COLORADO AGRIVOLTAIC LEARNING CENTER
at Jack's Solar Garden

Solar Design Considerations for Agrivoltaic Compatibility

Agrivoltaics couples solar energy infrastructure with agricultural and/or conservation activities, leading to multiple societal benefits. Some modifications to traditional solar array designs can ensure compatibility with various land uses. This fact sheet explores important agrivoltaic design considerations, three solar racking designs, and their impacts on land management.

Module Height

The height of a module's leading edge should be sized to allow:

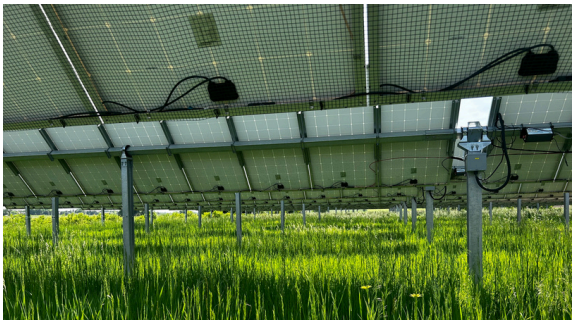
1. desired vegetation to grow to maturity without shading any part of the solar panels
2. livestock to exhibit their natural behavior without risk of injury to themselves or damage to solar infrastructure
3. farm laborers and their machinery to work safely, ergonomically, and with minimal impediments

Row Spacing

Row spacing is important when a set amount of sunlight is required for specific vegetation, or when large pieces of machinery like tractors with attachments must traverse the solar array without risk of damage. The wider the row spacing, the less impact the shade and moisture redistribution from the panels have on vegetation.

Wire Management

Any interaction between a wire and a person, animal, or equipment will likely be a negative one. Wire snag risks can be minimized by restricting access to wiring, putting wires in conduit, and minimizing the size of wire loops. Keeping wires "high and tight" is recommended. This means that wires are out of reach, flush against solar energy infrastructure, and have minimal slack. Using durable wire fasteners and preventatively replacing them before wear and tear sets in can aid in long-term wire management safety.



The Colorado Agrivoltaic Learning Center showcases clean energy generation coupled with local food production to educate and inspire our community into taking action to improve land stewardship within solar arrays.

Solar Design Impacts on Shade and Moisture Concentrations

Solar Design	Shading Impacts	Precipitation Diversion
Fixed-Tilt	Majority of areas are either in full sun or full shade throughout the day. Spaces between the rows will experience full days of sun in the summer and significant shade in the winter.	Rain and snow will concentrate below the drip edge of the modules. If there are two modules in portrait with spaces between them, then water runoff will also concentrate under that gap.
Single-Axis Tracking	All areas of the project will experience partial shading; no one area is in full sun or full shade. The most sun exposure will be in the center of the rows and the most shading directly under the torque tubes. The land at the east edge of a module will receive morning sunlight when temperatures are cooler while the land at the west edge will receive afternoon sunlight when temperatures are hotter.	Rain and snow will concentrate at the modules' drip edges. The timing of precipitation events will dictate which drip edge has the highest seasonal concentration of runoff. Morning dew or overnight snow will concentrate off the module's east drip edge, while afternoon rains will concentrate off the module's west drip edge.
Fixed Vertical Bifacial	Similar shading considerations to single-axis tracking systems are expected, except that overall shading is reduced, particularly at midday when there is nominal shading.	Soil moisture is expected to be impacted directly around the solar panels as snow, rain, and dew contacting the panels will accumulate at their base. The leeward side of the panel will have drier soils.

Conclusion

Each of these solar array designs can be coupled with agricultural and/or conservation activities, however each design will provide varying limitations as to what land use activities are possible. For example, a single-axis tracking design with drivelines would obstruct farm equipment from fully accessing each row, while one with individual tracking motors would not.

Thoughtful, thorough, and up-front planning is the best way to ensure long-term agrivoltaic compatibility. It is recommended to consult with agricultural or conservation land managers in the pre-design phase to strategize what makes the most sense for a particular field, geography, and community. Holistically, it is less costly to create alternative designs upfront than it is to work around compatibility issues for the duration of a project's operational life.