C2C: Clean Energy *to* Communities
U.S. DEPARTMENT OF ENERGY

**Expert Match**

# Agrivoltaic Designs and Configurations

This guide will inform the initial design of your agrivoltaic system to meet your farm's needs and goals.

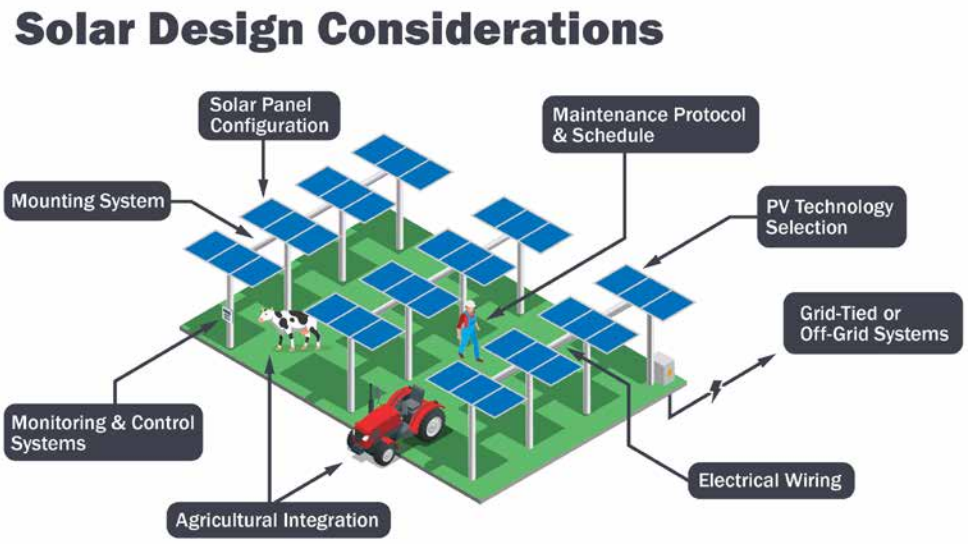


*Illustration by Tom Hickey and Al Hicks, NREL*

Important considerations include:

- **Solar panel placement strategies for maximizing energy production and/or crop yield.** While agrivoltaics allows for both renewable energy and agricultural production on the same plot of land, there are often energy and/or agricultural tradeoff considerations for different solar designs. Designs can be tailored to project-specific goals and work to maximize energy and/or agricultural production, but rarely both.
- **Analysis of different mounting systems and their suitability for agrivoltaic installations.** Different mounting systems (e.g., fixed tilt, tracking, or vertical bifacial) will impact electricity generation, installation cost, and ability to perform agricultural activities. Generally, single-axis tracking systems will produce more annual electricity than fixed-tilt systems, while fixed-tilt systems will generally be cheaper to install and maintain. Size and farming orientation will also impact the use of different racking structures.
- **Integration of solar panel infrastructure with agricultural practices.** Depending on your desired agrivoltaics operations, the photovoltaics (PV) system design may need to be updated to allow for safe agricultural operations around the solar infrastructure. Updates can include altering panel height, spacing, and design, wire depth, irrigation and equipment placement, and setbacks to perimeter fencing.
- **Selection and sizing of solar panels and associated components (e.g., inverters, batteries, etc.) for agrivoltaic systems**. Specific equipment types for agrivoltaic systems depend on the developer you are working with and the lead time to get access to equipment. Equipment is specified by the solar developer based on past experience, agreements with manufacturers, and product availability. System sizing will also vary based on the chosen agrivoltaic system and project goals. For on-farm energy use, the system sizing will be based on the amount of energy used

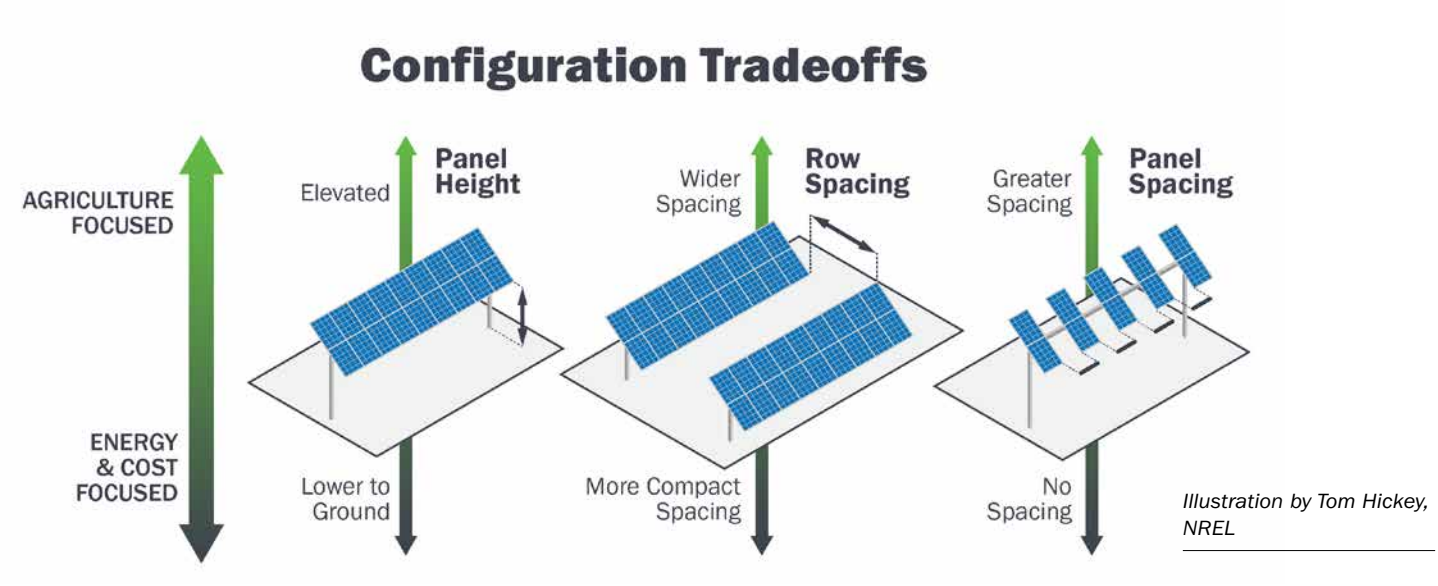


*Illustration by Tom Hickey, NREL*

over a year. Systems are often sized to offset 100% of annual electric load. For sale to the grid, system sizing is often dependent on land availability, amount of local transmission capacity, and installation cost.

- **Electrical wiring and configuration considerations for connecting solar panels to the grid or off-grid systems.** There are several options for connecting your PV system to the grid and it is often dependent on how you will get compensated for generation. Behind-the-meter systems are often smaller, and generation will be used to offset your electric bill; front-of-the-meter systems are larger and sell directly to the local grid operator.
- **Monitoring and control systems for optimizing performance and detecting issues in agrivoltaic installations.** Agrivoltaics systems may require more monitoring than traditional PV systems. Traditional PV systems will monitor PV production and provide real- time information on panel and inverter performance. In addition to PV performance monitoring, agrivoltaic systems may also benefit from monitoring soil health and moisture, soil temperatures, and incident light to crops.
- **Weatherproofing and durability measures to protect solar panels and agricultural crops from environmental factors.** Although agrivoltaic installations can help mitigate extreme weather conditions for agricultural crops, proper care and storage of agricultural equipment can help extend the life and durability of this investment. The higher the solar panels are installed off the ground, the more wind loading on the system will impact the design. Water and rain runoff from the panels may also impact land and/or farming practices around the drip edge of the panels.
- **Maintenance protocols and schedules for ensuring the long-term functionality and efficiency of agrivoltaic systems.** It is important to identify who is responsible for each part of the agrivoltaic system. Knowing the points of contact to call in case of an emergency or other maintenance issue can impact the availability of the PV system to generate electricity.
- **Opportunities for connecting to the grid and off-grid systems.** Grid-tied systems and off-grid systems will operate differently. Grid-tied systems will offset electricity purchases from the grid or allow for a way to sell excess electricity. Grid-tied systems can face challenges connecting to the electrical grid if there is no local capacity for grid interconnection or there are delays in the interconnection process. There are potential needed upgrades to the electrical grid that may impact project costs. Off-grid systems will often need a battery or microgrid controller installed in conjunction with the PV system to ensure safe operation, but that will lead to higher costs. Project goals and grid connection availability will highly impact choices here.

**For supporting resources, visit:**

- **InSPIRE Financial Calculator** (openei.org/wiki/InSPIRE/Financial_Calculator)
- NREL's **PV Watts calculator** (pvwatts.nrel.gov)
- **National Community Solar Partnership** (energy.gov/communitysolar/about-national-community-solar-partnership)

**For more information, visit:**
openei.org/wiki/InSPIRE

DOE/GO-102024-6470 · November 2024