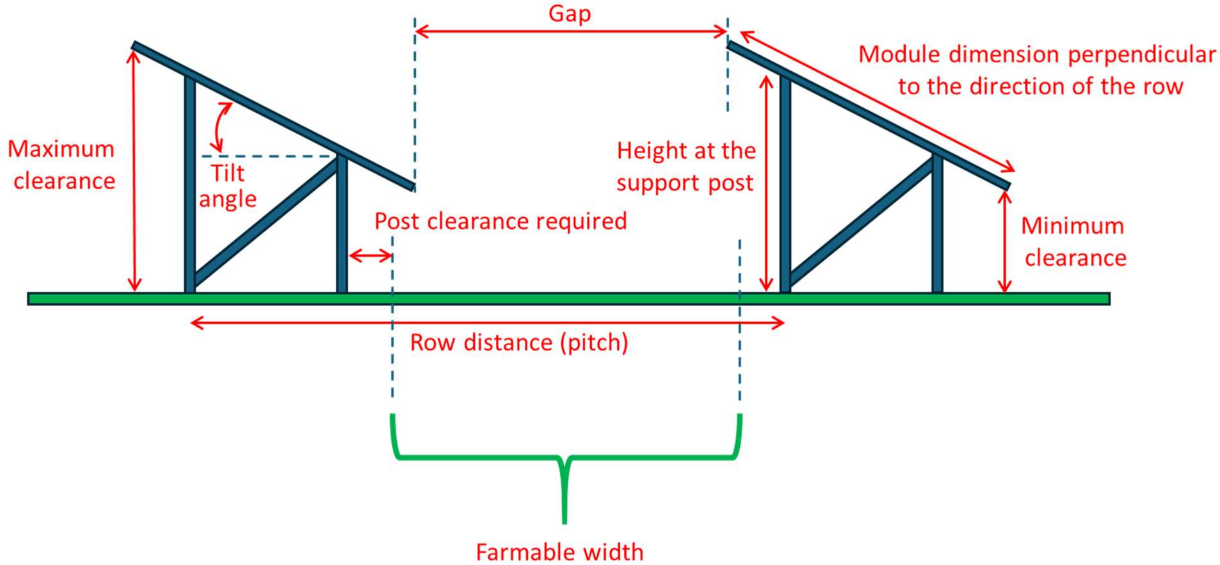
December 2025

Key Dimensions and Calculations for Agrivoltaic Installations

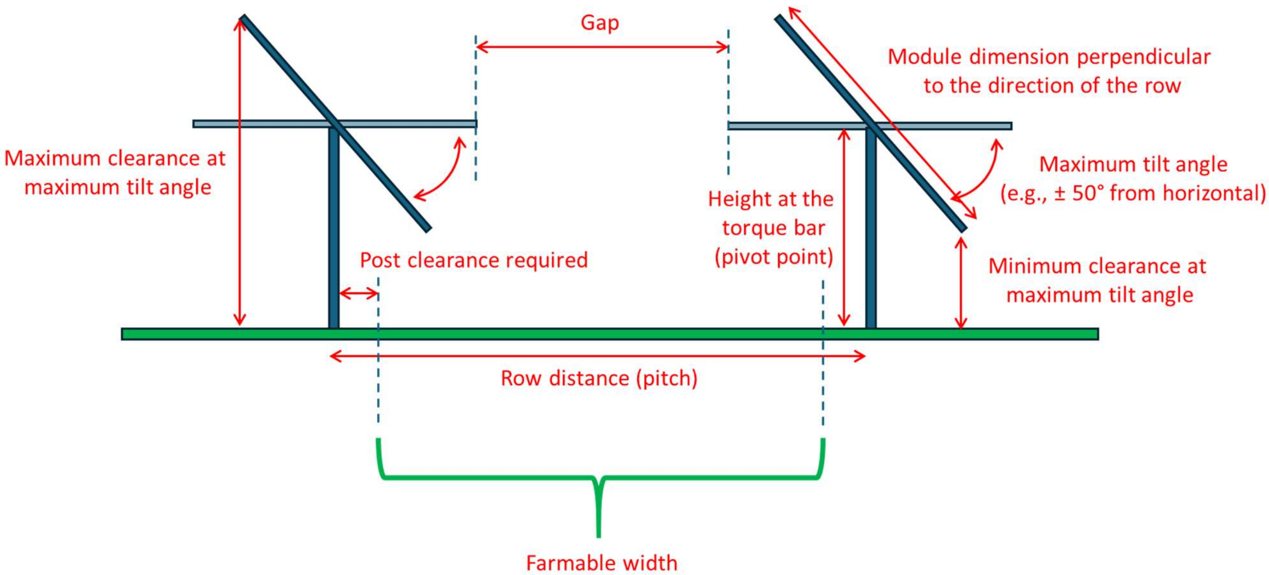
This information sheet discusses key dimensions and calculations used for agrivoltaic installations. Three different array designs are included: Fixed-tilt arrays, single-axis trackers, and vertical bifacial systems. In addition, the concepts of land equivalent ratio (LER) and levelized cost of energy (LCOE) are discussed.

Key Dimensions for Fixed-Tilt Arrays:



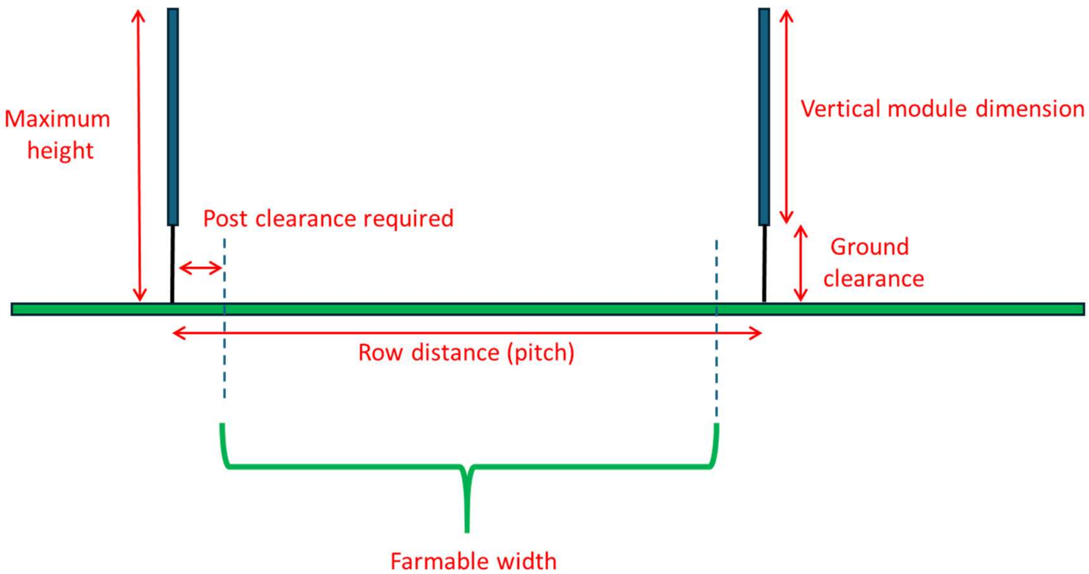
Note: Some fixed-tilt arrays use a single support post with a cross-brace for each row, which might allow a larger farmable width, depending on having equipment fit under the array on either high or low side.

Key Dimensions for Single-Axis Trackers:



Note: Supports for some single-axis tracker arrays consist of post configurations with a wider ground-level footprint causing a possibly smaller farmable width. For taller equipment, the farmable width may end up being only as big as the gap (with additional clearance needed on both sides). Also, some array brands have driveshaft components that connect between rows. This may also impede full length access along the rows depending on the specific geometry.

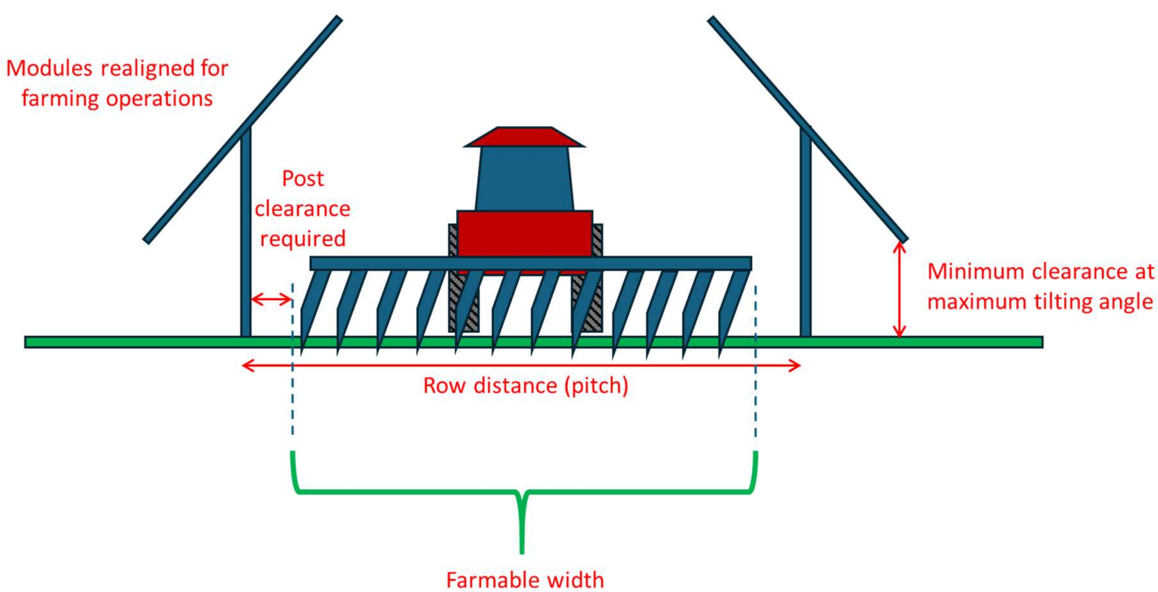
Key Dimensions for Vertical Bifacial Systems:



Key Dimension for All Array Types:

A key metric used in the solar industry is the ground coverage ratio (GCR). For both the fixed-tilt arrays and the single-axis trackers, the GCR_I is calculated by dividing the module (panel) dimension perpendicular to the direction of the row by the row pitch. For vertical bifacial systems, the GCR_I is calculated by dividing the vertical module dimension by the row pitch. Note that another way for calculating the GCR_A is to divide the total module surface area by the total land area used for the agrivoltaic installation (including farming equipment turnaround areas, a.k.a. headlands). The subscripts I (industry) and A (agriculture) can be used to distinguish between the different GCR calculation methods.

Farming Scenario Involving Single-Axis Trackers:



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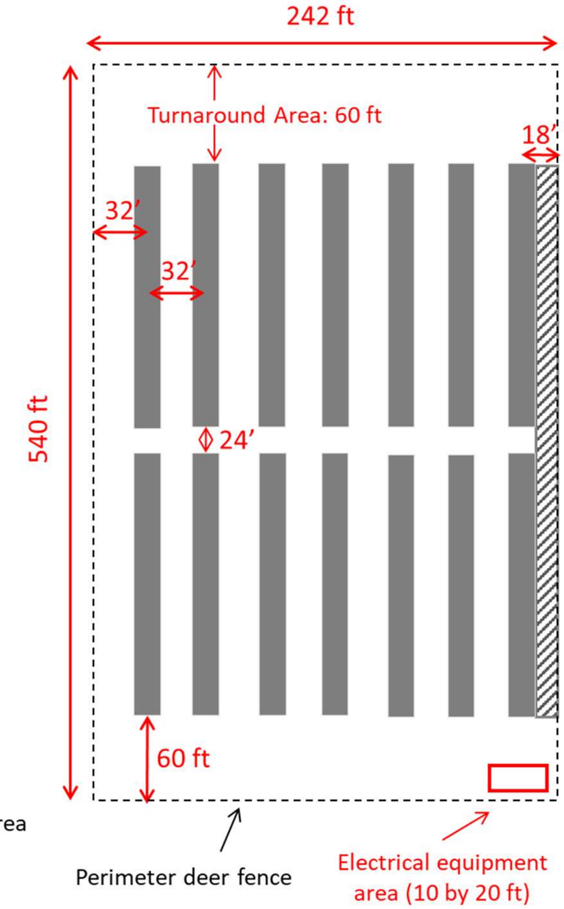
Example of Calculating Key Metrics for a Single-Axis Tracker Array:

Given:
Land area: 3 acres (242 by 540 feet)
Single-axis trackers with an 8 feet pivot point
Module dimensions: 1 by 2 m (3.28 by 6.56 feet)
Modules mounted in single file in portrait orientation (1P)
120 modules per row (2 sections of 60 modules)
7 rows, 32 feet row spacing (a.k.a. pitch)
Farmable width between rows: 28 feet
Gap between rows: 25.44 feet
Hatched area: deemed too narrow for farming (18 ft)

Calculations:
Land area (LA) = 3 acres (130,680 ft^2)
Total module surface area (TMSA) = 18,074 ft^2
Ground coverage ratio (GCR_A*) = 13.8%
Ground coverage ratio (GCR_I**) = 20.5%
Farmable area (FA***) = 111,160 ft^2
Percent farmable land (%FL) = 85%
Electrical equipment area (EEA) = 200 ft^2
Turnaround area (TA) = 29,040 ft^2 (including EEA)

*GCR_A = total panel surface area/land area
**GCR_I = panel length/row pitch
***FA = turnaround areas plus 7 strips of 28 feet minus electrical equipment area



A metric used to compare an agrivoltaic installation with a solar farm is the land equivalent ratio (LER). A solar farm is typically optimized for energy generation and therefore leaves little room for agriculture or horticulture on the same piece of land. The LER is calculated by summing two ratios[1]:

$$LER = (\text{Crop Yield}_{\text{agrivoltaics}}/\text{Crop Yield}_{\text{control}}) + (\text{Electricity Generated}_{\text{agrivoltaics}}/\text{Electricity Generated}_{\text{solar farm}})$$

The subscript control refers to a field with equivalent agricultural potential but without any solar panels. If the LER is greater than 1, the agrivoltaic system is more productive than a farm used for crop production alone or as a solar farm alone while using the same land area. If the LER is less than 1, the agrivoltaic system is less productive than either one. The table below shows how the LER is calculated by summing two ratios.

	Relative Crop Yield	Relative Electricity Yield	LER
Solar Farm	0.2	1	1.2
Agrivoltaics	0.8	0.5	1.3

Finally, it can be useful to determine the levelized cost of energy (LCOE) for agrivoltaic systems. The LCOE can be calculated with or without considering the discount rate (i.e., the time-value of money). In the simplified case, without considering the discount rate, the LCOE can be calculated by dividing the total lifecycle cost ($) by the total electricity generated over the lifetime of the equipment (kWh). The total lifecycle cost includes financing costs, installation costs, operating and maintenance costs, and decommissioning costs. Reported LCOE values for agrivoltaics installations range between \$0.03 and \$0.15 per kWh[2].

When the discount rate is considered, the LCOE can be calculated using the equation:

$$\text{LCOE} = \frac{\sum_{t=1}^{n} Expenditures_t/(1+i)^t}{\sum_{t=1}^{n} Energy_t/(1+i)^t}$$

Where: i = discount rate, t = year for which the calculations are made, n = life of the system (years), *Expenditures* are the total (annual) cost (\$), and *Energy* represents the (annual) electricity generated (kWh). There are several online calculation tools that can be used to calculate the LCOE[3]. For the calculation of the LCOE it can be helpful to consider that the conversion efficiency of most solar panels drops by 0.5-1.0% of the conversion efficiency of the panels when they were new (i.e., over a 20-year operating period, the conversion efficiency may drop by as much as 20% of the original conversion efficiency).

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Additional agrivoltaics information can be found at: https://agrivoltaics.rutgers.edu

[1] Mead, R. and R.W. Willey. 1980. The concept of a 'Land Equivalent Ratio' and advantages in yields from intercropping. *Experimental Agriculture* 16(3):217-228. https://doi.org/10.1017/S0014479700010978

[2] Based on data reported in the scientific literature and calculations by members of the Rutgers Agrivoltaics Program

[3] https://www.nrel.gov/analysis/tech-lcoe; https://www.nrel.gov/analysis/crest