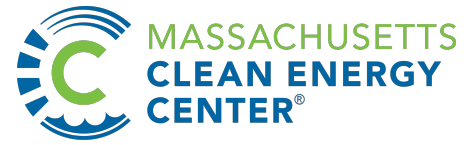


Mass Solar Loan Technical Requirements



Below are the technical requirements for the Mass Solar Loan program as published in the [Program Manual v11](#), active as of the program close December 2020. These are intended to serve as a resource for lenders establishing their own product and considering potential requirements beyond the standard electric code. Note that some requirements included below may be specific to a publicly funded program, the specific design of Mass Solar Loan, or may be less applicable as time has passed and other incentives and market structures have changed.

MASS Solar Loan

From 2015 - 2020, MassCEC helped 17 lenders originate \$180 Million in residential loans through the Mass Solar Loan program. MassCEC has developed these resources with insights from the program to support lenders in launching their own product.

- Equipment and eligible cost descriptions are generally intended to mimic eligibility definitions for the federal tax credit, with some costs such as tree work and re-roofing specifically called out to ensure some constraint on project scopes under the program.
- Design and Production Requirements are intended to ensure well producing systems given that public funds were utilized as loan support and dictate requirements for how production estimates could be documented in applications.
- The majority of requirements are intended to highlight elements already required as part of the Massachusetts Electric Code or certain industry best practices.
- Warranty and efficiency requirements are intended to ensure a level of consumer protection and awareness of other energy costs.
- Some requirements, such as metering, and reporting requirements are specific to other incentive programs active during the program's operation and may be less applicable over time or for certain customers.

Eligible and Related Equipment

All installations must use solar photovoltaic (PV) technology, which is defined as cells or solar photovoltaic arrays that directly convert energy from the sun into electricity. Building integrated installations are eligible assuming all other requirements are met.

Eligible Project Costs

Qualified solar electric property costs include those that use solar energy to generate electricity for residential use in Massachusetts. No costs relating to a solar panel or other property installed as a roof (or portion thereof) will fail to qualify solely because the property constitutes a structural component of the structure on which it is installed. The home does not have to be your main home so long as the home is located in the Commonwealth of Massachusetts.

Battery or energy storage system costs may be eligible when paired with a new solar PV system and meeting the Energy Storage requirements detailed in this document.

Eligible Project Costs Continued

The following costs associated with a PV project may not be financed through the Mass Solar Loan Program. Please note that this list is not comprehensive:

- Tree trimming or other vegetation management
- Re-roofing costs

Minimum Design and Estimated Production Requirements

The PV project must be designed so that the estimated annual energy output for the PV project, based on actual site specific shading, azimuth, and inclination is at least 70% of the default optimal output for a fixed PV project of the same capacity, as estimated by PVWATTS with a shade estimate from an accepted shading analysis tool as noted below. Solmetric SunEye, Solar Pathfinder, Wiley ASSET, Aurora software with LIDAR data available, Bright Harvest remote solar assessment service, Scanify or other MassCEC approved shading analyses will be accepted.

MassCEC will require a copy of the shading analysis for each PV project in the Mass Solar Loan Program. Please note that PV projects that have multiple arrays with varying tilts and azimuths will require a separate analysis/separate skylines for each array. The shade analyses must demonstrate that the 70% threshold is met before the project can receive Technical Application approval. For projects with multiple arrays, the 70% threshold must be met for the weighted average of the entire system (so an individual array might fall below the threshold as long as the system as a whole meets the requirement). Please contact MassCEC at SolarLoan@masscec.com prior to submitting a shading analysis that is not listed above.

Optimal parameters for purposes of a PVWATTS estimate are: 1) system losses of 14 percent, 2) 42 degree array tilt, and 3) 180 degree (True South) azimuth. PVWATTS is available at the following website <http://pvwatts.nrel.gov>

Installation Requirements¹

The PV project electrical work must be performed by a Massachusetts licensed electrician. For more information: <https://www.mass.gov/orgs/board-of-state-examiners-of-electricians>

The PV project must be installed according to the manufacturer's instructions and in compliance with all applicable codes, standards, interconnection and permitting requirements including:

- Local, state, and/or federal building and electrical² laws, codes and practices.
- The provisions of the most current edition of the Massachusetts Electric Code (MEC) as specified by state code. In all cases where manufacturer instructions, third-party guides/handbooks, or other materials contradict the most current edition of any local, state, or federal code, the applicable code shall take precedence over such materials.
- Interconnection Agreement - A separate application must be submitted to the electric utility to start the formal interconnection process, and sufficient lead time should be allowed as part of the installation, based on time frames listed in the Interconnection Tariff. All PV projects must have an appropriate electric utility interconnection agreement in place, and have authorization to interconnect from the utility at the time of interconnection to the utility grid.

¹ All references are to the 2017 Massachusetts Electrical Code unless otherwise noted.

² Massachusetts Building Code (780 CMR) and Electrical Code (527 CMR) are available from the Executive Office of Public Safety and the Board of Fire Prevention Regulations, respectively.

Installation Requirements Continued

All pertinent permits and inspections must be obtained and copies kept on file as may be required by local codes and/or state law.

Additional general installation practices to be followed include:

- All installations must follow the most current edition of the MEC with the following changes as noted below.
- Solar PV projects designed to be installed on pitched (greater than 5°), non-flat roofs, are required to have a tilt and azimuth that is the same as the roof pitch and azimuth, in order to be eligible for the Program.
- Installations of ground- and pole-mounted arrays must have an equipment disconnecting means as described in Article 690.15(D), located at the array to isolate all DC current carrying conductors. For installations on buildings, refer to Article 690.12.
- Solar PV systems shall not be connected directly to the output of a standby generator, unless the generator is designed to be operated in parallel with a PV system. Connecting in this manner may void the generator or PV inverter manufacturer's warranty.
- Areas where wiring passes through ceilings, walls, or other areas of the building must be properly restored, booted, and sealed.
- Thermal insulation in areas where wiring is installed must be returned to "as found or better" condition.
- All installed electrical components must be listed by a nationally recognized testing laboratory such as Underwriters Laboratory (UL), and/or be compliant with Institute of Electrical and Electronics Engineers (IEEE) standards, or the American National Standards Institute (ANSI), or other nationally recognized testing laboratory standards (e.g., UL, CSA, ETL, TUV, etc.), unless otherwise noted in this document, and installed in a manner consistent with the relevant listing and labeling.
- An owner's manual of operating and maintenance instructions must be provided to the PV project owner and preferably also posted on or near the PV project. The owner's manual should include manufacturer's specifications, serial numbers, warranty policies, etc.
- Owners must be provided with, at minimum, a basic training orientation that includes maintenance instructions, troubleshooting, meter reading, and electric production reporting instructions. Owners should also be informed of any opportunities to sell Solar Renewable Energy Certificates (SRECs) or of any opportunities to participate in any successor program, such as the Solar Massachusetts Renewable Target (SMART) program. For more information, see the Energy Production Reporting Requirements section later in this document.

Energy Storage Requirements

- For purposes of these Minimum Technical Requirements the energy storage system is considered a part of the PV project.
- The energy storage installation, as with all elements of the PV project, must follow the most current edition of the MEC.
- The PV project, including the energy storage system, must qualify under the SMART program (if available), and must seek the energy storage adder. If the PV project is located in a Municipal Light Plant (MLP) territory it must ensure the MLP has provisions for interconnecting Energy Storage to the grid.

Energy Storage Requirements Continued

- The energy storage system (even if located in a MLP territory) must meet the Eligibility Requirements for Energy Storage under the SMART program, including Rated Power, Useful Energy and Operational Requirements as further detailed in the SMART Guideline on Energy Storage, available at www.masmartsolar.com.
- The Energy Storage System must meet known eligibility requirements for the Federal Tax Credit including operational requirements.
- All energy storage equipment must be new and must be certified by a nationally recognized testing laboratory.
- System shall comply with MEC Article 706 as outlined in this [best practices and summary document](#).
- Systems shall conform to Underwriters Laboratory (“UL”) 9540, lithium-ion cells shall conform to UL 1642 and the battery modules shall conform to UL 1973. Inverters shall conform to UL 1741 or Institute of Electrical and Electronics Engineers (“IEEE”) 1547. Systems shall comply with NFPA 1, the International Building Code, the International Mechanical Code, the International Fire Code, NEC 110.26(F) (garage), NEC 480.9 (A) (garage ventilation), NEC 690.5(C), 690.55 (warning labels/signage), and NFPA 855 (to the extent such standard is in place), provided that these codes do not conflict with the codes and standards imposed by the local Authority Having Jurisdiction. Installer shall verify that the quality of the installation conforms to National Electrical Contractors Association (“NECA”) 416-16 and that the Systems’ installation follows NFPA70E for worker safety. Installer shall verify that the installation and interconnection conform with either (i) IEEE C2, (ii) National Fire Protection Association (“NFPA”) 70, or both (i) and (ii), as may be required based on whether the Systems are located on the customer/meter or EDC side of the electric grid.

Best Practice/ Common Installation Violations

- All work must be completed in a neat and professional manner, as required by Article 110.12.
- Twist-on wire connectors (wire nuts) shall not be used in any outdoor enclosure unless listed to UL 486D for use in damp/wet locations. Proof of listing will be required during inspection if applicable. (See Article 110.28 for more information).
- Warning labels, as specified in the MEC must be posted on disconnects, panel enclosures, DC raceways, and accessible junction boxes. The labels shall be suitable for the environment in which they are installed, as required by Article 110.21(B).
- Article 300.7(A) requires raceways passing from the interior to the exterior of a building be filled with an approved material to prevent the circulation of warm air to a colder section of the raceway.
- Terminal ratings and conductor size/limitations must be followed per Article 110.3(B). Common violations include multiple conductors under a terminal listed for a single conductor, or conductors undersized for the terminals, such as inside a meter enclosure.
- A permanent plaque or directory denoting the location of all electric power source disconnecting means on or in the premises shall be installed at each service equipment location and at the location(s) of the system disconnect(s) for all electric power production sources capable of being interconnected. As outlined by MEC 705.10.
- MassCEC recommends that photos be taken of the following system components for all rooftop solar arrays: module frame grounding method, array grounding method, array wire management, interior of any rooftop enclosures, and exterior of any rooftop enclosures. These photos shall be kept on record with the primary installer and made available to MassCEC upon request.

Best Practice/ Common Installation Violations Continued

- MassCEC recommends, but does not require, that all PV projects installed under the Mass Solar Loan program include appropriate surge arresters or other means to protect PV project components from lightning and other surge events. However, it is the responsibility of the installer to ensure that the installation meets any local, state or federal building and electrical laws that address lightning and surge protection.

PV Project and Equipment Warranty Requirements

- **Installer Warranty.** All PV projects must have a minimum 5 year labor warranty provided by the installer to protect the system owner against defective workmanship, PV project or component breakdown (exceptions noted below), or degradation in electrical output of more than fifteen percent from their originally rated electrical output during the warranty period. The warranty must cover the PV project, including PV modules (panels), inverters, and energy storage system if applicable, and provide for no-cost repair or replacement of the PV project or system components, including any associated labor during the warranty period.
- **Manufacturer Warranty.** All major equipment must meet the following minimum manufacturer warranties:
 - Photovoltaic Module: Minimum of one year product warranty from date of sale to first System Owner for product workmanship and materials, plus a minimum performance warranty of 20 years within which time the module will produce, under standard test conditions, a minimum of 80% of the product's minimum rated power at time of sale;
 - Inverters: Minimum of 10 years product warranty from date of sale to first System Owner for product workmanship and materials;
 - Energy Storage Components (if applicable): Minimum of 10 years product warranty from date of sale;
 - Revenue grade production meters 2 year product warranty;
 - Mounting equipment: 5 year product warranty.
- **Exception**
 - Aforementioned warranty requirements do not apply to the components of a Data Acquisition System with exception of the revenue grade meter. However, equivalent warranties, if available, or equivalent service contracts are strongly recommended for such equipment.

Additional Solar PV Equipment Requirements

The equipment and components that comprise the PV project must have the following characteristics:

- All electrical equipment funded in part or in whole by MassCEC must be new, with the exception of remanufactured revenue grade meters for application to PV systems of 10 kW capacity or less.
- Underwriters Laboratory (UL) listed and compliant with Institute of Electrical and Electronics Engineers (IEEE) standards, or other nationally recognized testing laboratory standards (e.g., UL, CSA, ETL, TUV, etc).
 - All photovoltaic modules must be certified by a nationally recognized testing laboratory as meeting the requirements of the UL Standard 1703.
 - Inverters must be certified as meeting the requirements of IEEE 1547 and UL Standard 1741.

Additional Solar PV Equipment Requirements Continued

- All modules, inverters, and production meters must be on the California Energy Commission’s list of eligible renewable energy equipment:
http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php
 - Non-Expedited Solar Installers wishing to confirm that the equipment is listed in the application portal, please contact the Mass Solar Loan Team at solarloan@masscec.com.
 Note: Unlisted equipment must meet the above mentioned requirements and be added to the California Energy Commissions list of eligible renewable energy equipment to be eligible in the program.
- Exceptions:
 - A Data Acquisition System does not need to be UL listed.
 - Reconditioned meters recertified to meet accuracy standards.

Electricity Production Meter Requirements

All PV projects must have production meters meeting the requirements of the SREC II or SMART incentive programs as applicable. Meeting the following characteristics as appropriate:

- Is readily accessible and easily understood by the System Owner;
- Records the PV project’s AC output as measured on the AC side of the PV project’s inverter; in the case of DC-only PV projects the meter should record the PV project output provided to the facility load; if a storage device is integral to the PV project, the meter should record the output from the storage device;
- Shall be separate from the utility billing meter and shall not interfere with utility billing or net-metering;
- Must be a standard utility “revenue quality” meter that conforms to applicable American National Standards Institute (ANSI) C-12 standards and shall be installed on the AC output side of the PV projects inverter; and
- Shall be available for periodic testing and/or re-calibration, if necessary.
- Must meet the accuracy and other requirements specified in the most recent version of the SREC II – Production Metering Requirements, and any other relevant requirements put forth by MassCEC for SREC reporting.
- If a PV system requires two revenue grade meters to establish the amount of AC energy generated, such as in the case of some systems incorporating energy storage, then two revenue grade meters shall be installed. Installer must provide training to the person(s) who will be reporting to the MassCEC PTS on how to derive the appropriate energy generation value from readings on the two meters.

Project Timeframe

In order to qualify for payment, applications must be submitted in the application portal, and a Loan Support Request must be submitted and approved by MassCEC prior to receiving authorization to interconnect by the utility for a solar project. Any installation work done prior to Loan Support Request approval is done at your own risk. By signing the Project Completion Form, all parties certify that the System Owner has incurred costs by the installer after the award date for an amount equal to or greater than the Program Loan.

Project Timeframe Continued

- All projects must be completed within one year of the Loan Support Qualification Award date. Awards for Projects that do not achieve Project Completion within one year will be automatically rescinded, unless an extension is requested, in writing, by the System Owner, and approved by MassCEC.
- MassCEC maintains sole discretion on the determination of which projects qualify for such extensions. It is the general policy of MassCEC to **not** grant extensions unless there are extenuating circumstances.
- For community shared solar projects, please contact the Mass Solar Loan team at solarloan@masscec.com

Minimum Energy Efficiency Requirement

Prior to disbursement of the Interest Rate Buy Down and Moderate Income Loan Support payment (if applicable) MassCEC expects each System Owner to fulfill one of the following requirements:

1. Have an energy audit performed on all applicable structures on their property;
2. Be able to demonstrate that an energy audit has been performed within the past five years on all applicable structures on their property; or
3. Be able to demonstrate that an energy audit has been scheduled for all applicable structures on their property.

MassCEC reserves the right to request verification of fulfilling one of the above requirement measures at any time.

Energy audits can be performed by a utility or Cape Light Compact efficiency program, a certified energy manager (CEM), a professional engineer (PE), or an experienced energy services professional. Audits or audit checklists completed by the homeowner are unacceptable.

By signing to the program Participant's Agreement, the Installer and the System Owner are certifying that an energy audit as defined above, or the equivalent of an energy audit (i.e. building permit for new building construction) has occurred.

MassCEC strongly recommends, but does not require, that System Owners perform any feasible measures recommended by such audits, as energy efficiency is generally the most cost-effective energy solution.

Energy Efficiency Exception for New or Recent Construction:

An energy efficiency audit is not required if a building was constructed in compliance with current energy codes (the 7th Edition of the Massachusetts State Building Code's Energy Conservation Requirements).

Residential one- and two-family, detached buildings that can be established to have been constructed based upon a building permit issued after October 6, 2008, are exempted from the minimum energy efficiency requirements. However, partial renovations or additions do not qualify for this exception. **Note:** While a new energy audit is not required if one was performed on the building within the last five years, homeowners are encouraged to have an additional energy audit. Energy efficiency incentives have been added to the Mass Save program over the last several years, for which customers may be eligible.

Minimum Energy Efficiency Requirement Continued

Energy Efficiency Resources

For System Owners residing in investor-owned utility territory, more information on energy efficiency audits can be found at MassSave: <http://www.masssave.com/>

For System Owners residing in municipal light plant territory, contact your local municipal light plant to learn about the options for a free residential energy audit.

Energy Production Reporting Requirements

Manual or Automated PTS Reporting. System Owners (or their designated PTS Representatives) are required to report the project's electrical output every month to MassCEC's Production Tracking System (PTS) located at www.masscec-pts.com or to applicable entity for any successor program to the SREC-II Program. The monthly system production may be reported manually or automatically through a Data Acquisition System (DAS). The PTS is used to help MassCEC monitor project performance and is a required component to participating in the SREC-II program.

Reporting to the PTS involves the following steps:

- Prior to Project Completion, the System Owner's aggregator or Solar Installer will apply for SREC qualification with the DOER via the online registration long form, indicating participation in the program in that application. Shortly after Project Completion paperwork is submitted in the Solar Loan Application Portal, MassCEC or the PTS Administrator will e-mail each System Owner (and their PTS Representative, if applicable) the project PTS login information including a username and password. Upon receipt of the PTS login information, System Owners or their designated PTS Representatives should log in and retain their assigned usernames and passwords in a safe place for later use.
- The System Owner, or designated PTS Representative, may go to the PTS website specified in the instructions and enter all first time data (e.g., the date the project started producing power, which must be after the utility authorization to interconnect).
- Each month, unless using Automated Reporting through a DAS, the System Owner, or designated PTS Representative, can manually enter a meter reading into the website.

Note: As part of the Mass Solar Loan Program, it is required that System Owners are RPS Class I eligible and that they are able to qualify under the Massachusetts RPS Solar Carve-Out II Program (SREC-II Program) or any successor program (such as the Solar Massachusetts Renewable Target (SMART) program. As such, monthly production reporting to the PTS will be required. Please note that any PV project greater than 10 kW will be required to report monthly production through a DAS for the purposes of selling SRECs. MassCEC, as designated by DOER, serves as the Independent Third-Party Meter Reader and verifies monthly production for projects generating SRECs. In addition, if you are adding solar capacity to an existing system, contact DOER to determine eligibility for the added capacity to generate SRECs. In some instances, additional capacity may need to be metered separately for purposes of selling SRECs. For more information about reporting requirement and the PTS, visit the [Production Tracking System Guide](#).