Fact Sheet:
Financial Considerations for Developing an Agrivoltaic System

By Colorado Agrivoltaic Learning Center
at Jack's Solar Garden
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PURPOSE AND SCOPE

Compared to conventional solar energy developments, agrivoltaic systems may have different capital expenditures, cash flows, and risk impacts for a solar asset owner. Discussed herein are only broad, qualitative financial impacts, as there are too many agrivoltaic applications (e.g., over orchards, grasslands, croplands, livestock), solar designs (e.g., fixed-tilt, tracking, one or two panels in portrait), and local considerations (e.g., terrain, regulations, wildlife, agricultural markets) to share a concise financial impact assessment.

Financial impacts are labeled as either standard or potential considerations. Standard considerations are those that apply to agrivoltaic developments that can support diverse agricultural activities in addition to compatibility with small-scale machinery and agricultural laborers. Potential considerations are those that would apply only in specific circumstances.

This fact sheet focuses on new-build projects considering US federal and Colorado state-specific tax benefits, though most non-tax topics are more broadly applicable.

AGRIVOLTAICS EXPLAINED

Agrivoltaics is the coupling of agriculture with solar developments where solar panels are above and around agricultural activities. It requires partnerships between agricultural and solar industry professionals, improved safety considerations for agricultural workers and livestock, and adjustments by both the agricultural and solar industry partners to effectively integrate their businesses together.

Agrivoltaics utilizes the microclimates created by solar panels to influence agricultural activities. Solar panels shade the land around them, thereby reducing temperatures, limiting evaporation, increasing soil moisture retention, and redirecting precipitation, which can benefit plants and animals. Humidity produced by the transpiration of vegetation growing underneath and around solar infrastructure may cool the solar panels, reducing heat losses and improving electrical efficiencies.

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.

CAPEX SAVINGS

Standard Consideration:

- Increased Investment Tax Credit (ITC) value due to higher capital cost of agrivoltaic systems (additional racking, altered solar array designs, added legal work, and/or labor requirements).

Potential Considerations:

- Reduced site preparation and civil costs due to reduced clearing, grubbing, soil stripping, grading, and/or adding gravel.
- Saved time and money working with community and local government during the permitting and community engagement phase, depending on local jurisdiction's favorability toward agrivoltaics.
- Reduced environmental assessment costs/delays and mitigation investments (e.g., stormwater prevention, dust control, etc.), depending on local jurisdiction's requirements for agricultural land.
- Decreased investment in site access roads, only if farm access roads exist.

CAPEX SAVINGS

Standard Considerations:

- Elevated racking increases steel I-beam costs on both its height and pile width.
- Added wire management alteration cost (e.g., wire mesh, wires in conduit, trenching for conduits).
- Larger Engineering, Procurement, and Construction (EPC) margin due to higher capital cost of agrivoltaics.
- Increased overhead due to additional considerations and processes required for agricultural integration (e.g., alternative construction equipment used to reduce land degradation).

Potential Considerations:

- Expanded labor costs and added time to adhere to Occupational Safety and Health Administration (OSHA) regulations for fall protection practices, only if equipment height exceeds 6 feet. osha.gov/fall-protection
- Increased cost of tracking equipment due to the need for individual motors, only if a conventional single-axis tracker design uses drivelines.
- Added internal fencing for rotational grazing on-site.
- Extended / subterranean fencing to prevent predators from entering the site (e.g., coyotes, foxes, weasels, etc.).
- Added civil costs for trenching irrigation lines below the frost line for sprinklers, drip irrigation, or taps for livestock.
- Infrastructure for animal health (e.g., water wells and pumps, interspersed troughs for water and mineral content).
- Increased sales taxes due to higher capital cost of agrivoltaics, only if the local government does not recognize Colorado Exemption K - see link below to Colorado sales tax rates. tax.colorado.gov/sites/tax/files/documents/DR_1002_2023.pdf

AGRIVOLTAIC CASH FLOW INCREASES

Standard Considerations:

- Reduced vegetation management, as it is managed by agricultural partners.
- Farmers may accept lower land lease rates in exchange for continued agricultural production.
- Reduced down time when agricultural partners in the field can expeditiously alert the solar operator of faults.
- Fewer operational issues due to safer wire management.
- Increased revenue due to reduction of heat losses.
- Increased Production Tax Credit (PTC) value from reduction of heat losses.
- Potential for extended useful life due to reduction of heat losses.
- Increased tax benefit of accelerated depreciation due to higher capital cost of agrivoltaics.

Potential Considerations:

- Exempt personal property tax via Colorado Senate Bill 23-092, only if project design qualifies, for 2024-2029. See link below for details.
  leg.colorado.gov/bills/sb23-092
- Reduced soiling losses due to dust suppression of vegetation and overwintering cover crops.
- Higher residual value of solar equipment due to additional scrap materials available.
- Higher residual value of land due to land stewardship practices that do not degrade soils over the project's life.
- Potential increase in Power Purchase Agreement (PPA) and/or Renewable Energy Certificates (RECs) for electricity produced from an agrivoltaic site, assuming governments and/or off-takers financially incentivize land stewardship (e.g., conservation, marketing, etc.).
- Decreased operations and maintenance costs if farmers/ranchers are cross-trained in repairing site issues.

AGRIVOLTAIC CASH FLOW DECREASES

Standard Considerations:

- Increased debt service due to higher capital cost of agrivoltaics.
- Increased insurance premiums due to increased underlying capital cost/value of agrivoltaic equipment.

Potential Considerations:

- Increased preventative and/or corrective maintenance labor cost due to OSHA fall protection practices, only if equipment height exceeds 6 feet.
- Reduced revenue potential, only if inter-panel spacing is increased above optimal ground coverage ratio for solar design to accommodate farming equipment.

AGRIVOLTAIC RISK MITIGATION

Potential Considerations:

- Reduced permitting risk due to increased local/community support for agrivoltaic systems.
- Reduced risk of litigation during environmental review and permitting, depending on local jurisdiction's favorability toward agrivoltaics.

AGRIVOLTAIC RISK POTENTIAL

Standard Consideration:

- Financing risk due to higher capital cost of agrivoltaic systems.

Potential Consideration:

- Longer payback period given the additional time it takes for ongoing cash flow increases to offset the higher capital cost of agrivoltaic systems (assuming no state-level agrivoltaic incentive).

CONCLUSION

Agrivoltaics can realize positive ongoing cash flow and positive risk benefits despite initial capex increases. Larger agrivoltaic projects likely realize smaller marginal CAPEX increases and larger marginal cash flow increases than smaller projects, as larger projects realize economies of scale. Local and project-specific factors can affect the magnitude of these relationships.

Local policy incentives can play a major role in expanding agrivoltaic developments—for example, decisions on whether to allow solar infrastructure on farmland, at what rate to value agrivoltaic personal property taxes, or if higher PPA, REC, or adder rates are allowed. Policy incentives may be the key to rapid agrivoltaic adoption in the solar industry. However, with time, the market should rely less and less on such incentives as agrivoltaic systems expand, persist, innovate, and mature.

Innovation will be key in the emerging agrivoltaic industry and should focus on reducing CAPEX costs to accomplish more sophisticated agrivoltaic interventions. Research and development into new racking infrastructure is key to reducing steel costs, facilitating safer wire management practices, and reducing time taken for EPCs to install solar panels. Further, racking systems that can more easily adapt to various terrain types should reduce the likelihood of grading and backfilling practices.

In the near term, solar companies that focus on implementing agrivoltaic systems in communities that value land stewardship will reap the most benefit. Those who can find utility, commercial, governmental, or residential clients willing to pay higher prices for better land management practices will also fare better. Overall, engaging and educating communities while marketing agrivoltaic projects will likely yield the most financial benefit for the solar industry.

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