Sun$_2$O Partners LLC.

Ciel & Terre

Kaitlyn Kelly
Renewable Energy Program Coordinator
Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, MA 02114

RE: Sun$_2$O Partners and Ciel et Terre USA comments to the DOER regarding 225 CMR 20.00: SOLAR MASSACHUSETTS RENEWABLE TARGET (SMART) PROGRAM

Dear Ms. Kelly,

Sun$_2$O Partners ("Sun$_2$O") and Ciel et Terre USA, Inc ("Ciel et Terre") would like to thank the Department of Energy Resources ("DOER") for the opportunity to provide comments on the Solar Massachusetts Renewable Target ("SMART") Program. These comments follow the Sun2o and Ciel et Terre jointly filed comments on the Next Generation Incentive Program dated October 21st, 2016. Sun$_2$O is a solar development company focused on commercial, industrial, municipal and small utility scale projects across the United States. Ciel et Terre is the floating solar technology pioneer and has developed the Hydrelio© system which has been used for floating solar installations around the world.

With regards to the SMART program, Sun$_2$O and Ciel et Terre are commenting on how floating solar installations should be included in SMART as its own qualified Floating Solar Tariff Generation Unit, fall under Category 1 for both Agricultural and Non-Agricultural land use and accordingly have its own adder incentive.

Including floating solar in this program would allow for the growth of an installation type which directly furthers the DOER objectives of addressing land use concerns, expanding access to incentives and maintaining robust growth of installations across all sectors. Furthermore, inclusion of floating solar in the program would allow for the development of solar with a financially challenged segment of the agricultural industry, who with the current proposed program design would be limited in their ability to participate.

To allow for a successful implementation of floating solar into the program, Sun2o has worked with the MassDEP to formulate siting criteria and standards for floating solar which are explained further below. In addition, Sun$_2$O is proposing language to be included in the program legislation, which is included in Appendix A.

Floating Solar Overview

The floating PV market is expanding within the solar energy market as an alternative to traditional ground and roof mounted PV systems.

Floating solar refers to solutions installed on water that produce solar energy in the same manner as ground mounted or rooftop systems. Nevertheless, it is important to differentiate between *floating PV* and *floating PV offshore*.

The former concerns installations on inland compounded and unused bodies of water, e.g. ponds, lakes, reservoirs owned by industries, water utility companies or agricultural companies. While the latter indicates installations on seas and oceans that vary enormously in characteristics, e.g. salt water, strong currents, complicated anchoring system, etc. Our focus here is only on floating PV solutions.

A floating PV installation is a standard PV array with a floating mounting system. Typically, installations are made up of three main components; the array, the electrical transmission system and the anchoring system. The array includes the Hydrelio technology, the floating mounting system, and then industry standard PV panels and electrical collection equipment. The Hydrelio is a well-established technology with over 72 MW of operational projects in countries including the United States, the U.K. and Japan with another 100 MW of projects in development. To transmit the electricity produced to shore, a small Hydrelio bridge carries DC cables to an on-shore centralized inverter. The system is anchored using either plates or helix screws along the embankment or bed of the water body, both of which have very minimal impact. All major PV components are IEEE and UL Standard compliant and the installation of the system leaves no permanent impact to the project site. For further information on the floating solar technology, please refer to Appendix B.

Floating solar has several additional benefits in comparison to ground or roof mounted systems including:

- Preservation of valuable lands for other uses such as agriculture
- Ability to convert otherwise unused space, the water's surface, into a renewable energy generation space
- Reduce water evaporation by covering a portion of the surface area of the water body, which can also limit algae growth and risk of eutrophication
- Increased system efficiency due to the natural cooling effect of the water on the PV panels
- Environmentally friendly - recyclable drinking water compliant materials with no harm to local ecosystem when property sited and designed

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Opportunity for Floating Solar in Massachusetts

Sun$_2$O applauds the goals set by the SMART program for the development of 1,600 MW of further solar installations in Massachusetts. Therefore, it is understood that the DOER must prioritize what it finds to be significant potential avenues for the development of solar when evaluating what to include in the SMART program. Likewise, as evidenced by the location, technology and offtaker based adders, the DOER is designing the program such that it can better guide solar development in a direction that more efficiently benefits Massachusetts as a whole.

Sun$_2$O has done extensive work to evaluate the opportunities for floating solar in Massachusetts following the criteria established through working with MassDEP. Thus far, the total floating solar locations identified in Massachusetts exceeds 50, which represents over 100 MW of potential development opportunities. This list is by no means exhaustive, and Sun$_2$O believes floating solar can meaningly contribute to the SMART goals. Sun$_2$O feels this poses a great opportunity for the DOER to expand the program to include a technology type which would enable a broader base of participants to benefit from the program, on a scale that would have a significant footprint on the program.

The inclusing of floating solar in SMART enables potentially underserved population segments under the current design to benefit from SMART. For example, over 70% of the opportunities identified for floating solar are with agricultural users, predominantly cranberry farmers. Many cranberry farmers are struggling financially and their limited ability to participate in SMART as currently designed could have significant consequences.

Floating Solar can help struggling historic businesses maintain their operations

The proliferation of solar throughout the state has been welcomed by many residents and small businesses due not only to its clear environmental benefits but also because of the local economic benefits it can bring. Those benefits have included new jobs, rising property values and the potential for attractive lease revenues.

A group in particular who has utilized solar as a means of economic support has been cranberry farmers. This industry in Massachusetts has seen a substantial drop in the price of cranberries while at the same time an increase in the cost of farming. While many of these farms have century long histories, financial realities have pressured them to convert some of their cranberry growing operations into sites for ground mounted solar installations. Solar land leases have been a needed source of revenue for some while also having the benefit of allowing for broad development of solar. However, this has come at the cost of those farmers sacrificing some of their historical growing operations.

Sun$_2$O and Ciel et Terre strongly believe that floating solar presents this group with the opportunity to continue their historic cranberry farming operations, while also benefiting from solar development. Many cranberry farmers have built on their farms large water storage basins due to water supply security and operational needs. These basins are in many cases man-made, serve only as a storage area and have no current use of the water surface. Floating solar allows these farmers to benefit from solar development without compromising their farming operations and potentially augmenting the basins function. Floating solar can have the benefit of mitigating water evaporation, helping the farmers preserve valuable water resources.

As an example, below you will find a cranberry bog holding pond located in Carver with a potential floating solar system. By utilizing this water holding basin, the cranberry grower could maintain her vast farming operations while benefiting from a 2,100 KW solar development. This installation would comply with all siting and design criteria formulated with the MassDEP, namely a coverage ratio over the total water body of below 50%.

Note: The above depiction represents a 2,100 KW floating solar installation. The total acreage the array covers is 5.5, of the 18 acre water body.

With the current program design restricting development of solar on MassDEP jurisdictional wetlands, many cranberry growers may not be able to participate in the new SMART program which would be financially meaningful. The consequences of this could mean less equitable and diverse development of solar throughout the state, with the potential to still result in the closing of these cranberry farming operations for other avenues of development.

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Including Floating Solar in the SMART program would help meet the DOER Goals

As Sun$_2$O and Ciel et Terre had previously commented, including floating solar in the SMART program would directly further the DOER's goals for the program. The floating solar installation type provides the unique ability to deploy solar while completely maintaining the function of the area beneath the canopy. This is especially true since floating solar installations make use of an otherwise vacant space, while leaving the water body ecosystem and function unaffected. In addition to this, floating solar provides opportunities to deploy various sized arrays in a diverse range of locations across the state to otherwise unserved clients. These projects would directly benefit the energy offtakers, water body owners and municipalities who wish to increase their solar presence yet lack the available space to do so with traditional roof or ground installations.

As Sun$_2$O and Ciel et Terre had stated in its comments submitted, floating solar installations could fall under the definition of Solar Canopy, because floating solar leaves the area beneath undisturbed. This was argued on the basis that, as the definition for solar canopy is proposed in the current draft of CMR 225, a floating PV system does not alter the primary function of the water body (water storage for irrigation or treatment, cooling processes, rain water control reservoir, etc.) and the area beneath the canopy. Furthermore, floating solar could even improve this primary function by reducing evaporation due to the shading effect on the water and limiting algal blooms that can lead to water quality degradation. It is also compatible with aquaculture activities as evidenced by a recently announced project in California. This provides shelter for the fishes from fishing birds and solar aerators can be powered directly by the solar array to enhance oxygen level in the water for improving fish population. While floating solar could fall under the Canopy definition, following a meeting with the DOER, MDAR and conversations with the MassDEP, Sun$_2$O found that it would be more appropriate to specifically propose creating a unique SMART designation for floating solar.

Sun$_2$O believes that it is important for the DOER to incentivize solar development that does not jeopardize the Greenfields or the pristine farmland of Massachusetts. Solar development is currently viewed by many within the land conservation and agricultural community as a threat and Sun$_2$O supports the DOER decision to add siting criteria for ground mounted systems and Agricultural Generation Units that address these concerns. Floating solar advances the DOER's objective by deploying solar arrays on otherwise vacant space, leaving the surrounding land and the function of the water body unaffected. Floating solar is also able to reach clients with insufficient roof or ground space to pursue solar development in the past, thus advancing the DOER's objective of ensuring widespread and equitable access to solar.

Solar Achieved with Minimal Environmental Impact

A floating solar array that is designed using the correct methodology and sited on a water body that does not have a high ecological value, can result in a solar development with minimal environmental impact. When a floating solar array is installed on an irrigation pond, for example, the water body's function is not altered or diminished. The pond can still be used for crop irrigation and the floating solar array provides the extra benefit of reducing water evaporation and algae growth. The land owner can reap the benefits solar provides without sacrificing valuable farmland. Whether installed on storm water drainage basins, reservoirs or irrigations ponds, the environmental impact to that basin is minimal due to the fact that there are few natural systems that can be interfered with and the array is designed such that any sensitive areas are avoided.

The environmental impact of a floating solar installation is limited, and can largely be addressed through proper design and site selection. A recent study titled "Statewide Ecological Report for the Implementation of Hydrelio Floating Photovoltaic Arrays" conducted by WRA Environmental Consultants, found that:

> *"Potential adverse effects associated with the installation, maintenance and eventual removal of a Hydrelio PV Solar Array to wildlife species at manmade operational waterbodies within California are limited. Assembly and deployment of each array is very fast and is generally completed by hand in previously disturbed areas. Ground disturbance, use of heavy equipment and vegetation removal are typically not required in order to install or service an array. The material that the array is constructed from is considered inert and does not leak any chemicals into the environment. Furthermore, maintenance is straight-forward, infrequent, and requires no detergents or chemicals. The Hydrelio arrays therefore poses very little risk to wildlife."*

The two principle factors in assessing any potential impact of a floating system on a given water body are the size of the array and the type of water body. To the former, Sun$_2$O targets installations with a total water area coverage ratio of less than 50%, significantly reducing any risk to the ecology of the water body. To the latter, as explained previously, ideal installation areas are operational water bodies with limited to no present biota. The combination of an under 50% coverage ratio and operational water bodies results in little to no impact on the surrounding environment. Following these two principles, site-specific environmental impact analysis will also be completed as necessary in conjunction with the MassDEP. To address concerns regarding the siting of floating solar and implementation, Sun$_2$O has worked with the MassDEP to develop siting criteria, which can be found below.

Prior Regulatory Recognitions of Floating Solar

In the United Kingdom, there are different subsidies for PV installations: A Feed in Tariff and Renewable Obligation Certificate (ROC). The ROC is a subsidy based on the value of a tradable certificate created for each MWh generated by the renewable energy generator. Each technology generates a different number of ROCs per MWh for 20-years – the government uses this rate to control its capital spend.

OFGEM, the government regulator for gas and electricity markets in Great Britain, formally accredited floating PV projects for the higher "Building Mounted" ROC band (e.g. 1.6) rather than the lower "Ground Mounted" (e.g. 1.4) ROC band as they recognize the non-conflict use of land for floating PV projects.

In France, the last national public tender for solar PV installations, “CRE 4,” included specifically the eligibility of “tous plans d’eau” which translate as all water bodies.

Incentive Design for Floating Solar

Sun$_2$O believes that floating solar should be incorporated with its own Locational Based Adder. As with Canopy Solar Generation Units and Agricultural Solar Generation Units, floating solar is more expensive than a traditional ground mounted system, but its numerous benefits described herein will make it a valuable part of the SMART program. For floating solar, the increased cost is driven by anchoring, permitting, racking and cost of capital. To compensate for added development costs, floating solar should receive its own Locational Based Adder category with a rate of $0.06/kWh. With this adder, development of projects will be feasible, benefiting stakeholders across Massachusetts. Without the inclusion of a Floating Solar Generation Unit adder, most all floating solar development would not be financially possible.

Regulation of Floating Solar with MassDEP and Applicable Locations

Sun$_2$O and Ciel et Terre understand that floating solar development is appropriate in certain bodies of water with a site-specific design. Thus, the regulation of its deployment must take an approach which acknowledges these factors yet promotes the deployment of this beneficial technology. Such an approach is well reflected in the DOER and MDAR’s proposed language for the design, siting and land use criteria for Agricultural Solar Tariff Generation Units. We applaud this approach and have attempted to mimic that in our proposed addition to the program.

To best understand the concerns of regulating floating solar, Sun$_2$O has worked with the MassDEP to communicate the technology, concept and potential locations for its deployment.

Following that, Sun$_2$O worked with the MassDEP to formulate standards and siting criteria for floating solar deployment throughout the state which can be found in Appendix A. From both the MassDEP as well as Sun$_2$O's perspective, the development of floating solar is best suited for Operational Water Bodies where little natural features currently exist. Operational Water Bodies are those which can be manmade and are currently used for some agricultural, water treatment or industrial purpose. These water bodies have minimal natural features as their designed purpose was to function in a human process. Therefore, the installation of a floating solar array would not interfere with a natural ecosystem nor the function of the water body.

Additionally, we have formulated with the MassDEP other standards for floating solar's design and implementation. Among those included are a restriction of a surface area coverage ratio on the body of water of less than 50%, anchoring to be installed along the embankment of the body of water, and standards for the materials used to float the installation. These design and siting criteria have been formulated with prior floating solar installations experience as support in addition to an independent environmental impacts analysis.

For further assurance of the measured approach which Sun$_2$O and MassDEP believes appropriate, Sun$_2$O has included in its proposed language that the final determination for projects will be done in conjunction with the DOER and MassDEP.

Sun$_2$O and Ciel et Terre would be glad to work with the DOER to provide any further information on floating solar or determine the applicable regulatory criteria for floating solar in the SMART program.

Thank you for your interest and consideration of these comments. Sun$_2$O and Ciel et Terre are available to help in any way we can to develop the incentive program in a way that best furthers Massachusetts renewable energy goals.

Sincerely,

Victor Stolt-Nielsen Holten
Managing Partner
Sun$_2$O Partners, LLC.
Victor@sun2o.com

Corey Kupersmith
Managing Partner
Sun$_2$O Partners, LLC.
Corey@sun2o.com

Eva Pauly-Bowles
International Sales Director
Ciel & Terre USA, Inc
epauly@cieletterre.net

Sun$_2$O Partners LLC.

Ciel & Terre

Appendix A: Sun2O and Ciel et Terre Proposal for Amendments to the 225 CMR 20.00: SOLAR MASSACHUSETTS RENEWABLE TARGET (SMART) PROGRAM Legislation

Definitions:

Floating Solar Tariff Generating Unit. A Solar Tariff Generation Unit located on an Operational Water Body that allows for the continued use of the water body.

Operational Water Body. A body of water that is currently or was formerly used for water treatment, agricultural or industrial activities.

Great Pond. A Great Pond as defined in M.G.L. c. 91

Water Body Coverage Ratio. The ratio of the total surface area covered by the Floating Solar Tariff Generating Unit divided by the total surface area of the Operational Water Body under standard conditions.

Amendment to 225 CMR 20.05(5)(e)1a:

- iv. Floating Solar Tariff Generating Unit

Amendment to 225 CMR 20.05(5)(e)1b:

- Vii. Floating Solar Tariff Generating Unit

Amendment to 225 CMR 20.06(1):

(h) Special Provisions for Floating Solar Tariff Generation Units. To qualify as a Floating Solar Tariff Generation Unit, a Solar Tariff Generation Unit must submit documentation itemized in 225 CMR 20.06(1)(h) below. All final determinations regarding the eligibility of such facilities will be made by the Department, in consultation with MassDEP.

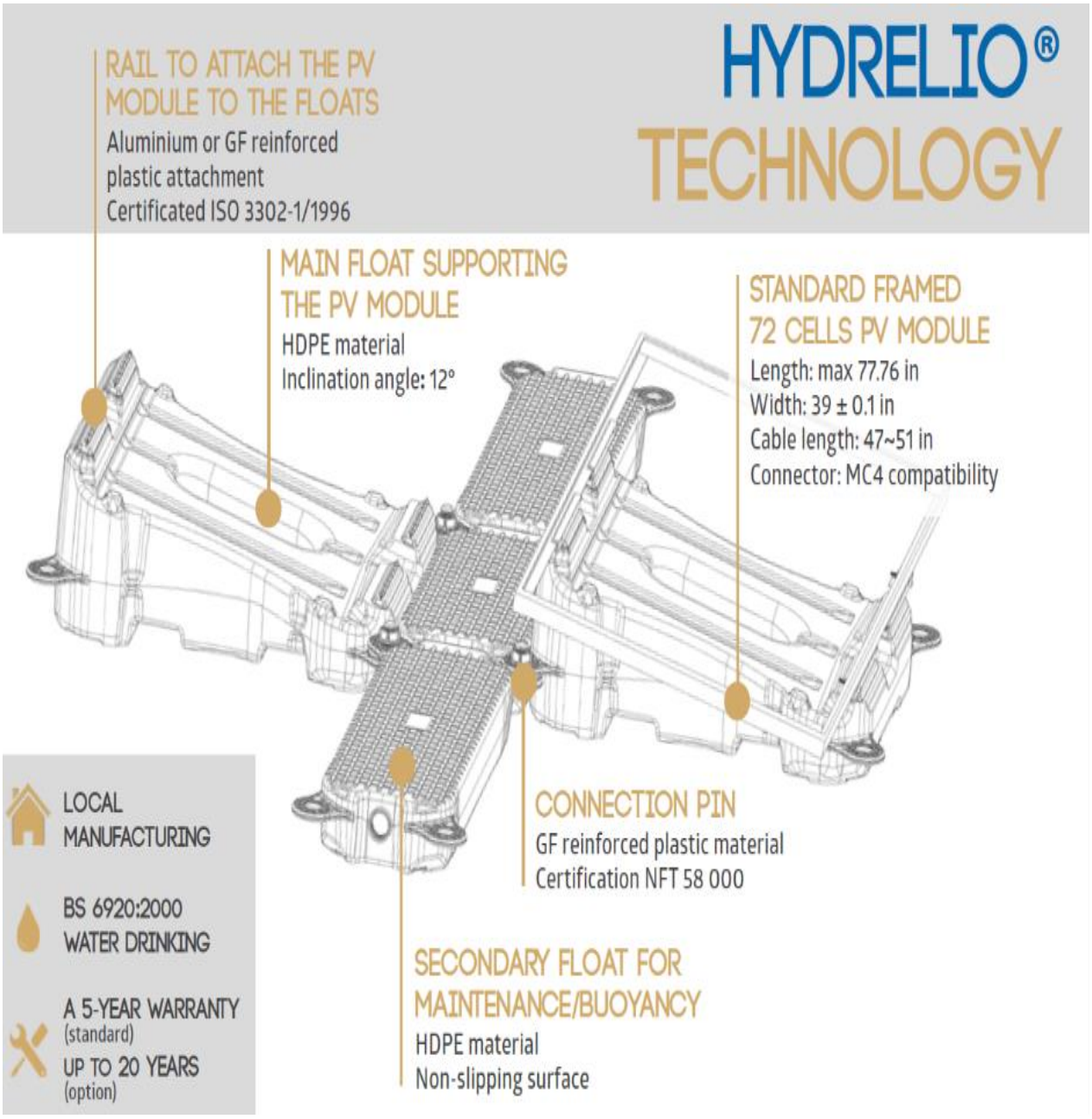
1. the Solar Tariff Generation Unit will not interfere with the continued use of the water body for its designed purposes;
2. the Solar Tariff Generation Unit will be permitted on Operational Water Bodies;
3. the Solar Tariff Generation Unit will not exceed a Coverage Ratio of 50%;
4. the racking system shall be made of materials that have been tested for water quality impact;
5. the Solar Tariff Generation Unit will not be permitted on Great Ponds;
6. the Solar Tariff Generation Unit shall be designed to minimize potential interaction with native species;
7. the Solar Tariff Generation Unit is a floating structure allowing for continued use and maintenance of the Operational Water Body while generating clean electricity; and
8. other system design information, which shall include, but not be limited to:
    a) total gross acres of open water to be integrated with the project;
    b) designated function of Operational Water Body;
    c) anchoring system design and materials; and
    d) design drawing including mounting system type, panel tilt, panel row spacing, individual panel spacing, etc.; and

9. If in the future new potential installation locations and technologies for floating solar not considered in 225 CMR 20.06(1)(h) should emerge, the Commission in conjunction with the MassDEP may conditionally permit such projects

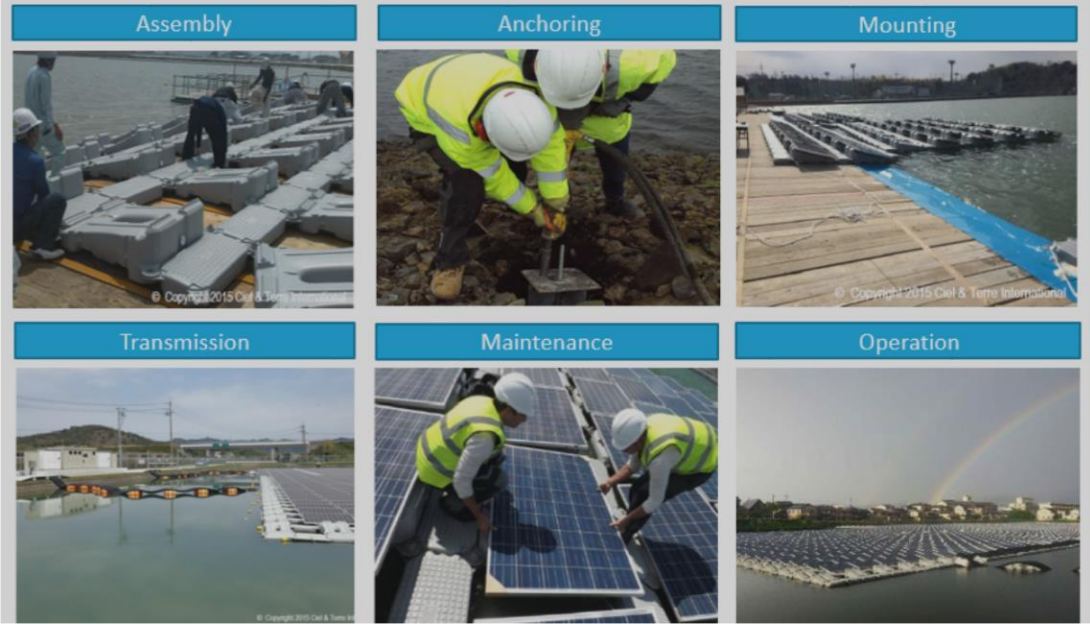
Amendment to 225 CMR 20.07(4)(a);
(a) Location Based Adders. Initial Location Based Adder Rates shall be established as follows:

Generation Unit Type	Adder Value ($/kWh)
Building Mounted Solar Tariff Generation Unit	$0.02
Solar Tariff Generation Unit on a Brownfield	$0.03
Solar Tariff Generation Unit on an Eligible Landfill	$0.04
Canopy Solar Tariff Generation Unit	$0.06
Agricultural Solar Tariff Generation Unit	$0.06
Floating Solar Tariff Generation Unit	$0.06

Appendix B: Floating Solar Technical and Design Information



Installation and Operation



Floating Solar Components

Array	• Hydrelio Floats • Drinking water compliant Solar Panels • Industry standard electrical collection equipment	
Transmission System	• Corex or Hydrelio Bridge • DC Cables transmit power to inverter • On-shore Tier 1 centralized inverter	
Anchoring System	• Anchors secured to basin embankment • Breaker bars fasten array to anchors • Anchored using helix screws or plates	

All major array components are IEEE 1547 and UL 1741 compliant

Note: Photos credit of Ciel et Terre and their proprietary Hydrelio Technology

Hydrelio System Facts

Safe and Drinking Water Compliant	▫ Drinking water compliance tested by the English Independent Water Quality Control Center ▫ Technology currently being used to install a 4.4MW array on the Bordertown Water Treatment Plant's reservoir ▫ Two operating projects on drinking water reservoirs in the U.K.
Wind Resistant	▫ Tested by ONERA (the French aerospace laboratory), Hydrelio® technology can withstand up to 212 km/h (118 mph) winds
Simple Mounting & Maintenance	▫ Hydrelio® system has been designed to be easily and quickly deployed ▫ Main yearly maintenance items include cleaning the panels, inspecting all connector pins and checking the system anchoring and buoyancy
Resistant to UV Corrosion	▫ Hydrelio® floats are made of HDPE through a blow molding manufacturing process ▫ Highly resistant composition gives the system a 20+ year useful life
Cold Weather Resistant	▫ Tested in Sweden over 100 day period and showed no impact on the mechanical properties of float ▫ Can withstand local snow loading requirements with additional mitigation systems if needed