

BLUEWAVE

September 27, 2019

Commissioner Judith Judson
Massachusetts Department of Energy Resources
100 Cambridge Street
Suite 1020
Boston, MA 02114

Re: Comments on the 400 MW Review Straw Proposal

Dear Commissioner Judson:

Thank you for the opportunity to comment on the Department of Energy Resources (DOER) Solar Massachusetts Renewable Target (SMART) 400 MW Review Straw Proposal that was released to the public on September 5, 2019. BlueWave Solar (BlueWave) supports comments submitted by the Solar Commenters representing various solar industry associations and stakeholders and we appreciate the opportunity to supplement them with our comments below. This letter specifically addresses the proposed changes to the SMART Agricultural Solar Generation Tariff Unit (dual-use) regulations and guidelines.

We applaud DOER and Massachusetts Department of Agricultural Resources (MDAR) for enabling the synergies between solar clean energy and agricultural land preservation in the Commonwealth. We are grateful to be a partner in that effort and are proud to be working with MDAR, Paul Knowlton and Knowlton Farms, DOER, and several environmental and agricultural NGOs to undertake the first privately-owned dual-benefit / dual-use pilot project in the Commonwealth. We are grateful as well for your support of BlueWave's partnership with DOER in developing the ASTGU Shade Analysis Tool.

We appreciate the fact that it's no easy job designing the next phase of what can fairly be labelled a wildly successful solar program, especially one as complex and interwoven as is the Commonwealth's.

Dual-benefit/dual-use projects are an important mechanism for providing farmers with a meaningful economic opportunity and to preserve, and in many cases expand agricultural production on farmland. The existing program is well poised to enable these results, however, if those changes being contemplated in DOER's September 5, 2019 proposal are enacted, we are concerned the opposite will occur. We greatly appreciate your consideration of the following:

1) Remove or Increase the Proposed 2.5 MW DC Cap on Dual-Use Projects and Maintain Status Quo for Projects in Active Development

Predictability, objectivity, and stability in dual-use regulations and guidelines are critical for success. The solar and farming communities have invested significant planning time and

resources to advance dual-use projects at great expense and risk in response to the initial SMART regulations released in November 2018. Changing important guiding principles now (i.e. the 2.0 MWAC cap and sunlight requirements), particularly when no dual-use projects have yet been built and when many have reached a critical juncture in their interconnection, permitting, and business planning, will undercut much of the work to date and harm both industries in the process.

It has taken significant time and effort for market participants (i.e. farmers, developers, and investors) to gain comfort with the existing set of rules and design parameters; significant financial investments have been made; and economic arrangements have been negotiated. Changing guiding principles at this time before the first set of projects are built will erode trust in an emerging asset class already viewed as more complex than standard solar, and in a regulatory process that remains unpredictable. The proposed rule changes jeopardize our existing arrangements with farmers because projects will not be built as planned (e.g. smaller sizes, non-dual use), if at all. The \$0.06 / kWh dual-use adder is significant, and the proposed rule changes will cap the financial benefit available to farmers and decrease energy production. These rule changes will also jeopardize the millions of dollars that developers, including Bluewave, have invested to build business models around dual-use/dual-benefit projects in addition to actual project expenditures for interconnection studies, engineering, permitting, and land control in the year and half since the start of the regulatory process.

Our portfolio has been driven by an expectation that dual-use will have sufficient DC sizing and design flexibility to address a wide range of interconnection and storage challenges. The proposed guidelines will significantly reduce the opportunity to combine dual-use projects with storage. BlueWave has a significant number of dual-use projects under development, all of which have been sized and planned around the current 2.0 MWAC cap. Standard interconnection study timelines can extend to 12 months or more, and because interconnection costs across MA are trending upward, projects with the DC-sizing and storage flexibility required to defray costs and take advantage of emerging storage markets are the ones that will remain financially viable. Since current market conditions call for storage DC:AC ratios of roughly 3:1 for projects that do not have the dual-use adder (e.g. 6.0 MWDC for 2.0 MWAC), arbitrarily capping dual-use DC-sizes at levels below market conventions will disadvantage many projects underway (many which have incurred significant investment since early 2018). It should be noted that the dual-use adder does promote greater DC/AC ratios.

We feel this should be viewed as a positive lever where the Commonwealth is getting the optimal result from both its goals to increase or maintain agricultural production and increase storage capacity and its benefits to the grid. However, we understand larger DC/AC ratio projects potentially warrant greater discussion and review. We believe this review can be accomplished through a working group comprised of industry professionals and policymakers from the energy and agricultural sectors, grounded in a philosophy of research, data collection, and continued adaptive management centered on shaping future guideline changes.

2) Currently Available Data Does Not Support Increasing the Sunlight Requirement for Dual-Use Projects

The proposed guideline changes (i.e. size cap and sunlight requirements) create uncertainty and are arbitrary because they don't consider existing data or input from the agricultural community, particularly practicing farmers. A growing body of evidence suggests that less than 50% of direct sunlight is sufficient to enable viable agricultural production. This evidence includes, but is not limited to, (i) established conventions in farming practice, (ii) publicly available university research on dual-benefit / dual-use, (iii) and the demonstrated comfort levels of BlueWave's farming partners.

- A wide range of shade tolerant crops exist with varied sunlight requirements, many with ranges upward of 60%.¹
- The UMass Amherst dual-use array has shading conditions as high as 62% as calculated by the DOER Shade Analysis Tool, and based on interviews with the managing researcher, the crops are performing well.
- In an experimental agrivoltaic project with panels elevated 10 feet off the ground, a University of Arizona research project found that, despite reducing direct sunlight available to plants by 75%, there was enough diffuse sunlight available to create noticeable improvements in agricultural yield; primarily due to the beneficial impacts of shade on microclimatic conditions and water conservation.² A good portion of food crops grown under the panels increased in yield or improved in other metrics (e.g. water use efficiency). Summarily, the study found that "shading by the PV panels provides multiple additive and synergistic benefits, including reduced plant drought stress, greater food production and reduced PV panel heat stress."³
- A 2014 University Oregon research project tested the viability of growing lettuce under solar panels by simulating crop trials under a wooden shade structure simulating an array, creating conditions of 52 percent shade, 61 percent shade, and 69 percent shade. Lettuce under 52 percent shade grew the best, beating out even the crop trials conducted in full sun.⁴⁵
- A University of Oregon research project on agrivoltaics found that, under conventionally designed solar panels (i.e. with shade impacts greater than 50% as modeled by the DOER Shade Analysis Tool), "areas under PV solar panels maintained higher soil moisture throughout the period of observation. A significant increase in late season biomass was also observed for areas under the PV panels (90% more biomass), and areas under PV panels were significantly more water efficient 328% more efficient."⁶

¹ <https://www.cmac.com.au/blog/choosing-right-shade-cloth-for-your-plants>

² <https://www.azocleantech.com/news.aspx?newsID=26511>

³ <https://www.nature.com/articles/s41893-019-0364-5>

⁴ <https://ashlandtidings.com/archive/research-solar-panels-benefit-crops>

⁵ <https://prezi.com/kdv8dmmaksof/a-rogue-valley-experiment-in-solar-double-cropping/>

⁶ Hassanpour Adeb E, Selker JS, Higgins CW (2018) Remarkable agrivoltaic influence on soil moisture, micrometeorology and water-use efficiency.

- The shade analysis tool developed by DOER fundamentally under-represents the amount of available sunlight, considering its focus on direct sunlight only. TMY datasets show that Global irradiance in Massachusetts is ~20-30% diffuse light, with the remaining 70-80% comprised of direct sunlight, and it is reasonable to conclude that a significant portion of diffuse light will still be available (in addition to what's modeled at 50%) at canopy heights of 8' or more.⁷
- Many BlueWave partners are professional farmers who are comfortable with the premise of farming under 50% shade conditions, and are willing to invest themselves personally, professionally, and financially to maintain the adder under the currently established framework.

3) Dual Use is Aligned with the Baker Administration's Land Conservation Priorities

At its core, dual-use is a conservation exercise that should be promoted over other types of land development. Many BlueWave partners face difficulty keeping their agricultural operations viable, and as many approach retirement or similar crossroads, questions of land succession almost always result in consideration for some form of development. Without solar, virtually all our landowner partners have expressed that they would have sold their land for some form of development (most often housing) to realize income and none have current or future plans to convert their land to permanent conservation.

In the case of one BlueWave project in Dighton, the farm projected to host a recently permitted dual-use array (pending submission to DOER) is surrounded by development pressure that will undoubtedly threaten the property should the project fail to materialize. The property has eight direct abutters that have either developed housing since 2015, or are currently approved by the Town to build housing in the near future. The farmer has already engaged a younger farmer willing to take over the operation under the panels upon his retirement. The younger farmer is excited about the potential to produce on land for the duration of the SMART program that would otherwise be too expensive to acquire (vegetable returns just can't compete with development returns). Faced with this estate planning reality, the farmer expressed that he would sell the land for housing to supplement his retirement if it were not for dual-use. He views dual-use as the main strategy to maintain the farm and transition it to the next generation of management. Given the steep interconnection costs facing this specific project, however, the proposed guideline changes to DC-size and sunlight requirements threaten to undermine the business strategy BlueWave has developed since submitting the interconnection application in March 2018 – and in turn, the farm succession plan is well underway.

4) Dual-Benefit Dual-use Can Increase Positive Ecological Outcomes Across the Commonwealth.

⁷ X. Sun, M. R. Khan, C. Deline, and M.A. Alam "Optimization and Performance of Bifacial Solar Modules: A Global Perspective," Applied Energy, 2018

In many cases, dual-use can enhance the ecological footprint of land through sustainable land management strategies rooted in philosophies that include but are not limited to: building healthy soils, promoting carbon sequestration, rotating crops, sustainable grazing, enhancing species diversity, promoting water conservation, and improving upon input intensive industrial farming methods. We strongly believe these outcomes can contribute to balancing out the land use equation for solar, and help the solar and agricultural sectors advance together in a more positive direction from a land use perspective. Given the comfort level expressed by our farmers in implementing these techniques on a large scale, we know dual-use can play an important role in advancing these outcomes across the Commonwealth. It is from this perspective that we encourage DOER to avoid arbitrary caps that disadvantage dual-use compared to standard solar, and prevent Massachusetts from realizing important conservation opportunities.

5) Broader Agricultural Interests Should Be Kept in Focus

Enabling new and maintaining any type of agricultural production should be prioritized. In light of pressures facing farmers across the Commonwealth, DOER should treat dual-use as a positive land use outcome provided it simply facilitates agricultural production. Other state-sponsored agricultural programs, such as Chapter 61A or the APR program, place either minimal requirements on farmers to maintain production, or no requirements at all in exchange for financial benefits. Qualification for financial assistance through MDAR's Agricultural Environmental Enhancement Program (AEEP), Agricultural Climate Resiliency & Efficiencies Program (ACRE) and Agricultural Food Safety Improvement Program (AFSIP) simply requires a farmer check "yes" acknowledging "I am a farmer as identified in Massachusetts General Laws Chapter 128. Sec. 1". Requiring dual-use to facilitate net *increases* in agricultural production, or *optimized* agricultural production, over a predetermined baseline ignores everyday realities of farming (e.g. bad weather or crop years, blight, drought) and the fact that "optimal" is an undefined term. Farmers will improve their techniques over time, and the drivers behind that process should be left in their hands. Holding dual-use to higher yet unproven standards compared to other agricultural programs unfairly encumbers the approach before it has had a chance to flourish.

Dual-use is no longer a science experiment, but an understood technique that now commands larger scales as well as attention and investment from professional farmers. Many of BlueWave's farming partners have been in the business for decades, and similar to many developing farming techniques, are prepared to adapt well-established farming practice to a dual-use context. They are accustomed to managing farmlands that are dozens if not hundreds of acres in size, and the scale of techniques and equipment required for a 2.5 MWDC dual-use array (i.e. 12 acres) is no different than the scale of techniques and equipment required for a 5.0 MWDC array (i.e. 25 acres). Allowing farmers to apply these techniques and operate in larger projects even, well in excess of the proposed caps, will create efficiencies and economies of scale that significantly increase the long-term agricultural benefits to the Commonwealth.

Forestry and certain Forested lands are an important part of the agricultural community in Massachusetts, and their place within any dual-use program should be preserved. Not all forests are made equal, and it is important to consider both the local and historical context in any dual-use plan. For example, many farmers own land that, while currently forested, were previously farmed but now only forested because that land fell out of active agricultural use. We have at least a handful of landowners who are in this situation and we are actively developing dual-use projects to augment existing agricultural operations. Additionally, larger forestland managers are constantly reviewing their portfolios to ensure prudent stewardship, and frequently consider converting holdings to farming or a wide range of other uses depending on management conditions in a given year (e.g. forest blight). In light of these and other factors, dual-use offers the appropriate framework to promote well balanced land-use options for a land conversion decision that almost all farmers and forestland owners face on a consistent basis and have for centuries.

6) Establish a Working Group to Maintain Feedback From All Stakeholders

Continued program improvements should be made in concert with farmers, agricultural experts, and the solar industry through a formal and active working group organized around adaptive management. To date, farmers and their representatives have not had a formal seat at the table in crafting dual-use guidelines. Steering the development of new dual-use guidelines in the direction of further subjectivity and complexity despite feedback from the energy and agricultural sectors to the contrary will likely diminish the innovative vision underlying the premise of dual-benefit / dual-use, as well as its long-term potential. We hope this is considered in the establishment of a working group that can help inform and advise DOER in its on-going development.

We believe that this working group is the appropriate forum to develop potential changes to the ASTGU guidelines that can simultaneously provide more certainty to farmers and developers and address MDAR's concerns regarding yield impacts or other elements behind the science and practice of dual-use. We believe an appropriate action would be to develop a new methodology for assessing shading impacts based on crop specific sunlight requirements rather than a "one-size-fits-all" approach. By including farmers, agricultural research experts and solar developers in the discussion, we are confident that a substantially improved dual-use certification process can be achieved.

7) There is a Mechanism to Ensure Success of the Dual-Use Projects Currently in Place

Despite the hurdles facing the rollout of the program, the solar and farming industries have made significant progress toward understanding and implementing dual-use strategies well positioned for success. If in spite of this progress questions remain regarding the effectiveness of specific dual-use projects, it can always rely on the backstop of revoking the subsidy in a given year if it is clear that reporting requirements are not being met, or that there is significant enough

departure from the approved farming plan to warrant questions over whether farming is occurring, or will occur, at all. It is on this premise we believe DOER and MDAR have sufficient levers to discourage bad actors, all while enabling dual-use to compete with the rest of the solar typologies supported by the SMART program.

8) Getting Dual-Use “Right” Can Yield Great Benefits for the Commonwealth

In light of the above, we appreciate that, while dual-use is a new development approach, enough research and data exists to suggest that important next-level questions should be investigated within the maturing programmatic framework that DOER and the industry have established to date (e.g. the shade tool, solar design philosophies, emerging farm models). Not only will pursuing answers to these questions drive new innovations in farming, land use, and solar energy, it will also help to strengthen the competitive advantage of urban and rural communities across Massachusetts. Given that New England is projected to become hotter and drier under future climate change projections, it will also better position the Commonwealth to weather these challenges.

For example:

- Understanding the Role of Irradiance and Microclimate – photosynthetically active radiation (PAR) is the select portion of visible light actively used by plants for photosynthesis; as such, how does PAR fluctuate between different solar designs, shade regimes, or time durations? How much time is required in a given season for a given crop to absorb its optimal PAR? What differences in yield or other characteristics of plant growth are influenced by PAR, and how does PAR interplay with other microclimatic benefits created by shade, such as temperature attenuation or improved water efficiency?
- Understanding the Impact of Dual-Use on Farm Resilience – how does an improved understanding of microclimatic conditions, PAR, and productivity influence the development of new or improved farming methods in a dual-use context? What does this hold for improving farm productivity and resilience generally, as well as for improving the overall productivity and resilience of specific crops in our food supply? What might this mean in the context of climate change in New England and beyond?
- Leveraging the Interplay Between Energy Storage and Farming – upon learning from the first generation of storage projects in MA, how might dual-use leverage its additional value in the SMART program and economies of scale to create ratepayer savings and grid benefits via optimal solar + storage designs not otherwise available to standard solar? How does this notion of grid reliability and its associated value factor into sizing an array to promote a specific farming model, or vice versa? Given the localized benefits of farming within a dual-use array, what new agricultural processing opportunities are enabled when paired with the grid stability and resilience benefits of distributed energy storage?

- *Driving New Opportunities in Education, Curriculum, and Vocational Training* – being that dual-use is inherently labor- and innovation-driven, new opportunities will emerge to educate the next generation of farmers, electricians, ecologists, technologists, land managers, and so on – all within MA communities. Many dual-use projects will reside within close enough proximity to schools and colleges to garner curiosity and inspire new ideas and career paths. As such, the Commonwealth would be wise to seize this opportunity and position the dual-use sector as a positive driver of community development.
- *Aligning the Individual and Collective Missions Within EEA* – with the current global impetus for holistic, climate-focused solutions (particularly those calling for a transformation of the energy and agricultural sectors), the Commonwealth has created a policy uniquely positioned for success. This policy will command unique forms of collaboration between DOER and MDAR not unlike others that have proven successful within EEA. Similar to the Clean Energy Results Program – which fostered collaboration between DOER and DEP in the creation of new review procedures, development guidelines, and public resources to educate the industry on best practices for developing solar on landfills – DOER and MDAR have the opportunity to both deepen and merge their respective missions in ways that uniquely empower the energy and farming spheres to deliver effective projects. Upholding the integrity of the framework established to date is critical for the success of this collaboration, and we encourage EEA to leverage it as a key component of the Commonwealth’s climate change strategy.

Thank you for the opportunity to comment on the SMART 400 MW Straw Proposal. We appreciate DOER’s efforts in creating a long-term solar program for the Commonwealth and encourage you to consider these comments intended to improve the dual use program. BlueWave stands ready to work with DOER and the Executive Office of Energy and Environmental Affairs to help achieve the Commonwealth’s clean energy goals. Please do not hesitate to reach out to Mark Sylvia, Chief of Staff, Msylvia@bluewavesolar.com, with any questions you may have.

Sincerely,

John DeVillars, Chairman

Mark Sylvia, Chief of Staff