A Guidebook for Community Solar Programs in Michigan Communities

"This report is intended to help guide Michigan groups through the web of rules and regulations specific to Community Solar in Michigan, and provide up-front information to enthusiasts, community groups, and developers on how to successfully move Community Solar forward in Michigan."

Dave Konkle, Community Solar Specialist
Great Lakes Renewable Energy Association

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This Community Solar PV Guidebook was written by David Konkle, with assistance from Loch McCabe, John Sarver, James Carter (representing the Great Lakes Renewable Energy Association), the Michigan Energy Office, the Michigan Public Service Commission, and others. The purpose of the Guidebook is "Consumer Education". We especially wish to thank the reviewers who helped finalize this document. The cover photograph appears courtesy of Oak Ridge National Laboratory.

GLREA and the Michigan Energy Office note that solar offers many potential community, economic, environmental, national security, and societal benefits for the state. The authors believe that Community Solar is an increasingly attractive way for Michigan to secure these benefits. Toward that end, the reader is encouraged to review the following additional publications:

- Readying Michigan to Make Good Energy Decisions: Renewable Energy – In November 2012, Governor Snyder laid out a vision for a "no regrets" energy policy – one that would be adaptable and built on three pillars: excellent reliability, an affordable price, and a protected environment. Four reports were generated from this process: Renewable Energy, Energy Efficiency, Electric Choice, and one on "Additional Areas" related to energy policy. These reports can be viewed at: http://www.michigan.gov/energy.

- National Renewable Energy Laboratory's, A Guide to Community Shared Solar is a comprehensive guide for those who want to develop Community Solar projects, from community organizers or solar energy advocates to government officials or utility managers. The guide can be downloaded from: http://www.nrel.gov/docs/fy12osti/54570.pdf.

- Interstate Renewable Energy Council's, Model Rules for Shared Renewable Energy Programs provides guiding principles that are important when designing Community Solar projects. It can be downloaded from: http://www.irecusa.org/wp-content/uploads/2013/06/IREC-Model-Rules-for-Shared-Renewable-Energy-Programs-2013.pdf.

- Clean Energy Coalition's, Becoming a Solar Ready Community: *A Guidebook for Michigan's Municipalities*, September 2013. The report can be found at: http://cec-mi.org/communities/programs/michigan-renewable-energy-tools/solar-ready-community.

- Michigan Interfaith Power and Light's, Renewable Energy Fact Sheet: Solar Aggregation in Houses of Worship, available at: http://www.miipl.org/devwordpress/wp-content/uploads/2013/02/Renewable-Energy-Fact-Sheet-Solar-Aggregation-Final.pdf.

About the MEDC - Michigan Energy Office

The U.S. Department of Energy provides Michigan with a grant to operate a State Energy Office. Executive Order 2011-4 transferred the State Energy Office in Michigan to the Michigan Strategic Fund (MEDC) and renamed it the Michigan Energy Office (MEO). The MEO Consumer Education & Renewable Energy Section educates, helps, and incentivizes consumers, businesses, communities, and organizations capitalize on their energy efficiency and renewable energy assets as a way to foster community and economic reinvention in the state. For more information on this project, future grants, and/or the MEO Solar-Ready Community Initiative, please contact: Mark H. Clevey, Manager, Renewable Energy and Consumer Education Programs, MEDC-Michigan Energy Office, 300 N. Washington Square, Lansing, MI 48913. Tel: (517) 241-6280.
Email: cleveym@michigan.gov.

"*We will have reached our 10 percent goal for renewable energy, and will have well-established efficiency programs, so we will be in a good position to set higher goals in both these areas*."

Governor Snyder,
"Ensuring our Future:
Energy and the Environment" message
(11/28/12)

"*Renewable energy resources, such as community solar, offer many potential community, economic, environmental, national security, and societal benefits for the state.*"

Michael A. Finney,
MEDC President and CEO,
May 2013

"*Community Solar is the newest entry into the solar arena for Michigan. It bridges the gap between communities and a huge segment of our population who cannot utilize solar for whatever reason for their homes, communities and businesses. Now they can be involved.*"

Allan O'Shea,
President, Contractors Building Supply
V.P. of GLREA and Founder of the American Wind Energy Association
Project Developer on the 1st Community Solar Program in Michigan

Foreword

Readying Michigan to Make Good Energy Decisions: Renewable Energy (excerpt)

"Under a recent Michigan Energy Office Grant, the Great Lakes Renewable Energy Association studied community solar and prepared "Feasibility of Community Solar in Michigan: A Guidebook for Community Solar" which will be issued in September 2013. A draft of the report defines Community Solar:

> Under a Community Solar program, the actual generation of renewable energy does not occur at the customer's home or business site. Instead, the customer subscribes to a portion of a shared renewable energy facility (much like a resident may invest in a community garden) located elsewhere in the community and the power generated results in each subscriber receiving their portion of the benefit based on their investment.
>
> It has lots of names; community based renewable energy, solar gardens, shared solar, virtual net-metering, community shared solar gardens, and more.

There are 14 states with Community Solar projects – including Michigan. Cherryland Electric Cooperative and Traverse City Light and Power are the first electric providers in Michigan to offer a joint community solar program – Solar Up North (SUN) Alliance Program. The framework for this program comes from the energy optimization standard of Act 295 and not net metering or the renewable energy standard.

Cherryland Electric Cooperative members and Traverse City Light and Power customers can purchase solar shares for a one time investment of $470.00 each. The participants receive a $75.00 Energy Optimization rebate per panel. The electric providers use the wholesale electric market prices to determine the amount of monthly bill credit to provide to the participants. It is estimated that the credit will be an average of $2.00 per month. This amount will be based on total monthly array output and will vary based on weather conditions. The Community Solar program has been very successful initially and is continuing to grow."

> John D. Quackenbush, Chairman , Michigan Public Service Commission, Michigan Department of Licensing and Regulatory Affairs and Steve Bakkal, Director, Michigan Energy Office, Michigan Economic Development Corporation, "Readying Michigan to Make Good Energy Decisions: Renewable Energy", September 20, 2013.

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EXECUTIVE SUMMARY

In 2008, the Michigan Legislature passed Public Act 295, the Michigan Clean, Renewable and Efficient Energy Act. The purpose of PA 295 is "to promote the development of clean energy, renewable energy, and energy optimization through the implementation of a clean, renewable, and energy efficient standard that will cost-effectively do all of the following: (a) diversify the resources used to reliably meet the energy needs of consumers in this state; (b) provide greater energy security through the use of indigenous energy resources available within this state; (c) encourage private investment in renewable energy and energy efficiency; and (d) provide improved air quality and other benefits to energy consumers and citizens of this state" (MCL 460.1001). The Act requires Michigan electric providers to ramp up their use of renewable energy in order to obtain 10% of their electricity sales from renewable resources in 2015. The most recent report prepared by the Michigan Public Service Commission (MPSC) discussing the status of renewable energy in Michigan is the Report on the Implementation of the P.A. 295 Renewable Energy Standard and the Cost-Effectiveness of the Energy Standards.

Solar energy is a mature technology and a rapidly growing global market which has many potential community, economic, environmental, national security, and societal benefits for the State. Many Michigan citizens who are interested in utilizing solar energy do not have access to a proper site for a renewable energy system. National studies estimate only 20% to 30% of homes or businesses are a good site for solar energy. Many sites are shaded or not oriented in the proper direction. Renters and condominium owners do not have ownership of the space needed to install solar collectors. The complexity of installing a renewable energy system also is a barrier to many. Finally, renewable energy systems often require a large up-front cost that makes it difficult for many homeowners or businesses to get involved. For these citizens, and those interested in community/economic reinvention, Community Solar is a viable alternative.

Under a Community Solar program, the actual generation of solar electricity does not occur at the customer's home or business site. Instead, the customer subscribes to a portion of a shared solar energy facility (much like a resident may invest in a community garden) located elsewhere in the community, and the power generated results in each subscriber receiving their portion of the benefit based on their investment.

Community Solar allows Michigan residents, organizations and businesses to invest in systems located at optimal sites, with the costs shared by multiple owners and the benefits divided among the participants. No longer limited to systems on their own property, shareholders can take advantage of economies of scale by helping to build larger systems at a lower cost-per-installed-kilowatt (kW) (i.e. a bulk discount). Moreover, participants can rely on professional renewable energy project developers to design, install, operate, and maintain the system for optimal performance. The developer will handle all the local permitting and approvals while taking advantage of any available tax credits, rebates and other incentives to maximize the financial return to all participants, and in some cases, arrange financing (e.g., leasing, aggregated purchasing, etc.).

Community Solar can also be done in Michigan using a number of different approaches. For example, Community Solar can be an attractive option for utilities to diversify their electric generation mix and provide a popular investment option for their members or customers. Cherryland Electric Cooperative and Traverse City Light & Power, initiators of Michigan's first Community Solar project, have found that many of their members and customers are enthusiastic about investing in a local and clean energy resource like solar. Municipal utilities and electric co-ops can offer Community Solar programs for their members now. Investor-owned utilities (e.g., DTE and Consumers Energy), can request the MPSC to authorize a pilot program for Community Solar projects and assist efforts to get state legislation to facilitate Community Solar. Utilities can use "Buy Power", "Buy Panels", or "Lease Panels" approaches.

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Local governments and businesses who have sites with high electric use can also install PV self-generation "behind the meter" and offer Community Solar options to their citizens or customers. They have the option to provide project participants with credits on water or property bills or credits on store purchases. Project sponsors can use "Buy Panels", "Lease Panels", or "Invest in PV" approaches. Finally, any organization can install PV behind the meter and use net metering to develop Community Solar projects 150 kW or under depending on the site electric load. Project sponsors typically use an "Invest in PV" approach.

Community Solar projects are springing up all over the country, especially in states where legislation or policies have been passed that enable or mandate Community Solar projects. The solar capacity of Community Solar projects in the U.S. has increased from a total of 10,000 kW in August 2012 to nearly 40,000 kW In September 2013 – *a growth of 400% in one year*!

However, there are barriers to Community Solar that can be addressed to make it simpler to do for those interested in investing in renewable energy in Michigan. Legislation and regulations vary from state to state, and greatly affect the ability to develop Community Solar projects in each state. This report examines existing legislation and regulations specific to Michigan, identifies barriers, and recommends solutions to encourage the development of Community Solar in Michigan.

The award of the "Community Solar PV Garden Feasibility Study for Michigan" grant from the Michigan Energy Office to GLREA made this Community Solar guide possible. In addition to the development and publishing of this guide, the grant led to a very successful effort to "spread the word" about Community Solar to Michigan citizens and businesses, within the context of PA 295. Project staff participated in 13 public forums that reached 241 persons. Project staff had 29 meetings with utilities, local governments, businesses, neighborhood associations, and non-profits. These meetings provided an opportunity to both learn about "real world" issues and provide technical assistance on how to start up a Community Solar project.

The grant also made it possible to use and create financial modeling tools in partnership with the Michigan Public Service Commission and the U.S. Department of Energy's National Renewable Energy Laboratory. The modeling tools consist of the DOE's "Systems Analysis Model" (SAM), economic modeling software for renewable energy projects, and the newly created "Michigan Community Solar Analysis Tool", an Excel spreadsheet-based tool that uses data from the SAM modeling tool to analyze various Community Solar configurations. These tools enable Michigan utilities, businesses, neighborhood associations, citizens' groups, and others to analyze the financial effects of using various structures and configurations in the development of their projects.

The information, tools, and resources contained in this guidebook provide a basic framework for Community Solar in Michigan. This report is intended to assist a variety of groups in understanding the options available and the steps necessary to plan and implement successful projects. To that end, we hope these groups will feel empowered to take their interest in Community Solar to the next level and are successful going forward.

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SOLAR ENERGY 101

Solar energy is a proven technology that harnesses energy from the sun to create electricity. This electricity can be used for everything from heating homes, to powering electronics, or charging vehicles. Converting the Sun's energy into electricity is not a new concept. A French scientist discovered the photovoltaic (PV) effect in 1839, and in 1953, American physicists developed the first silicon solar cell capable of powering everyday electronics.[1, 2] Today, PV cells are used in a wide variety of applications, from charging a calculator battery, to PV systems, which contain many interconnected solar cells, that provide power to homes or businesses, or, in a large array, to the grid. Most solar systems installed today are either roof-mounted or ground-mounted, depending on the location and size of the installation.

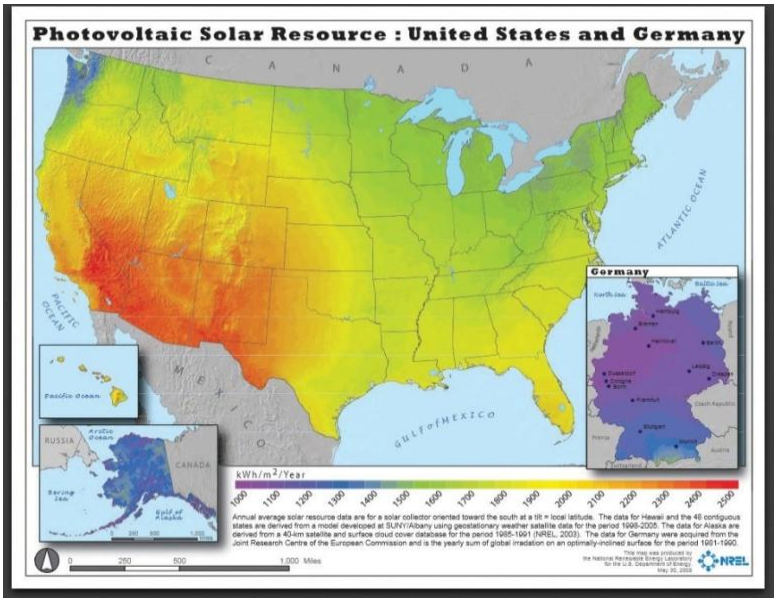
How Solar Panels Work

Photovoltaics, a Greek term that means "light volt," are more commonly known as "solar panels," but the technology is not just limited to panels.

1. Solar arrays are made up of panels that contain many solar cells. Each solar cell converts sunlight into electricity.
2. The electricity is fed into an inverter that converts it from DC to AC power so that it is compatible with standard U.S. electrical systems.
3. AC electricity is used to power the building's appliances and other energy needs.
4. Any excess electricity is sent back to the utility grid through a meter.

Solar Energy and Michigan

One of the most commonly raised questions, when discussing the potential for solar in Michigan, is whether it is viable given our fluctuating weather and seasonal conditions. Despite the fact that Michigan is not known for its abundant sunshine like the southwestern states, the opportunity to harness energy from the sun in Michigan is great.



[1] http://www1.eere.energy.gov/solar/pdfs/solar_timeline.pdf
[2] http://www.californiasolarcenter.org/history_pv.html

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Germany, for example, is not particularly sunny, but due to its solar advancement policies and programs, has put solar to the test in a setting that experiences lower levels of sun access than Michigan (see map, previous page). From its southern to northern border, Germany's latitude runs from 48 to 54 degrees. In Michigan, the highest latitude in the state is 47 degrees (Houghton, Upper Peninsula). The highest latitude in the Lower Peninsula is 45 degrees (Mackinaw City) and the lowest is 41 degrees (New Buffalo). Yet, despite having less access to solar radiation, Germany is setting the global record for solar power production.

Germany, the world's leader in solar energy generation, receives about as much sunlight as the state of Alaska, yet Germany has 80 times more solar power feeding the grid than the U.S.[3] In Germany, the solar-promoting policies and generous government subsidies provided to the industry are main contributors to solar energy flourishing there. Closer to home, New Jersey is a great example of a state that is not especially sunny, but has one of the fastest growing solar markets in the nation. In New Jersey, the governor's Energy Master Plan set strong solar policies that are launching their solar adoption initiative.[4]

What does the Solar Energy Market Look Like?

Advanced photovoltaic manufacturers are creating new thin-film technology to reduce the size and breadth of PV systems to integrate into buildings by replacing traditional building materials. Michigan-based Dow Chemical Company is currently manufacturing a shingle product, which protects roofs like a standard shingle and contains solar cells that can power a home.[5]

Solar installations in the U.S. increased 76 percent between 2011 and 2012 alone, and the market continues to grow dramatically.[6] Currently, there are about 6.4 gigawatts (GW) of solar capacity installed in the U.S., generated from approximately 270,000 PV installations across the country.[7] More than half of the installed capacity is the result of utility-scale solar plants, which are large installations owned and operated by a utility, usually ranging from a few megawatts (MW) to hundreds of megawatts in size.[8]

These large-scale "solar farms" are connected to transmission systems, which transmit the power to electrical substations. The remaining installed PV capacity in the U.S. comes from relatively smaller residential and non-residential installations, ranging in size from a few kilowatts (kW) for residential, to hundreds of kilowatts for large commercial systems.[9] These types of installations are categorized as distributed generation, because some or all of the electricity generated is used onsite. Most PV systems are "grid-tied," meaning they are connected to the power grid and none of the electricity produced is stored for later usage.

Renewable Portfolio Standards and Michigan

A renewable portfolio standard (RPS), also known as a renewable energy standard (RES), is a policy mechanism that mandates electric utilities to supply a specified amount of power from renewable or alternative sources by a certain target date. There is no U.S. federal RPS; each of the 30 states with an RPS-type directive in place has its own widely varying standards. Michigan's RPS sets the requirement for 10 percent renewable energy by 2015. Some states have "carve-outs" in the policy to promote a specific technology, such as solar. An ambitious RPS, even at the state level, can encourage economic development in states by jump-starting the solar industry and creating jobs in the sector.[10] The uncertainty of this policy post-

[3] http://cleantechnica.com/2012/03/16/germany-80-times-more-peak-solar-power-than-u-s-compared-to-electricity-demand/
[4] http://www.seia.org/state-solar-policy/New-Jersey
[5] http://www.dowpowerhouse.com/
[6] http://www.seia.org/sites/default/files/resources/ZDgLD2dxPGYIR-2012-ES.pdf.
[7] http://www.energymanagertoday.com/more-than-6-4-gw-solar-electric-capacity-installed-in-us-087753/
[8] http://www.seia.org/sites/default/files/resources/ZDgLD2dxPGYIR-2012-ES.pdf
[9] http://www1.eere.energy.gov/solar/pdfs/47927.pdf
[10] http://www.seia.org/policy/renewable-energy-deployment/renewable-energy-standards.

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2015, coupled with the lack of robust, consistent, and reliable utility incentives for solar installations in Michigan, inhibits growth and investment in the sector.

A small number of Michigan cities have set their own formal timelines and goals for renewable energy usage in municipal facilities, including Ann Arbor, Grand Rapids, and Lansing. Communities primarily meet this goal by executing purchase agreements with local utilities to provide a specified percentage of their electricity use with renewable energy. Ann Arbor relies on local sources of renewable energy, mostly from landfill gas and two hydroelectric dams.

A recent study by The Pew Charitable Trusts concluded that the U.S. is losing its share of the revenues from the global clean energy sector, which are expected to total $1.9 trillion between 2012 and 2018, and calls for the President and Congress to introduce a national clean energy standard to replace the current piecemeal approach of the state-by-state RPS.[11] The report also notes that although PV installations in the U.S. have doubled in the last two years, the added capacity is less than one-third of that added by Germany or Italy, and China surpassed the U.S. for the first time in 2011. The clean energy sector represents a massive economic opportunity for the U.S., but the opportunity could slip away if we fail to invest in it now. Pew projects that the combination of public-sector incentives and access to capital and credit to develop businesses and technology could develop an industry that is fully cost-competitive and free from the need of federal incentives by 2020.

[11] http://www.pewenvironment.org/uploadedFiles/PEG/Newsroom/Press_Release/Innovate,%20Manufacture,%20Compete.pdf

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INTRODUCTION TO COMMUNITY SOLAR

Community Solar projects are springing up all over the country, especially in states where legislation or policies have been passed that enable or mandate Community Solar projects. The solar capacity of Community Solar projects in the U.S. has increased from a total of 10,000 kW in August 2012 to nearly 40,000 kW In September 2013 – *a growth of 400% in one year*! Why is Community Solar's growth exploding? What makes it so popular? Can we expect the same thing to happen here in Michigan?

This report examines the many different types of Community Solar projects that are currently operating in the U.S., from large projects implemented by utilities to small projects organized by neighborhood groups. It then describes Michigan's first (and currently only) Community Solar project, the Solar Up North (SUN) Alliance, and discusses a variety of important considerations for planning and implementing Community Solar projects in Michigan.

What is Community Solar?

Community Solar, also called "shared solar," is defined by the U.S. Department of Energy's, National Renewable Energy Laboratory (NREL) as "a solar-electric system that provides power and/or financial benefit to multiple community members." [12] Under a Community Solar program, the actual generation of renewable energy does not occur at the customer's home or business site. Instead, the customer subscribes to a portion of a shared renewable energy facility (much like a resident may invest in a community garden) located elsewhere in the community and the power generated results in each subscriber receiving their portion of the benefit based on their investment.

Community Solar has lots of names: community-based renewable energy, solar gardens, shared solar, virtual net-metering, community-shared solar gardens, and more. Well over 90% of the Community Solar projects built in the U.S. involve solar photovoltaic systems (solar PV). Therefore, this study will focus on the investment in, and installation of, solar PV systems in Community Solar projects. However, it is worth noting that many of the issues, solutions, and financial analysis addressed in this study for solar PV systems can be applied to community-based renewable energy projects that use other forms of renewable energy, such as solar thermal, wind, biomass, and geothermal.

Community Solar would allow for Michigan residents, organizations, and businesses to access renewable energy benefits from systems located at optimal sites, with the system installation and operation costs shared by multiple owners (participants), and the benefits divided among the participants according to their share of the investment. No longer limited to renewable energy options on their own property, homeowners, businesses, non-profits, and public entities can take advantage of economies of scale to get more "bang for their buck", by building larger systems at a cheaper cost-per-kilowatt (kW).

Community Solar participants do not need to be familiar with the complexities involved in implementing a renewable energy project. They can rely on professional renewable energy project developers to design, install, operate, and maintain the renewable energy system for optimal performance, especially since the developers will rely on the system's performance to make their share of the profit. The developer will handle all the local permitting and approvals, while taking advantage of any available tax credits, rebates, and other incentives to maximize the financial return to all participants.

[12] "A Guide to Community Shared Solar: Utility, Private and Non-profit Project Development." National Renewable Energy Lab. U.S. Department of Energy. May 2012.

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Community Solar projects can be set up according to many different models of ownership and participation, which are covered in this report. Important to all models is that the project should:

- offer affordable shares to participants;
- maximize available tax credits, rebates, and incentives;
- maximize the return on investment for all parties and participants;
- provide new value for empty rooftops and degraded or idle land;
- serve as a hedge to ever-increasing energy costs (value of a share rises as energy costs rise); and
- contribute towards community goals for renewable energy and related community/economic reinvention.

The development of Community Solar will provide an opportunity for all Michigan citizens and businesses to directly invest in renewable energy and create local jobs.

Why Do We Need Community Solar?

Many Michigan citizens are interested in capitalizing on the state's solar energy assets, reducing their energy bills, and supporting renewable energy as a community/economic reinvention strategy. However, many people who are interested in utilizing solar energy are unable to install their own system, or it may be difficult to do so, for a variety of reasons. For example, many do not own or have access to a proper site for a renewable energy system, are inhibited by large up-front costs, and/or are deterred by the complexity of installing and maintaining their own system. However, Community Solar provides a number of options and opportunities for various groups in Michigan, including non-profits, religious organizations, neighborhood groups, local governments, and others, to overcome some of these obstacles.

The following section outlines a number of market barriers to solar energy, many of which may be reduced by using a Community Solar approach:

- **Siting** – Many consumers do not have access to a proper site for a renewable energy system. National studies estimate only 20% to 30% of homes or businesses are a good site for solar energy. Moreover, many sites are shaded or not oriented in the proper direction. Renters and condominium owners do not have ownership of the space needed to install solar collectors.

- **Complexity** – The complexity of installing a renewable energy system onsite can be a barrier to many. For example, such complexities can include: financing (e.g., How much does a system cost and how big of a system is needed? What rebates and tax incentives are available, who is eligible, and how do I apply?); regulatory issues (What building and/or electrical codes need to be followed?); technical issues (e.g., Which collectors are best? At what angle should they be mounted? What other equipment will be needed? How do I connect to the utility? What are the utility company's requirements? How do I maintain the system?); business issues (e.g., Where are qualified solar companies located?); and finally, national security issues (e.g., How do I decide between U.S. versus foreign products, and what is actually available?).

- **Permitting, Planning, and Zoning** – Property owners, installers, builders, and architects find solar application processes confusing when there are no regulations or significant variations in regulations among jurisdictions. Because of this, there has been some resistance by these individuals to engage in the solar energy market in Michigan. However, communities can address this by updating their policies to include a clear process for permitting and installing solar (and/or other renewable energy) systems. The "Barriers and Opportunities" section of this report covers this topic in more detail and provides helpful recommendations on how communities can become solar-ready.

- **Property Tax** – Tax policy can significantly spur or hinder the acceleration of solar and other renewable energy installations at the local, state, and federal levels. Property tax incentives at the local level can eliminate the added financial burden on a PV system owner due to an increase in the assessed value of their property.

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Currently, 36 states offer some form of renewable energy property tax incentive, which typically excludes the added value of PV systems for property tax valuation purposes.[13]

Michigan's property tax exemption, which is limited to commercial and industrial sectors, is currently confusing due to a difference in interpretation between the legislative and implementing bodies. The Alternative Energy Personal Property Tax Exemption (AEPPTE), enacted by Michigan's legislature in 2002, was designed to promote the development of a range of alternative energy technologies by exempting them from personal property tax.

In 2008, the Michigan State Tax Commission ruled that PV systems be classified as "real property," not "personal property," and should be assessed as an improvement to the property on which they are located, unless they are owned by someone other than the property owner.[14] The decision was backed by the Michigan Department of Treasury, essentially nullifying the legislation and exemption and creating confusion among PV system owners and assessors alike. Similarly, there is no property tax exemption policy or specific rules on the valuation of residential solar installations, which results in discrepancies on how residential PV systems are assessed in local jurisdictions across the state, which can sometimes be a significant additional expense to the PV system owner. The AEPPTE expired on December 31, 2012, leaving the state without a property tax incentive, although there have been several attempts to reintroduce legislation that would continue the exemption and clarify the real versus personal property issue.[15,16, 17]

- **Homeowners' Association Regulations -** Homeowners' association rules, which are typically outside the control of local governments, can sometimes impede, restrict, or prohibit the installation of solar PV.[18] Forty states have adopted some form of solar access law that either limits restrictive or prohibitive covenants, or allows local jurisdictions to do so. Michigan does not currently have any solar access laws.

- **Incentive Uncertainty -** Without consistent, reliable incentives available, the solar installation industry in Michigan will be in a constant boom-and-bust state. The lottery-based incentive award system in place in the state's only two solar PV incentive programs creates a climate of uncertainty for those interested in installing solar, as well as the solar installers themselves. Many utility customers could not afford an installation without the incentive to offset the initial cost. While there will always be a demand for incentives, using a Community Solar approach can make solar more affordable, with or without additional incentives.

- **Community Awareness/Readiness -** There are a number of common fears and misperceptions associated with solar adoption. Many people believe that Michigan does not receive enough sun to be able to effectively employ solar technology, as discussed in the previous section. In addition, many residents and businesses mistakenly believe solar has a longer payback period than it actually does. This is especially untrue if there are local incentives and purchasing programs, such as community purchasing programs, in place. Another concern voiced by residents is that solar energy systems might negatively impact property values, or be considered unattractive and a bad fit for the neighborhood. Local jurisdictions can help debunk these myths by providing easily accessible and ample information about the potential for and benefits of solar installations in the community.

Community Solar Publications and Resources

There are a number of local and national publications on developing Community Solar projects that are excellent in describing the necessary steps to planning a Community Solar project in general. It is recommended that the reader study these resources, which this report is intended to supplement. For a comprehensive list of resources, please refer to the Community Solar Websites and Resources guide in Appendix III of this report.

[13] http://ncsc.ncsu.edu/wp-content/uploads/DSIRESolarPolicyGuide-1.pdf
[14] http://www.nrel.gov/docs/fy12osti/54574.pdf
[15] http://legislature.mi.gov/doc.aspx?mcl-211-9i
[16] http://legislature.mi.gov/doc.aspx?2011-SB-0328
[17] http://legislature.mi.gov/doc.aspx?2013-HB-4245
[18] http://www.planning.org/research/solar/briefingpapers/localdevelopmentregulations.htm?print=true

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NATIONAL SURVEY OF COMMUNITY SOLAR PROGRAMS

Community Solar is emerging as an increasingly viable and popular renewable energy option for utilities and electricity users alike. Since the pioneering SolarShares Community Solar program was implemented by the Sacramento Municipal Utilities District in 2009, more than 33 Community Solar programs have been established in 14 states. Currently, Colorado (followed by Arizona) has the most Community Solar projects. The interest in and pace of new Community Solar projects is increasing rapidly nationwide.[19]

The basic ownership, legal, financial, and operational parameters for different types of utility, special purpose entity (SPE), and non-profit Community Solar project models are understood, and have been well-described by the U.S. Department of Energy (DOE), the Interstate Renewable Energy Council (IREC), and others.

This section, instead, offers a view of different *Community Solar business models*, with a focus on highlighting different ways community participants (i.e., "buyers") *interact in the marketplace* with Community Solar utility, 3rd party, or investor group "suppliers."

There are four emerging Community Solar business models that characterize the majority of Community Solar projects currently in operation and in development. These models ask Community Solar participants to:

- ***Buy PV power*** generated by one or more local Community Solar farms;
- ***Lease PV panels*** located at a specific Community Solar farm;
- ***Purchase PV panels*** located at a specific Community Solar farm; or
- ***Invest in a PV project***, along with other "community" members.

Each of these models has different key attributes related to *accessibility* by community members, financial *risk* and *payback*, and related to *control* and *scalability* by utilities and developers.

These business models have been proven to be viable and successful, have proponents, and are becoming easier to implement. Some utilities choose to develop and manage Community Solar projects themselves. There is also a rapidly emerging set of third party Community Solar project developers that are significantly increasing the ability to develop, finance, construct, market, and run Community Solar projects quickly.

What follows is an overview of each of these Community Solar business models, supported with selected case studies of representative successful Community Solar programs. A summary of the highlights of these business models is provided at the end of this report.

Community Solar Business Model #1: "BUY PV POWER"

The "Buy PV Power" model focuses on *simplicity* and *accessibility* for community participants, and *control* and *scalability* for utilities. In this model, buyers pay a specified price to purchase "blocks" of solar power. The cost of these blocks is added to the customer's monthly bill, and the value of the energy of the solar power purchased is deducted from the customer's monthly bill. If a customer's purchase of solar power exceeds its actual energy usage in a given month, the customer receives a credit that is applied against future bills.

Typical roles and responsibilities, advantages, and disadvantages for buyers and suppliers in the "Buy PV Power" model can be described as:

[19] See the chart at the end of this section for an accounting of projects by state and utility type.

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Roles & Responsibilities Include:

"Buyers" Residents, Businesses, Institutions	"Suppliers" Utilities & 3rd Party Contractors
• Buyers purchase fixed kWh "blocks" of PV power or the kWh produced from a fixed kW PV system equivalent. • PV block prices are fixed for a period of time, which can be for as long as 20 years. • PV blocks (kWh or $ value) are applied to the buyer's electric bill on a monthly basis. • Any excess "credits" in one month can be applied to a future month.	• Providers finance, own, manage, maintain, and take risks for all PV-generating assets. • Utilities manage billing reconciliation for PV power buyers.

Advantages Include:

"Buyers" Residents, Businesses, Institutions	"Suppliers" Utilities & 3rd Party Contractors
• *Convenience*: As long as capacity is available, customers can be signed up immediately and easily. Buyers can leave the program with limited notice and no additional costs. • *Access*: Buyers can sign up with no out-of-pocket costs. They do not need to own property or manage anything related to the solar system. Poor credit is not a concern. • *Price Hedge*: PV is bought in fixed kWh amounts or in equivalent kW system sizes at prices that are stable over long periods of time. This creates a hedge against rising base fuel costs.	• *Maintaining Ownership and Control:* Suppliers maintain ownership and control over the PV asset through the life of the project, and indeed the life of the panels. • *Financial Benefits:* Suppliers can internalize all tax benefits, sell all solar RECs, and receive a price premium for PV that covers any additional investment. • *Flexibility:* Utilities can have flexibility in accessing multiple PV generation sources. • *Scalability:* As they are in complete control of the program, utilities can scale up this type of Community Solar project very quickly.

Disadvantages Include:

"Buyers" Residents, Businesses, Institutions	"Suppliers" Utilities & 3rd Party Contractors
• *Premiums for PV:* In practice to date, participants have paid more for PV power than for fossil fuel dominated "base power" (though these premiums are shrinking). • *Poor Returns Potential:* The actual rate of return can be very low, zero, or even negative as the buyer will often pay a premium for PV power, and may never pay less for PV power than it would for the utility's mix of standard fuels. • *Lack of PV Ownership or Control:* The buyer is usually procuring PV power on terms that can be changed by the utility at their discretion. Buyers lack any direct or indirect ownership stake in or control of the Community Solar project.	• *Incurs All Costs and Risks:* All project capital and operational costs and risks are borne by the utility and their contractors during the project lifetime. • *Managing Continuous Transactions:* High participant accessibility means that utilities must manage a continuous stream of buyers entering and leaving the system over the life of the system.

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"Buy PV Power" Community Solar Examples:

The "Buy PV Power" model is most easily implemented by utilities seeking to establish large, easily scalable Community Solar projects. Community Solar projects that use this model include:

- **Bright Arizona Community Solar** – An investor-owned UniSource Energy Services project that sells fixed monthly blocks of 150 kWh per month in ways similar to the Bright Tucson Community Solar program.
- **Bright Tucson Community Solar** – Similar to Bright Arizona Community Solar, see Case Study #1 for more details about this very rapidly growing program.
- **SRP Community Solar** – A Salt River Project (AZ) municipal utility program that has 20 MW for commercial/industrial, school, and residential customers. Customers can buy 2,500 kWh/yr. solar blocks for up to half of annual energy consumption at prices fixed for 10 years. The allocation of the 2,500 kWh/yr. follows the load of the solar farm, so monthly outputs are higher in the summer and lower in the winter.
- **SolarShares/SMUD** – Installed in 2009 and one of the early Community Solar projects in the country, SolarShares sells "subscriptions" to portions of the SMUD solar farm based on equivalent 1-4 kW system sizes. Subscribers receive proportional PV output throughout the year, which of course varies from month to month and year to year. See Case Study #2 for more information.

These projects allow consumer to purchase PV power in three different ways:

- Buyers purchase a set and stable monthly block of PV kWh that provides the same amount of PV power every month (Bright Tucson)
- Buyers purchase an annual block of PV kWh that is allocated on a load-distributed basis (SRP)
- Buyers purchase access to the equivalent of a kW system, and the buyer is credited with PV power produced by that kW equivalent system on a load-distributed basis (SolarShares/SMUD)

A closer look at the Bright Tucson and SolarShares programs follows:

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CASE STUDY #1: BRIGHT TUCSON COMMUNITY SOLAR

Project: **Bright Tucson Community Solar Program (AZ)**
Utility: Tucson Electric Power (TEP)
Contact: Marc Romito, Renewable Energy Manager, TEP

Business Model: The Tucson Electric Power (TEP) model enables utility ratepayers to purchase blocks of 150 kWh/month of solar power for a fixed price for 20 years. A 150 kWh block is roughly equivalent to the output of a 1 kW PV system. The PV block offsets customer energy derived from other fuel sources. TEP builds and owns the solar farm infrastructure, purchases PV power from third parties, and keeps and sells solar RECs. TEP's current all-in costs to install utility-scale solar are $1.90/watt.

For TEP, the Bright Tucson Community Solar design has been very successful and is highly scalable. TEP began this program in March of 2011 with an original target of 1.6 MW of Community Solar. As of the end of April 2013 (two years later), TEP has 12 MW of solar power in Bright Tucson Community Solar, providing 981 residential customers and 31 commercial customers with 10,026 energy blocks.

Community Participant Costs and Benefits: The program provides customers with an easy, low cost, and highly scalable way to purchase locally-generated solar power and to use that power to offset TEP's "base" multi-fuel mix. TEP residential and business customers can purchase one or more 150 kWh blocks of solar power. Participants do not purchase or lease panels themselves. To purchase 150 kWh PV blocks, participants pay a premium of $3/block (or 2¢ per kWh) and then pay a "base fuel charge" (currently around 3¢/kWh). These charges are fixed (i.e. will not increase) for a term of 20 years as long as the customer stays in the program. Participants continue to pay distribution related charges.

Benefits for customers include:

- Customers can participate with no up-front costs or dropout penalties. This program includes customers who rent, who have poor credit, who do not want to or cannot put solar on their own roofs, or who are not prepared to make up front or long term financial commitments.
- Customers can purchase enough blocks to offset all their energy needs. Solar blocks directly offset base energy usage, and can be "banked" to offset costs in future months. Solar blocks purchased in winter when usage is low are routinely used to offset higher summer energy bills.
- Solar power costs are fixed for 20 years, thus the solar energy portion of customer bills will not increase even if "base" fuel costs increase. Also, participants receive energy bill reductions from two small exemptions to surcharges that do not apply to the Community Solar program: a Renewable Energy Standard Tariff and a Purchased Power and Fuel Adjustment Clause.

Marketing and Sales Activities: TEP has more than 400,000 customers in southern Arizona. Thus, there is significant opportunity for continued program growth. Currently, marketing/sales is done primarily through the TEP website as one of several renewable energy programs, and through its customer service representatives.

Other Insights & Best Practices: Other factors that support TEP's success include:

- PV power costs for program participants are affordable for many, at slightly more than 5¢/kWh.
- TEP places its Community Solar arrays on its distribution lines, eliminating expensive interconnection costs associated with transmission, as well as avoiding transmission congestion constraints.
- Solar is already a major part of TEP's fuel mix, with roughly 10% - 30% of the load being served by 250 MW of renewable energy (80% solar) already in place. This program makes it very easy for TEP to scale up the program as more customers seek to go 100% solar.
- TEP is encouraging more commercial participation in the Bright Tucson Community Solar Program. TEP recently added in the local county (Pima) government that is purchasing 5,000 blocks and the City of Tucson has officially requested 10,000 blocks awaiting Arizona Corporation Commission approval.

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CASE STUDY #2: SMUD'S SOLARSHARES PROGRAM

Project: **SolarShares**
Utility: Sacramento Municipal Utility District (CA)
Contact: Stephen Frantz, Project Manager, Retail Solar Programs

Business Model: SMUD's SolarShares program enables SMUD residential ratepayers to pay a monthly fee to secure PV output from the equivalent of 1.0, 1.5, 2.0, 3.0, or 4.0 kW systems from SMUD's current 1.0 MW solar farm. Customers may request kW equivalents for up to half of their estimated annual load. Customers pay a monthly fee for 12-months, and receive energy credits that follow the solar output of the system size subscribed. PV outputs follow the solar load, hence the solar kWh outputs for any given system will be lower in the winter and higher in the summer.

Currently, the SolarShares 1.0 MW facility has roughly 600 residential subscribers and is at capacity. SMUD plans to add another 1.4 MW system in the near future, to be followed by an additional projected 5.0 MW system. The 1.4 MW solar farm will be open to small and medium sized enterprises as well as residents, and the 5.0 MW system will be largely set aside for State of California office buildings in the district. These new additions will lower average costs across the system. These cost savings will be passed on to SolarShares subscribers in the form of lower rates.

Community Participant Costs and Benefits: Residential customers who rent, who have poor credit, or who do not want to or cannot put solar on their own roofs are all eligible to participate. Subscriber costs are fixed for 12 months. The current 1.0 MW solar farm was installed in 2008, when solar costs were considerably higher than today. Subscribers pay 18.7¢/kWh for SolarShares PV, or a premium of more than 5¢/kWh compared to standard energy costs of approximately 13.5¢/kWh. As new, lower cost solar farms are added to the SMUD system, costs will be blended across solar farms. This will reduce average costs for all participants from current levels.

Marketing and Sales Activities: SMUD has a significant marketing infrastructure that provides SMUD's 536,000 residential meter customers with an array of options to use PV and to reduce energy usage. SMUD expects that SolarShares demand will increase as:

- Subscription costs are lowered when new lower-cost capacity is added, and
- Subscriptions are opened up to small and medium sized enterprises, many of whom are tenants and thus do not have options to install PV at their locations.

Other Insights & Best Practices: Several other insights can be gained from SMUD's experiences, including:

- As SMUD lowers PV solar farm costs and these costs approach parity with standard fuel costs, SMUD believes that demand for Community Solar may then grow very rapidly.
- SMUD has found that accessing multi-acre parcels on available non-agricultural land for 20+ years within the district is very challenging.
- SMUD is looking closely at locating future Community Solar farms at locations that will reduce grid interconnection costs and improve voltage regulation and distribution grid efficiency.
- SMUD is reorganizing its marketing approach from a current program-by-program situation where customers receive multiple separate information pieces from different programs, to a "portfolio" approach that presents a menu of options under one "clean energy" banner.

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Community Solar Business Model #2: "LEASE PANELS"

In the "lease panels" model, utilities lease specific numbers of PV panels to community participants for a long period, typically up to the warranted lifetime of the panel. A utility or third party owns the PV panels and is responsible for initial financing, construction, operation, and maintenance.

Customers agree to pay the up-front cost to effectively lease one or more panels for a specific period of time, often 20 years or more. Once the lease purchase is made, the customer receives a pro-rata production credit of those panels on their energy bills. Credits can appear as kWh deductions or as financial credits. If power produced by a lessee's panels exceeds actual energy usage in a given month, the customer receives a credit that is applied against future bills. Customers do not pay maintenance or replacement fees, or costs for insurance and the like, as these stay the full responsibility of the owner-utility or third party. Typical roles and responsibilities, advantages and disadvantages for buyers and suppliers in the Lease Panels model can be described as:

Roles & Responsibilities Include:

"Buyers" **Residents, Businesses, Institutions**	**"Suppliers"** **Utilities & 3rd Party Contractors**
• Buyers lease one or more PV panels located at a Community Solar farm. • After panels are leased, the buyer receives the pro-rata portion of solar power produced by leased panels applied to the leaser's monthly utility bill by the local utility as a kWh deduction or more often as a financial credit. • Any excess "credits" in one month can be applied to future months.	• Providers finance, own, manage, maintain, and take risks for all PV-generating assets. • Utilities manage billing reconciliation for PV power buyers. • It is common for 3rd parties to enter into a PPA with a utility and then finance and develop the Community Solar farm. • It is typical for the providers that develop the solar farm to also be responsible for selling leases.

Advantages Include:

"Buyers" **Residents, Businesses, Institutions**	**"Suppliers"** **Utilities & 3rd Party Contractors**
• *Energy Cost Hedge Against Base Energy Costs:* PV panels can be leased at a one-time set cost for a long period of time, typically 20 years. PV power produced by leased panels offsets the lessee's energy bill in kWh or financial credits for the length of the term. • *No Liabilities or O&M Responsibilities:* Customers do not have liabilities, as the panels are owned by the supplier, and there are no ongoing O&M fees or project liabilities. • *Positive Payback:* Lessees will generally have a positive payback within 15-20 years, and sometimes more quickly than that. • *Lease Resale:* If the buyer has to leave the area, he or she may be able to capture a portion of the panel's outstanding value if transferred to future home buyers.	• *Rapid Implementation:* Utilities can contract out PV panel leasing projects to 3rd parties who can typically set these types of programs up within 6 months. • *Flexibility:* Since suppliers own the panels, they can have the flexibility to locate panels in multiple locations, or to divide panels into smaller portions, e.g. ½ panels, etc. • *Positive Cash Flow:* Panel leasing can offset much of the up-front capital costs incurred to install the Community Solar farm. Providers can elect to pre-sell panels before starting project installation. • *Shared Tax Savings:* Project developers receive all tax benefits, which are often passed on as lower pricing to panel lessees. • *RECs:* Utilities typically receive and can sell all sRECs. • *Control:* Providers maintain control over the PV asset through the life of the project.

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Disadvantages Include:

"Buyers" Residents, Businesses, Institutions	"Suppliers" Utilities & 3rd Party Contractors
• *Affordability?* PV panel leasing prices may be beyond reach for many rate payers. • *Resale?* Lessees may have difficulty re-selling leases if they have to exit before the contract period is done. • *Limited Payback Period:* Lessees receive value from the panels only up to the length of lease, regardless of the panel's actual useful life period.	• *Financial Risk:* All project capital and operational costs are borne by the provider during the project lifetime. • *Need for Secondary Market:* Providers must strive to provide a secondary market for leases that must be terminated early.

"Lease Panels" Community Solar Examples:

This model seems to be particularly popular with municipal utilities and electric cooperatives. Community Solar projects that use the Leasing Panels model include:

- **Berea Solar Farms –** See Case Study #3 below.
- **SunShare** – Case Study #4 below.
- **Trico Community Sun Farm** – Trico Electric Coop owns and operates a 227 kW solar farm. Trico customers can lease access to the power generated from 270-watt "full" panel for 20 years for a single up-front fee of $920 per panel. Customers can also lease half and quarter panels also, all of which are owned and maintained by Trico. Trico provides customers with a kWh credits at a set rate of 36 kWh per month per full panel.
- **Cherryland Electric Cooperative** – Michigan's first SUN Alliance Community Solar farm operates an 80-panel array. Customers buy leases to panels at a price of $470/panel, for which they get access to the power generated by the panel for 25 years. Expected returns are about $24/year, with a payback just short of 20 years. The program is popular. There is a waiting list for another 80 panels.

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CASE STUDY #3: BEREA SOLAR FARMS

Project: **Berea Solar Farms**
Utility: Berea Municipal Utility (KY)
Contact: Josh Bills, Berea Utility Advisory Board Chair

Business Model: Berea Municipal Utility made PV panel leases available for purchase for its first Community Solar farm in October 2011 and its current expansion in October 2012.

Berea Solar Farms sited Phase 1 and Phase 2 "behind the meter" at the Berea wastewater treatment plant. The 28.8 kW Phase 1 and 2 systems had installation costs of $140,000 ($4.86/watt) with federal EECBG funds financing about half of this investment and lease payments financing the balance. The city has not provided financing, though it did provide the site. Berea Municipal Utility owns and maintains the panels.

Berea Municipal Utility is now seeking sites and agreements for Phases 3 and 4, which will be a projected 32.3 kW and have an installation cost of around $100,000 ($3.10/watt). 100% of funding will come from lease payments.

Berea Municipal Utility is a distribution utility, purchasing its power from investor-owned Kentucky Utilities Company (KU). The Berea Solar Farms sites are covered under net metering statutes as long as solar output within the BMU territory does not exceed a voluntary limit of 3% of the utility's peak load.

Community Participant Costs and Benefits: Any Berea rate payer can lease panels. The cost of a 25 year lease is $750 per panel. Lessees receive a "Panel Production Credit" of proportional kWh produced monthly applied to their electric bill. The kWh credit offsets the lessee's retail rate, which are around 8¢/kWh for residential and 6.3-5.7¢/kWh for commercial. The value of PV credit offsets will increase as PPA costs with KU increase. Negotiations around this are interesting as BMU pays KU higher wholesale rates for peak power, which solar helps to offset.

Marketing and Sales Activities: When introduced, the first 60 panels were leased in 4.5 days. Phase 2 panels were leased within 4 months. The utility has found that participants are largely driven by the desire to participate and be a stakeholder in a project that will grow. Lessees are not motivated financially, for estimated payback periods exceed 20 years. Enthusiasm for Phases 3 and 4 seems strong as there is demand for leases before final sites have even been selected.

Other Insights & Items: Several other insights and items from Berea's experience include:

- Berea would like to place a portion of Phases 3 and 4 behind the meter at some city facilities that are serviced by an adjacent electric cooperative, Bluegrass Energy Cooperative. These facilities are paying higher retail rates to Bluegrass, and thus solar offsets are more valuable. As the direct transfer of kWh savings appears to be legally problematic, they are striving to manage credits to future leasers through a system of transferable solar renewable energy credits.
- Berea is prepared to buy out leases if lessees must break the lease and cannot or choose not to sell it to another party or to donate it to charity.
- Siting solar farm facilities behind the meter at municipal buildings really helps to make this work.

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CASE STUDY #4: SUNSHARE – COLORADO SPRINGS UTILITIES

Project: **SunShare**
Utility: Colorado Springs Utilities (CO)
Contact: Karen Gados, Business Development, SunShare LLC

Business Model: SunShare, LLC is the first private company in the nation to finance, build, and fully subscribe Community Solar leasing projects for utilities. Its first project was a 1.0 MW Community Solar farm under contract with the municipal Colorado Springs Utilities. The program is open to residential customers and educational institutions.

Since its pilot program in Colorado Springs, SunShare has been awarded 2.5 MW of Xcel Energy's 2013 Solar Rewards Community Projects (over half the year's allocation) and is poised to expand nationally within the next year. The company is currently headquartered in Colorado Springs, Colorado. SunShare is also working on several new Community Solar leasing models that will accommodate different levels of utility involvement, branding, and investment.

Leveraging partnerships with local non-profits in Colorado Springs, Sun Share located both Community Solar farms at "host" community organizations – Venetucci Farm and the Good Shepherd United Methodist Church. In return for land use, SunShare built extra capacity on both sites to meet each host's annual power needs.

Community Participant Costs and Benefits: Under SunShare's pilot program, Colorado Springs residents must purchase leases for at least two 230-watt panels for a cost of $550 each, making a minimum purchase of $1100 ($2.39/watt). This one-time cost is paid up front, with a 20-year lease period. Lessees can transfer or sell their leases if they move out of the service territory. Per tariffs set by the Colorado Springs Utilities, lessees are paid 9¢/kWh for PV generated proportionately by their panels on a monthly basis. Payback periods are estimated to be 11-12 years. Large customers are able to pay over time, and SunShare is currently developing a model to allow a monthly payment option for residential customers in Xcel territory.

Marketing and Sales Activities: Customer participation in SunShare has been very strong. The first site leased out within 6 weeks, with enough overflow demand to fill the second site.

SunShare utilizes a community engagement model to educate and subscribe ratepayers to the program. Residential campaign efforts included house parties, speaker series, community events, direct mail, newspaper advertisements, and radio. Commercial customer marketing efforts focused on one-to-one relationship building.

Other Insights & Items:

- Inviting a third-party developer to market directly to the public allowed Colorado Springs Utilities to mitigate subscription risk, diversify its subscriber base, and reduce marketing and administrative overhead.
- The program stimulated local job creation and economic development through the creation of construction jobs, sales, community engagement, and account management jobs, many of which will be maintained over the 20-year duration of the program.
- Colorado Springs was the first municipal utility in the nation to develop a Community Solar-specific tariff and has been recognized for its pioneering leadership and innovation.
- SunShare sends monthly digital reports on system output, percentage of system subscribed, and customer meter information to Colorado Springs Utilities. CSU uses these monthly digital reports to process customer bill credits equivalent to the customer's monthly kilowatt-hour production at the array.
- SunShare's customer leasing arrangements are 20 years in length to correspond with the length of Colorado Spring Utility's interconnection agreements.
- The 9¢/kWh rate paid for Sun Share PV is set by the local utility as part of its tariff structure. This rate may change over time.

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Community Solar Business Model #3: "BUY PANELS"

In the "Buy Panels" model, community participants actually purchase one or more solar panels located at a Community Solar farm. *This is a true ownership program, not a lease, which results in a far superior financial payback for the participants*. The proportional solar power those panels generate are credited monthly to the purchaser's utility bills for the warranted life of the system, which can be as long at 50 years. Credits can appear as kWh deductions, though more commonly they are financial credits. Maintenance, insurance, and other costs associated with the upkeep of the solar panels are all covered as part of the PPA rate negotiated with the utility. In essence, the participants in the program do not have to maintain the panels, maintain the inverter, or incur *any* additional costs associated with this program. Participants simply buy the solar panels. The panels are maintained by the utility or project developer for the panel's useful life, which can be decades longer than the warranted life of the panel.

Typical roles and responsibilities, advantages and disadvantages for buyers and suppliers in the Buy Panels model can be described as:

Roles & Responsibilities Include:

"Buyers" Residents, Businesses, Institutions	**"Suppliers" Utilities & 3rd Party Contractors**
• Participants purchase one or more actual PV panels located at a Community Solar farm. • After panels are purchased, the buyer receives the pro-rata portion of solar power produced by the owned panels, applied to the buyer's monthly utility bill by the local utility as a kWh deduction or more often as a financial credit. • Any excess "credits" in one month can be applied to future months.	• Providers finance, own, manage, maintain and take risks for the Community Solar farm. • The providers supply the utility company with bill crediting software to automatically manage billing reconciliation for PV panel buyers. • It is common for 3rd parties to enter a PPA with a utility and then finance and develop the Community Solar farm. • It is typical for the providers that develop the solar farm to also be responsible for selling panels, ongoing administration, operating, and maintaining the system.

***Advantages Include*:**

"Buyers" Residents, Businesses, Institutions	**"Suppliers" Utilities & 3rd Party Contractors**
• *Price Hedge:* PV panels can be purchased individually for a one-time cost, offsetting escalating costs for comparable amounts of fossil-fuel derived power for the life of the panels. The PV power produced by purchased panels offset the owner's energy bill in kWh or financial credits. • *Positive Payback:* Panel purchasers will typically have a positive payback within 15 years or less. • *Very Long Term Benefits:* Panel buyers own the panels outright, retaining solar production benefits for the life of the system, which can be up to 50 years! Panels can be resold, passed on as an asset to future owners of the home location, or donated to charitable causes. • *No additional costs.* Once the buyer purchases the panel they no longer have any costs. Even if the panels fail or a natural disaster strikes the solar	• *Rapid Implementation:* Utilities can engage 3rd parties to develop the Community Solar project and sell the panels. Projects can be installed in less than 6 months. • *Positive Cash Flow:* Panel purchasing can offset much of the up-front capital costs incurred to install the Community Solar farm. Suppliers can even elect to pre-sell a portion of panels before starting project installation. • *Shared Tax Benefits:* Project developers receive all tax benefits (as long as they technically own the panels for the first 5 years), which are often passed on in lower pricing to panel purchasers. Note: non-profit utilities that do this model themselves do not qualify for these credits, pushing panel buyer prices higher and paybacks lower (unless they contract with a 3rd party to (Continued, next page)

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facility, they do not incur additional costs to repair the facility, as these are covered through the supplier's Operations and Maintenance fund. • *No liability for the buyer.* Because the system is not in one's yard or on one's roof, the buyer does not have to incur any risks associated with installing or maintaining the system.	own the panels and take the tax credits). • *Control*: Providers maintain managerial control over the PV asset through the life of the solar farm and take on all liability. • *RECs:* Utilities typically receive all solar RECs and can use them to satisfy RPS requirements or even monetize them.

Disadvantages Include:

"Buyers" **Residents, Businesses, Institutions**	**"Suppliers"** **Utilities & 3rd Party Contractors**
• *Affordability?* PV panels must be purchased up front and may be beyond financial reach for some rate payers, though this can be mitigated with a financing or scholarship program. • *Resale?* Panel owners could have difficulty re-selling panels if they have to leave the utility's service territory.	• *Higher SEC, Tax, & Consumer Protection Scrutiny:* The panel ownership supplier must adequately address complicated securities (SEC), tax and consumer protection laws. • *Ongoing Liabilities:* Suppliers are responsible for O&M support during the life of the solar farm, and must set up and manage a fund for these expenses. • *Quick Sale:* Providers must sell PV panels in a timely manner to offset its project costs. • *Resale:* Providers must strive to provide a secondary market for panel resale.

After purchasing panels, customers receive an on-going payback in the form of lower utility bills for many years. Panels are often priced for complete paybacks within 10-15 years (6% – 8% year-1 returns), much better than a bank and less volatile than the stock market. Customers own the panels for their useful life, which is likely to go well beyond the initial panel warranty.

"Buy Panels" Community Solar Examples:

Community Solar projects that involve purchasing of PV panels by customers are usually owned by a developer under contract with the local utility. The "Buy Panels" model has been extensively pioneered by Clean Energy Collective, LLC (CEC), of Carbondale, Colorado. CEC is a Community Solar partner to numerous rural electric coops, municipal utilities, and investor-owned utilities – representing more than half of all Community Solar projects in the country. CEC-managed projects that allow customers to purchase PV panels include:

- Holy Cross Energy
- SMPA Community Solar (San Miguel Power Association)
- Colorado Springs Utilities
- Poudre Valley REA Community Solar Farm
- Kit Carson Cooperative Community Solar
- Green Mountain Power
- Xcel Energy
- Wright-Hennepin Solar Community
- Yampa Valley Electric Association

A more detailed description of CEC's business model in Case Study #5, below, shows how different utilities are engaging this model.

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CASE STUDY #5: CLEAN ENERGY COLLECTIVE, LLC (CEC)

Contact: Paul Spencer, CEO, Clean Energy Collective, LLC
Bart Rupert, SVP of Business Development

CEC Business Model: CEC is a 3rd party Community Solar developer, owner, and operator that is engaged by utilities that wish to add Community Solar with minimal effort, quickly and at little or no cost. In its turn-key model, once a PPA is established with a utility, CEC will finance, build, operate, and maintain a Community Solar program for the life of the system. CEC applies monthly pro-rated PV production amounts directly to the utility's billing system for customer on-bill credits through its proprietary RemoteMeter® system, providing its utility partners with reconciliation reports for quick and easy review.

CEC prefers to build Community Solar arrays equal to or larger than 500 kW in capacity for maximum cost-savings for panel-purchasing customers, and sells each panel separately. Participants receive financial benefits once panels are purchased and operational.

CEC's primary source of revenue is from the sale of solar panels. CEC will draw and escrow a small fee from PV generation to cover O&M and related servicing costs, in addition to a generous seed-payment made to the O&M fund by CEC upon each panel sale. Panel sale proceeds fund most of the balance of CEC's personnel, marketing, project costs, overhead, and profit.

CEC can work with utilities under a PPA engagement, FIT (feed-in tariff) or rate tariffs. Utilities purchase all power produced, regardless if the panels used to generate the power have actually been sold yet or not. PPA terms are for at least for 25 years, and preferably 50 years. CEC believes that the optimal actual solar farm life is 50 years or more if fully maintained, and so are negotiating 50 year PPAs (25 years plus a 25 year renewal) with most utilities. PPAs will also spell out PV rate schedules for panel purchasers.

Community Participant Costs and Benefits: CEC strives to provide panel purchasers with rates of return of 5.5% or more in year 1, with a system payback of 12-15 years or less. The rate of payback improves each year with energy inflation. Panel owners will immediately benefit from the production of their solar panels which will produce energy credits for up to 50 years. Purchased panels belong 100% to the buyer. Buyers may move within the utility network (panels move with them) and resell the panels at any time.

Different utilities apply different rates. For example:

- **SMPA Community Solar**, a project of San Miguel Power Association, is a 1.12 MW Community Solar project for residential and commercial rate payers of this rural electric co-operative. Co-op members pay $747 per 235 watt panel ($3.18/watt), and receive a fixed 11¢/kWh plus a yearly escalator for the PV power generated by purchased panels. PPA terms are for 25 years, with a 25 year extension.
- **Colorado Springs Clean Energy** is a 500 kW Community Solar project of the Colorado Spring Utilities (alongside the other 1 MW Sun Share lease project highlighted earlier). Residential and educational customers receive 9¢/kWh payment for PV power produced, a rate equivalent to the retail rate (which is likely to rise over time). The utility also offered a $1.50/watt rebate that helped drive down costs further. CEC is selling its 2,300 panels in this project at a price of $624 per 220-watt panel ($2.84/watt) to residential and educational customers.
- **Colorado Community Solar** is a multi-megawatt program sponsored by Xcel Energy, an investor-owned utility. Xcel Energy's program is structured under smaller 500 kW (or smaller) Community Solar projects in specific counties to serve members of those specific counties. County rate payers can purchase a minimum of 4 panels (250 W panels), or 1 kW, for a cost of $3.70 per watt, or $3,700/kW. In return, panel owners receive 5.5-7¢/kWh for power generated by their panels, which represents the retail rate minus transmission and distribution. In addition, panel owners receive an additional "Performance-Based Incentives," which are legislatively mandated and derived in part from sREC sales. CEC estimates payback periods of 11-12 years for residential customers and as low as 5 years for commercial customers. The Colorado Community Solar program has 500 kW operating in Boulder county and an additional 3.076 MW under construction in other counties. Xcel is currently authorized to expand this program to 9 MW.

(Continued, next page)

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CASE STUDY #5: CLEAN ENERGY COLLECTIVE, LLC (CEC) (cont.)

Marketing and Sales Activities: CEC is responsible for marketing and selling panels, and selling panels is critical to CEC's business. CEC researches each market it is operating in, pilots different approaches, and tailors its marketing and sales strategies to target likely customers in each individual market. In some markets, CEC finds that focus on community events and grassroots marketing works particularly well. In others, broad advertising works. In some, internet marketing in conjunction with local organizations is effective. CEC has tried a variety of approaches and finds that different combinations work in different places. CEC has also found that panel sales are higher (sell more quickly) when payback periods are less than 15 years, first year payback rates exceed 5.5%, and the systems have a useful life approaching 50 years.

Other Insights & Items: CEC's experiences offer many useful observations, including:

- Once an effective PPA is structured, a third party like CEC can be engaged to provide a whole Community Solar system on a turn-key basis.
- CEC has invested significant resources towards ensuring its model complies with SEC regulations, the tax code, and consumer protection laws. CEC has concerns that leasing models, if not thoroughly vetted by SEC and tax attorneys and designed correctly, can run into legal trouble down the road and become unexpectedly expensive for community participants, developers and/or utilities. Such an event could give Community Solar a negative reputation.
- Given its 50 year time horizon, CEC sets up an escrowed O&M reserve. This fund covers costs for maintenance, insurance, unexpected equipment replacement, and the like.
- Legislation favorable to Community Solar can be a helpful tool to encourage investor-owned utilities to embrace this offering, though it is not required for CEC's program.
- Utilities often find that CEC's program is a viable solution to leverage solar momentum in the utility's favor under a fair arrangement with ratepayers.

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Community Solar Business Model #4: "INVEST IN A PV PROJECT"

In the "Invest in a PV Project" model, individuals come together as members of a limited liability company (LLC) to co-invest in a specific solar project located in a community. The member investors may or may not actually be from that community. The members form an LLC, and through this Special Purpose Entity (SPE), they purchase, install, manage and maintain the PV system. The PV system is typically located "behind the meter" at a host site, and the host agrees to pay the LLC a specific rate for PV power generated. The LLC usually keeps and sells RECs generated by the project. LLC members are compensated for their investment through profit distributions and tax credits, which can be transferred directly to members as equity payments and/or tax credits, or can be monetized through interest payments to investors.

Typical roles and responsibilities, advantages, and disadvantages for the buyer – who is actually the host – and the supplier, which is the developer organized as a LLC, in the PV Project Investment model can be described as:

***Roles & Responsibilities Include*:**

"Host" **Businesses or Institutions**	**"LLC"** **Investors**
• Agrees to provide access to a site for the solar system • Provides the LLC with a PPA to purchase power generated by the solar system at a set price for a set period of time • Works with the local utility to ensure integration within net metering regulations.	• Ensure all necessary federal and state SEC and other legal work is proper and complete • Recruit accredited and non-accredited investors according to SEC guidelines. Depending upon how the LLC is organized, the LLC may have up to 35 non-accredited members (25 in Michigan). • Finance, own, manage, maintain and take risks for all PV generating assets for the life of the project • Negotiate a PPA with the host • Retain and sell solar RECs generated • Maintain bookkeeping and proper management of investment moneys and profit distributions.

Advantages Include:

"Host" **Businesses or Institutions**	**"LLC"** **Investors**
• *Price Certainty:* PV investor groups can provide PV power to the host at a known price for the life of the project. The PV power produced by project panels offsets the host's energy bill in kWh or financial credits for the length of the term. • *Low Risk:* There are no ongoing O&M fees or project liabilities, as these are handled by the LLC. • *Member Participation:* There may be opportunities for individuals affiliated with the host (such as members of a place of worship) to invest in the project that will supply the host with PV. • *Purchase or Removal Flexibility:* Hosts may elect to purchase the PV system in the future, or have the PV panels removed after the project period.	• *Return on Investment:* ROI may be relatively attractive, especially in locations with higher energy costs and/or high solar REC prices. LLC member investments can be less than $5,000, and each members' financial returns come from tax benefits, pro-rata portions of net LLC income, solar RECs sales, and proceeds from future sale of the system. • *Control:* The LLC maintains control over the PV asset through the life of the project.

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Disadvantages Include:

"Host" Businesses or Institutions	"LLC" Investors
• *Long-term Commitment:* The host has to be able to make a long-term commitment to be a stable site for the PV project. • *Aesthetics:* Depending upon location and style, the PV project may negatively impact what some view as the aesthetics of the host's facility.	• *Financial Risk:* All relevant project legal, capital, operational, insurance, and other costs are borne by the LLC during the project lifetime. • *SEC Adherence:* The LLC is an investment vehicle that must adhere to all appropriate federal and state securities requirements, which can be expensive to set up and complicated to manage. • *There is no guarantee of positive returns:* Risk is relatively high and return on investment can be poor, especially if solar REC prices are depressed.

The PV Investor Groups Community Solar business model can be highly flexible. Operating independent of local utilities, these groups can finance new or existing solar projects. This model works for individuals who want to organize to invest in a single project, or for a project manager who wants to form a pool of individual investors.

"Invest In A PV Project" Examples:

The PV Investor Group model is particularly well suited to small to mid-sized projects. Examples of PV investor groups include:

- **University Park Community Solar LLC** – In 2010, a group of 30+ local individuals in University Park, Maryland, pooled $130,000 to fund the installation of a 21.6 kW PV system on the roof of the University Park Church of the Brethren. The LLC owns the PV system, which sells power to the church at a rate less than what it pays the local utility. The LLC sells the solar RECs, and has the option to sell the system to the church at a future date. The group pioneered this approach and developed a template that has been used by Greenbelt Community Solar LLC and others.
- **Greenbelt Community Solar, LLC** – See Case Study #6 below.
- **Ethical Community Solar, LLC** – A recent installation of a 30.2 kW system that was done in conjunction with a roof replacement at the Washington Ethical Society, a humanist church in Washington, D.C. In this case, all investors are members of the Society.
- **Solar Mosaic (aka "Mosaic Solar")** – See Case Study #7 below. Since September 2012, the crowd-sourcing investment platform of Solar Mosaic has enabled individual investors to finance more than a dozen projects ranging from a 26 kW PV system on a St. Vincent de Paul building in Oakland County, California, to a 622 kW PV system located at a charter school in Federal Heights, Colorado.

PV Investor Groups give individuals who otherwise could not be involved in a PV project an opportunity to become directly involved. Depending upon how the LLC is set up, the PV investor group may have a small number of local investors, such as with Greenbelt Community Solar, LLC, or hundreds via crowd-funding through online portals like Solar Mosaic. Investors may come from a particular area or from all over the U.S.

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CASE STUDY #6: GREENBELT COMMUNITY SOLAR, LLC

Project: **Greenbelt Community Solar, LLC** (http://www.greenbeltcommunitysolar.com)
Contact: Steve Skolnik, Chair for the Management Committee

Business Model: More than 30 investors in and around Greenbelt, MD joined together to form Greenbelt Community Solar LLC. Through this LLC, each investor member contributed towards the more than $100,000 needed to finance and install a 21.6 kW solar array located on the property of the "host" Greenbelt Baptist Church. The LLC and the church established a 20-year Power Purchase Agreement (PPA) that pegs the price for PV power initially at a 10% discount relative to the utility price. The PPA with the church has a modest escalation rate, though the price for PV power will never exceed the utility price for electricity. This discount enables the church to receive immediate and long-term positive returns in the form of lower energy prices.

The LLC has to register as an investment entity with the State of Maryland, and has to report to the state. The LLC is size-limited and organized under rules so that it does not have to report to the Federal Securities and Exchange Commission (SEC).

Greenbelt Community Solar, LLC was modeled after the University Park Community Solar, LLC, and has itself spawned the Ethical Community Solar, LLC in Washington, D.C. (30.8kW solar array, also located at a place of worship).

Host Costs and Benefits: The host church has no expenses, except that it must add a rider to its existing insurance policy, and receives discounted electricity for the life of the PPA. After 12 years, it has an option to purchase the PV system.

Member Costs and Benefits: LLC members bear all legal, capital, operational, and other costs for the PV system located at the church. The LLC receives income from the sale of PV electricity to the church, and the sale of solar RECs. After costs are paid, LLC net proceeds are distributed on a pro-rata basis to members as passive income. LLC members also benefited from the 30% federal grant (now an investment tax credit) and accelerated depreciation. The payback period for investors was originally projected to be 5 years; currently falling sREC prices may result in a payback period closer to 12 years.

Marketing and Sales Activities: The LLC members were found through word of mouth and personal invitation, as no public solicitation is allowed. It took organizers of the LLC only a few weeks to secure the member investors needed. All LLC members had to complete a subscription questionnaire, to ensure that they were knowledgeable about the nature of the investment they were considering, and that they could afford to lose the investment.

Other Insights & Items: Several other insights and items from Greenbelt Community Solar's experience include:

- Greenbelt group benefited greatly from legal work previously done by University Park Community Solar, who shared their documents at no cost. Greenbelt group also was able to secure *pro bono* legal services to modify and update organizing legal documents.
- LLC member financial returns are highly correlated with the PPA price for PV power and the solar REC prices (sREC prices in Maryland have trended down, lengthening the payback period significantly).
- LLC member returns are not particularly high (initial projection of 5% average over 20-year term, much lower now due to decreased sREC value). Investors must not be looking for a quick financial return, but be patient, in for the long-term, and interested in environmental stewardship.
- The underlying economics have to be attractive to finance these kinds of locally-funded Community Solar projects. Ideally, payback periods are 7 years or less. This requires electricity prices of at least 15¢/kWh and a strong solar REC market. As solar PV prices continue to fall, individual investor financing should become more attractive and easier.
- Greenbelt Community Solar, LLC is committed to enabling others who want to form similar PV investor groups.

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CASE STUDY #7: SOLAR MOSAIC, INC. (aka "MOSAIC SOLAR")

Company: **Solar Mosaic, Inc.**

Business Model: Mosaic is a crowd-sourcing online platform (www.joinmosaic.com) for financing solar projects in states such as California, New Jersey, and Colorado. Anyone from California, Colorado, Nevada, Oregon, and New York, and accredited investors from other states, may be eligible to invest in Mosaic-financed projects. Investors can invest as little as $25 in specific solar projects and receive their principal plus interest back over a specific time period. Mosaic projects rates of return of between 4.5-6.3% after management fees, over specific periods of time from 5-10 years.

The Mosaic platform has demonstrated an impressive ability to raise money. A recent offering for a 114 kW installation on a Ronald McDonald House in San Diego raised nearly $160,000 from 171 investors within 6 hours. To date, individual investors working through Solar Mosaic have successfully financed more than a dozen PV projects. Projects include:

- A 26 kW PV system on the roof of a St. Vincent de Paul building in Oakland, California
- A 78 kW system at an affordable housing complex in San Bruno, California
- Three 487 kW systems at the Convention Center in Wildwood, New Jersey
- A 622 kW system at a charter school in Federal Heights, Colorado

Mosaic's investments are largely governed – and limited – by state security laws. Such laws generally discourage crowd-sourcing, but this is changing. Mosaic recently received approval from security regulators in California to offer $100 million in solar project investments to residents of California.

Community Participant Costs and Benefits: Where state laws allow, crowd sourcing platforms like Mosaic enable a very wide range of community members to invest directly in local solar projects. Investment thresholds can be very low. Returns will have varying degrees of risk. Solar Mosaic takes care of project origination and management, prepares and manages each offering in accordance with applicable federal and state securities laws, and manages payment of the financial returns.

These investments are neither risk nor cost-free. There are risks that the solar project or Mosaic could fail financially. And similar to mutual funds, investors pay Mosaic a small account management fee that is deducted from investor returns.

Marketing and Sales Activities: Solar Mosaic does its marketing and sales activities online, through its web portal, through other digital and non-digital media.

Other Insights & Items: Several other insights and items from Solar Mosaic's experience include:

- There may be considerable pent up demand for individual investors who want to invest in solar projects in and outside their community.
- While not at all high, Mosaic project rates of return of around 5% will be considered by many to be competitive when compared to current Treasury returns of <2%.
- A primary limitation to Mosaic operating in states like Michigan is the challenges and expenses of working with (and in some cases changing) state securities laws. As of now, Mosaic can work with accredited investors from throughout the U.S., and non-accredited investors from California, New York, Colorado, Nevada, and Oregon.

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BEST FIT FOR MICHIGAN

This report has reviewed four distinct Community Solar business models, each of which are being replicated in projects across the U.S. They each can be very successful, and they each can be done with varying degrees of involvement from utilities and a growing number of able third-party developers. Which of these models are best fits for what types of situations? While inherently problematic to generalize, "best fits" might be summarized as follows:

The "Buy PV Power" business model can work well for utilities that want to offer ratepayers easy, affordable, flexible, and scalable access to locally produced PV power to offset their consumption of a "base" power mix that is dominated with fossil fuels. Even when priced at a premium, demand for locally produced PV power can be strong, so utilities should have plans in place for additional local solar generation sites. This model works for ratepayers who want to support the increased use of PV and who would like to use PV as a hedge against future base fuel costs, but who do not have specific financial "payback" needs or expectations.

The "Lease Panels" business model can work well for utilities that want to offer ratepayers the ability to purchase up front the power produced by a specific number of PV panels that are owned by the utility or its 3rd party Community Solar developer. Utilities and third-party developers must be able to sell leases to the public in a timely manner, as leases repay financiers and provide capital for future Community Solar expansions. Utilities retain control of the PV panels after the life of the panels. Before selling leases, utilities and third-party developers must invest in the legal due diligence necessary to ensure that the leasing projects are designed and implemented in ways that are in accordance with SEC, tax, and consumer protection laws. The "Lease Panels" model works well for ratepayers who want to promote local PV generation, are looking for a long-term hedge against base energy costs, have equally long-term financial payback expectations, and are willing to "give back" the panels at the end of the lease period.

The "Buy Panels" business model can work well for utilities that want to offer ratepayers the ability to purchase up front the power produced by a specific number of PV panels *for the life of the panel (see vendors warranty, insurance requirements, etc.).* As with leases, utilities and third-party developers must be able to sell panels to the public in a timely manner. Even more than with leasing, utilities and third-party developers must invest in the legal due diligence necessary to ensure that the projects are designed and implemented in ways that are in accordance with SEC, tax, and consumer protection laws before selling panels. They also must be able and willing to manage, operate and maintain the Community Solar project for the life of the project, even though they do not own the actual panels. This model works for ratepayers who want to support increased PV use, and who want to use PV as a hedge against future fuel costs for a very long time.

The "Invest in A PV Project" model works for individuals who are willing to band together and can afford to invest in a specific PV project located at the site of a local host. This is for individuals who want to promote solar in their community, invest in and own part of a PV project, and who want a reasonable financial return from the investment. Individuals may organize themselves, or may join already formed groups. These projects can be high risk and must be done in accordance with all state and federal security laws. It is typically required that investors indicate their financial suitability and sophistication, and their ability to afford losing their investment.

All of these Community Solar business models have their merits, and all are proven in the marketplace. They also all require the ability to "sell" the PV power, lease, panel or investment, and have their financial and operational risks.

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Community Solar Project Distributions by State and Entity Type (May 2013)

State	# of CS Projects	IOU	Muni	Co-ops	Non-utility Entity
Arizona	5	3	1	1	
California	1		1		
Colorado	9	1	1	7	
Delaware	1	1			
Florida	1			1	
Kentucky	1		1		
Massachusetts	1				1
Michigan	1			1	
Maryland	2				2
New Mexico	1			1	
Oregon	1		1		
Utah	1		1		
Vermont	3	2		1	
Washington	5		3		2
Total	33	7	9	12	5

Source: Interstate Renewable Energy Council Inc., Solar Electric Power Association

SolarShare Community Solar Bonds (a Canadian addition to the survey)

In Ontario the non-profit cooperative SolarShare has introduced a new way to engage communities in solar financing. Using their co-op model, SolarShare allows Ontario residents and businesses to benefit from investing in bonds backed by large commercial and smaller rural solar projects. Co-op membership costs $40, and each member is able to invest $1000 in the solar bonds. Bond investments are used to finance fully completed projects, which shields bondholders from pre-development and construction risks. Each project is backed with a 20-year PPA with Ontario Power Authority with fixed pricing for the power produced, ensuring a steady and long-term revenue stream. Bond repayments are made semiannually with 5% interest, and are fully repayable after completion of a five-year term. Currently, the SolarShare project portfolio consists of 18 solar installations. For more information, see www.solarbonds.ca.

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MICHIGAN'S FIRST COMMUNITY SOLAR PROGRAM: SOLAR UP NORTH ALLIANCE (SUN)

The first Community Solar program is currently underway in Michigan, and officially started on April 15, 2013. Cherryland Electric Cooperative and Traverse City Light and Power (TCL&P) have partnered to offer the Solar Up North (SUN) Alliance to their members. Cherryland is an electric cooperative with 33,000 members and TCL&P is a municipal utility with 12,000 members. As municipal and co-op electric companies, they are not restricted by MPSC regulations and can simply choose to offer a Community Solar program if they feel it is in the best interest of their members.

When interviewed, staff from both companies agreed that this had been an idea they had been discussing for over a year, and finally, in January 2013, they decided that, seeing very little risk, they would just make the decision to move the project forward. The initial idea was that collectors would not be installed until they were sold, and the solar energy generated would be credited back to the participants at last year's average wholesale cost of power. These decisions meant that the utilities would be taking very little risk.

The NREL "Guide to Community Solar" includes case studies of one or two projects that invested money up-front in large PV electric systems and then tried to sell enough "shares" to get their money back. Poor participation rates and rapidly dropping solar installation costs (a new project could be built much cheaper than buying into the original project) led to very few of the collectors actually being sold. The low-risk recommendation now is to not build the system until it is nearly fully subscribed. This was SUN's plan.

The decision to value the solar energy produced at last year's average wholesale rate meant that the paybacks on the investment by program participants will not be as good as they would be by valuing the energy at full retail or even an enhanced solar value. However, the goal for the local utilities was to avoid any appearance that the costs of the SUN Program were being subsidized by non-participants. If the SUN project was paying no more for the energy than they would from their electric supplier, than there was no threat of additional costs to all rate payers of the utilities.

The first PV system was planned to be sited at the Cherryland office in Grawn, MI, with the energy feeding into the Cherryland offices through net metering and the excess feeding into the grid. Area solar installers were invited to submit proposals. A contract was awarded to Contractors Building Supply Company to build a ground-mounted PV system consisting of forty-two 235-watt panels, for a total capacity of 9.87 kW. Installed price for these panels was very near $3 per watt, or about $30,000 for the 42-collector array.

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Cherryland, as a cooperative, was not eligible to take advantage of federal tax incentives, which, with the income tax credit and accelerated depreciation, could be as much as 40-50% of the project costs. Capturing these credits is an important component of keeping the participants' costs down and their returns on investment up. Therefore, an agreement was negotiated with Spartan Renewable Energy, a for-profit subsidiary of Wolverine Power Cooperative that supplies electricity to Cherryland, that Spartan would be the owners of the panels and capture the tax incentives and lease the collectors back to the SUN project. After six years, SUN will purchase the collectors from Spartan.

SUN would lease individual solar panels to voluntary participants in the Cherryland and TCL&P territories for $470 per panel for 25 years. An Energy Optimization Program rebate of $75 was available for participants bringing their cost down to $395 per panel. Some members were eligible for an additional rebate bringing their cost down from $395 to $320. Participants could lease any number of panels (until all available panels were leased) and would then get a credit on their electric bill for the kWh generated by their panels each month. The solar kWhs are valued at last year's average wholesale rate for electricity purchased from Wolverine Power Cooperative, which for 2013 was 7.8 cents/kWh, and that amount is then subtracted from the monthly electric bill total.

Participation is easy for Cherryland and TCL&P customers who simply sign up for the number of panels they wish to lease, pay the $395 per panel (or less), and then receive reductions in their electric bill based on the panel's electric production for the next 25 years. If there is more savings in a given month than the electric bill total, a credit is passed on to the next month. If, after a twelve month period, there is still an excess savings, SUN will write a check to zero-out the excess credit and start over again.

If the participant moves within the program territory, the account moves with them. If they move outside the territory, and no new buyer can be found to lease the participant's solar collectors, the shares may be given away or revert back to SUN with no refund.

With energy production of a 235-watt solar panel in Traverse City estimated to average 268 kWh/yr., this means the participant would receive about 268 kWh x $0.078/kWh = $20.87/yr. At a one-time cost of $395, this is a straight-line payback of 18.9 years and a ROI of 5.28%. However, SUN will adjust the energy value each year so that it can be expected to increase 2-5% every year. At a 3% inflation rate, the payback occurs in 15.2 years and the ROI = 7.7%.

Early interest in the program was strong and by the time the program was officially announced on April 15, 2013, SUN had already increased the program to 80 panels. With continued strong interest, by the time of the first ribbon cutting on June 7th for the original 80 panels, SUN was constructing racks for an additional 144 panels. At the end of July, Cherryland had 55 members who had purchased a total of 114 shares (collectors rented for 25 yrs). TCL&P has 22 shares. Of the total 224 collectors planned for the Cherryland office site, there were 88 left to sell. SUN is advertising that, "Once these shares are sold, it could be as long as a year or more before we have sited and approved a SUN Alliance installation elsewhere."

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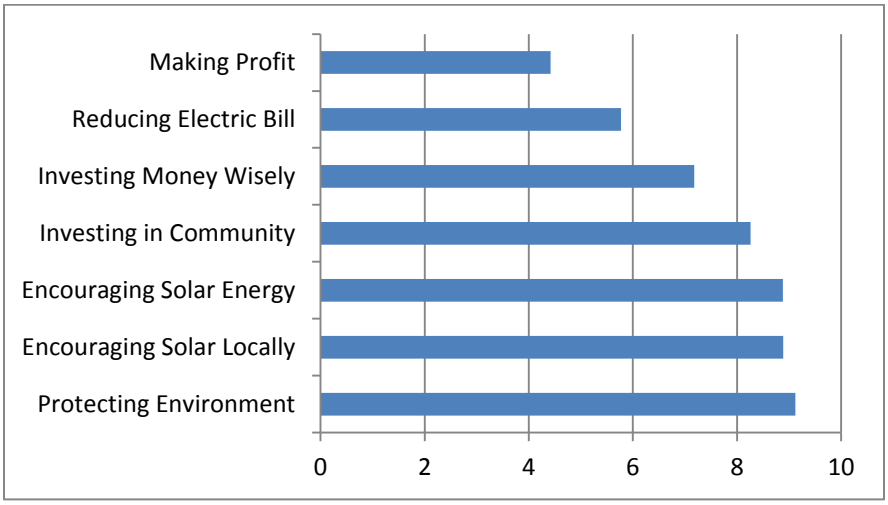
Traverse City Light & Power is still in the early stages of their customer outreach, as they started later than Cherryland. They are currently preparing a communication to all TCL&P business customers with the hope that it will spur some additional interest from that customer base. After 25 years, the output from the entire solar array will revert to the utility. Assuming the collectors are still producing electricity at that point (another ten years could be expected), SUN will continue to feed that power into the grid, but will no longer be paying any bill credits for it. This will allow SUN to recoup some of the maintenance and management costs borne over the previous 25 years. Assuming the collectors degraded to 75% of their original output after 25 years, the output from the 224 collectors would still be 45,000 kWh/yr. At 12.5 cents/kWh (assuming a 2% inflation rate over 25 yrs.), that would be $5,625/yr. for ten years.

The Great Lakes Renewable Energy Association (GLREA), in cooperation with Cherryland and TCL&P, surveyed their customers who are participating in the program or expressed some interest in the program to better understand this first Community Solar effort in Michigan. In July 2013, TCL&P sent the survey link to about 100 individuals and Cherryland sent the link to 64 individuals. There were 57 responses to the survey, a response rate of 35%.

The survey responses are described in detail in Appendix II. Almost all respondents (98%) would like to see more Community Solar projects in Michigan. Most of the respondents (77%) heard about the program from a Cherryland or TCL&P email, newsletter, or bill insert. Of those who responded, 18% have not joined yet. Many respondents (48%) joined within a week of hearing of the program. A third (33%) know other people who have joined.

The survey asks how important (1=not important, 10=extremely important) various reasons were for deciding to participate. "Protecting the environment" had the highest average points (9.12) and "Making a profit" had the lowest average points (4.42). "Reducing your electric bill" (5.77) and "Investing money wisely" (7.18) also had relatively low average points.



The environment was the primary motivation for joining. Many of the comments make this clear:

> *"For my grandchildren."*
>
> *"We want to encourage generation of electricity from non-polluting renewal sources which minimize global warming. This program enabled that, and provided a 2%+ estimated return on our investment."*
>
> *"I often talk about trying to be greener and this was a good opportunity to practice what I preach."*

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"Desire to help reduce carbon footprint which I believe is one of the causes of climate change."

"We want to reduce our use of fossil fuels, but live in the woods where solar and wind aren't practical. The Solar Garden allows us to use solar in an affordable, efficient way."

Investing in solar energy and investing locally were also very important. "Encouraging the development of solar energy" had a score of 8.88 and "Encouraging the development of solar energy locally" had a score of 8.89. "Investing in your community" received a score of 8.26. Most of the respondents (71%) have been out to the Cherryland offices in Grawn to see their collectors. Some comments from the respondents:

"The more local the energy is, the better off the community will be."

"It was the community aspect, more than anything else, that drew us to the project. We also liked that the panels were installed right here where we could see them."

The easy conclusions from the survey responses is that those who chose to join the SUN Alliance did so to promote solar, protect the environment, and invest in the community. The financial factors were not a high priority.

Cherryland Electric Cooperative – www.cecelec.com/content/community-solar
Traverse City Light and Power – www.tclp.org/Mutual/CommunitySolar/EnergySmart

GLREA is very grateful to Cherryland Electric Cooperative and Traverse City Light and Power for having the vision to start the first Community Solar program in Michigan. GLREA and Michigan are reaping great benefits from the lessons learned and the real-life demonstration that Community Solar programs can be very popular with utility rate payers and can bring a great deal of positive attention to the utility.

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MICHIGAN SURVEY OF INSTALLED PV COSTS

GLREA sent a survey to 38 Michigan PV installers in May 2013. The following data is based on 13 responses. The results are averages based on responses for that category. Categories had from 4-12 responses, with fewer responses in the larger size categories.

Dollar Cost per Watt of Installed PV

	Ground Mount	Roof Mount	Tracker Mount
Less than 5 kW	4.62	4.56	6.06
5-20 kW	4.07	4.00	5.23
21-150 kW	3.81	3.54	4.33
151-500 kW	3.23	3.05	3.96
Greater than 500 kW	3.00	2.80	3.65

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NET METERING

Most on-site renewable energy systems in the U.S. use net metering to account for the value of the electricity produced when production is greater than demand, such as when a homeowner is away in the middle of the day and the sun is shining on a solar PV system. Net metering allows customers to bank this excess electric generation on the grid, usually in the form of kilowatt-hour (kWh) credits during a billing period. Whenever the customer's system is producing more energy than the customer is consuming, the excess energy flows to the grid and the customer's meter effectively or literally "runs backwards." This results in the customer purchasing fewer kilowatt-hours from the utility, and the electricity produced from the renewable energy system is usually valued at the sum of the retail charges on a customer's bill based on kWh usage. Customer participation in the net metering programs in Michigan was up to 1,330 customers at the end of 2012, with a generation capacity of approximately 9,583 kilowatts (kW).

Michigan's True Net Metering Program

Michigan's legislature established a net metering program through Public Act 295, signed into law on October 6, 2008. Part 5 of this "Clean, Renewable and Efficient Energy Act" defined guidelines for the Michigan Public Service Commission to establish a statewide net metering program. The MPSC then issued the "Electronic Interconnection and Net Metering Standards", which establish the rules for the Michigan Net Metering program. These rules establish "true net metering" for renewable energy systems with a generating capacity of 20 kW or less. These smaller systems got to either figuratively or literally "run the meter backwards", valuing the renewable energy produced at the full retail value of electricity. The relevant rule states:

> Rule 50. (1) Net metering customers with a system capable of generating 20 kW or less shall qualify for true net metering. For customers who qualify for true net metering, the net of the bidirectional flow of kWh across the customer interconnection with the utility distribution system during the billing period or during each time-of-use pricing period within the billing period, including excess generation, shall be credited at the full retail rate.

Modified Net Metering

Larger systems, above 20 kW and up to 150 kW generating capacity, qualify for "modified net metering" which credits net metering customers not at the full retail value of electricity for any excess renewable energy generation, but the value of the electric generation supply (energy) component only. Full retail includes both a power supply cost component, the cost to generate the electricity, and a transmission and distribution cost component, which is the cost to deliver the electricity to the meter. For example, a general service or residential rate schedule may value the generation component at currently about 8 cents/kWh and the delivery cost at currently about 3.7 cents/kWh. These numbers are subject to change as the cost of electric generation and MPSC authorized rates change. The relevant rule about modified net metering states:

> Rule 52. (1) Net metering customers with a system capable of generating more than 20 kW qualify for modified net metering.
>
> The credit per kWh for kWh delivered into the provider's distribution system shall be 1 of the following as determined by the commission:
>
> (a) The monthly average real-time locational marginal price for energy at the commercial pricing node within the electric provider's distribution service territory, or for a net metering customer on a time-based rate schedule, the monthly average real-time locational marginal price for energy at the commercial pricing node within the electric provider's distribution service territory during the time-of-use pricing period.
>
> (b) The electric provider or alternative electric supplier's power supply component of the full retail rate during the billing period or time-of-use pricing period.

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Since Community Solar projects tend to be larger than 20 kW capacity, most in the hundreds of kW, they are not currently eligible for true net metering when connected to the utility grid. This reduces the funds available to share between the members and creates more difficult economics for project developers. One solution that can help enable Community Solar is to increase the size of systems allowed to participate in true net metering. Nineteen states currently allow net metering systems of 500 kW or larger capacities.[20]

Net Metering Program and System Size Limitations

Public Act 295 established that an electric utility or alternative electric supplier is not required to allow for net metering that is greater than 1% of its in-state peak load. The relevant rule states:

> Sec. 173(2) An electric utility or alternative electric supplier is not required to allow for net metering that is greater than 1% of its in-state peak load for the preceding calendar year.

The 1% limit is allocated among the different size categories of net metering with 0.5% allocated to customers with generators that are 20 kW or less. The MPSC is charged with tracking this capacity as part of the Annual Net Metering Reporting requirements for each Michigan Utility and Co-op. The 1% limit is not currently seen as a barrier. Data from the MPSC 2012 Utility Annual Net Metering Reports shows that for the 20 kW and under size category, Consumers Energy has 1,050 kW of net metering in place with space remaining for 40,885 kW more of generating capacity before it reaches its the 0.5% limit. Detroit Edison has 5,750 kW in place with space remaining for 50,820 kW more capacity. There is no current concern that these utilities will reach their 1% capacity limits anytime soon.

Public Act 295 limits the size of renewable energy systems eligible for net metering to a 150 kW capacity. The relevant rule states:

> Sec. 5(b) "Eligible electric generator" means a … renewable energy system with a generation capacity limited to the customer's electric need and that does not exceed the following:
> (i) For a renewable energy system, 150 kilowatts of aggregate generation at a single site.

To enable Community Solar development in Michigan, this size limitation of 150 kW for net metering would need to be increased. This increase could be targeted specifically for Community Solar projects. There is no stated limit on the aggregate net metering capacity in Colorado. Delaware limits the size based on number of customers, allowing up to 25 kW per residential customer and 2 MW per non-residential customer. New Jersey has no size limitation. Minnesota recently raised its net metering system size cap from 40 kW to 1 MW.

The MPSC Standards also limit the size of a net metering system to no larger than the capacity estimated to provide the expected annual electricity usage for the site. Rule 460.640 (7) states:

> Net metering programs provided by electric providers and alternative electric suppliers shall limit each applicant to generation capacity designed to meet the customer's electric needs.

To accommodate Community Solar, this language could be modified to include the electric power needs of all the member/owners of the Community Solar project, and not just the needs of a customer at the project location. Delaware PUC Order No. 7984, section 8.5.4, states:

> A Community Energy Facility shall not exceed the sum total of the capacity limits (as defined in previous sections) among the Subscribers of a Community Energy Facility."

[20] www.DSIREusa.org

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Net Metering Location Limitations

PA 295 and MPSC rules establish that a renewable energy system eligible for net metering must be located at the net metering customer's site.

> From MPSC Net Metering Standards, R 460.601 (o) "Customer-generator" means a person that uses a project on-site that is interconnected to an electric utility distribution system.
>
> From MI PA 295 – Sec 13,
> (a) "Site" means a contiguous site, regardless of the number of meters at that site. A site that would be contiguous but for the presence of a street, road, or highway shall be considered to be contiguous for the purposes of this subdivision.

This may pose a barrier to utilizing net metering for Community Solar in Michigan. A number of other states have defined net metering to allow the aggregation of individual meters from multiple sites. An example is the State of Delaware Order No 7984 passed on June 11, 2011.
http://www.depsc.delaware.gov/orders/7984.pdf:

> "This bill will further strengthen net energy metering provisions by providing customers the opportunity to aggregate individual meters for the purpose of allocating net metering credits to electricity accounts other than the account that hosts an energy generating facility. The bill also provides community choice aggregation provisions for community-owned energy generating facilities that are established by a group of customers."

The Delaware bill allows a "Host Customer/Multiple Subscribers/Multiple Premises where a Community Energy Facility, either behind the meter of a Subscriber or as a stand-alone facility, provides Net Metering for multiple Subscribers and multiple premises."

Virtual Net Metering – Group Net Metering

Virtual net metering is enabled in Colorado, Delaware, Massachusetts, California, and Minnesota, which allows for Community Solar programs to distribute economic benefits from a shared solar energy system. Virtual net metering allows net metering credits generated by a single renewable system to offset load at multiple retail electric accounts within a utility's service territory. As with traditional net metering, credits appear on each individual customer's bill.

Group net metering definitions can include at least three different types: (1) virtual net metering where a solar array is owned by multiple unaffiliated customers; (2) multiple, affiliated customers owning and operating a single generator whose output is netted against multiple billing accounts; and (3) a single customer with a single generator with the output netted against multiple billing meters, all on the same or adjacent premises. There are currently 16 states with some form of group net metering provisions.

Net Metering and Renewable Energy Credits

Besides the value of the electricity generated, another component of the income stream for a Community Solar project is the Renewable Energy Credits (RECs) that are generated. These are covered in another section of this study. The Michigan net metering laws state that the RECs are the property of the electric generator and therefore can be sold for additional income to the Community Solar project. Rule 460.654 states:

> (1) An eligible electric generator shall own any renewable energy credits granted for electricity generated under the net metering program.

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(2) An electric provider may purchase or trade renewable energy certificates from a net metering customer if agreed to by the net metering customer.
(3) The commission may develop a program for aggregating renewable energy certificates from net metering customers.

Utility Net Metering Issues

Although net metering rules have been established in over 40 U.S. states, many utility companies are concerned that by paying full retail (generation costs plus distribution costs) for excess kWh's generated by net metering systems, the net metering participants may be using the distribution system without fully paying for it. Also, since the utility is required to pay a higher price for the solar power (generation plus distribution) than their average power costs, this could cause electric rates in general to go up. The more net metering programs grow, the more rates could be forced to rise for everyone.

"It means you're taking advantage of the system but you're not paying for it," says Jeanne Fox, chair of the Committee on Energy Resources and the Environment for the National Association of Regulatory Utility Commissioners, in an article by Phys.org. "You're going to have a lot more people who are able to 'island off.' How is the utility making its money? You still have to pay for the transmission and distribution system." [21]

Many studies have been performed to analyze net metering program benefits and costs. In his 2013 report, State and Utility Solar Energy Support Programs: Recommended Approaches for Maturing Solar Markets, Tom Stanton, Principal Researcher of Energy and Environment at the National Regulatory Research Institute, notes that 12 studies have been completed between 2009 and the present. Seven of the twelve studies find the net value of solar energy for the utilities to be higher than full retail value and conclude there is little, if any, subsidy to solar producers if the solar electricity is valued at the average full retail price, as it is in true net metering programs. To quote Stanton,

> "That is basically because the hours of the day and months of the year when solar production is highest correspond quite well to air conditioning loads and thus to high-usage and high-cost time periods. This means that the utility's avoided energy cost during the hours of solar production tends to be enough above average that it is not unusual for the aggregated value of solar production to equal or exceed the average retail price."

Only 3 of the 12 studies determined a value less than full retail for solar energy. As net metering programs continue to grow, the issue of cross-subsidization will need to be addressed fairly, with the full value of solar generation taken into account.

Net Metering Barriers to Community Solar

- Limitation of net metering to a single site needs to be changed to allow aggregation of multiple meters served by a single Community Solar project. This could be accomplished by establishing virtual net metering.
- Size of solar energy systems allowed for net metering needs to be increased, with systems up to 550 kW capacity eligible for true net metering. Community Solar projects could then count on using net metering for the crediting of excess renewable energy produced.
- Value of solar energy to the utility and its customers' needs to be established to ensure that there is no subsidization of the program by non-participants, and that the true value of the solar energy is awarded to Community Solar participants.

[21] http://phys.org/news/2013-05-growth-electricity.html

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Michigan Net Metering Laws

Michigan utility law does not currently allow virtual net metering or group net metering. A redefinition of net metering to allow virtual or group net metering would be important for the development of Community Solar in Michigan but would require a new rulemaking process. MPSC staff have provided the following information on this process:

> "A rate regulated utility may voluntarily propose a pilot or experimental Community Solar program as part of its biennial renewable energy plan filing. Outside of the voluntary utility pilot or experimental option, Michigan utility law does not currently provide for virtual net metering or group net metering. A redefinition of net metering to allow virtual or group net metering would be important for the development of Community Solar in Michigan but would require a waiver or legislative revisions. Rule 12 (R 460.612) of the MPSC's Electric Interconnection and Net Metering Standards provides, "an electric utility, alternative electric supplier, or applicant may apply for a waiver from 1 or more provisions of these rules." The Commission may grant the waiver upon a showing of good cause and finding the waiver is in the public interest. The waiver must not conflict with Act 295. A waiver filed by a customer (or net metering applicant) would likely result in a contested case hearing with an order issued within one year. If the affected utility, Commission Staff and interveners were able to reach agreement, a settlement could be approved by the Commission in less than one year."

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RENEWABLE ENERGY CERTIFICATES (RECS)

One potential value stream from renewable energy production when looking at the financing of renewable energy systems is from the sale of Renewable Energy Certificates (RECs). A Renewable Energy Certificate (REC), and a Solar Renewable Energy Certificate (sREC), are tradable certificates that represent all the clean energy benefits of energy produced by a renewable energy system. Each time a renewable energy system generates a megawatt-hour (1,000 kWh) of energy, a REC (or sREC if it is from solar) can be issued. This can then be sold or traded, either together with or separately from the electric energy itself.

The ability to secure payments for RECs can make it easier for individuals and businesses to finance and invest in clean, renewable energy. REC values are usually set through bilateral contracts, negotiated in competitive market trading. The values vary with market conditions. sRECs tend to be more valuable than RECs, especially in the 16 states that have specific requirements for solar energy. For instance, Ohio RPS rules provide that solar must produce at least 0.09% of the state's total generation in 2013 (approximately 140,000 MWh) and the required percentage continues to increase at a mildly accelerated rate to 0.50% (about 1,000,000 MWh) by 2028. This type of requirement is intended to ensure a growing level of solar development in Ohio.

Michigan RECs

Michigan has a Renewable Energy Portfolio (RPS) that requires all utilities to provide 10% of their energy from renewable sources by 2015. Compliance to this requirement is measured though RECs, either self-generated or purchased from others. RECs must be produced in Michigan or in the out-of-state service territory of a Michigan utility with a few minor exceptions. Any utility can use RECs from a renewable facility that is in the out-of-state service territory of a Michigan utility. For example, WE Energies is using RECs from a biomass facility in Wisconsin that qualifies because it is located in WPSC's service territory. Michigan does not have a specific requirement for any portion of the qualifying renewable energy to be produced by solar energy.

While Michigan lacks a requirement for a specific quota of solar generation, solar energy is given extra value by a provision that a MWh of electricity from solar generates 1 REC plus two Michigan incentive RECs for the purpose of meeting the Michigan RPS requirements. This effectively triples the value of RECs generated by solar in Michigan.

There are restrictions on when a REC will be issued, who owns it, and how and when it can be traded. For RECs generated in Michigan,

- One renewable energy credit shall be granted to the owner of a renewable energy system for each megawatt hour of electricity generated from the renewable energy system.
- Two Michigan incentive renewable energy credits shall be granted for each megawatt hour of electricity from solar power.
- A renewable energy credit expires at the earliest of the following times:
    - When used by an electric provider to comply with its renewable energy credit standard or
    - 3 years after the end of the month in which the renewable energy credit was generated.

Michigan Incentive RECs are available for four other reasons; in-state manufacturing, installation by in-state labor, advanced energy storage, and on-peak production. Solar energy production generally coincides with high peak demand times for Michigan utilities. Renewable electricity produced at peak demand times by technologies other than wind receives an additional 1/5 credit per MWh. Peak demand time is defined by the MPSC in a December 2008 temporary order as weekdays between 6:00 AM and 10:00 PM, excepting certain holidays. However, Michigan Incentive RECs have no value in other states' compliance markets.

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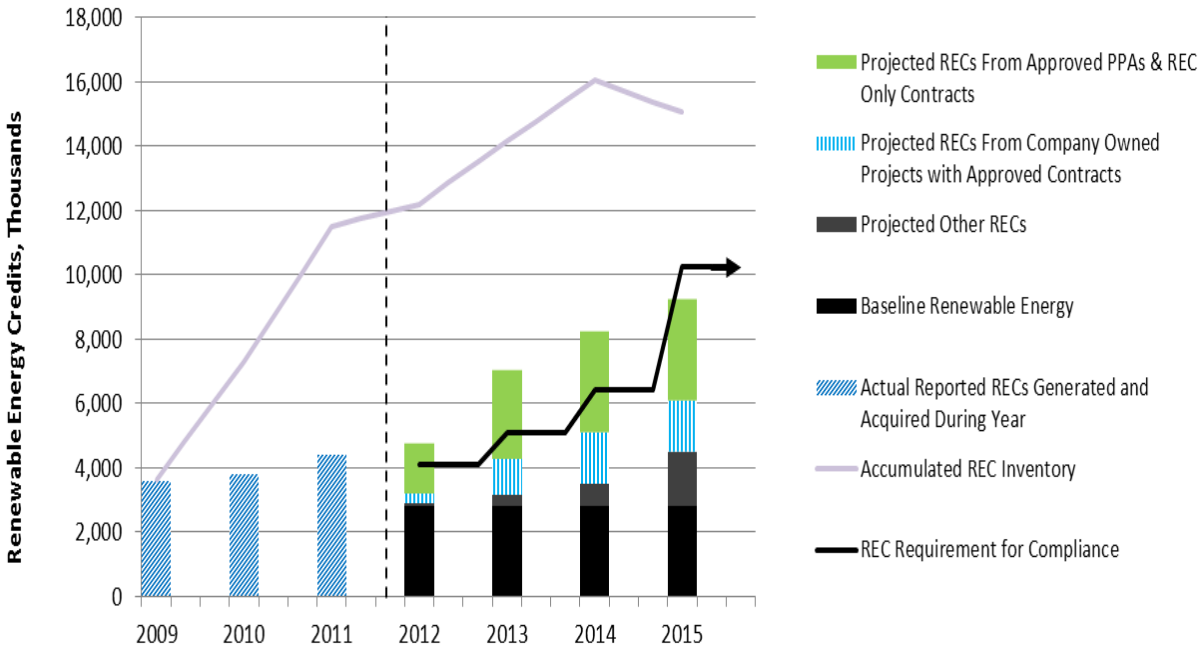
Per Public Act 295, the Michigan Public Service Commission established a renewable energy credit certification and tracking program to certify:

- renewable energy systems;
- a method for determining the date on which a renewable energy credit is generated and valid for transfer;
- a method for transferring renewable energy credits; and,
- a method for ensuring that each renewable energy credit transferred under this act is properly accounted for under PA 295.

The official Michigan Renewable Energy Certification System (MIRECS) is located at http://www.mirecs.org/. Also, smaller renewable energy generators can utilize REC Aggregation programs, such as the one offered by 5 Lakes Energy, LLC, found at http://www.5lakesenergy.com/services/rec-aggregation/.

The three year lifetime of Michigan RECs allowed Michigan utilities to bank RECs, including those from pre-existing landfill gas, hydro, and other renewable energy systems for use in meeting RPS goals. The graph below illustrates how the accumulated RECs from 2009 – 2011 produced a flood of RECs available in Michigan. This greatly assisted Michigan utilities in meeting RPS requirements and has kept the value of RECs in Michigan very low. If RPS requirements were raised in the future, the value of Michigan RECs could be expected to rise significantly.



Although nationally published lists of states with active REC markets do not include Michigan, RECs have been sold in Michigan. The following REC sales in Michigan are on file with the MPSC. The Michigan Public Service Commission has no record of any sREC sales in Michigan.

• UPPCO and Sterling Planet – 3,000,000 RECs, misc. and hydro	$12.46/REC
• Boyce Hydro, 210,000 RECs w/ option for 112,000 more	$ 7.75/REC
• L'Anse Warden Biomass, 110,374 RECs	$11.98/REC
• Michigan Waste Energy (Incinerator) up to 65,000/yr.	$ 7.00/REC
• Alpena Power bought RECs from Consumers	$30.37/REC

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REC Markets in Other States

Based on current laws in other states, the only states where Michigan sRECS can be traded for compliance in mandatory markets are Ohio and Pennsylvania, where sRECs were recently valued at sRECTrade.com at $11 and $14 (effectively 1.1 to 1.4 cents/kWh). According to conversations with some Michigan solar installers who are GLREA members, these markets are proving difficult and unreliable.

The dollar value of RECs and sRECs varies widely across the US. The 7 states listed nationally by sRECTrade.com and Flettexchange.com that have an active sREC market are:

sREC Prices – June, 2013	
Delaware	$35
Maryland	$122.50
Massachusetts	$215
New Jersey	$130
Ohio (out of state)	$14
Pennsylvania	$11
Washington, D.C.	$489

Current spot prices for sRECs in most states with solar portfolio standards can be viewed at www.srectrade.com and www.flettexchange.com.

In U-17301, Consumers Energy's most recent RE Plan, the Company values RECs at $2.00/REC. That is the equivalent added value of 0.2 cents/kWh.

Conclusion on RECs

Although Michigan has a program that offers "two additional incentive RECs for solar energy generation", this has not proven to be effective in increasing the value of sREC's under the RPS standards. Therefore, Community Solar project developers in Michigan are encouraged to take great care in calculating the role sREC's are expected to play in the value proposition for their projects.

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BUY-MICHIGAN PREFERENCES

Buy-Michigan Preferences provide preferential treatment for Michigan labor or equipment or equipment components made in Michigan. Michigan has a significant and growing solar industry. *The Solar and Wind Energy Supply Chain in Michigan* study by the Environmental Law & Policy Center in March 2011 identified 121 Michigan businesses in the solar industry. Community Solar projects can assist this industry to grow and this section will review some of the issues and opportunities related to Buy-Michigan Preferences.

Existing Buy-Michigan Preferences

Some Buy-Michigan Preferences are already in place in Michigan for the purchase and installation of renewable energy systems. PA 295 only allows utilities operating in Michigan to use renewable energy certificates from renewable energy systems located within the state or outside of the state in the service territory of a Michigan utility to meet the mandated Renewable Portfolio Standard (RPS) of 10% renewables by 2015. While some parts of some service territories are in other states, most are in Michigan and other out-of-state renewables cannot be counted toward the Michigan 10% RPS requirement.

Michigan RPS policies provide a Renewable Energy Certificate (REC) incentive for Michigan-made equipment and Michigan labor. If a renewable energy system is constructed using Michigan labor, a $1/10^{th}$ incentive credit for Michigan Labor is granted for the first three years. Renewable energy that is generated from a system that was constructed using Michigan-made equipment qualifies for Michigan incentive renewable energy credits equal to $1/10^{th}$ REC per MWh for the first three years (subject to a calculation that takes into account all components of the renewable energy system).

Example:

If the solar panel(s) qualify for the Michigan Equipment incentive REC's but the inverters and racking do not, then the $1/10^{th}$ REC would be prorated unless a threshold level of Michigan Equipment is met. If the threshold level of Michigan Equipment is used then the entire $1/10^{th}$ REC is awarded. Additionally if the system is constructed using Michigan labor, the $1/10^{th}$ incentive credit for Michigan Labor is also granted for the first three years in a manner similar to the Michigan Equipment provision. The Michigan Equipment and Labor incentive credits are only available for the first three years.

In addition, there are programs that can assist renewable energy system developers to buy local. The Pure Michigan Business Connect (PMBC) program is a public-private initiative developed by the Michigan Economic Development Corp. (MEDC) that helps Michigan companies identify local suppliers. The PMBC system enables posting of procurement opportunities, collaboration needs, and unique offers available to Michigan businesses. Companies in the system can be both buyers and sellers. DTE Energy and Consumers Energy have made major commitments to increase their purchases of Michigan products and services. More specifics on this program can be found at:
http://www.michiganbusiness.org/grow/pure-michigan-business-connect/

The Great Lakes Renewable Energy Assoc. has a business directory that can assist purchasers to identify solar products and services. Approximately half of the GLREA business members manufacture, sell, or install solar products or provide consulting services to assist businesses or institutions interested in buying renewable energy systems. Renewable energy products made in Michigan by GLREA members include solar panels, inverters, racks and tracking systems, and wind energy systems and towers. The business directory can be found at www.glrea.org.

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Buy-Local Preferences – Examples from Other States and Provinces

The Province of Ontario provides an example of local content or labor requirements. Ontario's feed-in tariff (FIT) program requires that renewable energy project developers purchase 50 to 60% of the systems and equipment for their projects from Ontario suppliers. This policy may be changed because the European Union and Japan filed a complaint against Ontario with the World Trade Organization (WTO). The WTO has decided that the Ontario Green Energy Program "local content" requirements violate international trade law.

The State of Minnesota provides an example of financial incentives for local products. Beginning in January 2014, the Department of Commerce (DOC) will administer a state "Made in Minnesota" Solar Energy Production Incentive. Residential, commercial, non-profit, and multi-residential customers are eligible for the incentive. Payments will be set by the Commerce Commissioner and go to owners of grid-connected solar projects smaller than 40 kilowatts. Each incentive contract will have a 10-year term and RECs are transferred to the utility. A total of $15 million is allocated each year for ten consecutive years to finance the "Made in Minnesota" solar production incentives.

Manufacturers interested in participating in the incentive program must apply to the DOC to be certified as "Made in Minnesota." In order to be eligible, the PV module must be manufactured at a facility located in Minnesota. Systems must be manufactured by a process that includes tabbing, stringing, and lamination, or must be manufactured by interconnecting low-voltage DC PV elements that produce the final useful PV output of the modules.

The State of Washington enacted Senate Bill 5101 in May 2005, establishing production incentives for individuals, businesses, and local governments that generate electricity from solar power, wind power or anaerobic digesters. The incentive amount paid to the producer starts at a base rate of $0.15 per kWh and is adjusted by multiplying the incentive by the following factors:

- Electricity produced using solar modules manufactured in Washington: 2.4
- Electricity produced using a solar or wind generator equipped with an inverter manufactured in Washington: 1.2
- Electricity produced using an anaerobic digester, by other solar equipment, or using a wind generator equipped with blades manufactured in Washington: 1.0

These multipliers result in production incentives ranging from $0.12 to $0.54/kWh, capped at $5,000 per year. Ownership of the renewable energy credits (RECs) associated with generation remains with the customer-generator and does not transfer to the state or utility.

In May 2009, Washington passed SB 6170, and with the passage of this legislation, Community Solar projects were able to receive the production incentive. Community Solar projects are defined as solar energy systems up to 75 kW that are owned by local entities and placed on local government property or owned by utilities and funded voluntarily by utility ratepayers. This legislation also allows projects on local government property that are owned by limited liability companies, cooperatives, mutual corporations, or associations to receive the incentive. The company itself is not eligible, but owners may take advantage of the incentive.

The base rate for Community Solar projects is $0.30/kWh and the multipliers are the same as those used for other types of projects. The actual production incentives range from $0.30/kWh to $1.08/kWh and the incentive is capped at $5,000 per year. Each participant in a Community Solar project, or each owner of a project, can apply to receive this incentive and may receive up to $5,000 per year. The state's utilities will pay the incentives and earn a tax credit equal to the cost of those payments. The incentives apply to power generated as of July 1, 2005, and remain in effect through June 30, 2020.

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Legal Issues with Buy Local Preferences

There are legal and institutional barriers to "buy-local" requirements or preferences. The Commerce Clause of the U.S. Constitution prohibits states from favoring local industry to the disadvantage of out-of-state competitors for economically protectionist reasons.

The 7th U.S. Circuit Court of Appeals found in June 2013 that it's unconstitutional for Michigan to discriminate against out-of-state renewable electricity. The case did not involve a direct challenge to the Michigan RPS, but Judge Richard Posner found that Michigan's law violates the commerce clause. "Michigan cannot, without violating the commerce clause of Article I of the Constitution, discriminate against out-of-state renewable energy," Posner wrote. What remains unclear is whether a party – possibly a wind or solar developer barred from the Michigan market – will file a lawsuit based on the court's decision and push the issue forward.

There are also international trade agreements which forbid or restrict "favorable treatment" for local manufacturers. After the European Union and Japan filed a complaint against Ontario, the World Trade Organization decided that the Ontario Green Energy Program "local content" requirements violate international trade law.

The Commerce Clause of the U.S. Constitution and international trade agreements provide constraints on how state and local governments can implement stronger preference policies, but private businesses and non-profits do not have these constraints.

Buy-Michigan Preferences and Community Solar

Most persons would agree that supporting local businesses is a good thing. How best to do this is not as clear. At a minimum, a Community Solar project sponsor would want to take advantage of information sources, e.g. the GLREA Business Directory, which can identify local businesses that provide solar products and services. It also is easy to buy-local "other things being equal."

Some procurement processes use low bid to award project contracts, but it is also possible to use a selection process that has multiple factors including contractor qualifications and experience, project cost, and "buy-local" criteria. For example, a selection process could award points as follows:

Project cost	**40%**
Contractor qualifications	**30%**
Buy-local criterion	**30%**

A "buy-local" criterion could provide a certain number of selection points if:

1) The contractor is physically located in Michigan;
2) The contractor uses Michigan labor; and/or,
3) The contractor will provide equipment made in Michigan.

The "made in Michigan" factor needs to recognize the complexity of the global economy and use a proportional basis or minimum threshold to determine eligibility. For example, the dollar value of Michigan components as a percentage of total system costs could be used as a proportional basis or "Michigan made" could be defined as 50% or more of total cost coming from Michigan components.

Using a "buy-local" criterion in the purchasing process has the advantage of favoring local businesses, while not excluding other non-local bidders that may have quality or price advantages. The appropriate weight to

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give to a “buy-local” criterion could vary depending on project sponsor preferences or policies. As indicated earlier, there are at least 121 Michigan businesses in the solar industry and a “buy-local” criterion in purchasing provides an excellent opportunity to support the growth of Michigan companies.

Beyond Michigan REC incentives, state government financial incentives for Michigan-made solar projects do not exist at this time and utility financial incentives are awarded using a lottery system. Content requirements by state and local government agencies may violate the Commerce Clause of the U.S. Constitution or international trade agreements. A “buy-local” criterion in purchasing could be used by Community Solar project sponsors to favor Michigan businesses while providing some flexibility in the selection process. This appears to be the best approach at this time.

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ECONOMIC ANALYSIS OF COMMUNITY SOLAR BUSINESS MODELS

In the "National Survey of Community Solar Programs" section of this report, the programs were broken down into four different types based on exactly what the participant is purchasing; therefore they are "Purchase" models:

- **Buy PV power** generated by one or more local Community Solar farms;
- **Lease PV panels** located at a specific Community Solar farm;
- **Purchase PV panels** located at a specific Community Solar farm; and
- **Invest in a PV project**, along with other "community" members.

There are many financial structures possible within each model and it impossible to address all of them in the scope of this report. The "Guide to Community Shared Solar" published by the National Renewable Energy Laboratory (NREL), defines three separate models based on sponsorship. These "Sponsorship" models are "Utility-Sponsored Model", "Special Purpose Entity Model (SPE)", and "Non-Profit Model". Each of the four "Purchase" models we present in this report can have any of the three "Sponsorship" models. A brief description of each of these "Ownership" models is provided here, but the reader is encouraged to study the "Guide to Community Shared Solar" for a more in-depth analysis.

- **Utility-Sponsored Model**: A utility owns or operates a project that is open to voluntary ratepayer participation. In Michigan, municipal and electric co-ops have little to no barriers to sponsoring Community Solar projects, but only 10% of Michigan citizens are owners (members) of a municipal utility or electric co-op. The other 90% are in investor-owned utility territories, like Consumers Energy and DTE. These utilities are regulated by the Michigan Public Service Commission and state legislation and sponsoring a Community Solar projects is difficult under existing rules. They may request a pilot program from the MPSC or new state legislation. This is unfortunate since utilities have the legal, financial, and program management infrastructure to handle organizing and implementing a community shared solar project already in place. This is often considered the "preferred" model due to its relative simplicity when compared to the other two alternatives.

- **Special Purpose Entity (SPE) Model**: Individuals join in a business enterprise to develop a community shared solar project. A special purpose entity must assume the significant complexity of forming and running a business. It must navigate the legal and financial hurdles of setting up a business, raising capital, capturing tax credits, and complying with securities regulation. In addition, it must negotiate contracts among the participant/owners, the site host and the utility; set up legal and financial processes for sharing benefits; and manage business operations. This model is available to most Michigan citizens.

- **Non-profit Model**: A charitable non-profit corporation administers a community shared solar project on behalf of donors or members. Non-profits may organize and administer a community shared solar project that shares benefits with participating members. This would require that the non-profit comply with state and federal securities regulations. While the non-profit is not eligible for the federal commercial ITC and depreciation benefits, a third-party owner should be identified that does have the tax appetite to take the credits and reduce overall project costs. This model is available to most Michigan citizens.

  Another option is for the non-profit to solicit donations for a solar projects targeted fund. This fund could either pay to construct solar energy systems on non-profit or other facilities, or invest the funds in an existing Community Solar project available to the non-profit. GLREA has been working with the Michigan Energy Office and a number of statewide non-profits to explore this idea for Michigan

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non-profits. The idea is to have a non-profit located in the SUN Alliance Community Solar project territory accept targeted donations from members across the state to be used to purchase shares in the SUN Community Solar project. SUN has stated that any ratepayer in their territory can purchase as many shares as they want, limited only by the number of shares available. If the credits from the shares are greater than the electric use of the purchaser, there is a true-up mechanism every 12 months that will reimburse the purchaser in cash for any excess credit. While this is not strictly "community shared solar," in that the donors do not share directly in the benefits of the solar installation, the donors do share indirectly, by lowering energy costs for their favored non-profit and demonstrating environmental leadership.

Lastly, the Michigan Council for the Arts and Cultural Affairs, State of Michigan, funds Capital Improvements on Libraries, Museums and Cultural buildings in the state. The Capital Improvements Program is a competitive matching grant program for nonprofit arts organizations, counties, cities, townships and villages that provides funding assistance for the expansion, renovation or construction of arts and cultural facilities. CIP funding can be sought to support Community Solar projects located on eligible buildings. Please see:
http://www.michiganbusiness.org/cm/files/mcaca/2014_documents/cip-guidelines(1).pdf

Legal Issues

The NREL Guide to Community Shared Solar lists a number of legal issues that need to be considered when putting together various types of Community Solar projects. Information below is taken directly from the NREL Guide, with Michigan-specific information added:

Securities Compliance – In designing mechanisms for customer participation in solar projects, developers must be careful to comply with state and federal securities regulations. This requires carefully considering what benefit a participant receives in exchange for a financial contribution to the project and how the project is marketed. For example, customer participants may be offered ownership stakes in the solar system itself or just the rights to certain benefits from the energy produced. Regardless of how the program is marketed, the receipt of benefits may constitute a return on an investment and fall within the blue sky laws (state laws that regulate the offering and sale of securities).

To reduce the burden of securities compliance, small projects in Michigan may seek a "private placement exemption" to registration requirements. The Michigan Uniform Securities Act, enacted in 2008, allows a "private offering" for up to 25 participants, so long as there is no general solicitation or general advertising, no commission is paid, and the issuer believes the purchasers are purchasing for investment. (MCL 451.2202 Sec. 201). This "private offering" can also avoid federal securities regulation as long as all the securities come to rest with Michigan residents, the issuer is a Michigan company, and the business is conducted in Michigan. (See Securities Act of 1933, Section 3(11), 15 USC 77c.)

The practical effect is to limit the number of individuals who can invest in a community shared solar project. Therefore, project developers must carefully consider how to reconcile their financing mechanism with the size of their project and the number of participants.

Income Taxes – The IRS has not ruled definitively on whether the benefits that result from purchase of a panel or share of a Community Solar installation, usually in the form of electric bill credits, are taxable income. In general, when a credit, discount or rebate is received as part of the same transaction, it is not taxable income, since it is considered part of the purchase or subscription (such as when subscribing for electric service or subscribing for a credit card). However, where there is a separate transaction, such as an electricity user purchasing a panel or share in a Community Solar installation,

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the electricity credits may be considered a return on investment and therefore taxable income by the IRS.

The tax treatment of electricity credits from the purchase of a panel or share in a Community Solar installation may differ depending upon whether the solar installation is operated by a cooperative. Under the Internal Revenue Code, such a credit may be considered a nontaxable patronage dividend or capital credit. One electric cooperative is known to be characterizing the electricity credits as similar to capital credits and not taxable, based upon a letter from the IRS relating to capital credits.

Flip Structure – Michigan has good third-party laws that allow ownership of the solar PV system by a third-party, usually in order to capture tax credits and depreciation to lower overall project costs. Tax laws require ownership of at least five years to be eligible for the tax credits. After five years, ownership can be transferred (flipped) back to the project developers or participants.

An example scenario is when a Community Solar Special Purpose Entity partners with a tax-motivated investor. Initially, most of the equity comes from the tax investor and most of the benefit (as much as 99%) would flow to the tax investor. When the tax investor has fully monetized the tax benefits and achieved an agreed-upon rate of return, the allocation of benefits and majority ownership (95%) would "flip" to the community SPE (but not within the first five years). After the flip, the community SPE has the option to buy out all or most of the tax investor's interest in the project at the fair market value of the tax investor's remaining interest.

Value of Solar

An important factor in the economic analysis of a Community Solar project is the value of the solar energy produced. Obviously, the greater the solar energy value, the better the return for project investors. However, utilities are often concerned that if the solar energy is valued too high, the project would be subsidized unfairly by non-participants. At the low end, the "average wholesale rate of energy" is the average price that a utility pays for the purchase of energy from all sources including coal, natural gas, and nuclear generators. Solar priced at this rate is no more expensive than other energy purchased by the utility, and therefore cannot be said to cause subsidization by non-participants.

A common value for solar is the "net-metered" price, which is usually the retail cost of electricity. The retail price includes both the cost of producing the power and the cost of delivering the power to the end user. Many states, including Michigan, have net metering laws in place (see Net Metering section of this report). Michigan's law values solar at the full retail rate for systems up to 20 kW, but drops that rate to the wholesale power costs for systems from 20-150 kW.

Some states have set, or are in the process of setting, a standardized value of solar energy. This value takes into account the base value of the energy generated (basically the wholesale cost of energy) and then adds or subtracts value for:

- **reducing the need to purchase more expensive peak power since solar typically generates at peak times**
- **intermittency, since solar is only available when the sun is shining**
- **avoiding transmission and distribution losses**
- **reducing the need to build or upgrade transmission and distribution infrastructure**
- **reducing the need to build new power plants**
- **providing a price hedge against future fossil fuel price increases**
- **environmental and social value – solar is a clean, non-polluting energy source and helps utilities meet renewable energy requirements. (See Renewable Energy Certificates section of this report.)**

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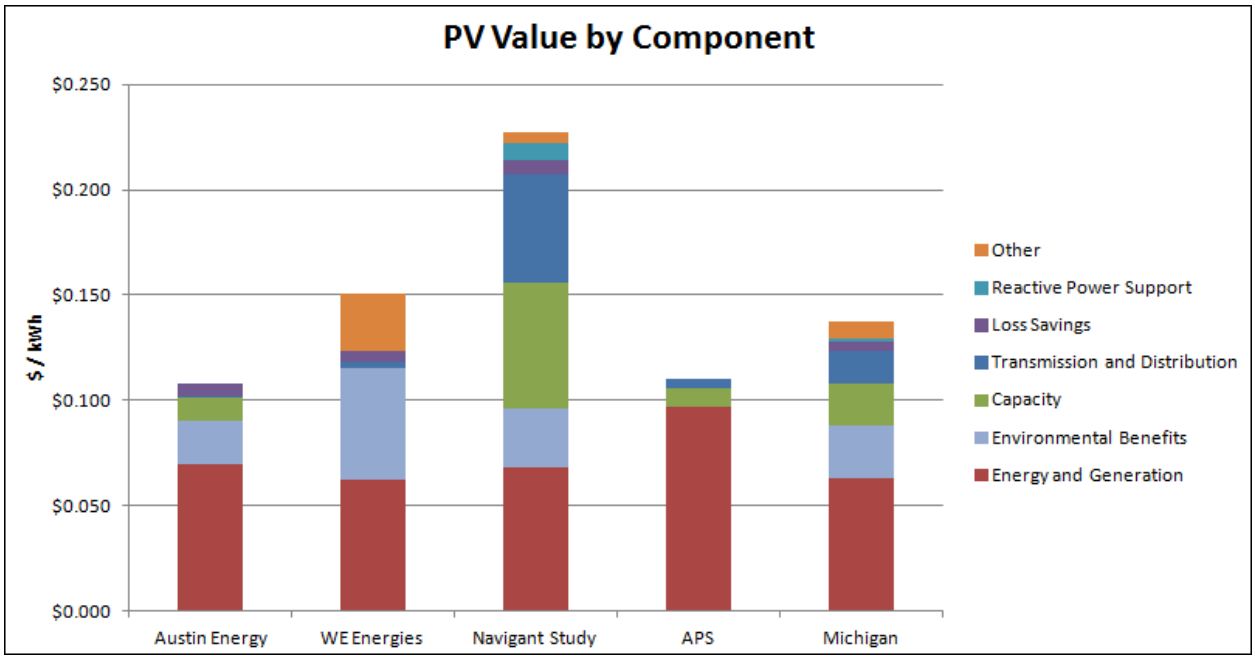
The chart below shows the results of a number of studies on the value of solar energy for various utilities and states, including a study done by NREL in 2012 for Michigan that suggests a solar value of 13.8 cents/kWh.



This project financial analysis uses three different values for solar energy, the average wholesale rate of energy set at 7 cents/kWh, the full retail value of energy set at 12 cents/kWh, and solar rate set at 14 cents/kWh.

National Renewable Energy Laboratory Technical Assistance

A "State Technical Assistance Team (STAT) grant was awarded to the Michigan Public Service Commission on behalf of GLREA to provide financial modeling assistance for Community Solar projects in Michigan. This included the selection of appropriate NREL tools for the analysis and running models with data provided by the Great Lakes Renewable Energy Association (GLREA). For the modeling, NREL recommended the Systems Analysis Model (SAM) and then created the "Michigan Community Solar Analysis Tool", an Excel spreadsheet that uses data from the SAM modeling tool to analyze various Community Solar configurations. These tools will now enable GLREA to assist Michigan utilities, businesses, non-profits, and citizens groups interested in developing Community Solar projects to analyze the financial effects of using various structures and configurations in the development of their project. For more information on SAM and the Michigan Community Solar Analysis Tool, see Appendix V.

"Buy PV Power"

The "Buy PV Power" model involves agreeing to buy power generated from a local solar farm but having no ownership or lease of particular solar panels. The participant simply agrees to purchase a fixed amount of power from the solar farm at a fixed price. The contract should be for a long enough period of time at a fixed rate that the purchase serves as a hedge against future energy costs. This meets one of the primary goals of Community Solar and could serve as a positive long range investment. While the initial price may be at or above current retail electric cost, over time, with inflation, the contract can result in a net savings for the participant.

The project developer's goal is to contract with enough power purchasers to finance the installation and maintenance of the solar energy system. Once the system is constructed, the solar energy is "free". The developer needs to factor

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in the initial cost of installation, a small annual maintenance cost and determine at what price the solar energy can be sold to make the project viable.

In Case Study #1, Bright Tucson Community Solar, the project developer's "all-in" installed cost was $1.90/watt or $1,900 per installed kW. Federal Investment Tax Credits of 30%, plus Arizona State tax credits of 10%, plus accelerated depreciation valued at 10%, provide a total incentive of 50%, reducing the installed-cost-per-kW to $950/kW.

Participants can buy blocks of 150 kWh for a cost of the base fuel charge (3 cents/kWh) plus a 2-cent/kWh premium. This total of 5 cents/kWh for each 150 kWh block of power is locked in for 20 years.

NREL's PVWatts™ program calculates the annual output of a 1 kW PV system in Tucson as 1,663 kWhs or roughly the equivalent of 11 blocks (1,663/150). The developer's all-in costs for building the system and delivering a 150 kWh block each month for 20 years are:

- **$950 per kW / 11 blocks per kW = $86.36 per block.**
- **Each 150 kWh block costs the participant $0.05/kWh x 150 kWh = $7.50**
- **The developer's break-even point is: $86.36 / $7.50 per year = 11.5 years**

Over the 20-yr. contract, the developer gets 20 yrs. x $7.50/yr. = $150, a gain of $63.64 per block. However, there needs to be some additional funds factored in for operation, maintenance and insurance costs. NREL suggests O&M cost of around $20/kW per year, which is $1.81/yr. per block, for a total of $36.36 over 20 yrs.

Whether or not the participant saves money on this deal over the 20-year period will depend on the rate that electric power increases by. The participant is paying a fixed rate of $.05/kWh for the energy portion of their electric bill cost for 150 kWh for 20 yrs. (There are also added costs for electricity delivery, but those are not relevant to this analysis.) The total amount paid for the 150 kWh block of solar energy for 20 years will be $150.00. A non-participant will start out paying $.03/kWh in year one for the energy portion of their electric bill, but that cost will rise with the rate of electric cost inflation. As the chart below shows, the participant breaks even if electric rates increase about 5% each year.

Starting cost participant = $.03/kWh base + $.02/kWh premium **150 kWh = $7.50**

Starting cost for non-participant = $.03 base but inflates **150 kWh = $4.50**

The chart below shows the Community Solar participant's electric energy cost per block over the 20 year contract, which is fixed in the first year at 5 cents/kWh and remains the same for all 20 years, for a total of $150. The next 4 rows show what non-participants would be paying after 20 years at 4 different energy inflation rates. The last two columns show total cost and savings over 20 years. It shows that non-participants nearly break even with the solar participant at a 5% annual rate increase. If electric rates increase above 5%, the participant saves some money compared to the non-participant.

	Inflation	Start Cost $/kWh	End Cost $/kWh	Total Cost	Cost Savings
Participant	0%	$0.05	$0.05	$150.00	
Non-participant	2.50%	$0.03	$0.048	$114.95	-$35.05
Non-participant	5.00%	$0.03	$0.076	$148.80	-$1.20
Non-participant	6.00%	$0.03	$0.091	$165.54	$15.54
Non-participant	7.50%	$0.03	$0.119	$194.87	$44.87

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"Lease PV Panels"

The "Lease PV Panels" model is a popular model, particularly with municipal utilities and electric co-ops, which has the developer of the project selling long-term leases for individual solar panels to the project participants. The participants then get credited for the output from their solar panels, either on their electric bill if a utility is involved or by share payment. It is often necessary for project developers who do not have federal tax load, (i.e. non-profits, governments, municipal utilities, co-ops) to have a third-party owner who can take the federal tax credits and depreciation to bring down the overall cost of the project. Federal tax code requires the system be owned for a minimum of five years to be eligible for these benefits and therefore precludes any participant ownership for at least the first five years. After five years, projects may have a "flip" mechanism that allows transfer of ownership to the project developers, the participants or the site owner.

The "Lease PV Panels" model we analyze here is based on the Michigan Community Solar project "Solar Up North Alliance" (SUN), operated by Cherryland Electric Cooperative and Traverse City Light & Power.

SUN installs the 52.6 kW PV system (224 panels at 235 w/panel) for $157,800. A third-party owner gets the federal tax credits and depreciation. SUN is responsible for operating and maintaining the solar system and has the right to sell or use the power. SUN leases individual panels to program participants who pay a $395 ($470 - $75 incentive) one-time, up-front fee and receive bill credits based on the collector output for 25 years. They are currently paying $0.078/kWh (the average wholesale rate) but this will be adjusted every year and can be expected to go up.

The system will produce 60,000 kWh/yr. (according to PVWatts™). At 7.8 cents/kWh this equals $4,680/yr. in electric sales. Without tax credits this would be a 33.7 yr. payback ($157,800/$4,680), a 3.0% return on investment ($4,680/$157,800).

The third party taking the 30% Federal ITC and assuming another 10% for depreciation brings the project costs down to $94,680 (60% of $157,800). The $75 per panel incentive (from another program) reduces the project cost an additional $16,800 (224 panels x $75), yielding a total project cost of $77,880 ($94,680 - $16,800). At this cost the project has a 16.6 yr. payback ($77,880/$4,680) and a 6.0% ($4,680/$77,880) return on investment.

The cost analysis for the SUN Project yields the following:

> Assuming operation and maintenance costs of $1,052/yr. (based on $20/kW per year * 52.6 kW) and insurance costs of $789/yr. (based on 0.5% of original installed cost of $157,800) reduces annual revenue by $1,841 to $2,839/yr. and now yields a 27 yr. payback ($77,880/$2,839) and a return on investment of 3.6% ($2,839/$77,880).

The cost analysis for a project participant yields the following:

> A panel is purchased for $395 and generates 268 kWh/yr. Each panel would pay $20.87/yr. (268 kWh * $0.078/kWh). This is an 18.9 yr. payback ($395/$20.87) of and a return on investment of 5.3% ($395/$20.87).

(<u>PLEASE NOTE</u>: The financial results from the utility side and the participant side differ, but does not mean the analysis is inaccurate. They are not required to match. The utility does its own financial analysis to define the purchase price for collectors and solar energy to meet its own financial goals. Assumptions in the above analysis about insurance and overhead costs have not been confirmed by the utility, as well as any REC value or actual contract terms with Spartan Renewable Energy. Therefore, this analysis is hypothetical for the utility side. The utility value of the energy produced for the participant and the purchase price of a collector lease completely define the investment value for the participant. The analysis is therefore real for the participant.)

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SUN will adjust the energy value each year based on the average wholesale cost of energy, so that it can be expected to increase 2-5% every year.

For the participant at a 2% inflation rate, the average electric payment rate over the 25 year lease will be $0.10/kWh (from a standard inflation calculation spreadsheet) and the average annual payment over the 25 years would be $26.80/yr. (268 kWh/yr. x $0.10/ kWh). With the 2% inflation factored in, the payback for the panel lessee occurs in 14.7 years ($395/$26.80) and the return on investment is 6.8% ($26.80/$395).

For the utility project as a whole, a 2% electric power inflation/yr. raises the average annual electric output value to $6,000/yr. (60,000 kWh/yr. * $0.10/kWh). Subtracting annual operation, maintenance and insurance costs ($1,841) yields an average net gain of $4,159/yr. over the 25 yr. lease, an 18.7 yr. payback ($77,880/$4,159) and return on investment of 5.3% ($4,159/$77,880).

After 25 years, the output from the entire solar array will revert to SUN. Assuming the collectors can operate another 10 years at 75% of their original output yields 45,000 kWh/yr. The electric value assuming a 2% electric power inflation will be $0.125/kWh after 25 years. This would generate additional income of $5,625/yr. for ten years, or $56,250.

"Purchase PV Panels"

In this model the participants purchase and own the actual PV panels and the solar power generated from their panels is credited to the purchaser's utility bill or the value of that power is credited to the panel owner. System maintenance, insurance, and other requirements involved in the upkeep of the solar panel system are all the responsibility of the project developer with the associated costs covered as part of the solar power purchase rate negotiated with the power purchaser.

The only significant difference in the economics between the "Purchase PV Panels" and "Lease PV Panels" models is how long the solar shareholder receives credits or revenue. As indicated above, the solar array could potentially generate an additional $56,250 after a 25 year lease ends. However, this does not take into account costs and liabilities during this later period of production. It makes sense that the purchase or lease price of a panel may vary depending on who receives the speculative benefits of this later period of production.

"Invest in a PV Project"

Individuals come together to co-invest in a specific solar project. They are not purchasing or leasing panels and getting compensated based on the power produced, they are buying shares and getting compensated based on their share of the profits. The members form a Special Purpose Entity (SPE) that may be an LLC or Co-op or other. Through this SPE they purchase, install, manage, and maintain the PV system. A third-party may be contracted to own and operate the system and capture tax benefits.

The PV system is typically located "behind the meter" at a host site, and the host agrees to pay the SPE a specific rate for PV power generated. Utility companies are only peripherally involved, possibly through net metering or for excess power generation. Ideally, the system is sized so that the host can utilize all or most of the solar power generated on site. SPE members are compensated for their investment through profit distributions, which can be transferred directly to members as equity payments, or can be monetized through interest payments to investors. Examples of this type of structure include Solar Mosaic where hundreds of investors from all over the U.S. participate in 500 kW systems to small projects like University Park, Maryland where 30 local people invested in a 21.6 kW system at a church.

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In this model, 25 individuals come together to co-invest in a 50 kW solar PV system on the roof of a local government building. They contract with a third party to purchase, install, manage and maintain the PV system. This third party is able to capture tax credits and depreciation to lower overall project costs. The installed cost of the system is $200,000 ($4/watt). The PV system is located "behind the meter" at the government facility which uses enough daytime electricity to use all of the PV system output, so that little to no electricity is net metered. The facility currently pays an average of 11.3 cents/kWh for electricity and agrees to pay 11 cents/kWh for the PV power generated for 25 years.

The system will produce 60,000 kWh/yr. (according to PVWatts™). At 11 cents/kWh this equals $6,600/yr. in electric sales. Without tax credits, this would be a 30.3 yr. payback ($200,000/$6,600) or a 3.3% return on investment ($6,600/$200,000).

Taking the 30% Federal ITC and assuming another 10% for depreciation brings the project costs down to $120,000, reducing payback to 18.2 years ($120,000/$6,600) and a return on investment of 5.5% ($6,600/$120,000).

Assuming operation and maintenance costs of $1,000/yr. (based on $20/kW per year) and insurance cost of $1,000/yr. (based on 0.5% of original installed cost) reduces revenue to $4,600/yr. and yields a 26 yr. payback and a return on investment of 3.8%.

Each of the 25 participants purchases a 2 kW share for $5,280 (that's $120,000 system cost plus 10% profit, $12,000 for the third party developer = $132,000/25) and is compensated for their investment through profit distributions from the generation of electricity. That's $4,600/yr. to divide between 25 shares = $184/yr. per share. The share costs $5,280, so straight line payback is 28 years and ROI is 3.5%.

Economic Variables

The economic analyses above show ROI of 5.28% ("Lease PV Panels") and 3.5% ("Invest in PV Project"), which are modest returns, but secure investments based on a reliable technology with no fuel costs. These analyses are examples and the economics of each project will depend on a number of variables, the most important being:

- **Participation of a third party who can take advantage of federal tax benefits may reduce costs by 30-50%.**
- **Economies of scale – cost of ground-mounted PV can go from $4.62/watt (for systems less than 5 kW in size) to $3.00/watt (for systems greater than 500 kW), a cost reduction of 35%.**
- **Value of energy produced – revenue based on solar value, e.g. 14 cents/kWh, rather than a wholesale value, e.g. 7 cents/kWh, would double the revenue.**
- **Increase in electric rates – the "Buy PV Power" example above shows that an annual increase greater than 5% is needed for that project to be a price hedge for the participants. Historically, rate increases in Michigan have been around 2%, but a decreasing use of inexpensive coal may change that. Regardless, as electric rates go up, the value of electricity produced by a Community Solar project will increase.**

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BARRIERS AND OPPORTUNITIES

This section will look at various barriers and opportunities related to Community Solar in Michigan, including zoning and permitting, third-party ownership, standby charges, property taxes, and federal and state securities laws and regulations.

Zoning and Permitting Barriers

When developing Community Solar projects, zoning and permitting issues must be addressed. Many Michigan communities do not currently have solar PV zoning/permitting processes in place, which can cause delay and additional expense for Community Solar projects.

From the American Planning Association's, Planning and Zoning for Solar Energy, published in July 2011, the following issues were identified:

- **Zoning that identifies and allows solar energy systems,**
- **Addresses both roof mounted and ground mounted solar collectors,**
- **Solar access provisions and solar easements that define and protect property owners' rights to sunlight,**
- **Zoning that addresses the siting of large-scale commercial solar energy systems**

APA also encourages development codes to promote active and passive use of solar through subdivision solar siting provisions, which orient lots for maximum solar gain, and solar-ready provisions for new development, which require the installation of electrical and plumbing components needed for future solar energy system installation in walls and concrete during the initial construction phase, which will reduce the cost of solar added at a later time.

The ICLEI Municipal Clean Energy Toolkit provides a *Zoning Ordinance/Bylaw Checklist* for local governments to help them plan for solar development.

> "Developing proper zoning ordinance or bylaw language is often regarded as one of the biggest challenges in installing clean energy systems. The reason for this is that many clean energy systems require special zoning that often doesn't exist. Additionally, in some cases, local governments may have language in existing local policies that inhibits the use or installation of clean energy systems or requires lengthy permitting processes. Therefore, it is imperative for local governments to update their policies by passing new ordinances or bylaws or updating current zoning language to provide clear processes for installing clean energy and by streamlining the permitting process pertaining to clean energy installations." [22]

ICLEI Municipal Clean Energy Toolkit - Zoning Ordinance/Bylaw Checklist

Step 1 - Identify Types of Clean Energy: Work with municipal staff and community stakeholders to identify the various types of clean energy your municipality is interested in installing – both short term and long term. Information on clean energy types can be found on the Clean Energy Overview page.[23]

Step 2 - Review Current Policies: Review existing local and utility policies to see if there is any language that enables or prohibits the installation of clean energy systems.

[22] http://www.icleiusa.org/action-center/tools/municipal-clean-energy-toolkit/ordinances. This page also contains sample wind and solar ordinances/bylaws.
[23] http://www.icleiusa.org/action-center/tools/municipal-clean-energy-toolkit/clean-energy-overview

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Step 3 - Evaluate Obstacles: What obstacles to the adoption of clean energy systems exist: Complex permitting process? High permitting fee? Cumbersome zoning requirements? Meet with clean energy installers to learn more. Once obstacles are identified, work to create systems to overcome obstacles.

Step 4 - Review Sample Ordinances: Check with surrounding municipalities and surrounding communities to see who has ordinance/bylaw and zoning language that may be applicable to your jurisdiction. Remember to seek advice from municipal counsel and municipal leagues before proceeding with the creation of your ordinance/bylaw.

Step 5 - Pass New or Update Existing Zoning Ordinance/Bylaw Language: Draft and pass new ordinance/bylaw and zoning language if necessary, or update existing language to encourage the installation of clean energy systems. Remember to educate the community about your proposed change or about the new ordinance/bylaw to ensure you have community support for your clean energy installation.

Step 6 - Advertise New/Revised Clean Energy Zoning Ordinance/Bylaw: Once you've altered zoning and/or passed new clean energy ordinances/bylaws, make sure that you let your community know.

The *ICLEI Municipal Clean Energy Toolkit* found that Current Zoning Provisions in the U.S. that do address solar mainly focus on the visibility of the solar panels from the street (aesthetic view). Most ordinances regulate commercial solar as an accessory use. Most ordinances do not allow for free standing solar panels in residential areas. Most ordinances do not provide protections/rights to solar (sun) access.

The full toolkit can be found at http://www.icleiusa.org/action-center/tools/municipal-clean-energy-toolkit/ordinances. See also the "companion guide" to the GLREA Community Solar Guidebook, Becoming a Solar Ready Community: *A Guidebook for Michigan's Municipalities*, published by the Clean Energy Coalition, September 2013: http://cec-mi.org/communities/programs/michigan-renewable-energy-tools/solar-ready-community. (Funded by the Michigan Energy Office.)

The recently completed report, Advancing Solar: Great Lakes Bay Region, written by the Clean Energy Coalition for a number of communities in the Saginaw Bay region of Michigan, advises:

> "Communities should set the direction of solar in their policy documents, such as a master plan. Master plan language can promote the potential for solar energy use in the region, set goals for solar energy development, and provide solar-specific implementation strategies. While developing implementation strategies for a community-wide policy that embraces and encourages solar, communities will need to make decisions related to solar access, solar easements, and solar siting provisions (e.g., orienting developments to maximize solar input)."

In this policy development stage, it is important to recognize that different types of installations will require different zoning treatment. For example, installations that are on rooftops versus those that are ground-mounted, or that are part of a large-scale solar farm, will have drastically different impacts on land use.

Communities should begin to plan for how they might incorporate solar energy, and specifically, larger solar PV energy systems, into their communities to encourage Community Solar development.
Many Michigan communities have not set any policies towards solar energy development and do not have solar PV zoning/permitting ordinances in place at this time. Even for those communities that have created solar development goals and have experience with permitting solar PV energy systems, very few have experience with systems larger than 20 kW due to the Michigan net metering regulations that limit the size of solar systems to 20 kW or less for true net metering. However, the average size of a Community Solar system

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being constructed today in the U.S. is well over 100 kW, with some being 500 kW or larger. Development regulations that address large-scale solar installations typically permit them as conditional uses in a limited number of industrial or agricultural zoning districts. They may also be subject to specific use standards to address aesthetics or minimize environmental impacts.

CEC's Ten Steps to becoming Solar Ready – Community Solar

Finally, the Clean Energy Coalition, under a grant from the Michigan Energy Office, has published a companion guide to the GLREA Community Solar Guide, titled, Becoming a Solar-Ready Community: *A Guide for Michigan Local Governments*. In this publication, CEC outlines the following ten steps, which provide a pathway for Michigan local governments to achieve "Solar Readiness status". Many of these steps can be taken simultaneously and all can be adapted to suit local needs and conditions. Community Solar comes into play in these steps as follows:

Step 1: Begin the Discussion – Introduce the concept of Solar Readiness to raise awareness and gather support for the project. Reaching out to neighboring jurisdictions and utility providers is important to consider during this step.

- *Community Solar would be part of this Solar Ready discussion, primarily for those who are interested in solar but are unable to house a system on their site (see "market barriers").*

Step 2: Adopt a Resolution – The resolution adoption process introduces the conversation of solar at the leadership level, helping to both inform and ensure buy-in by local officials.

- *Community Solar would be included in the resolution (For example, see Resolution to Encourage Community Solar Development in Ann Arbor (approved, 9/3/2013, Enactment # R-13-283).*

Step 3: Establish a Guiding Policy That Supports Solar – Planning document language that supports the advancement of solar will set the direction towards Solar Readiness and provide the basis for solar related land use regulation.

- *Community Solar would be included in the planning document language.*

Step 4: Update Code Language – Solar language in your zoning codes will give clear guidance about how solar installations are to be integrated into your community.

- *Community Solar would be included in new zoning codes.*

Step 5: Create an Easy to Use Permitting Process – Common information and permitting language will help residents, businesses, developers, and installers have a clearer understanding of the local and regional expectations with regard to solar installation.

- *Community Solar will most likely require a distinct Use Permitting Process.*

Step 6: Provide Easy Access to Information – Online and printed materials that detail how solar installation works in your community will help interested property owners and installers understand local expectations and better prepare for an installation process.

- *The GLREA Guide to Community Solar provides details on how Community Solar projects can be crafted and implemented.*

Step 7: Establish Solar Installation Targets – Establishing solar installation targets will help continue the momentum and ensure that measures are taken to truly be a solar leader in Michigan.

- *For example, Community Solar targets can be built around goals for watts installed, target price for watts installed, organization targets (e.g., Solar Aggregation in Houses of Worship), etc.*

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Step 8: Train Staff – Increasing staff familiarity with solar technology and installation will help make the permitting process more efficient.

- *GLREA and CEC are collaborating with the newly formed Michigan Solar Ready Community Coalition to develop a Solar Ready Community Practitioners Certification and related training.*

Step 9: Pursue Solar Business Development Opportunities – Working with development specialists on solar can leverage your Solar Ready Community's status to enhance economic development.

- *Renewable energy resources, such as Community Solar, offer many potential community, economic, environmental, national security, and societal benefits for the state.*

Step 10: Go the Extra Mile – Going the extra mile is for communities that are really looking to be a solar leader by developing creative outreach efforts and encouraging programs.

- *Community Solar is a way to bring the benefits of solar energy to the widest number of citizens in a community.*

Third-Party Ownership Issues

Third-party owned solar is important for many models for Community Solar projects. The up-front cost of buying and installing solar energy systems can be a major barrier. Third-party arrangements can offer a monthly payment contract that also covers repair and maintenance of the system. Third-party ownership also provides a mechanism for entities that are not eligible to benefit from the tax credits available from installing renewable energy systems, (30% federal tax rebate plus accelerated depreciation) to get access to these tax credits and reduce overall project costs.

Governments and non-profits looking to host or operate Community Solar projects should consider finding a third party that will own the system and be eligible for the tax benefits. Federal law requires the third party accepting tax benefits to maintain ownership for a minimum of 5 years. After five years, a contact can define whether ownership remains with the third party or rolls over to the building owner for an agreed-upon cost.

In states where third-party solar is specifically allowed, such as Arizona and Colorado, the arrangements have accounted for up to 90 percent of new installations, according to the Solar Energy Industries Association. At least 22 states, including Michigan, specifically allow third-party-owned solar arrangements, according to the Database of State Incentives for Renewables and Efficiency (DSIRE). Another half-dozen states prohibit third-party-owned solar, and the law is unclear in the rest of the country.

Third party ownership is addressed in Michigan Public Act No. 286 of 2008:

> Section (12) This act does not prohibit or limit the right of a person to obtain self-service power and does not impose a transition, implementation, exit fee, or any other similar charge on self-service power. A person using self-service power is not an electric supplier, electric utility, or a person conducting an electric utility business. As used in this subsection, "self-service power" means any of the following:
>
> (a) Electricity generated and consumed at an industrial site or contiguous industrial site or single commercial establishment or single residence without the use of an electric utility's transmission and distribution system.
>
> (d) A commercial or industrial facility or single residence that meets the requirements of subdivision (a) or (b) meets this definition whether or not the generation facility is owned by an entity different from the owner of the commercial or industrial site or single residence.

This language frees solar developers in Michigan from worry about issues with the local utility when constructing a solar energy system within certain size constraints *(see: "Standby Charges" below)* that

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provides electricity to a customer on the customer's side of the meter. It specifically allows ownership of the system to be "different from the owner of the site" and also specifically states that, "A person using self-service power is not an electric supplier, electric utility, or a person conducting an electric utility business." This does not appear, however, to clearly state that the third party supplying power to the site owner is not conducting an electric utility business. If this is a concern, contracts between the third party and the site owner can be structured to avoid specifically mentioning the sale or purchase of power.

For example, consider a scenario where a private company, ABC Solar, would install solar arrays on municipal buildings at no up-front cost to the city. ABC Solar would then own and maintain the systems over the life of a contract and provide the energy to the buildings on the owner's side of the meter. The solar panels would be paid for, installed, and owned by ABC Solar, which, as a for-profit business, would qualify for federal tax benefits that are unavailable to nonprofits and government entities.

ABC Solar would lease the rooftop space. The city would pay ABC Solar for the renewable electricity credits, or RECs, associated with the project. The price for the RECs would be calculated near to what the municipality is currently paying their utility company for electricity. By design, nowhere in the contract is the sale of electricity mentioned. This is to avoid the possibility of an electric utility arguing that a third-party solar firm that sells electricity to customers should be regulated as a utility, and that the public utility has the exclusive right to provide electricity to the city.

In Iowa, for example, Alliant Energy, along with other utility interests, took legal action to stop the City of Dubuque from buying solar power directly from a company that would own and manage panels on City buildings. Alliant has appealed a district court's decision to the Iowa Supreme Court. The argument by Alliant is that third-party solar firms that sell electricity to customers should be regulated as utilities, and that the Dubuque project would encroach on Alliant's exclusive right to provide electricity to the city.

ABC Solar could then directly, or in partnership with a non-profit or other entity, make this a Community Solar project by selling memberships to participants who would receive periodic payments from the sale of the RECs based on their level of membership.

The City of Monona in Wisconsin, a state that does not have third-party solar laws, is working on a contract very similar to the example above. More information on Monona's ongoing efforts can be found at: http://www.midwestenergynews.com/wp-content/uploads/2013/07/monona-third-party-solar.pdf

While Michigan has many barriers to address to simplify Community Solar, we are lucky to have third-party laws in place which do allow third-party ownership for renewable energy systems at a customer's site. The law could be improved by clearly stating that, "A person using self-service power, and a third party that owns a generation system on that persons site, is not an electric supplier, electric utility, or a person conducting an electric utility business." (Please Note: *It is unclear if third-party ownership is only available to customers of MPSC rate regulated utilities. The MPSC has not completed a legal analysis of this issue because they don't regulate municipal utilities).*

Standby Charges

Standby rates are charges levied by utilities in case a distributed generation system, such as a PV system, experiences an outage, and then must rely on power purchased from the grid. These charges are generally composed of three elements: fixed charges, in $/month, which recover energy and delivery costs that are not dependent on the amount of energy used; energy charges, in $/kWh, which reflect the actual energy provided; and demand charges, in $/kW, which attempt to recover the costs to the utility of providing the infrastructure

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to meet the electric demand of the facility. The rationale for standby charges is that utilities must have electric capacity available in case the distributed generation system is not operating and the facility needs the power.[24]

Standby charges can be an issue for Community Solar economics. Net metering projects which can be up to 150 kW do not have standby charges. In addition, Consumers Energy does not have standby charges for projects up to 550 kW. Other utilities, including DTE Energy, will have standby charges for projects above 150 kW and these rates can be complicated. One can conclude that standby charges are a non-issue for Community Solar projects up to 150 kW and a non-issue for most Community Solar projects in the Consumers Energy territory. Standby charges can be an economic barrier for Community Solar projects outside the Consumers Energy territory and this will depend on specific utilities and their standby rates.

Property Taxes

If residential solar and wind systems are taxed at installed cost, homeowners will not be able to invest in the systems. The increase in property taxes would be higher than the dollar value of the electricity produced by a small solar or wind system. This is a significant risk for homeowners and discourages installations. One solution to this barrier, implemented in many other states, is to exempt smaller renewable energy systems from property taxes. No tax revenue is lost because no revenue will be generated if homeowners cannot install solar and wind energy systems because of high property taxes. (*Please Note: Michigan did have a law prohibiting property tax increases for solar installations in the 1970s, but that law has expired).*

Federal and State Securities Laws and Regulations

Federal and state securities laws and regulations are complicated. This section provides some guidance but simplifies important issues for Community Solar projects. *Any project developer or sponsor should obtain legal advice from an attorney who has expertise in this area.*

Federal securities regulation is done by the U.S. Securities and Exchange Commission (SEC). State regulation is done by the State Securities Division of the Michigan Department of Licensing and Regulatory Affairs. Under federal securities statutes, an issuer must register a security unless it falls within an exemption stated in the federal statutes. If you cannot find a federal exemption, you have to register with the SEC. There *is* an "intrastate exemption" allowed under federal statutes. To use this type of exemption, all the securities must come to rest with Michigan residents, the company must be formed in Michigan, and do business in Michigan. There is also the "private offering exemption" at the federal level, where 35 offers or sales can be made. Michigan limits the "private offering exemption" to 25.

One way to develop a Community Solar project is through what the DOE "Guide to Community Solar" terms *"Special Purpose Entities".* These are non-utility developers that will have to be sure to structure their Community Solar offerings to comply with SEC rules and regulations. They may use the "intrastate exemption" and the "private placement exemption", which limits the number of investors to 25, limits project location and investors to Michigan only, and does not allow general advertising or solicitation.

There are state legislative and regulatory changes that could facilitate Community Solar in Michigan. At the state legislative level, an exemption could be added to MCL 451.2201 for entities which offer any economic return based upon or derived from the generation of electricity from any photovoltaic system. This could read as follows:

[24] See page 8, Electric Utility Standby Rates: Updates For Today and Tomorrow, NRRI, Stanton, Tom, July 2012, http://www.nrri.org/documents/317330/94c186ab-4f16-4a69-8e8c-ece658e752b1

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[Under list of exempt securities in MCL 451.2201]
Any security offering any economic return in any form produced by a solar photovoltaic system. The issuer of such security shall place all proceeds from such an offering in a segregated escrow account. Interest, if any, earned on the funds in the escrow account shall be paid to the investors. The funds in the escrow account shall only be disbursed to the issuer when the solar photovoltaic system, or part thereof, for which the funds are paid, is in existence and in operation. If the solar photovoltaic system, or part thereof for which the funds are paid, is not in operation within two years after any funds from investors are placed in the account, the funds shall be repaid to the investors with any accumulated interest.

OR

[Add to list of exempted securities in MCL 451.2201]
A security issued by a person organized and operated exclusively for religious, educational, benevolent, fraternal, charitable, social, athletic, or reformatory purposes, or as a chamber of commerce, and not for pecuniary profit, where such security offers an economic return to the investor in any form based upon the generation of electricity from a solar photovoltaic system or part thereof.

At the regulatory level, the State Securities Division could simplify and streamline the process called "Registration by Qualification" so it is standardized and expedited for Solar PV securities. This could be done by describing in detail the requirements that would constitute a safe harbor. If the securities met the requirements of the safe harbor, then the State Securities Division would approve them in a specified period of time, e.g., 45 days. One huge benefit would be an unlimited number of sales and allowance of general solicitation and advertising. In other words, this would be a complete registration on the state level, but could be done expeditiously with reasonable expense. The policy reason behind specifying the safe harbor is the low risk of solar investment (once the system is in place). The resource is known. The panel output is known. There are no fuel costs. Use of electricity is unlikely to diminish.

In order to make project economics attractive, all these approaches rely on a for-profit entity that can take advantage of federal tax credits and accelerated depreciation. The Federal Commercial Investment Tax Credit (ITC) allows owners of PV systems to take a one-time tax credit equivalent to 30% of qualified installed costs. Since the ITC allows the owner of the PV system for tax purposes to be different from the owner of the host property, and Michigan has well-crafted third-party ownership laws in place, every effort should be made to make use of federal tax credits either directly or through third-party ownership.

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CONCLUSIONS

The award of the "Community Solar PV Garden Feasibility Study for Michigan" grant from the Michigan Energy Office to GLREA made this report possible. In addition to the development and publishing of this Guide, the grant led to a very successful effort to "spread the word" about Community Solar to Michigan citizens and businesses. Project staff participated in 13 public forums that reached 241 persons. Project staff had 29 meetings with utilities, local governments, businesses, neighborhood associations, and non-profits. These meetings provided an opportunity to both learn about "real world" issues and provide technical assistance on how to start up a Community Solar project.

The grant also made it possible to use and create financial modeling tools in partnership with the Michigan Public Service Commission and the U.S. Department of Energy's National Renewable Energy Laboratory. The modeling tools consist of the DOE's "Systems Analysis Model" (SAM), economic modeling software for renewable energy projects, and the newly created "Michigan Community Solar Analysis Tool", an Excel spreadsheet-based tool that uses data from the SAM modeling tool to analyze various Community Solar configurations. These tools enable Michigan utilities, businesses, non-profits, and citizens' groups to analyze the financial effects of using various structures and configurations in the development of their projects.

The economic examples in this report show ROI of 5.28% ("Lease PV Panels") and 3.5% ("Invest in PV Project"), modest returns but secure investments based on a reliable technology with no fuel costs. Also, as fuel costs inflate, the rate of return on these investments improves. These analyses are examples, and the economics of each project will depend on a number of variables, the most important being:

- Participation of a third party who can take advantage of federal tax benefits can reduce costs by 30-50%.
- Economies of scale – cost of ground-mounted PV can go from $4.62/watt (for systems smaller than 5 kW) to $3.00/watt (for systems greater than 500 kW), a cost reduction of 35%.
- Value of energy produced – revenue based on solar value, e.g. 14 cents/kWh, rather than a wholesale value, e.g. 7 cents/kWh, would double the revenue.
- Increase in electric rates – Historically rate increases in Michigan have been around 2%, but a decreasing use of inexpensive coal, and Michigan's aging fleet of power plants may change that. Regardless, as electric rates go up the value of electricity produced by a Community Solar project will increase.

There are barriers to Community Solar that can be addressed to make it simpler to do for those interested in investing in renewable energy in Michigan. Community Solar can also be done in Michigan using a number of different approaches.

- Community Solar can be an attractive option for utilities to diversify their electric generation mix and provide a popular investment option for their members or customers. Cherryland Electric Cooperative and Traverse City Light & Power, initiators of Michigan's first Community Solar project, have found that many of their members and customers are enthusiastic about investing in a local and clean energy resource like solar. Municipal utilities and electric co-ops can offer Community Solar programs for their members now. Investor-owned utilities, e.g. DTE, Consumers Energy, can request the MPSC to authorize a pilot program for Community Solar projects and assist efforts to get state legislation to facilitate Community Solar. Utilities can use "Buy Power", "Buy Panels", or "Lease Panels" approaches.

- Local governments and businesses who have sites with high electric use can install PV self-generation "behind-the-meter" and offer Community Solar options to their citizens or customers. They have the option to provide project participants with credits on water or property bills or credits on store purchases. Project sponsors can use "Buy Panels", "Lease Panels", or "Invest in PV" approaches.

- Any organization can install PV behind the meter and use net metering to develop Community Solar projects 150 kW or under depending on the site electric load. Project sponsors typically use an "Invest in PV" approach.

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One way to develop a Community Solar project is through what the DOE "Guide to Community Solar" terms "Special Purpose Entities". These are non-utility developers that will have to be sure to structure their Community Solar offerings to comply with SEC rules and regulations. Under SEC requirements, one method for Community Solar projects is through the "Private Placement exemption", which limits the number of investors to 25, limits project location and investors to Michigan only, and does not allow general advertising.

In order to make project economics attractive, all these approaches rely on a for-profit entity that can take advantage of federal tax credits and accelerated depreciation. The Federal Commercial Investment Tax Credit (ITC) allows owners of PV systems to take a one-time tax credit equivalent to 30% of qualified installed costs. Since the ITC allows the owner of the PV system for tax purposes to be different from the owner of the host property, and Michigan has well-crafted third-party ownership laws in place, every effort should be made to make use federal tax credits either directly or through third-party ownership.

Many businesses are becoming Community Solar project developers/third-party owners of Community Solar systems. These companies provide turn-key services including financing, designing and building, advertising and subscribing members, operating and maintaining the system, and providing billing and crediting services. Some, like SunShare and Clean Energy Collective, both located in Colorado, have expanded their services nationally and market primarily to utility companies. Every municipal utility and co-op GLREA has talked with in Michigan about Community Solar had already been contacted by Clean Energy Collective. They are obviously interested in expanding their service territory to include Michigan. In many states, including Michigan, local developers and non-profit organizations are exploring the possibility of offering similar "turn-key" services for local groups exploring Community Solar.

An important aspect of allowing utility ownership/participation in a Community Solar project is having all costs incurred by the utility to operate the Community Solar project recovered from program participants, both to avoid subsidization by non-participating ratepayers and to allow a level playing field with other competitive non-utility providers of Community Solar.

It is recommended that potential project developers study the Community Solar Websites and Resources listed in Appendix III, as this report is intended to supplement them. In particular, the reader is encouraged to review the following publications:

- Readying Michigan to Make Good Energy Decisions: Renewable Energy – In November 2012, Governor Snyder laid out a vision for a "no regrets" energy policy – one that would be adaptable and built on three pillars: excellent reliability, an affordable price, and a protected environment. Four reports were generated from this process: Renewable Energy, Energy Efficiency, Electric Choice, and one on "Additional Areas" related to energy policy. These reports can be viewed at: http://www.michigan.gov/energy.
- National Renewable Energy Laboratory's, A Guide to Community Shared Solar is a comprehensive guide for those who want to develop Community Solar projects, from community organizers or solar energy advocates to government officials or utility managers. The guide can be downloaded from: http://www.nrel.gov/docs/fy12osti/54570.pdf.
- Interstate Renewable Energy Council's, Model Rules for Shared Renewable Energy Programs provides guiding principles that are important when designing Community Solar projects. It can be downloaded from: http://www.irecusa.org/wp-content/uploads/2013/06/IREC-Model-Rules-for-Shared-Renewable-Energy-Programs-2013.pdf.
- Clean Energy Coalition's, Becoming a Solar Ready Community: *A Guidebook for Michigan's Municipalities*, September 2013. The report can be found at: http://cec-mi.org/communities/programs/michigan-renewable-energy-tools/solar-ready-community.
- Michigan Interfaith Power and Light's, Renewable Energy Fact Sheet: Solar Aggregation in Houses of Worship, available at: http://www.miipl.org/devwordpress/wp-content/uploads/2013/02/Renewable-Energy-Fact-Sheet-Solar-Aggregation-Final.pdf.

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APPENDIX I

GLOSSARY OF RELEVANT TERMS

- **AC Power (alternating current)**: An electrical current whose magnitude and direction varies. It is considered the "standard" electrical power.
- **Attached System**: A solar system in which solar panels are mounted directly on the building (typically the roof).
- **Community Purchasing Program**: A program that facilitates bulk purchasing of solar to help lower the installed cost per watt for PV in the community. In Michigan, the Great Lakes Bay Region is currently piloting a community purchasing program.
- **Community Solar**: Under a Community Solar model, multiple shareholders (owners) purchase one or more solar panels in a large, centralized, PV array whose energy is sold to a third party. These shareholders then receive financial benefit (credit on their utility bills, cash payments, etc.) based on the energy produced by the solar array.
- **DC Power (direct current)**: An electrical current whose magnitude and direction stay constant. The photovoltaic cells on solar panels capture energy from sunlight in the form of DC and must be converted to AC by an inverter.
- **Detached Systems**: Also known as a Ground Mounted Systems, a solar system that is not attached directly to a building, but is supported by a structure that is built on the ground.
- **Distributed Generation**: as opposed to centralized generation, distributed generation refers to a number of small power-generating modules located at or near the point of energy consumption.
- **Gigawatt**: A unit of power equal to one billion watts.
- **GLREA:** Great Lakes Renewable Energy Association.
- **Grid**: The infrastructure of power lines, transformers and substations that delivers electric power to buildings. The utility grid is owned and managed by electric utility companies.
- **Hard costs**: The costs for all of the actual hardware and materials included in a solar installation.
- **Home Rule**: The Home Rule City Act (P.A. 279 of 1909) and the Home Rule Village Act 278 of 1908) provides a framework for cities and villages to exercise a range of self-governing powers.
- **Installer**: A contractor that installs solar systems.
- **Interconnection**: The link between a utility company and a building that enables power to move in either direction.
- **Inverter**: A device that converts DC power captured by the photovoltaic cells on solar panels into AC power.
- **Kilowatt**: A unit of power equal to one thousand watts.
- **Local Governments**: Michigan's townships, cities, and villages are considered a local unit of government. Michigan's constitution and Home Rule Acts provide extensive local control provisions to these entities. Typically, a Community Solar program will be housed within a local government jurisdiction.
- **Master Plan**: A document adopted by a local government under the Michigan Planning Enabling Act (P.A. 33 of 2008) that establishes a vision and guide for the community's future growth and land use.
- **Megawatt**: a unit of power equal to one million watts.
- **Michigan IPL:** Michigan Interfaith Power and Light, LLC.

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- **Michigan Energy Office:** The U.S. Department of Energy provides Michigan with a grant to operate a State Energy Office. Executive Order 2011-4 transferred the State Energy Office in Michigan to the Michigan Strategic Fund (MEDC) and renamed it the Michigan Energy Office. The MEO Consumer Education & Renewable Energy Section educates, helps and incentivizes consumers, businesses, communities and organizations capitalize on their energy efficiency and renewable energy assets as a way to foster community and economic reinvention in the state. Mark H. Clevey, MPA, serves as the Manager, of the Consumer Education & Renewable Energy Programs section.

- **Net Metering**: A policy whereby utility customers with small-scale renewable power sources, including solar, receive credit from their utility provider for electricity generated in excess of their needs (also known as "net excess generation").

- **On/Off Grid System**: A solar energy system that is interconnected with the utility grid is an on-grid or grid-tied system, while a system with battery storage is not interconnected and is an off-grid system.

- **Permitting**: The process by which a local unit of government allows for certain development, changes, and activities in their jurisdiction.

- **Prescriptive Systems**: Solar systems that fit within existing rules and regulations.

- **Photovoltaic (PV)**: A method of generating electrical power by converting solar radiation (sunlight) into direct current electricity using semiconductors.

- **Readying Michigan to Make Good Energy Decisions – Renewable Energy:** Readying Michigan to Make Good Energy Decisions – Renewable Energy – In November 2012 Governor Snyder laid out a vision for a "no regrets" energy policy – one that would be adaptable and built on three pillars: excellent reliability, an affordable price, and a protected environment. Four reports were generated from this process: Renewable Energy, Energy Efficiency, Electric Choice, and one on "Additional Areas" related to energy policy.

- **Renewable Energy Credits (RECs)**: Also known as renewable energy certificates, RECs are tradable commodities that put a value to the environmental benefits of the renewable power in use. One REC represents 1 MWh of electricity from renewable sources. RECs are valuable to utilities because they can act as proof of compliance to renewable portfolio standards.

- **Renewable Portfolio Standards (RPS):** Also known as a renewable energy standard, is a policy mechanism that mandates electric utilities to supply a specified amount of power from renewable or alternative sources by a certain target date.

- **Soft Costs**: All other costs that are not Hard Costs.

- **Solar Farm**: An installation or area of land in which a large number of solar panels are set up to generate electricity.

- **Solar Photovoltaic System**: The total components and subsystems that, in combination, convert solar energy into electric energy suitable for connection to utilization load.

- **Time-of-use (tOu) Rates**: A utility billing system in which the price of electricity depends upon the hour of day at which it is used. Rates are higher during the afternoon when electric demand is at its peak. Rates are lower during the night when electric demand is off peak.

- **Virtual Net Metering**: Virtual net metering allows net metering credits generated by a single renewable system to offset load at multiple retail electric accounts within a utility's service territory.

- **Zoning Ordinance**: A document adopted by a local government – the Michigan Zoning Enabling Act (P.A. 110 of 2006) – that establishes local land use regulations.

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APPENDIX II

SURVEY OF CHERRYLAND ELECTRIC COOPERATIVE & TRAVERSE CITY LIGHT & POWER'S COMMUNITY SOLAR PARTICIPANTS

Solar Up North (SUN), a joint program by Cherryland Electric Cooperative (CEC) and Traverse City Light & Power (TCL&P), is Michigan's first Community Solar program. The Great Lakes Renewable Energy Association (GLREA), in cooperation with CEC and TCL&P, surveyed their customers who are participating in the program or expressed some interest in the program to better understand this first Community Solar effort in Michigan. The TCLP sent the survey link to about 100 individuals and CEC sent the link to 64 individuals. There were 57 responses to the survey, a response rate of 35%.

Survey questions follow along with results.

1. **How did you hear about the Cherryland/TCL&P Solar Up North Project?**
   - a) Cherryland Email/Newsletter/Bill insert 51%
   - b) Traverse City Light & Power Email/Newsletter/Bill insert 26%
   - c) Newspaper/internet 5%
   - d) Friends or neighbors 4%
   - e) Other (please explain) 14%

2. **How long did it take for you to decide to join after hearing of the program?**
   - a) One day 29%
   - b) One week 19%
   - c) Two to four weeks 27%
   - d) Longer than four weeks 7%
   - e) Have not joined 18%

3. **Do you know any of the other people who joined?**
   - a) Yes 33%
   - b) No 67%

4. **What is their relationship to you? Choose all that apply.**
   - a) Family 14%
   - b) Friends 43%
   - c) Neighbors 10%
   - d) Acquaintances 48%
   - e) Other 14%

5. **Are you aware that Solar Up North is Michigan's first Community Solar project?**
   - a) Yes 84%
   - b) No 16%

6. **How many collectors did you purchase?**
   - a) One 46%
   - b) Two-Three 25%
   - c) Four- Eight 3%
   - d) More than Eight 3%
   - e) None 23%

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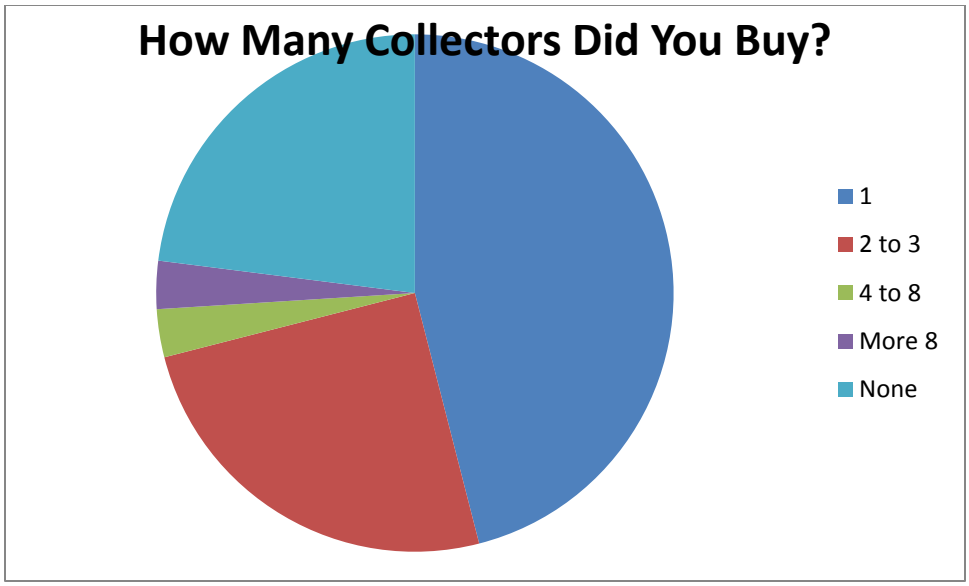

7. **Have you been out to the Cherryland offices in Grawn to see your collectors?**

a) Yes	71%
b) No	29%

8. **Would you like to see more Community Solar projects in Michigan?**

a) Yes	98%
b) No	2%

9. **Please rate the importance of each (1 = not important, 10 = extremely important) relative to your decision making process to participate in the Solar Up North program:**

Investing money wisely	7.18
Investing in your community	8.26
Protecting the environment	9.12
Making a profit	4.42
Reducing your electric bill	5.77
Encouraging the development of solar energy	8.88
Encouraging the development of solar energy locally	8.89

Question 9 asks how important various reasons were for deciding to participate. "Protecting the environment" had the highest average points (9.12) and "Making a profit" had the lowest average points (4.42). "Reducing your electric bill" (5.77) and "Investing money wisely" (7.18) also had relatively low average points.

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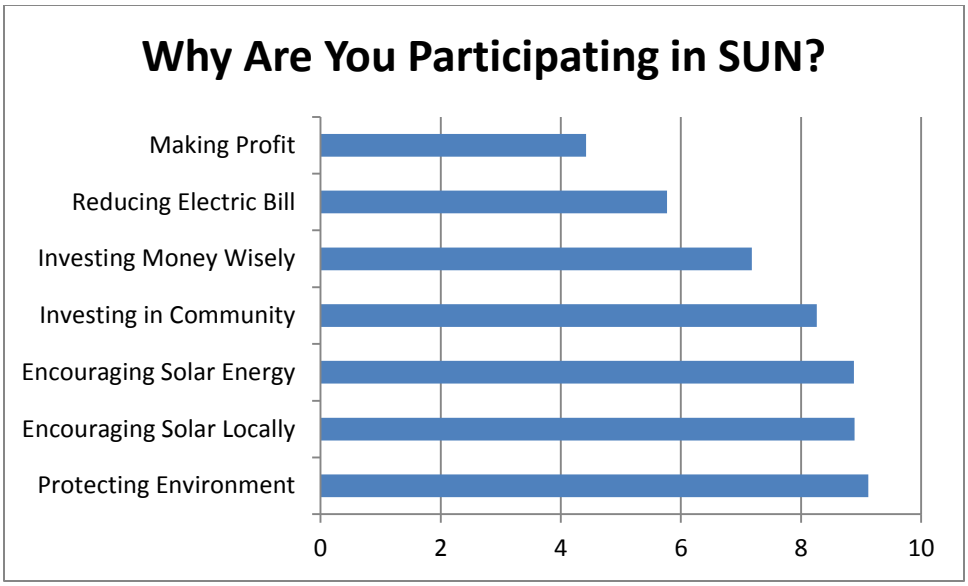

The environment was the primary motivation for joining. Many of the comments make this clear.

> *For my grandchildren.*
>
> *We want to encourage generation of electricity from non-polluting renewal sources which minimize global warming. This program enabled that, and provided a 2%+ estimated return on our investment.*
>
> *I often talk about trying to be greener and this was a good opportunity to practice what I preach.*
>
> *Desire to help reduce carbon footprint which I believe is one of the causes of climate change.*
>
> *We want to reduce our use of fossil fuels, but live in the woods where solar and wind aren't practical. The Solar Garden allows us to use solar in an affordable, efficient way.*

Investing in solar energy and investing locally were also very important. "Encouraging the development of solar energy" had a score of 8.88 and "Encouraging the development of solar energy locally" had a score of 8.89. "Investing in your community" received a score of 8.26. Most of the respondents (71%) have been out to the Cherryland offices in Grawn to see their collectors. Some comments from the respondents:

> *The more local the energy is, the better off the community will be.*
>
> *It was the community aspect, more than anything else, that drew us to the project. We also liked that the panels were installed right here where we could see them.*

10. **Why did you decide to join, or not join? Please provide any comments you would like to about the program.**
In addition to the comments indicated in the previous paragraphs, respondents made the following comments:

> *We felt joining the SUN program was one way to infintessimally reduce our dependence on foreign oil for our energy. We need to take responsibility for our own energy wants/needs. We felt that programs like SUN are a better option than drilling for domestic oil and Wind energy has it's own legitimate aesthetic issues. This seemed like a reasonable way to sustainably meet some of our energy needs. It's also very convenient as we didn't have to install/maintain the equipment at our house. Thanks for your leadership in this program!*
>
> *We have to make changes in the way we produce power. It is the right thing to do for the environment and the community.*
>
> *I would have joined if the program was available where I live, but I get my electricity from Consumers Energy.*
>
> *I have been looking for ways to be an activist on behalf of our lovely planet. I researched fracking and pipelines and felt I wanted to do something for renewable energy rather than just oppose energy sources on their way to depletion. I have belonged to*

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Cherryland Electric for many years and thought this a good way to do it. My church is also looking into installing solar panels and geo-thermal heating.

We have spoken to Tony about doing a joint solar project with the Sun Alliance and definitely want to follow through.

I WOULD LIKE TO JOIN AND LIKELY WILL SOON. BUT I WOULD RATHER SEE PANELS ON TOP OF THE SCHOOL ACROSS THE STREET FROM ME, THAT I COULD PURCHASE A SHARE IN. MY IDEA BEING THE MORE DIFFERENT POCKETS OF COLLECTORS THE LESS SUCCEPTIBLE WE ARE TO PROBLEMS WITH LONG DISTANCE TRANSMISSION LINES.... THANKS

Still saving up to join!

I joined to support Community Solar in northern Michigan, showing others that it can be done.

I'm so excited about this project!! It is time to harness other energies. It is clean and the only way to go for the future. With the planets forever expanding population, diminishing plant fossils supplies, etc., this is the only way to go. I don't care if it is wind or sun power - these are the ways to go. Thanks for doing this. What else can be done?

I am still deciding whether to purchase a panel. I will make some kind of investment in solar within the next year. However, I was dismayed to hear the comments of TCL&P and Cherryland board members (during an open meeting about this project) that their goal was to make sure that every penny of the costs are passed on to the consumer to "show the real cost of renewable energy" to those who are always "pushing" for it. I was so glad to hear my friend, Pat Timmons speak at public comment that evening to say "let's compare the real cost of dirty energy, without subsidies, and taking into consideration climate change and the costs of pollution, before we assume clean energy is "too expensive." That very evening, I also spoke with a solar installer, who has done an energy audit for solar at my home, who said this program is not the best we can do, and is much more expensive than it needs to be, although he was glad the utility is taking that "first step." I also know others who are putting solar panels on their homes instead of purchasing through this program because this system is not the best system for providing low cost Community Solar that is available. I worry that the utility is setting it up to fail, so they can wash their hands of renewable energy.

Actions speak louder than words. I acted.

Solar gardens in unused parking lots would make good use of land. Also on top of big box stores.

I did not join. There is much greater ROI in a program where the developer can take advantage of the ITC and possible depreciation credits. This is a JOKE program that fulfills Tony Anderson's desire to paint solar in the worst light possible while at the same time 'looking green'. Get real, do it right. Quit allowing the utilities to call the shots. A BAD program is worse than NO program as the public perception is now jaded.

oil, gas, coal destructive

Did not join because purchase was $450 (or thereabouts) ONLY. We cannot afford that, and do not know anybody with whom we would want to split the purchase -- if that was even possible.

I did not join. I do not live in Traverse City. I would join if possible.

I would love to join but do not have the money at this time.

Climate change is happening and anything we can do to get off fossil fuels is critical.

Looking at a sixteen year payback has made it a tough decision for us, but we will still likely join once our budget allows.

After reviewing the financial side of the program, it is evident this is not feasible without significant government and electrical company subsidies. If individuals want to spend their money on this type of energy, they should do it without using tax money to offset their costs. This type of energy is not sustainable on its own, which means the tax payer will finance these projects and not get any benefits for them. As a small business owner, I cannot support programs that are financially unsustainable just so some people can feel good about the environment.

To growth depth of experience in solar locally, we need to test small scale projects locally. This project does that for TCLP and Cherryland.

I've watched with envy other states and countries enthusiastically support renewable energy while Michigan crawls. If I had the right property, I would have installed my own array years ago. Community Solar is the next best thing. Instead of building more

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"dirty" electrical capacity, we should be investing those billions by simply incentiviving (sp) individuals to install panels on their homes.

This was an opportunity to actively participate in a solar project at a level I could afford. By participating it has increased my knowledge and awareness of solar energy. A greater understanding its current limitations, but more importantly to encourage a working model that could potentially have a positive influence on solar power as a viable energy source in the future.

I have been saving specifically for the goal of putting up a solar array once we purchased our new home in MI. This was the perfect opportunity to invest in solar without such a large output of my savings. I love the fact that the array on US 31 is such a visible statement in the community.

I'm 68 years old and do not think I will see a good ROI but this project just seemed like the right thing to do. I believe in renewable energy sources. I think that wind would have been a better choice for NW lower Michigan but that choice is not yet available to me, when it is I will invest in that also, if I'm financially able.

Want to support and see more growth in wind and solar power usage by individuals and companies. I believe it will be the safest energy and always available to everyone. ITS THE RIGHT THING TO DO. Now we need to make the technology and make it happen.

It was very easy to participate. No hassle and the pluses and minuses were quite clearly stated.

1. Being on the "ground floor" of this development was very important and the encouraging of solar power locally was outstanding. 2. The ability to take advantage of solar energy without me having to do all the research, out of pocket expense, working with local building codes, maintenance of the equipment. CEC made it easy for me to be part of this program.

Just happened to have some money to invest at the time.

Would like to see a similar program for wind power.

I have been involved in solar energy from an ancillary basis (lead world's largest solar silicon metal producer) for many years. I believe solar should only be used where it is financially viable without extraneous credits or financial support. I joined this to have access to all the data to judge the financial viability of solar in northern Michigan.

It's a way for me to leave something positive to the world when I die. To make up for the energy I've used while I was here.

We MUST find viable options to fossil fuels and fracking (clean water is essential for the planet!) It must begin somewhere... I am EXTREMELY proud of Cherryland Electric and the leadership that they and our community have shown . Each of us must walk our talk.

Seemed like a good idea.

We enjoy being part of an electric cooperative and have been very impressed with Cherryland's dedication to its customers and to managing resources wisely. We thought this "solar sharing" was a wonderful idea, making alternative energy available to those of us who are concerned with the world's reliance on polluting fossil fuels but 1) don't have good solar-collecting home sites and 2) perhaps couldn't afford to install/maintain such equipment even if we did. We are very proud of "our" cooperative's initiative, and so thankful for the opportunity Cherryland has given its members to participate in this forward-thinking project.

The cost was not prohibitive and we wanted to support the project and the growth of solar power as an alternative to fossil fuel use.

Cherryland is the electricity supplier to Crystal Mountain Resort where I have a vacation home. Crystal is trying to be a green resort so this was a way to make my chalet a little "greener". I would like to have a small sign to put on the counter of my chalet (which is rented out often) so the renters would know about the solar project.

We had a few extra dollars and the rebate incentives were very helpful.

I wanted to do something just not sure what, I also wanted to teach my daughter and grandson that it starts somewhere, why not with us however small.

Supporting a different source of energy is very important.

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APPENDIX III

COMMUNITY SOLAR WEBSITES AND RESOURCES

Five "Must-Have" Resources:

Readying Michigan to Make Good Energy Decisions: Renewable Energy – In November 2012, Governor Snyder laid out a vision for a "no regrets" energy policy – one that would be adaptable and built on three pillars: excellent reliability, an affordable price, and a protected environment. Four reports were generated from this process: Renewable Energy, Energy Efficiency, Electric Choice, and one on "Additional Areas" related to energy policy. These reports can be viewed at: http://www.michigan.gov/energy.

National Renewable Energy Laboratory's, A Guide to Community Shared Solar is a comprehensive guide for those who want to develop Community Solar projects, from community organizers or solar energy advocates to government officials or utility managers. The guide can be downloaded from: http://www.nrel.gov/docs/fy12osti/54570.pdf.

Interstate Renewable Energy Council's, Model Rules for Shared Renewable Energy Programs provides guiding principles that are important when designing Community Solar projects. It can be downloaded from: http://www.irecusa.org/wp-content/uploads/2013/06/IREC-Model-Rules-for-Shared-Renewable-Energy-Programs-2013.pdf.

Clean Energy Coalition's, Becoming a Solar Ready Community: *A Guidebook for Michigan's Municipalities*, September 2013. The report can be found at: http://cec-mi.org/communities/programs/michigan-renewable-energy-tools/solar-ready-community.

Michigan Interfaith Power and Light's, Renewable Energy Fact Sheet: Solar Aggregation in Houses of Worship, available at: http://www.miipl.org/devwordpress/wp-content/uploads/2013/02/Renewable-Energy-Fact-Sheet-Solar-Aggregation-Final.pdf.

Best Up-to-Date List and Info for Community Solar Programs in the U.S.:

Shared Solar Program Comparison Chart where IREC and SEPA are keeping track of Community Solar programs to help utilities and others interested in starting a program of their own.
http://www.irecusa.org/wp-content/uploads/Shared-Solar-Program-Comparison-Chart.pdf

Best Resource for Renewable Energy Laws and Incentives:

The Database of State Incentives for Renewables and Efficiency (DSIRE) is a comprehensive source of information on state, local, utility, and federal incentives that promote renewable energy and energy efficiency.
http://www.dsireusa.org/solar/solarpolicyguide/?id=17

Best Calculator for Solar Energy System Output:

NREL's PVWatts™ calculator determines the energy production and cost savings of grid-connected photovoltaic (PV) energy systems throughout the world. It allows homeowners, installers, manufacturers, and researchers to easily develop estimates of the performance of hypothetical PV installations.
http://www.nrel.gov/rredc/pvwatts/

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Good Resource if You Are a Member of the Solar Electric Power Association, or Know One:

Utility Community Solar Handbook: A Development Guide for Utility-Managed Community Solar Programs – May 2013. Written specifically for utilities looking to create a Community Solar program, this handbook describes the major issues and components that need to be addressed in program design and provides methods to get the process started. These suggestions and considerations are based upon the lessons learned from Community Solar programs managed by several SEPA member utilities. (Members only)
http://www.solarelectricpower.org/resources/publications.aspx#Utility_Community_Solar_Handbook

National Organizations that Support Community Solar:

Interstate Renewable Energy Council (IREC) – Model policies and reports for bringing renewable energy to a community.
www.irecusa.org

The American Solar Energy Society (ASES) – Dedicated to increasing the use of solar energy, energy efficiency, and other sustainable technologies in the United States.
www.ases.org/

Shared Renewables – Committed to encouraging and supporting shared renewable energy projects.
www.SharedRenewables.org

Community Solar Gardens Institute – Helping organize communities to pool their resources and go solar.
http://www.solargardens.org

Community Power Network – Aggregated buying, offers examples and inspiration for community scale projects across the United States. The site includes a wiki to learn and share from other projects.
http://communitypowernetwork.com

Institute for Local Self-Reliance – Working towards the democratization of the electric grid, a network of independently-owned and widely dispersed renewable energy generators, dispersing economic benefits as broadly as electricity generation.
http://www.ilsr.org/initiatives/energy/

Interfaith Power and Light – Works with faith-based communities on energy conservation and renewable energy. Published Solar Resource Guide – An Overview for Congregations, providing general info about solar, costs and financing, and several testimonials about congregations in California who have gone solar.
http://interfaithpower.org/resources/solar-resource-guide/

Michigan Community Solar Programs & Support:

Traverse City Light and Power – Active Community Solar Program
http://www.tclp.org/Mutual/CommunitySolar/EnergySmart

Cherryland Electric Cooperative – Active Community Solar Program
http://www.cecelec.com/content/community-solar

Great Lakes Renewable Energy Association (GLREA) – Providing research, publication, education on Community Solar in Michigan
www.GLREA.org

Michigan Alternate and Renewable Energy Center (MAREC) – Offers renewable energy research and training including Community Solar classes.
http://www.gvsu.edu/marec/

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U.S. Department of Energy Resources:

National Renewable Energy Laboratory (NREL). "The Open PV Project."
Interactive database providing real-time statistics on the status of solar energy in the U.S.
http://openpv.nrel.gov/

National Renewable Energy Laboratory (NREL). "Solar Research."
Information on NREL programs focusing on photovoltaics and solar heating systems.
www.nrel.gov/solar/

U.S. Department of Energy. "SunShot Initiative."
DOE's SunShot Initiative focuses on making large-scale solar energy systems cost-competitive without subsidies by the end of the decade. Offers case studies, policy updates, and news of solar activities across the country.
www1.eere.energy.gov/solar/sunshot/

U.S. Department of Energy, Energy Efficiency and Renewable Energy. "Solar."
Clearinghouse page for all DOE solar resources and programs.
www.eere.energy.gov/topics/solar.html

U.S. Department of Energy, Energy Efficiency and Renewable Energy. "Solar America Communities."
Learn from the efforts of the DOE's 25 designated Solar America Cities
http://solaramericacommunities.energy.gov/

Solar America Board for Codes and Standards
Provides technical information on best-practice code requirements for solar energy systems
www.solarabcs.org/

Ontario Community Solar Program:

Toronto Renewable Energy Cooperative (TREC). Cooperative based Community Solar.
http://www.solarbonds.ca/, http://www.trec.on.ca/

Major National Developers of Community Solar Projects:

Clean Energy Collective
http://www.easycleanenergy.com/

SunShare
http://mysunshare.com/

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APPENDIX IV

RESOLUTION TO ENCOURAGE COMMUNITY SOLAR DEVELOPMENT IN ANN ARBOR (APPROVED, 9/3/2013, ENACTMENT # R-13-283)

Whereas the City of Ann Arbor has adopted a Climate Action Plan and developed a Solar Plan that both advocate maximizing the installation and use of solar photovoltaic (PV) systems;

Whereas, it is estimated that 30% of the citizens of Ann Arbor do not have the ability to invest in efficient or practical solar energy because of site issues (e.g., shading, roof orientation, renters, condo owners);

Whereas the high cost of installing a complete solar PV energy system is a barrier for many who alternately could afford to invest in a partial system or several solar collectors;

Whereas, many people do not feel comfortable purchasing or maintaining a solar energy system whose technology they know little about;

Whereas, Community Solar allows a group of people or businesses to purchase shares in a renewable energy system, not located at the site of their electric meter, to get their share of the value of the energy produced from the off-site renewable energy system as if it were located at their home or business;

Whereas, Community Solar can remove many of these barriers by allowing a group of investors to purchase shares in a group-owned solar energy system which is constructed, operated, and maintained by a third party;

Whereas, Community Solar projects also have the potential to be an economic development activity;

Whereas, These Community Solar participants would receive credit for the electricity produced from their share of the jointly owned solar energy system;

Whereas, Community Solar is proving very successful in areas where either State law (Colorado) or local utilities (Cherryland Electric Cooperative) have offered Community Solar programs;

Whereas, numerous Ann Arbor neighborhood and church groups have contacted the Ann Arbor Energy Office or the Ann Arbor Energy Commission stating their desire to implement a Community Solar project in Ann Arbor;

Whereas, current utility policy in Michigan does not allow public utilities like DTE and CE to offer Community Solar programs except as a MPSC approved pilot program;

Resolved, that the Ann Arbor City Council direct the Ann Arbor City staff to work under the direction of the Energy Commission and with DTE to create a Community Solar pilot program for Ann Arbor by March 31, 2014;

Resolved, that the Ann Arbor City Council encourage the Michigan Legislature to pass enabling legislation for Community Solar similar to the bill passed in the State of Minnesota on May 23, 2013 (Solar Energy Jobs Act - HF729) mandating public electric utilities to submit a plan to allow separately metered accounts to be credited for investment in a Community Shared Solar project.

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APPENDIX V

NATIONAL RENEWABLE ENERGY LABORATORY MODELING SOFTWARE

The NREL SAM Model

Some financial models used for this report utilized the National Renewable Energy Laboratory's (NREL) Systems Analysis Model (SAM), a tool created at NREL to analyze the financial properties of renewable energy system investment over the lifetime of the system. The most important output used from this SAM modeling software is the "Levelized Cost of Energy" (LCOE). LCOE is the price at which electricity must be generated to break even over the lifetime of the project. It is an economic assessment of the cost of the energy-generating system, including all the costs over its lifetime including: initial investment, operations and maintenance, cost of fuel, and cost of capital. GLREA worked with NREL and MPSC staff to utilize the Systems Analysis Model to compute the LCOE for many of the models analyzed.

Values included in the NREL SAM model:

- System location
- System output
- System output performance adjustment, default = 0.5 % /yr. decline in system output
- System Cost
- Operation and maintenance, default = $20/kW capacity per year
- Insurance, default = 0.5% of installed cost/yr.
- Land Cost
- Property tax
- Loan Rate
- Debt fraction
- WACC, weighted annual cost of capital
- Inflation Rate
- Real Discount Rate
- Nominal Discount Rate
- Federal Income tax rate
- State Income tax rate
- Sales tax rate
- Cost of Acquiring Financing
- Salvage Value

Results

- Levelized Cost of Energy - The price per kWh at which electricity must be generated to break even over the lifetime of the project.
- Internal Rate of Return
- Minimum Debt-Service Coverage Ratio
- Net Present Value

The NREL "Michigan Community Solar Analysis Tool"

This Excel spreadsheet-based tool was custom designed by NREL for use in analyzing the financing involved in Community Solar projects. The LCOE generated in the SAM model is used in this tool to model various Community Solar configurations. This tool allows analysis for a variety of the following variables:

- Levelized Cost of Energy
- System size
- System costs
- Project lifetime
- Project shares or number of participants
- Value of solar energy generated

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Outputs are provided from both the Shareholder perspective and the Utility (or project developer) perspective.

Shareholder perspective outputs include:

- Monthly Charge = avg charge per share per month
- Monthly Credit – credit shareholder gets per month
- Effective Cost per kWh – difference in LCOE and solar power rate
- One-time Up-front Charge – Cost to purchase share

Utility perspective outputs include:

- Average Annual Cost of Production
- Monthly Cost per Share
- Monthly Charge per Share
- Net Cost of Production per Share
- Net Cost to the Utility of Community Solar [$/kWh]

The User Guide for the Michigan Community Solar Analysis Tool follows:

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NREL
NATIONAL RENEWABLE ENERGY LABORATORY

MEMO

Date: Thursday, August 29, 2013

To: Jesse Harlow, Michigan PSC

From: Jason Coughlin and John Nangle

Subject: User Guide for the Community Solar Analysis Tool

Michigan STAT Request

The Michigan Public Service Commission (PSC) is assisting the State of Michigan Energy Office in producing a Community Solar Gardens Feasibility Study. The PSC is investigating community solar options for the state including (a) utility owned and operated, utility contracted with third party to own and operate, (b) special purpose entity owned and operated with energy sold through a power purchase agreement or used on site, or (c) a combination of these ownership models. The PSC is seeking assistance in modeling financial values for the various community solar models including tax credit utilization, accelerated depreciation, renewable energy credits, construction and maintenance costs and billing/crediting options.

NREL Task

NREL staff will provide financial modeling assistance for community solar projects in Michigan including selection of appropriate NREL tools for the analysis and running models with data provided by the Great Lakes Renewable Energy Association (GLREA).

Community Solar

Community Solar[1] is the concept of multiple participants sharing in both the costs and the benefits of a single, larger[2] photovoltaic (PV) system rather than each individual (or business) pursuing its own on-site PV project. There are many reasons why someone would opt to participate in a community solar project. For those who do not own their own home or building or who live in a condo, the option of installing an on-site PV system is limited. In addition, even those who own their own home or building may have a limited solar resource[3] either due to a

[1] Community Solar is also known as Shared Solar or Solar Gardens depending on the state, local government or utility implementing the project.
[2] Community solar gardens can be as small as 10 kW and as large as 1 MW or greater.
[3] In simple terms, solar resource can be thought of as the amount of sunlight falling on the space available either on the roof or somewhere on the lot where PV could be installed.

mature tree canopy shading the available area or a sub-optimal roof orientation. Others may not want an on-site PV system given future building expansion plans, aesthetic concerns or certain HOA restrictions. And finally, there is the cost issue. While the cost of PV has dropped dramatically in the past two to three years, it is still a relatively expensive undertaking. Given that there are economies of scale related to the cost of installing an on-site PV system, purchasing a very small system, ½ kilowatt (kW) for example, for on-site use might not be practical. However, within the context of a community solar project, participants can get involved by purchasing the output from as little as one solar panel.[4]

Given the expanded access that community solar offers, there have been a number of utilities that have begun to offer community solar programs. In some cases, it has been voluntary whereas in others, in Colorado for example, community solar was incorporated into the existing Renewable Portfolio Standard. Regardless, there are a number of possible variations as to how to structure a community solar project. In general, they are as follows:

1. A utility can install and own a PV system and develop a community solar program around the output of this system. Subscribers would either have the option of making a one time, upfront payment to join the program and in return, be entitled to the output of their share of the facility's production. Alternatively, programs can be structured with monthly, pay as you go, subscription fees, in return for a corresponding share of the facility's production.

2. Rather than directly acquire a PV system, a utility can enter into a Power Purchase Agreement (PPA) with a solar developer and purchase the output from a solar facility. In turn, the utility can then develop a community solar program around this purchased solar electricity. As with option #1, subscribers can either make an upfront payment or monthly payments.

3. In certain jurisdictions, a collection of community members can develop a community solar project "behind the meter" and then allocate the net metering and other benefits accordingly.

4. Finally, there are examples of "community" solar projects where certain community members form the investor group to develop a particular project with the output sold under a PPA to a third party which could be a non-profit, a church or a business, among other entities.

Existing Community Solar Resources

There are a number of existing reports and guides available on the topic of Community Solar. Therefore, rather than repeat what can be found in these resources, the following list can be consulted as necessary for additional information. The following documents provide case studies of existing community solar projects, guidelines on how to structure community solar projects as well as best practices and policy guidance.

[4] An average solar panel is 250-300 Watts. Therefore, 2 panels would be roughly equivalent to ½ kilowatt and 4 panels would be 1 kW.

• A Guide to Community Shared Solar published by the US Department of Energy in 2012.[5] This Guide is an update to the original Guide to Community Solar.[6] The Guides offer insights into the options available to structure community solar projects and numerous case studies. Given that some of these case studies have been changed or updated, both Guides are useful documents.

• IREC's Model Rules for Shared Renewable Energy Programs.[7] This document provides in depth information related to program administration, alternatives for valuing and calculating the benefits to subscribers and also, project ownership and financing alternatives.

• The Vote Solar Initiative's Shared Solar HQ[8] maintains a database of information pertaining to state policies related to community solar as well as a listing of actual community solar projects across the nation.

• The Great Lakes Renewable Energy Association (GLREA) is finalizing a Community Solar PV Garden Feasibility Study. The study is expected to be released in September 2013 and is supported by a grant from the Michigan State Energy Office. The study will "research and analyze various system ownership and financing models for Community Solar projects" and should be an excellent Michigan-focused resource.[9]

Community Solar Analysis Tool

NREL has developed an excel-based spreadsheet tool for Michigan in order to model various community solar scenarios. The tool has been developed to incorporate either a PPA price or a Levelized Cost of Energy (LCOE)[10] value that is calculated in the System Advisor Model (SAM)[11] or a comparable tool. Based on a given PPA or LCOE input, the tool user can model different subscriber payment options (e.g. a one time, up-front payment or a monthly pay as you go subscription fee) as well as various bill credit values that the utility can offer the community solar subscriber for its pro-rata production of the PV system. The tool incorporates the expected solar resource from a given PV system in Michigan using information obtained from PVWatts that is already incorporated into the SAM model.[12] In the actual calculations, Detroit was selected as the Michigan proxy for determining the expected annual solar resource.[13]

[5] http://www.nrel.gov/docs/fy12osti/54570.pdf
[6] http://www.nrel.gov/docs/fy11osti/49930.pdf
[7] http://www.irecusa.org/wp-content/uploads/2013/06/IREC-Model-Rules-for-Shared-Renewable-Energy-Programs-2013.pdf
[8] http://www.sharedrenewables.org/
[9] http://www.glrea.org/
[10] The LCOE is the total cost of installing and operating a project expressed in dollars (or cents) per kilowatt-hour of electricity generated by the system over its life.
[11] https://sam.nrel.gov/
[12] http://rredc.nrel.gov/solar/calculators/PVWATTS/version1/
[13] SAM offers nine different Michigan locations to determine the solar resource. Given that the variability across these locations is minimal, Detroit was selected as the proxy Michigan location.

Based on guidance from the Michigan PSC, NREL developed seven, community solar scenarios in SAM. These scenarios[14] were forwarded to the PSC as part of the packet of final deliverables. The seven scenarios were as follows:

1. An investor owned utility (IOU) directly purchases and owns[15] a PV system and develops a community solar program around the output of this system.
2. A tax exempt utility directly purchases and owns a PV system and develops a community solar program around the output of this system.
3. A third party developed solar project under which the electricity is sold to the utility under a power purchase agreement (PPA).
4. A third party developed solar project in which community members partner with a tax equity investor to develop the project and then sell the output under a PPA.
5. Similar to scenario #4, but rather than an all equity transaction, debt is incorporated into the transaction.
6. Similar to scenario #4, but below market rates for tax equity are incorporated into the model.[16]
7. Similar to scenario #5 with debt being incorporated into the transaction along with below market rates for tax equity.

Each one of these seven scenarios resulted in a different PPA or LCOE price which can be then plugged into the community solar analysis tool.

Once the user calculates either the LCOE or PPA price in SAM for a given system size and enters these two data points into the tool, other inputs can be modeled directly in the tool itself. These inputs are the number of subscriber shares, various bill credit values (on a per kWh basis), a per watt discount off of the one-time upfront payment and an estimate of expected program administrative and other costs. There is also a discount rate feature that the user can enable in order to calculate the present value of the net cost to a subscriber for participating in the program under the monthly, pay as you go method.

Upon entering these various inputs, the tool calculates the net cost to the community solar subscriber to participate in the program (either under the upfront, one-time payment option or the monthly pay as you go option) and the net cost to the utility to offer the program.[17] There is also

[14] Each scenario assumed a 500 kW system.
[15] Given that SAM does not allow users to model utility ownership of PV systems and take into account the need to normalize the tax benefits, NREL created a proxy model that incorporates a present value calculation of the ITC (which equals roughly 16%) as well as straight line depreciation (rather than 5 year MACRS).
[16] When market rates (e.g. 10%) are used for the tax equity investor return, the resulting PPA price is materially above market and is highly unlikely to result in a project getting completed. So the idea was introduced by GLREA to use a below market tax equity rate (e.g. 4%) under the assumption that a Michigan-based tax equity investor might be willing to invest in the project at below market terms in order to support the project's development.
[17] The tool is set up so that whatever the utility's cost to offer the community solar program is fully recouped either through the one-time payment or the monthly payments. Thus, the net cost to the utility is equal to whatever bill credit rate they decide to offer the subscriber for each kWh of solar electricity generated by the community solar project. Admittedly, modeling the costs and benefits of adding solar capacity to a utility's generation mix is complex which is one reason why this tool should be used as a scenario planning tool that provides some basic estimates of what a community solar program might cost the subscribers and the utility, rather than any definitive dollar values of such participation.

a graphical depiction of the cost of the electricity generated by the community solar project in relation to expected[18] average utility rates in Michigan during the life of the project.

Step by Step Example

In the investor-owned utility scenario referenced above in which the utility directly purchases a 500 kW PV system for a hypothetical community solar program, the resulting LCOE for the system was $0.211/kWh.[19] For the following example, this is the LCOE value inputted into the tool (along with the system size of 500 kW) as is illustrated below in Table 1.

Tool Inputs

Inputs		
System Size [kW]		500
Project Lifetime [yrs]		25
Number of Shares		500
LCOE or PPA Price [$/kWh]		0.211
Bill Credits		
Rate 1 [$/kWh]	$	0.05
Rate 2 [$/kWh]	$	0.10
Solar Value Rate [$/kWh]	$	0.15
Flat Discount per Share [$/W]	$	-
Project Costs		
Utility System Admin Costs [$]	$	10,000
Other Project Costs [$]	$	-
Discount Rate		
Subscriber Discount Rate [%]		0.00%

Table 1

Shares

In addition to system size and LCOE/PPA, the user can model the assumptions related to the number of shares to be offered under the program. A share refers to the claim on a given level of a PV system's production. In other words, a community solar participant or subscriber will buy one or more shares in a given project. In return for an upfront payment or a monthly payment, the subscriber will receive the production from his or her share of the system. In Table 1, the assumption is that 500 shares of 1 kW each will be sold in this community solar project.

Bill Credits

In the tool, bill credits represent the value that the utility will credit a subscriber for the production of his or her share of the community solar project. In the scenario presented in Table 1, there are three bill credit options; $0.05/kWh, $0.10/kWh and $0.15/kWh. This last value has been labeled a Solar Value Rate in that it assumes a bill credit at some premium to existing retail

[18] Expected future rates for the graph are based simply on past average annual rate increases.
[19] A cost per watt of $3.27 was used based on input from GLREA.

prices based on the perceived value to the utility that distributed generation provides.[20] Given that in the tool, the utility recoups its investment in a community solar project under either the one-time payment model or through the monthly payments, the bill credits offered by the utility also reflect its cost of acquiring the solar electricity used for the project.

Flat Discount per Share

The tool allows for a per watt incentive to be incorporated into the analysis. For example, if the user enters $1.00 in this field, it implies that an incentive of $1.00/W per share is being offered to subscribers under the one-time, up-front payment option. The flat discount per share directly reduces the one-time payment but it does not impact the monthly fee structure (this is impacted by the level at which the bill credit is established).

Project Costs

The user can incorporate annual administrative costs into the tool. The tool translates these costs into cents per kWh and adds them to the LCOE or PPA price to get the all-in cost to run the program. In Table 1, $10,000 has been entered to reflect the annual cost to administer this hypothetical program. In the calculations tab of the tool, the conversion to $/kWh can be found. In this example, $10,000 translates into an additional $0.017/kWh. This is then added to the original LCOE of $0.211 to calculate the total program costs.

Consumer Discount Rate

The tool does allow the user to discount the value of the net monthly subscription (e.g. monthly charge minus monthly credit) to calculate the present value of the 25 year commitment. The concept behind discounting payments to be made in the future is that a monthly community solar subscription fee of $25 made in 2025 is not equal in terms of its purchasing value as a $25 payment made in 2014 given the effects of inflation over time.

Outputs (Subscriber Perspective)

Upon entering the various inputs, the tool calculates the cost to the subscriber to participate in the community solar program. The costs are expressed on a per share perspective. This implies that a participant in a community solar program with 2 or more shares would have to multiply the values found in Table 2 to get the total cost to participate.

Community Solar Subscriber Perspective on a Per Share Basis							
	Monthly Charge	Average Monthly Bill Credit	Net Average Monthly Cost	Average Effective Cost per kWh	Average Monthly kWh per Share	One-Time, Up-Front Charge	Net Cost per Share over Program Lifetime (monthly payment plan)
Bill Credit @ Rate 1 [$]		$ 4.99	$ 19.40	$ 0.19		$ 5,012	$ 5,012
Bill Credit @ Rate 2 [$]	$ 24.38	$ 9.98	$ 14.41	$ 0.14	100	$ 3,601	$ 3,601
Bill Credit @ Solar Value Rate [$]		$ 14.97	$ 9.42	$ 0.09		$ 2,191	$ 2,191
One-Time Charge - No Bill Credit [$]	$ -	$ -	$ -	$ 0.23		$ 6,422	$ 6,422

Table 2

[20] While NREL previously did some preliminary analysis related to the value of distributed solar in Michigan, the assumptions used in the tool should not be considered in any way formal NREL recommendations or suggested bill credit levels.

Monthly Charge
The monthly charge represents the cost per share that fully reimburses the utility for the cost of offering the community solar program.

Monthly Credit
The monthly credit represents the bill credit in dollars that the utility will credit the subscriber's utility bill under the monthly payment option. It is the product of an estimate of the average output from the subscriber's share(s) in the community solar facility multiplied by the bill credit rate.

Net Monthly Cost
The net monthly cost is the difference between the monthly charge per share and the monthly bill credit. It represents the net monthly cost to the subscriber to participate in the community solar program.

Effective Cost per kWh
The effective cost per kWh is the difference between the subscriber's monthly charge and the monthly bill credit divided by the expected output per share. It reflects the price per kWh that the community solar subscriber will pay to receive electricity generated by the PV system.

Average Monthly kWh per Share
Based on the system size and number of shares offered under the program, the tool calculates an estimated average monthly kWh produced per share based on the expected first year production.[21]

One Time Upfront Charge
Many community solar projects are structured so that the subscriber makes a one-time payment on either a per-Watt or per solar panel basis and in return, receives a bill credit for the output from his or her share in the project. In this tool, the one-time charge is calculated on a per share basis. The cost is calculated by multiplying the subscriber's net cost to participate in the program (expressed in cents per kWh) and the expected output of a share over the 25 year life of the project. Under this scenario, the subscriber would then receive a bill credit expressed in kWh each month for the next 25 years. In essence, this option is similar to a prepaid PPA in that the subscriber is pre-paying for 25 years' worth of solar electricity upfront. If no consumer discount rate or upfront incentives are applied, the one-time upfront charge will equal the Net Cost per Share over the Lifetime of the Program.

Net Cost per Share over the Lifetime of the Program.
The net cost per share reflects the total sum of the difference between the monthly subscription fees paid to the utility by the community solar subscriber and the bill credits paid by the utility to the subscriber. As noted earlier, the user can choose to discount this value by using the Subscriber Discount Rate feature.

[21] In other words, it does not take into account system degradation that will likely occur over time. A rule of thumb for annual average degradation is in the .05-1% range.

Output (Utility Perspective)

The information in Table 3 summarizes the community solar project from the utility's perspective.

Utility Perspective					
	Program Costs	No Credit	Bill Credit @ Rate 1	Bill Credit @ Rate 2	Bill Credit @ Solar Value
Average Annual Cost of Production [$]	$ 146,306				
LCOE or PPA price + Project Costs [$/kWh]	$ 0.228				
Monthly Cost to Utility per Share [$]	$ 24.38				
Monthly Charge to Subscriber per Share [$]		$ 24.38	$ 19.40	$ 14.41	$ 9.42
Net Cost of Production for Utility per Share [$]		$ -	$ 4.99	$ 9.98	$ 14.97
Net Average Cost to Utility of Community Solar [$/kWh]		$ -	$ 0.05	$ 0.10	$ 0.15

Table 3

Average Annual Cost of Production ($)
The average annual cost of production is calculated by multiplying the LCOE or PPA price plus any additional project costs by the first year's expected annual production in kWh.

LCOE or PPA Price ($/kWh) + Project Costs
This value is the sum of the LCOE or PPA price previously calculated in SAM and entered into the tool along with any administrative or other program costs expressed in cents per kWh.

Monthly Cost to Utility per Share ($)
The monthly cost to the utility on a per share basis of the community solar project is calculated by dividing the average annual cost of production by the number of shares to get the annual cost and then again by twelve (12) to get the monthly cost. It reflects the utility's cost to procure either the solar project directly (e.g. LCOE-based calculation) or the solar electricity generated by the project under a PPA (e.g. PPA-based calculation).

Monthly Charge to Subscriber per Share ($)
Based on the bill credit value selected for the program, the monthly charge to the Subscriber per share reflects the difference between the utility's monthly cost per share and the bill credit per share offered to the subscriber. If no bill credit is offered to the subscribers, then the monthly cost to the utility and the monthly charge to the subscriber are equal which implies that the utility fully recoups its investment in the community solar project and all costs are borne by the subscribers.

Net Cost of Production for Utility per Share ($)
The net cost of production per share is the difference between the monthly charge that the utility will collect from each community solar subscriber minus the bill credit that it gives to each subscriber.

Net Cost to the Utility of Community Solar ($/kWh)
The net cost to the utility of community solar is equal to the value of the bill credit (in $/kWh) offered to the subscribers. As noted earlier, it can also be looked at as the "wholesale" cost to the utility to procure the solar electricity used for the community solar program.

Summary
NREL has developed an analysis tool to assist Michigan community solar stakeholders conduct scenario planning as it relates to various ownership and payment models for community solar. When combined with SAM or a comparable analytical model, the community solar analysis tool allows users to map out hypothetical project structures to determine if they will result in realistic market opportunities for community solar. The tool also makes it easy to model various incentive levels to determine what level of incentive would be necessary to develop a marketable program. Using the tool to model scenarios in collaboration with a utility that has expressed interest in offering a community solar program will likely result in the most realistic results given that the tool makes multiple assumptions related to utility costs that can be best confirmed by the utility itself.