Minutes 3/24/22 Agrivoltaic Roundtable Meeting

Rutgers, NJ Farm Bureau, NJ Board of Public Utilities, American Farmland Trust, Solar Agricultural Services, Coalition for Community Solar Access, Blue Wave, Advanced Solar Products, and individual growers in attendance

Program Goals – Dave Specca

In NJ, both farming and solar power are complex, and both have many stakeholders. We need independent research about how viable agrivoltaic dual-use installations could be.

This is a multi-year engagement with many changes and adaptations along the way.

We need open debate to find what concerns and common ground that all interested parties have. Crop yields, animal yields, electrical yields, social impacts, and environmental impacts all need to be considered.

As for what we consider agrivoltaics, it is not solar panels installed next to a farm, instead of a farm, or in such a way that it is so disruptive to farming that the land can only be used for limited operations like grazing or pollinators. Agrivoltaics must allow for a broad range of agricultural operations, and the dual uses must be more profitable together than either one alone. In all cases, agrivoltaics must focus on farming first, solar efficiency second.

Research and Development – AJ Both

We are not focused on maximizing electricity output with tilted panels low to the ground. And while they are fine ideas, we are not accepting grazing or apiaries under panels as proper agrivoltaics. The agrivoltaics we envision have a minimal impact on farming, involving raised panels above the ground with spaced out rows or vertical bifacial panels. In both situations, cows can roam freely amongst the panels, and tractors and combines can drive easily between and underneath them.

Fixed tilt and tracker panels are to be raised high enough that the equipment can run through, 10 to 14 feet tall.

NJ AES has a state fund to install 4 experimental sites throughout the state to assess the viability of plant, animal, and electricity production of several types of agrivoltaic arrays.

Current installed experimental arrays are mock-ups with no electrical output or solar panels. They measure light incident on the ground, shadowing, temperature, and moisture.

We are creating models for shadow maps and electrical output for several different geometries and types of agrivoltaic installations.

Explanation of Pilot Program – Scott Hunter, NJ Board of Public Utilities (BPU)

The pilot program is not ready yet, there has been no stakeholder meeting held so far.

The BPU is a state agency overseeing the utilities in New Jersey including electricity, water, television, and phone lines. Their aim is for these services to be widely accessible at a low cost, that they provide for a high quality of life, and that these services are used and provided in responsible ways.

Much of their involvement and responsibilities when it comes to agrivoltaics and their involvement in the pilot program is laid out in the NJ Clean Energy Act of 2018 and the Solar Energy Act of 2021.

The pilot program is a "market transformation program", which means it both changes and adapts in response to market factors, and aims to impact those same markets.

Net-metering and interconnection rules in the past have allowed solar users to make money off the power they produce by selling it to the grid at market pricing.

NJ is ranked 8th in the nation for solar power capacity, at roughly 4 GW. 80% of that power is net-metered, 20% is "grid-supplied" or purchased wholesale. Solar provides 5,400 jobs for the state.

In 2012, an earlier Solar Act was passed by the state, and there were concerns about solar development eating up prime farmland. In response, the legislature placed restrictions that would encourage solar development on landfills and other already developed land. Additionally, a size restriction was set in place such that a single solar installation cannot exceed 10 MW in capacity, in most cases.

In 2018, the SREC program was closed as it was deemed too expensive, and the projects that it developed were too uncertain in value. A new incentive is currently being developed to take its place and is in the process of being finalized.

In 2019, the clean energy masterplan was put into place, setting a goal for the state to reach 100% clean energy by 2050. It emphasizes decarbonization and distribution of power sources throughout the state. In the short- to mid-term, the state wants to install an additional 3.5 GW of solar capacity, effectively doubling it.

The Successor Solar Incentive, or SuSI, program is composed of two parts: Admin Determined Incentive (ADI) and Competitive Solar Incentive (CSI). The stakeholder meetings for CSI have started now and are still in progress. It has a component for siting and construction practices, which may be of interest to farmers and agrivoltaics practitioners. Webinars for the previous meetings are available on the BPU website. The dual-use meeting is still upcoming.

The grid does need to be expanded and modernized to fully support agrivoltaic development in very rural areas of the state. BPU is looking into this issue independently of the agrivoltaic and solar arenas.

The best way to hear about upcoming stakeholder meetings and other calls-to-action from the BPU is to sign up for their listservs.

Perspective on Agrivoltaics at the National Level – Ethan Winter, American Farmland Trust (AFT)

AFT is focused on protecting farmland, farmers, and the environment. They put out the Farmland Under Threat report, which identifies where the best, most robust farmland is, and when it gets taken up by other developments. Since 2001, NJ has lost over 70,000 acres of farmland (roughly 16%). A little over half of that land was converted into low-density residential uses.

NJ farming is up against a generational cliff; 40% of farmers are over the age of 65 and will be retiring soon. A diverse group of new farmers will need to take up the mantle.

Solar development is a new threat which could accelerate the conversion of farmland into developed and industrial land **OR** it could be used instead as a defensive measure against development, preserving the land for agricultural use.

NJ farming is a $300 million market in just vegetables and berries alone. Nursery and greenhouse products represent another $500 million.

AFT has six solar principles:

1) Maximize solar development on already developed or highly disturbed areas
2) Avoid developing solar on farmland
3) Protect soil health during construction
4) Optimize dual-use/agrivoltaics
5) Center farmers in all agrivoltaic conversations
6) Promote an inclusive process for developing agrivoltaic installation and overall policies

Agrivoltaics can lead to a 70% increase in land-use productivity.

Agrivoltaics promotes biodiversity through microclimates under the panels, wildflower growth and pollinators.

There are dual-use, agrivoltaic pilot programs going on in Maine, New York, Virginia, Illinois, and Colorado.

AFT predicts that the ethanol biofuel market will drastically change in the coming years as we pivot towards decarbonization.

Perspective from the Farmers Advocate – Ed Wengryn, NJ Farm Bureau

Many farms took advantage of incentives to install solar panels on their roofs, but restrictions always kept these projects small and not very profitable. Farms were able to offset some of their own power usage but they never became real suppliers of power like what was envisioned.

Solar power should be an additional source of income for farmers, but not an alternative source. This income stream should be able to support them through seasonal flux and help with poor annual yields. Agrivoltaics would give farmers control over the cost of their energy, something which is usually something they simply have to live with.

Farming has to come FIRST, agrivoltaics cannot be used as a ruse to phase out of farming and into solely power production.

Over 50% of farmland in NJ is owned by people or commercial entities from outside the state. They make their income off renting the land or a portion of the harvest. They do not have a personal or emotional investment into the farming itself, and can easily be swayed into selling the farm to developers if the profit paradigm shifts. We have to avoid perverse incentive schemes which would inadvertently give more subsidies to people doing all solar and no farming. This could be done by limiting the capacity of the array or insisting on dual-use only. Layered, inter-meshed incentives are the way to go, such as agriculture + solar + community investment incentive crossovers.

If enough farmland is lost to development, suppliers who serve the area may leave as well, making it harder to source necessary farming resources and possibly causing a negative feedback loop until it is untenable to farm there at all.

There is plenty of interest and eagerness for agrivoltaics, but there is a worry about haste leading to bad decision-making from land owners.

The Farm Bureau supports an extensive and broadly defined pilot program. We have to make mistakes and discover surprises to reach the best conclusions.

Perspective from NJ Solar Trade Association – Leslie Elder, Coalition for Community Solar Access

Agrivoltaics is a huge focus in the community solar field, they view this as a massive opportunity.

In a community solar arrangement, the developer obtains a lease agreement with the land owner. They gain access to develop solar on the land and make money off the panels in exchange for a regular payment and/or a portion of the government incentive and profits. Third parties can subscribe to the community solar project to provide their electricity.

Land used for agrivoltaics would effectively be restricted to agricultural work for the lifetime of the project, at least 20 years, ensuring that the farmland is continuously worked.

Unlike a housing development or warehouse, solar installations are not permanent. It is much easier to commission them and to maintain the health of the soil.

An agrivoltaic project installed on a blueberry farm in Maine was able to be financed and constructed without any government incentives.

Community solar projects in NJ are limited to 5 MW. Community solar is coming out of the pilot phase now and moving into a permanent status.

Other states in the area look to NJ as a leader in solar power. Our example could set the standard.

The tallest part of farm equipment is usually in the middle of the vehicle. The widest part of the vehicle is often very low to the ground. The physical limitations imposed by raised panels may not be as big an obstacle as predicted.

Observations from an Agrivoltaics Consultant – Iain Ward, Solar Agricultural Services LLC (SolAg)

Buying a new farm is incredibly difficult. Finding proper land for it is a huge obstacle, need prime soil and contiguous acres. The financing is also a huge obstacle; banks may not want to invest in a farm, and buyers from other industries are liable to outbid you. Dual-use combines farming with energy sector money, making at least the financing part of the problem much easier to overcome.

SolAg has obtained permitting from for agrivoltaic projects representing 42 MW, 240 acres, and 14 farms.

Every agrivoltaics project that gets built contributes to research; the technology is so new that we learn something every time that one is installed or operated.

Soft mats were placed on the ground during the installation of an agrivoltaic on a cranberry bog, to protect the soil from compaction by the construction vehicles. The mats can stay in place for three days, which can cause plants to go dormant, but will not cause permanent damage in that timeframe.

Agrivoltaic installations seem to have minimal negative effects on blueberry growth.

Incentives HAVE to be shared with the farmers themselves. Working around panels is an added inconvenience that needs to be compensated for.

Agrivoltaic panels have a positive effect on growth, by reducing the need for irrigation and defrosting.

We need more information about how agrivoltaics can be used with aquaculture.

Agrivoltaics in Practice – Byron Kominek, Jack's Solar Garden

Jack's Solar Garden is a 1.2 MW agrivoltaic array built on 4 acres of farmland. 35% of the land area is occupied by panels and there is < 50% shade.

The array was able to be put up without any government assistance or incentives, and the farm is a family-owned operation.

NREL is looking to perform their own studies on the farm, to research crop growth beneath the panels. University of Arizona is studying soil temperature and heat flux under the array, and the effect that the height of the panels has on those. It has been observed that the panels conserved heat underneath them, preventing frost damage.

Agritourism is a major opportunity in addition to the other benefits of agrivoltaics. Jack's Solar Garden saw over 1000 visitors last year from school groups, weddings, community events, and policymaker tours. There were no incidents of injuries or damage to the panels.

The rows of panels are spaced out 17 feet apart. The panels are raised 10 to 14 feet high.

Squash was not a great crop to grow under edge of the panels, at least not in the arid environment of Colorado. Water would drip off the side of the panels onto the squash leaves, causing a clear line of crops which experienced more disease and rot than surrounding crops. This may affect all root crops similarly.

The posts last longer than the panels. When the panels reach their end of life, new panels could be installed in their place using the same poles. If agrivoltaics is not the direction the farmer wants to go after the first panels are removed, the polls can be repurposed for high tunnel greenhouses, bat houses, or even as cow backscratchers.

Incentives have been put in place for large consumers of electricity to subscribe to community solar projects to offset some of their penalties.

If you want responsible use of agrivoltaics and preserve the quality of the land, you have to pay the land managers for vegetation and panel management. Go so far as to make land managers part owners of the array. Put penalties on poor land management and for harming the soil.

Open Discussion and Questions

- We need to prove it works in the pilot program first before we expand into preserved farmland. If it is shown to be successful and soil health can be maintained, then we can easily into preserved farmland.
- Orchards which use hail protectors can benefit immediately by converting those protectors into solar panels
- If done right, agrivoltaics can inform policy on grid scale projects. Maybe it makes sense to require some kind of agricultural activity on all solar projects
- We have to be smart about the incentives and strike the right balance so the people keep farming on agrivoltaic land
- Use threat of fee or decommissioning to ensure compliance
- Center farmers first! If crops can't grow well underneath the panels, then we have to change our ways.
- We need a lot more studies in order to replicate data on a regional basis.
- Be careful not to be too prescriptive with the policies we put in place. We don't know enough about the best way to install or use agrivoltaics to lay out the "one true" way to do it. We won't know that in 5, 10, or even more years. What Byron learned in just one year of operation is astounding.
- Farmers change their tactics a lot, so whatever structure we put up for agrivoltaics needs to be flexible too if it's going to last for 20 or 30 years
- Is an 80% or 90% crop yield acceptable under solar panels if the alternative is selling the land to a developer? There is some disagreement over this. Even a 10% loss in crop yield may be unacceptable for farmers, even if on the books the farm is more profitable due to the solar panels. We need to be very careful on how we design the panels and how we pitch the supposed effects to farmers.
- A community coming together to invest into a solar project does wonders for its perception. It's better for people when they take part in something rather than just see it get built.
- Be very careful with the government incentives and the social costs involved. Ocean Spray was forced to leave the state due to high utility costs, which they blame on SRECs.
- Germany has restrictions on the number of posts, acres, crop yield loss, etc for its agrivoltaic installations. We need to do research on acceptable numbers on all these metrics.
- Massachusetts has <u>never</u> held a stakeholder meeting like what we are doing.