What Community Solar Can Do

Suggestions for Realizing the Potential of Community Solar in Massachusetts

Produced by students of *Research for Environmental Agencies and Organizations,* Department of Earth and Environment, Boston University, April 2018[1]

Investment in EJ Communities and Completion of Stalled Waste Site Cleanups

Community Solar (CS) gives anyone an opportunity to invest in and access clean solar energy even if they cannot install panels on their roofs due to unsuitable roof space, living in a large condo building, or renting living space. Community members share investments in local solar farms and in return get electricity that costs less than the price they would ordinarily pay to their utility.[2] CS makes solar an accessible option to environmental justice (EJ) communities where options to invest in clean energy sources are especially limited. CS makes solar energy accessible to the public, not just the privileged.

Low-income communities bear the brunt of pollution and climate change. Engaging in community solar can help them increase energy independence, hedge against rising fuel costs, cut carbon emissions, and provide local jobs while using the profits of the electricity generation to finance waste site clean ups. Because low-income families spend a disproportionate amount of their income on utility bills, they receive a proportionally greater economic benefit from solar power.[3]

The National Renewable Energy Laboratory found that only 22% to 27% of residential rooftop area is suitable for hosting an on-site photovoltaic (PV) system after adjusting for structural, shading, or ownership issues. Community options are needed to expand access to solar power so that a wider population can participate in the transition to cleaner energy. CS more strategically uses space by installing solar farms in open areas that can house multiple solar panels, leading to more solar generation than would be possible by installing fewer panels on individual homes.[4] Opening up solar access for greater numbers of residents is important for many reasons – it will help meet the Commonwealth's goals for reducing greenhouse gas emissions, and it will address the unfortunate sense to many that solar is an option for only the few who can afford the money and time to invest in it, or who own a suitable space. Community solar helps realize the promise of "Solar for All".

In addition, community solar can be a means to finish cleanup of contaminated sites that have remained a blight on local neighborhoods, reducing property values and inhibiting economic development. Some current waste sites are ideal for CS and have the added benefit of generating extra revenue that can then be used to help complete the clean up. Various options, such as power purchase agreements, can be used to provide communities (neighborhoods, municipalities or regional entities) immediate benefits by generating extra revenue while simultaneously creating lasting benefits in the long term, as CS pays for itself. CS is especially beneficial for EJ communities since they often also have high incidences of serious health threats related to emissions pollution and waste sites contamination.

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[1] Walker Black, Alexander Seal, Katharina Voehler, Chelsea Wolgel, Undraa Zayamandakh, under the supervision of Rick Reibstein.
[2] https://www.energysage.com/solar/community-solar/community-solar-power-explained/
[3] http://www.lowincomesolar.org/why-act/
[4] https://www.energy.gov/eere/solar/community-and-shared-solar

Legislation could accelerate the growth of CS and enhance the chances that it will be implemented where it can have the most benefit. Through projects with DEP's solar and EJ staff, BU students learned how CS could generate revenue for both residents and waste site cleanup. Cleaning up waste sites – either under the brownfields program or simply as part of 21E, will have the added benefit of maintaining or even increasing local property values in many areas, removing the blight and stigma of living near a contaminated site. Reducing energy costs for residents will help them to be able to afford to stay where they live even with property values increasing, serving as a buffer against gentrification.

The establishment of solar farms that serve communities is an approach that has now been demonstrated and the technology is well established. But for CS to be successful for the purposes cited above, the community it serves requires organization. Transience of residents, scarcity of investment and time resources, and rental ownership are barriers to EJ communities creating such projects on their own. Legislation can assist in realizing the vision of CS for EJ communities by fostering the organization that could provide the anchor and stability necessary for ownership and operation. Incentives could be created for non-profits or municipalities to be in charge of a CS project. A municipality might be interested in this project because of the waste site cleanup component and the beneficial effect it would have on property values (which would ultimately increase taxes). Property Assessments for Clean Energy mechanisms could play a role in easing financing. Efforts to accelerate the use of CS to improve EJ areas could be accomplished through new legislation or by amendment of existing laws.

Figure 1. An aerial shot of a solar farm on a brownfield in Palmer, MA[5]

[5]https://solarbuildermag.com/news/brownfield-in-massachusetts-receives-6-mw-system-developed-by-syncarpha-capital/

Massachusetts Communities with the Greatest Potential and Need for Action

We started our analysis with a spreadsheet that lists all waste sites in environmental justice communities in Massachusetts. We prioritized the development of certain community solar projects on waste sites by looking at:

- The acreage of contaminated land in a community or the severity of contamination
- How big the single sites in that community are (for a typical 500 kW to 2,000 kW community solar project, approximately 3 to 12 contiguous acres are needed)[6]
- The surrounding communities for a possible collaboration or a united effort to develop community solar
- Starting with the ones that are currently not in use (according to Google Maps)

Site Selection and Resource Evaluation

There are other factors that are crucial to include for the site selection, that we could not include due to a lack of data. Proper siting includes a site analysis for any potential shading, as well as determining optimal tilt of the modules, location of inverters and other system components, foundation or structural support, and security or public access requirements. Distance to the nearest electrical substation should be less than or equal to 3 miles. There is typically a preference for community solar systems to be connected at the distribution level (rather than at the transmission level) of the electricity grid. Distances or interconnections that are longer or more complex could incur prohibitive costs.

The project owner must also obtain exclusive rights to build the solar project if they are not the property owner. This is usually negotiated through a land lease agreement with the property owner and/or site host. The lack of competing uses on contaminated land is of great advantage here.

Understanding the amount of solar resource and the effects of climate and latitude on solar energy production is critical to finalizing the system location and obtaining estimates for financial modeling. Typically, project organizers will rely on solar resource maps or solar energy production calculators, such as PV Watts or RETScreen to get an initial assessment of the solar resource.[7] Irradiance and annual electricity output are usually around 500 kW to 2,000 kW for a community solar project. Below 500 kW no economies of scale can be achieved, but most existing community solar programs are capped at a maximum individual project size of 2,000 kW.[8]

It makes sense to build on the largest sites first (which are waste sites above 12 acres with the actual solar site only being 12 acres), to give those communities with the biggest waste sites at least some ease. Also, the community solar site could generate enough profit to clean up more than just the 12 acres the solar site stands on.

There are solar projects on waste sites in place, but the approach of combining *community solar* and waste site clean ups in environmental justice communities is new. 166.7 acres of solar panels have been installed on contaminated land throughout Massachusetts, and another 255.5 acres have been proposed.[9] Although many of the sites examined below are currently in industrial use and thus may present complications concerning solar placement, it seems reasonable to conclude that the potential of community solar greatly exceeds current implementation.

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[6] https://www.epa.gov/sites/production/files/2016-12/documents/epa_repowering_community_solar_discussion_paper_final_120716_508.pdf

[7] A Guide to Community Solar, U.S. Department of Energy, November 2010

[8] https://www.epa.gov/sites/production/files/2016-12/documents/epa_repowering_community_solar_discussion_paper_final_120716_508.pdf

[9] http://www.mass.gov/eea/docs/dep/energy/solar-pv-on-contamintated-land.xls

Findings

- Out of the 441 contaminated sites in environmental justice communities in Massachusetts, 163 (37%) are big enough (>3 acres) to host a photovoltaic system. Altogether, these 163 sites make up 24,018.07 acres. **79% of them are currently in industrial use**, 9% are in commercial use, 4% are manufacturing sites, 3% are non-federal cleanup sites, 3% are vacant and 2% are municipal sites.
- If community solar systems were to be installed on all these 163 sites – the smallest being 3 acres, the largest being 12 acres – the acreage of PV systems would sum up to **1,335.24 acres**.
- The generation-weighted average land use (acres/GWh/yr) for small PV is 3.1.[10]
- 1,335.24 / 3.1 = **430.72 GWh/yr for Massachusetts**

We only looked at waste sides between 3 and 12 acres (and considered sites bigger than 12 acres only 12 acres big), because of the cap. But there are 59 sites that are bigger than that, and the potential for community solar would increase significantly **if the cap was lifted**. 5,402.83 additional acres of contaminated sites would then become eligible for solar development, producing an additional 1,742.85 GWh/yr - this corresponds to a **four-fold increase compared to the potential under current legislation**.

As seen on the map, there are certain hotspots of contaminated land throughout Massachusetts that deserve special attention:

	Contaminated sites (MA total: 441 sites)		Eligible for CS (>3 acres)		Conclusion
Worcester	99	560.06 acres	24	227.33 acres	highest potential
Springfield	33	381.61 acres	12	85.46 acres	high potential, agglomeration with West Springfield and Chicopee
New Bedford	20	18,113.62 acres	11	92.67 acres	high potential, especially at the harbor
Holyoke	20	164.13 acres	3	20,51 acres	sites too small to be developed
Chicopee	19	153.71 acres	7	90.53 acres	high potential, agglomeration with West Springfield and Chicopee
Fitchburg	19	104,01 acres	7	68,33 acres	action required, but too isolated to be prioritized

Of all 441 sites, 99 are located in **Worcester** – with 560 acres of contaminated land. 24 sites appear to be eligible for the development of a community solar project.
71.33 + (13x12) = **227.33 acres / 3.1 = 73.33 GWh/yr**

[10] Land-Use Requirements for Solar Power Plants in the United States, National Renewable Energy Laboratory, June 2013

Springfield is the second hotspot with over 33 waste sites. Due to its proximity to the highly contaminated Chicopee and West Springfield, this project could entail the greater urban area.
Chicopee: 18.53 + (6x12) = 90.53 acres
Springfield: 37.46 + (4x12) = 85.46 acres
West Springfield: 8.75+12 = 20.75 acres
Springfield (greater urban area) = 196.74 acres / 3.1 = 63.46 GWh/yr

New Bedford has high potential for the development of community solar projects on waste sides. This option can be seen as related to the efforts to redevelop the harbor. (Floating solar arrays may also be an option).
56.67 + (3x12) = **92.67 acres / 3.1 = 29.89 GWh/yr**

<u>10 Site Suggestions:</u>
We selected 10 Sites with varying states of land use as examples of potentially strong candidates based on their size, proximity to residences, and opportunity for further development. The locations and site names have been selected from the EPA's list of contaminated sites near environmental justice communities. Satellite images were used to confirm availability of space on the contaminated sites.

1. **Hampden Power Plant, Chicopee, MA (42.148, -72.616): Partially open, Partially wooded, 22 acres.**
   Vacant lot in Chicopee located between a strip of commercially used land and the Connecticut River. Some of the land is open while some of it is covered by trees. The size of the space along with its proximity to homes and business makes this a strong candidate.
2. **Barts Farm Stream Area, Leominster, MA (42.500, -71.744): Partially wooded, Partially open, 5.55 acres.**
   A partially wooded and partially open plot in southern Leominster. Centrally located within a residential area which could hamper or enhance feasibility of the project based on community receptivity.
3. **Westborough State Hospital, Westborough, MA (42.303, -71.606): Partially open, Partially developed, 456.54 acres.**
   One of the largest sites by acreage and the largest with a significant amount of open space. The land is centrally located between commercial and residential land in Westborough and Northborough. The hospital covers a portion of the area but there is enough available open space to support a community solar project.
4. **New Bedford Harbor, New Bedford, MA (41.606, -70.884): Waterbody with surrounding open area, 18000 acres.**
   This waterbody is the largest contaminated site on the list. The coastline around the harbor has ample open space to support community solar and is located in close proximity to New Bedford.
5. **H. Cohen & Co., Boston, MA (42.332, -71.057): Open, 6.2 acres.**
   Vacant lot in an industrial park in South Boston, located next to residential area. Lot is large enough to support a medium sized project and close enough to users to be logistically feasible.
6. **Haverhill Municipal Landfill, Haverhill, MA (42.753, -71.047): Open, 71 acres.**
   Closed landfill at southeastern edge of Haverhill. The EPA highlights such sites as strong candidates for community solar given their otherwise limited use to the community. As an open plot isolated by surrounding trees, community disturbance could be minimal.

7. **Springfield Industrial Center/Memorial Industrial Park, Springfield, MA (42.141, -72.557/42.138, -72.551): Partially open, partially developed, 14/120 acres.**
   Two adjacent plots of land within industrial parks of Springfield. Both sites have some industrial development but also offer several large plots of open land in close proximity to residences. Nearby solar fields highlight the feasibility of the area.
8. **Falulah Ind Assoc. Realty Trust, Fitchburg, MA (42.564, -71.774): Open, 10 acres.**
   Open plot of land within a Fitchburg industrial park. Located near residences in Fitchburg and Leominster, this site could support a moderately sized project.
9. **Wyman Gordon Co - Worcester, Worcester, MA (42.256, -71.802): Partially open, Partially developed, 26 acres.**
   One of the few sites in Worcester showing much promise, this has some industrial development but enough open space to offer potential for surrounding commercial and residential land.
10. **Polymerine Inc., New Bedford, MA (41.726, -70.958): Partially developed, partially wooded, 8.02.**
    Large patches of wooded land located between commercial and industrial development on the outskirts of New Bedford. The site offers ample space for a project but would need to be cleared of trees before construction. The most dense parts of New Bedford are possibly out of range of the project, but it could serve closer residential communities.

Figure 2. Aerial shot of Titcomb Pit landfill in Amesbury, MA currently in development for sola[11]r

Examples of potential changes in Current State law

The Massachusetts Green Communities Act (SB 2768) establishes a state effort to accelerate the development of clean energy.[12] An effort can be initiated to determine how it may be used, or amended, to promote the use of CS for EJ communities. The act enacted *virtual net metering*, enabling customers to

[11] https://brownfieldlistings.com/blog/post/solar-rfp-update--almost-40-interested-parties-in-titcomb-pit-landfill-in-amesbury
[12] www.malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter169

transfer generation credits to other customers. Participants are compensated at the full retail rate. All customer classes are eligible.

- Applies to investor-owned utilities. The Department of Public Utilities could examine actions to motivate utility support for CS in EJ – as, for example, ensuring that interconnection fees are not a barrier.
- Municipal utilities may choose to offer net metering. Incentives and other forms of assistance could increase the number of municipalities that choose to do this for their residents.

Net Metering Laws have increased the cap and continued authorization for virtual net metering. Neighborhood Net Metering (SB 2395)[13] enables the deployment of neighborhood net metering facilities with a minimum of 10 residential customers. Other customer classes are also permitted to participate. Participants are compensated at the retail rate minus default service, transmission, and transmission service charges. However:

- Customers must be located within the same municipality and service territory
- Projects are limited in size (2 MW each, 10 MW for government-owned systems). This limit should be regarded as a barrier to the expansion of solar for all.
- All net metering is capped at 6% of the utility's peak load (3% for government-owned systems, 3% for non- government-owned). This limit should be examined and grid modernization efforts undertaken in order to lift it, or the prospect of greatly expanded solar will not be realized.

Additional incentives and assistance to expand CS for EJ communities and to use it for the purposes discussed herein, could focus on:

- Building the capacity to organize and maintain a CS project by municipalities, as for example by incorporating provisions in the Green Communities Act;
- Increasing the use of CS for waste site cleanup, as for example by incorporating provisions in the Brownfields program to encourage such investment;
- Ensuring interconnection fees and net metering caps or limited net metering revenues do not limit the growth of CS and pursuing grid modernization to establish the infrastructure needed for

Potential Model to Follow: Colorado Community Solar Gardens Act.

In 2010, the Colorado State Legislature recognized that community solar gardens (another name for community solar sites) presented an excellent opportunity to increase solar energy investment while reducing electricity costs for low-income households. This led to the implementation of the Community Solar Gardens Act which established incentives related to the development and purchasing of credits generated by community solar sites and encouraged utilities to include low-income subscribers. As a result of this legislation, Colorado has experienced sudden growth in Community Solar Gardens[14]:

- In 2012 and 2013, Xcel Energy, Colorado's biggest power provider, approved the construction of 25 community solar projects, representing a total of 18 megawatts worth of renewable energy.[15]
- The success of Pikes Peak Solar Garden demonstrates the effectiveness of developing solar arrays on previously unused brownfield sites. The site is now home to a 10,000 panel solar array delivering affordable power to a range of customers including the local library system, the University of Colorado and hundreds of nearby families.[16]
- As of 2018, 43 community solar projects have been developed in Colorado with many more scheduled to begin construction. 28 of the 43 projects are completely sold out which

[13] https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXXII/Chapter164/Section140
[14]https://www.colorado.gov/pacific/sites/default/files/Insights%20from%20the%20CEO%20Low-Income%20Community%20Solar%20Demonstration%20Project.pdf
[15]https://www.bizjournals.com/denver/blog/earth_to_power/2014/09/community-solar-power-grows-in-colorado.html
[16]http://www.sharedrenewables.org/coop-energy-resources/case-studies/colorado

demonstrates the popularity of these systems.[17]

Utilizing the Brownfields programs

Existing brownfields programs can be used to enhance incentives and assistance for the special purposes discussed herein.

The purpose of the **Brownfields Redevelopment Access to Capital (BRAC) Program** is to encourage private sector lending on contaminated sites throughout Massachusetts. The program is administered by MassBusiness and addresses lenders' concerns that (1) cost overruns incurred during cleanup might impede the borrowers' ability to repay a loan; and (2) contaminated land is "impaired collateral" with a reduced value. BRAC backs private sector loans with environmental insurance to ensure that the cleanup is completed, the loan is repaid and the collateral is restored to its "clean" value. The environmental insurance is implemented to keep projects running. The borrowers' risks are protected through the BRAC Pollution Legal Liability and Cleanup Cost Cap Policies. The state, through MassBusiness, subsidizes the premiums of insurance policies up to 50%. The program currently has a $15 million appropriation.

The Brownfields Redevelopment Fund (BRF) is administered by MassDevelopment and provides low-interest loans and grants for site assessment and cleanup in the List of Economically Distressed Areas (EDAs). EDAs include all Economic Target Areas (ETAs), areas that meet the criteria for ETA designation, but have not been formally designated, and former manufactured gas plant sites. The program funds currently have a $30 million appropriation. Eligibility is limited to municipalities, redevelopment authorities and agencies, economic development and industrial corporations, community development corporations, and economic development authorities. MassDevelopment may designate "Priority Projects" though the Brownfields Redevelopment Fund. Eligibility for priority project designation is determined on a case by case basis by MassDevelopment.

Through special provisions for EJ CS: efforts could be made to increase utilization of these brownfields programs, the use of brownfields for EJ CS could be prioritized, MassBusiness and MassDevelopment funding could be increased, and environmental insurance and other administrative costs could be lowered

In addition, the Brownfields Tax Incentive[18], allows a taxpayer to fully deduct the costs of environmental cleanups in the year the costs were incurred rather than spreading them over a period of years. Perhaps increasing this incentive could help spur the cleanup and redevelopment of brownfields.

Also, the recent institution of the **Solar Massachusetts Renewable Target (SMART) program** includes "adders" that increase the value of certain projects above the fixed rate per (kWh) of solar energy produced.[19] These already include incentives for public entities and community shared solar users. Low-income property owners are also eligible for an adder worth $0.03 per kWh. However, these incentives may not be enough, and it is suggested that they be examined for their effectiveness.

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[17] https://www.communitysolarhub.com/search/results?keywords=Colorado

[18] Passed as part of the Taxpayer Relief Act of 1997 (Public Law 105-34), and codified through Section 198(a) of the Internal Revenue Code

[19] The compensation rate that a system owner receives is calculated by subtracting the value of the energy (through net metering credits) from the total incentive amount (so, as the value of the net metering credits go up, the value of the incentive is lower). Similar to the current SREC program, the proposed incentive for small-scale projects of less than 25 kW would run for 10 years. In addition to the baseline incentive amount, the program offers bonuses for particular types of installations. These "adders" increase the per-kWh incentive for building a solar canopy, using energy storage, and other innovative solar systems including building-mounted projects and systems installed on brownfields and landfills. Other adders are based on the person utilizing the electricity and can range from an additional $0.02 per kWh to $0.06 per kWh