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February 23, 2018

**Re: Comments on Agricultural Solar Tariff Generation Unit Guidelines**

Dear Committee Members:

I'm writing to offer comments on the proposed Agricultural Solar Tariff Generation Unit Guidelines ("AG STGU"). These comments refer to the January 9, 2018 draft. I understand the intent of the AG STGU as being to advance the State's policy goals relating to agricultural production, renewable energy generation, and land preservation by incentivizing dual ag/energy land uses that offer farmers the opportunity to derive a revenue stream from their lands while keeping them in active agricultural use.

By way of background, I've spent 20 years in the renewable energy industry as a solar and wind installer, designer, contractor, developer, and utility system operator. I currently work for a solar energy startup that is funded by the US Department of Energy. I am also the founder and owner/operator of Stony Hill Farm, a diversified farm located in Wilbraham Massachusetts where we raise chickens, turkeys, and goats, and grow and sell vegetables and cut flowers. My comments in this letter are based on my experience in both energy and agricultural fields.

In my professional opinion, I do not believe the current draft AG STGU in its current form will see significant uptake by the active farming community. Simply put, the \$0.06/kWh ag price adder is more than offset by the additional cost of qualifying for it. Some of the AG STGU requirements also fail to take account of the realities of small farm ownership and management and thereby miss "win-win" opportunities to ensure more energy project development on actively used ag lands with little or no additional cost. Further, it is even possible that the proposed guidelines will incentive farmers to remove land from agricultural production, rather than keep it in.

Like many small farmers, I am very interested in expanding my revenue generating options and I would genuinely like to participate in the program. And, I believe that this is possible while still honoring the program's intent of keeping land in agricultural use while also helping meet Massachusetts's energy policy goals. To this end, the remainder of this letter identifies some specific development challenges stemming from the proposed rules and suggests ways in which the spirit of those rules can be honored without undermining the incentive for farmers to develop dual ag/energy use properties.

**Issue #1: Minimum Height Requirements Are Needlessly High.** The AG STGU requires that for fixed tilt projects "the minimum height of the lowest panel point shall be eight (8) feet

above ground.” In comparison, a height of three feet is typically used for otherwise comparable ground mounted PV systems. At this height, racking costs are generally \$0.15 to \$0.20 per watt, or about 10% of the total construction costs of \$2.00 per watt. Raising the PV array from three to eight feet increases racking material costs by \$0.10 to \$0.15 per watt. The higher array requires additional structural supports that add another \$0.05 per watt.<sup>1</sup> Finally, much of the installation work (as well as O&M) would go from being done at ground level to requiring the use of a lift or ladder, thereby slowing down construction and increasing job site safety requirements substantially.

All told, the eight-foot height requirement roughly doubles the cost of the racking component of the project. As an alternative to the proposed rules, the requirement should be revised to offer additional options of lower heights for crops that can be grown and harvested without the need for mechanical cultivating equipment, for example, rhubarb, potted plants, livestock grazing. The rule should allow for default compliance based on the eight-foot height or exceptions if cultivation of a particular crop can be shown not to suffer from the lower array height.

**Issue #2: Proposed Irradiance Requirements Are Unduly Onerous And Not Appropriate to Some Crop Types or PV Equipment Options.** The AG STGU requires developers to demonstrate that the maximum sunlight reduction from the panels on every square foot of land directly beneath, behind and in the areas adjacent to and under the array shall not be more than 50% of baseline field conditions. Yet, some crops cannot endure or do not prosper under such baseline (full sun) conditions, need partial shading in order to thrive, especially during hot prolonged drought-prone summer conditions. Some examples include ginseng, mushrooms, lettuce and many bee-friendly pollinator plants. Assuming a farmer/developer intends to seek the efficiencies of co-locating shade-tolerant crops with the PV array, and will document that such crops have been planted, it makes more sense to employ a nuanced requirement in which the array’s ability to shade the crop is related to the crop’s tolerance to shade, rather than the blanket rule embodied in the proposed AG STGU.

In addition, there are a number of photovoltaic modules that are produced specifically for greenhouse glazing purposes and which allow specific amounts of sunlight through the module, in part by avoiding use of a light-blocking back sheet. California-based Soliculture ([www.soliculture.com](http://www.soliculture.com)), for example, uses cells produced in the USA with a translucent red EVA sheet to enhance plant growth. China’s Trina Solar makes a module that has approximately 50 percent irradiance transmission for greenhouse and BIPV applications (Appendix B). For comparison, standard high tunnel greenhouses use two layers of six millimeter polyethylene sheeting, each with 91 percent transmission rate, for a net transmission rate of 82 percent.

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<sup>1</sup> Note that these bracing supports may also undermine the intended purpose of the eight foot requirement of allowing for mechanical cultivation under the solar array. See appendix A for an agriculture installation photo with bottom edge of the modules at 8’ but diagonal bracing at 6’ above grade, potentially negating the benefit from the additional height gained.

**Issue #3: Spacing Requirements Around Solar Arrays are Not Well-Specified.** The proposed AG STGU specifies that fixed tilt designs “shall include a minimum four feet distance between each panel(s) in order to avoid full shade beneath and behind each row of panels; single- and double-axis tracking systems must demonstrate the 50% sunlight reduction maximum can be achieved without the minimum four feet distance.”<sup>2</sup> This spacing would roughly double the cost of racking and footing materials, while also increasing the need for mounting hardware, electrical wiring and conduit, in addition to the obvious implications for the cost of expanded site preparation.

Meanwhile, farms always have land that is not directly in production such as roads, drainage systems, and lands adjacent to greenhouses. In an effort to maximize energy production, one could site PV arrays so as to shade (even heavily) such areas with no detriment to crop production/agriculture use but still achieve the policy’s goal of maintaining agricultural production while increasing renewable energy supply. As long as the use could be documented, there would be no reason to require 50 percent solar access for these areas, since no productive crops are grown there.

In conclusion, it is clear to me that the proposed rules add significant costs and that the additional revenue they deliver does not offset these costs. This leaves the farmer with an easy choice and one that is at odds with the policy goal of keeping land in active agricultural production. To see this, note that a 1 MW AG STGU compliant PV project at eight foot module height and four foot inter-row spacing requires 10 acres (a standard 1 MW PV project uses 5 acres), faces \$15,000 more per year in lease rent, \$50,000 more in O&M, and roughly \$75,000 more in financing costs on the additional \$750,000 in construction (assuming financing at 6% for 15 years). This \$140,000 in extra costs is only compensated for by \$90,000 in additional revenue. Therefore, it is in the farmer’s interests to simply take 5 acres out of production entirely rather than pursue the \$0.06/kWh AG STGU adder.

As a result, it makes sense either to raise the AG STGU adder to fully compensate for the additional costs imposed by the proposed rules, or else rework the rules so that the farmers can comply with them while still keeping land in productive agricultural use, even as they generate renewable energy. Only in this way can the policy leverage the farmer’s expert knowledge of their land and crops rather than prescribing a path with regimented height and widths that do not optimize dual use for each farm.

Sincerely,

Brian Cunningham

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<sup>2</sup> Based on this requirement, it would seem that each and every module would need at least a four-foot spacing from every other module. Personal communication with staff at MDAR clarified that the intent was a four-foot horizontal spacing between each column of adjacent landscape modules in a given array, with the goal of 50% direct irradiation on the ground during the growing season.

## Appendix A

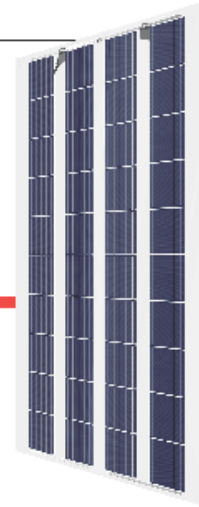


## Appendix B

Mono **Multi** Solutions

# THE DUOMAX

DUAL GLASS 40-CELL MODULE



**40 CELL**  
MULTICRYSTALLINE MODULE

**170-180W**  
POWER OUTPUT RANGE

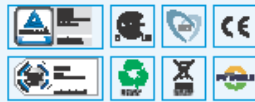
**10.9%**  
MAXIMUM EFFICIENCY

**0~+5W**  
POSITIVE POWER TOLERANCE

Founded in 1997, Trina Solar is the world's leading comprehensive solutions provider for solar energy. We believe close cooperation with our partners is critical to success. Trina Solar now distributes its PV products to over 60 countries all over the world. Trina is able to provide exceptional service to each customer in each market and supplement our innovative, reliable products with the backing of Trina as a strong, bankable partner. We are committed to building strategic, mutually beneficial collaboration with installers, developers, distributors and other partners.

### Comprehensive Products And System Certificates

IEC61215/IEC61730/UL1708/IEC61701/IEC62716  
ISO 9001: Quality Management System  
ISO 14001: Environmental Management System  
ISO 14064: Greenhouse gases Emissions Verification  
OHSAS 18001: Occupation Health and Safety Management System



**Trina**solar



### Highly reliable due to stringent quality control

- PID resistant and free of snail trails
- Increased module robustness to minimize micro-cracks
- 100% EL double inspection



### Enhanced safety

- Fire class A certified by TUV Rheinland according to fire test IEC 61730-2/MST 23
- Certified for fire type I3 (UL 1703)



### Increased value

- Higher maximum system voltage reduces BOS costs
- 30 year linear warranty
- 0.5% annual degradation
- Low thermal coefficients for more energy production at higher temperatures
- Designed for awning, carport, and greenhouse applications



### Certified to withstand the most challenging environmental conditions

- Module coating resistant to sand, acid, and alkali
- 2400 Pa wind load
- 5400 Pa snow load
- 35 mm hail stones at 97 km/h

Trina Solar's DUOMAX Linear Performance Warranty

