fix the plumbing before adding panels: larger pipe, fewer elbows and a correctly sized pressure tank are usually cheaper than extra kWp.

04 · WORKING WITH SOLHON

One contract. From design to delivery.

We integrate PV modules, pump controllers, mounting structures and BOS components into a single matched package — with one QC standard and one consolidated shipment.

Send us these six numbers

- ☒ Daily water volume (m³/day) and peak season
- ☒ Well depth, static water level and drawdown
- ☒ Horizontal pipe run and delivery height
- ☒ Crop type, irrigation method and area
- ☒ Site location and average peak sun hours
- ☒ Backup requirement (hours or days per year)

What the quotation includes

- ☒ PV array sizing and module datasheets
- ☒ Pump curve and MPPT controller selection
- ☒ Mounting, cabling and protection BOM
- ☒ Packing list and container loading plan
- ☒ Factory QC report and test records
- ☒ Installation guide and after-sales support

Typical scope we quote

Pumping packages

1–200 kW solar pump systems with submersible or surface pumps, MPPT controllers and mounting.

Hybrid inverters

Single- and three-phase hybrid inverters for farm backup and off-grid microgrids.

Battery storage

Outdoor air- or liquid-cooled ESS cabinets from 20 to 261 kWh for night-time supply.

BOS & mounting

PV cables, connectors, combiner boxes and ground, rooftop or agri-PV mounting structures.

Plan your farm energy system.

Tell us your crop, daily water demand and farm location. Our engineers will return a tailored BOM and quotation within 24 hours.

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Solar pumping · Off-grid ESS

This guide provides general engineering direction. Final system design must be verified against site survey data, local electrical codes and the selected pump manufacturer's performance curves. Specifications subject to change without notice. © 2026 Solhon. All rights reserved.