

### DUAL-USE SOLAR AND AGRICULTURE PROJECTS IN MASSACHUSETTS: 2018 – 2021 SUMMARY



#### Incentives for Dual-Use Solar and Agriculture in Massachusetts

In November 2018, the Massachusetts Department of Energy Resources (DOER) established a new solar photovoltaic (PV) program governing incentives for solar arrays built in Massachusetts known as the Solar Massachusetts Renewable Target Program, or SMART. The program was updated and expanded by Emergency Regulation in April 2020. The SMART program includes a provision for specific incentives associated with development of “dual-use” combined solar and agricultural systems, known as Agricultural Solar Tariff Generation Units (ASTGUs). These solar arrays are designed to be taller and to allow more light penetration to the ground below, so that agricultural activities can continue beneath the array, with crops or livestock grown or raised under and between rows of panels. As part of the SMART regulation, applicants for dual-use projects are required to consult with UMass Extension in developing an agricultural plan. UMass Clean Energy Extension and Agriculture Extension staff work closely together to review plans and provide feedback to applicants. In addition, through its Inter-Agency Agreement with DOER, Clean Energy Extension has developed educational materials and conducted outreach and education efforts to assist farmers and solar developers working across Massachusetts.

#### UMass Extension Review of Dual-Use Pre-Determination Applications

Agricultural plans for dual-use solar and agriculture projects are incorporated into Pre-Determination Applications, which must be submitted to DOER and the Massachusetts Department of Agricultural Resources (MDAR) in order to determine whether the project is in compliance with ASTGU guidelines, and can qualify for the ASTGU incentive. Prior to submitting the final Pre-Determination Application to DOER and MDAR, the applicant is required to submit a draft version to UMass Extension for review. This fulfills the requirement for applicants to consult with UMass Extension. UMass Extension provides written comments to the applicant, which can, if desired, be incorporated into the updated, final application. However, a revision of the draft application is not required before submission to DOER and MDAR, and UMass Extension plays no decision-making role in the success or failure of a given pre-determination request.

Between November 2018 and December 2019, UMass Extension received 21 draft Pre-Determination Applications for dual-use projects, including 19 submitted using a standard Pre-Determination Form adopted by DOER. UMass Extension received an additional 5 draft Pre-Determination Applications in 2020 and 9 in 2021. Review was provided by a combination of Clean Energy Extension staff (Dwayne Breger, River Strong, Zara Dowling, Mary Kraus), and Agriculture Extension staff with crop-specific expertise, as follows: Livestock,

hay/forage, and grains – Masoud Hashemi; vegetables – Clem Clay, Katie Campbell-Nelson, and Sue Scheufele; cranberries – Hilary Sandler and Giverson Mupambi; other fruit – Sonia Schloemann.

Of the 35 applications submitted since the program began in November 2018, 32 have received written comments from UMass Extension. The remaining 3 were received by Extension in late December 2021 and were under Extension review as of the end of the calendar year. The majority of applicants have chosen to hold a site visit with Extension and MDAR staff and/or submit a revised application form for Extension review before submitting a final Pre-Determination Application to MDAR and DOER. As of the end of 2021, 21 applications (60%) have received a final Pre-Determination Letter from MDAR/DOER, and 7 are in the applicant revision (9%) or Extension review (11%) process. In sum, 80% of proposed projects are on track to complete the Pre-Determination process.

UMass Extension is not always aware of the reasons for which some projects do not complete the Pre-Determination process; however, in at least one case, an interconnection study by the utility stalled the project development process. In another, the presence of potential wetlands on-site stalled the project, and the presence of a Farm Viability Enhancement Program (FVEP) covenant on another property rendered that site unsuitable. In several other cases, the project appeared to have been abandoned due to a lack of compliance with the ASTGU guideline (e.g. providing pollinator habitat instead of agricultural products as a crop, not sited on land defined in the guideline as Land in Agricultural Use or Important Agricultural Farmland).

### Summary of Proposed Dual-Use Projects

Twenty-one proposed dual-use projects were reviewed by UMass Clean Energy Extension between 2018 and 2019, five were reviewed in 2020, and nine applications were received in 2021. Data from all of these projects are incorporated into this summary.

#### Crop Choice

Crops proposed for cultivation in dual-use systems are shown below (Table 1). Note that the number of applications by crop sum to more than the total because some applications proposed more than one type of agricultural production under the same array. The most common combination was hay production and livestock grazing, but a number of applicants proposed a combination of grazing and experimentation with mixed vegetable crops or squash/pumpkins.

Proposed Crop(s)	Number of Applications		
	2018-2019	2020	2021
Cranberries	9	0	4
Livestock	7	3	2
Poultry	1	1	0
Hay	2	2	2
Squash/Pumpkins	2	1	1
Other Vegetables	3	4	2
Grain	0	2	0
Tree Crops (Apples, Nuts, Xmas Trees)	0	0	2
<b>TOTAL</b>	<b>21</b>	<b>5</b>	<b>9</b>

**Table 1** Proposed crops to be produced based on ASTGU applications received from 2018 through 2021. Note that the number of applications per type of crop sums to more than the total applications because for some sites, more than one type of crop was proposed.

### Farmer Status

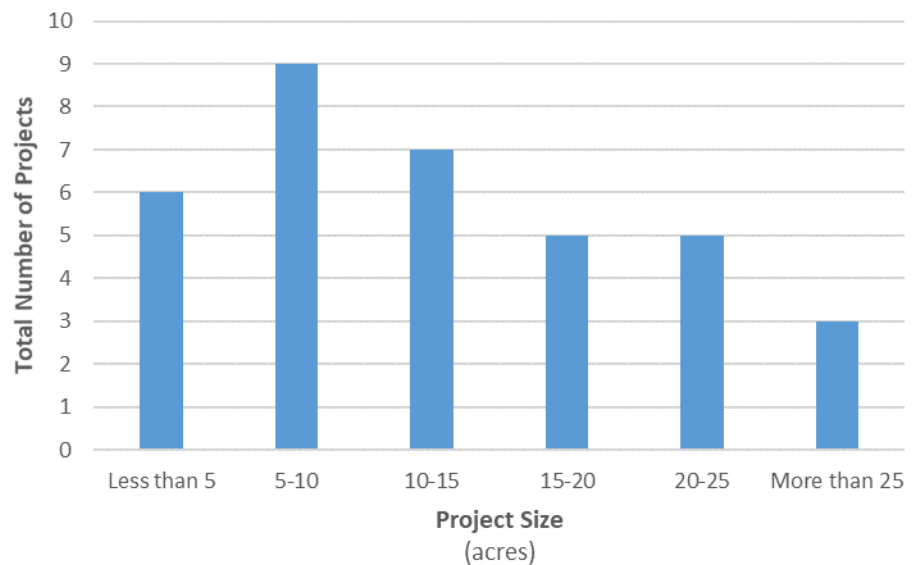
In 26 (74%) of the proposed projects, the current farmer was also the landowner of the property. However, in 11 of these cases (31% of proposed projects), sale of the property or retirement of the farmer was anticipated within 5 years. The SMART incentive program is designed to last 20 years.

### Project Capacity

Unless seeking a waiver, dual-use projects are required to be no larger than 2 MW AC in capacity. In the absence of energy storage, this is equivalent to 3 MW or less of DC capacity. However, a number of projects incorporated battery storage and had a much larger DC capacity. Three proposed projects were under 1 MW DC in capacity, 12 projects were 1-2 MW DC in capacity, 8 projects were 2-3 MW DC in capacity, and 12 were over 3 MW DC in capacity. The largest single project was 8.9 MW DC in capacity. A number of projects submitted individually to UMass Extension were located on adjacent parcels of land, and were expected to be bundled into a single ASTGU application for the purposes of the SMART program, feeding into the grid through a single interconnection point. These bundled sets of 2 or 3 projects had effective combined capacities of 4.3, 7.4, 10.0, and 10.3 MW DC, respectively. The incorporation of energy storage is beneficial to overall electricity grid stability and resiliency, and encouraged through SMART Program incentives. However, it is worth noting that the use of energy storage in ASTGU projects has allowed for the development of larger projects than might have been anticipated by DOER and MDAR in implementing a 2 MW AC cap. The intended purpose of the cap, as described by MDAR, was to allow for the experimental development of dual-use systems, to determine the success of different crops grown under shaded conditions, before promoting these systems on a large scale.

### Project Size

A traditional ground-mounted solar array with a capacity of 1 MW is expected to take up about 4-5 acres of land. Dual-use projects are more spread out to allow more light penetration, and may be expected to take up additional acreage on a per MW basis. See **Figure 1** for a summary of projects by acreage. The single largest project was designed to take up 65 acres. As described above, a number of projects submitted individually to UMass Extension were located on adjacent parcels of land, and were expected to be bundled into a single ASTGU application for the purposes of the SMART program, feeding into the grid through a single interconnection point. These bundled sets of 2 or 3 projects had effective footprints of 19.9, 30.2, 41, and 59 acres respectively.



**Figure 1** Range of proposed project sizes in acres, from 2018 through 2021.

## Additional Observations

**Marginal Land.** At least 8 projects were proposed to be sited completely or partly on marginal farmland, or on currently un-farmed land included as agricultural land under Chapter 61A. In several cases, the sites were overgrown fields, in which trees were expected to be cut in anticipation of livestock grazing or vegetable production. Other proposed sites included an abandoned gravel pit, a forestry processing operation site, and a currently forested site used for sand extraction for neighboring cranberry bogs. All of these sites would require significant soil remediation and incorporation of additional soil prior to use for agricultural production.

**Fencing.** A number of landowners noted the ancillary benefits of solar array security fencing for agricultural purposes, including deer control, containment of livestock, and predator exclusion.

## UMass Extension Educational Materials and Research

Between 2018 and 2019, UMass Clean Energy Extension developed 8 fact sheets related to the SMART program and dual-use specifically, all of which are available on the Clean Energy Extension website (<https://ag.umass.edu/clean-energy/current-initiatives/solar-pv-agriculture>). This site also includes links to dual-use research results from the UMass Amherst Research Farm in South Deerfield, and other SMART program and solar-related resources. In 2022, UMass will be initiating a Department of Energy-funded study to learn more about agricultural and economic aspects of dual-use solar systems. Information about this project will also be available on the Clean Energy Extension website.

UMass Cranberry Extension developed a fact sheet regarding dual-use solar and cranberries specifically, which is also available through Clean Energy Extension (<https://ag.umass.edu/clean-energy/dual-use-solar-pv-cranberry-production>). Identifying the need for research in this realm, Cranberry Extension faculty Giverson Mupambi and Hilary Sandler initiated research under a simulated dual-use array on a private cranberry bog in summer of 2019.