



Residential Ground-Source Heat Pump Program Program Manual

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The Massachusetts Clean Energy Center (“MassCEC”) provides rebates for the installation of high-efficiency ground-source heat pumps (“GSHP”) at residential properties through this Residential Ground-Source Heat Pump Program (“Residential GSHP Program” or “Program”).

This Residential GSHP Program Manual (the “Program Manual”) describes the process for applying for a rebate, the eligibility requirements, and the rebate levels. The capitalized terms used in the Program Documents (Program Manual, Participant’s Agreement, Application, and Award Letter), including key definitions and definitions pertaining to eligible technologies, are listed in Section 4 of the Program Manual. Program Documents and further program information are located at www.masscec.com/solicitations/residential-ground-source-heat-pumps.

1. How to Apply for a Rebate

Step 1-Submit Application for Rebate: Applications must be submitted to MassCEC prior to starting Project construction and construction may not commence until the Award Letter is received. The Application should be completed and submitted by the Primary Installer with the assistance and approval of the System Owner. Application documents must be emailed to GSHP@masscec.com. To expedite the review, please include “GSHP Application: *System Owner Surname*” in the subject line. Both the Primary Installer and System Owner should review all submitted information. A complete Application must include all items listed below:

1. Application – **Submitted as an Excel document**. Excel document available at www.masscec.com/solicitations/residential-ground-source-heat-pumps;
2. Participation Agreement signed by the System Owner and Primary Installer – PDF available at www.masscec.com/solicitations/residential-ground-source-heat-pumps;
3. Electric bill from Project Site clearly displaying the name of the utility, service address (not necessarily the mailing address) and the name of the current resident (if new construction, this deliverable may be submitted at project completion);
4. The summary report from the Manual J heat load calculation – see Section 3;
5. Heat pump AHRI rating certificate;
6. For horizontal loops only – Software design report showing all system inputs; and
7. For open loop systems only – **Estimation** of well water flow rate.



Step 2-Application Evaluation and Awarding: Upon receiving the Application, MassCEC program staff will send an email confirming the Application has been received. A second email will indicate:

- the Application is complete and has been accepted. The Award Letter and Project Completion Form will be attached to this email;
- the Application was incomplete and further information is needed; or
- the proposed Project is ineligible and has been rejected.

Applications will be evaluated to ensure that the Project will meet the Eligibility and Project Requirements stated in this Program Manual. MassCEC reserves the right to accept, assign inspections, or reject Applications based on completeness, qualitative criteria, and available funding; to make no Awards; to award less than the Applicant requests; and/or to award less than the maximum amount of funds potentially available through this Program.

MassCEC will notify Applicants of their Application status within four weeks of receipt of a complete Application barring extenuating circumstances. If the Application meets all requirements of this Program and funding remains available, MassCEC will issue an Award Letter to the System Owner via email which will provide details on the Award amount, and address to which party the payment will be sent. MassCEC will also attach a Project Completion Form, which will be submitted to MassCEC upon Project Completion.

Step 3-Complete Project: Project installation may commence only after receipt of the Award Letter. Projects must be completed within four (4) months of the Award Date on the Award Letter for Projects at existing buildings and within six (6) months for Projects at new construction buildings.

Upon Project Completion, the Primary Installer in cooperation with the System Owner will complete and submit the Project Completion Form and supporting documentation to MassCEC, including:

1. Project Completion Form;
 - Operating Coefficient of Performance (COP)
 - Operating Energy Efficiency Ratio (EER)
2. Completed GSHP manufacturer or distributor start-up sheet;
3. As-built site drawing that includes:
 - Well locations with GPS coordinates and distances from two points on the structure;
 - Distance between bore holes;
 - Well depth; and
 - Labelled supply and return lines.

This documentation should be submitted by email to GSHP@masscec.com with “GSHP Project Completion: *System Owner Surname*” in the subject line.

Step 4-Receive Rebate Payment: Rebates can be paid to the System Owner or Primary Installer, provided that the System Owner provides permission in the Application. Upon approval of the Project Completion Documentation, payment will be made to the designated Payee within four (4) weeks.



2. Eligibility & Requirements

Applicants, Primary Installers, and Projects must meet the following eligibility requirements.

2.1. Project Site Eligibility

Project Sites must be located in a service territory that contributes to the Renewable Energy Trust. This includes locations served by the following electric utilities: National Grid, NSTAR, Unitil, WMECO, or one of the following Municipal Lighting Plants that have opted to pay into the Renewable Energy Trust: Ashburnham, Holden, Holyoke, Russell or Templeton. Project Sites must be residential properties; new or existing single family homes or buildings with up to four units are eligible for this program. Project Sites must be occupied year-round.

Project installation may not commence until after the Application has been formally approved by MassCEC and the System Owner has received an Award Letter; Projects that have already commenced construction are not eligible for the rebate. The rebate may be combined with any other local, state or federal incentive and Applicants are encouraged to do so where possible. Grantees must declare this rebate if applying for a MassSave HEAT Loan.

2.2. Primary Installer Requirements

IGSHPA Accreditation

Prior to submitting Applications, Primary Installers participating in the Program must read and submit a signed copy of the Primary Installer Agreement (available at www.masscec.com/solicitations/residential-ground-source-heat-pumps) and provide MassCEC with a copy of their International Ground-Source Heat Pump Association (IGSHPA) accreditation. If not IGSHPA accredited, Primary Installers must provide references for three residential ground-source heat pump installations, including a phone number and email address for each reference, to receive conditional approval to participate in this program. Non-IGSHPA accredited Primary Installers must achieve IGSHPA accreditation within one year of submitting their first Application in order to continue participating in the Program.

Installation Inspections

MassCEC will send a third-party inspector to the site of each Primary Installer's first two Project Completions. MassCEC reserves the right to inspect subsequent Project Completions at random or due to suspected issues. If the inspector detects an issue with a heating system installation, MassCEC reserves the right to suspend current Applications and/or stop accepting Applications from that Primary Installer and/or its subcontractors. Inspections conducted in the Residential Ground-Source Heat Pump Pilot Program may count towards fulfilling this Program's inspection requirement.



2.3. Project Requirements

In order to be eligible for a rebate, Projects must meet the following requirements:

Equipment Requirements:

1. The GSHP must be Air-Conditioning, Heating, and Refrigeration Institute (AHRI) rated.
2. Eligible heat pumps must have an AHRI rated COP and EER equal to or greater than the following:

Product Type	EER	COP
Water-to-Air		
Closed Loop Water-to-Air	17.1	3.6
Open Loop Water-to-Air	21.1	4.1
Water-to-Water		
Closed Loop Water-to-Water	16.1	3.1
Open Loop Water-to-Water	20.1	3.5

- a. In the Application, EER and COP must be calculated using the following equations:
 - i. $EER = (full\ load\ EER + part\ load\ EER) / 2$
 - ii. $COP = (full\ load\ COP + part\ load\ COP) / 2$
- b. EER and COP figures for the above calculations must use the AHRI rated ground loop heat pump (GLHP) figures for closed loop systems and the AHRI rated ground water heat pump (GWHP) figures for open loop systems.
3. All GSHP systems must be designed to meet a minimum of 98% of the annual building heating load (kBtu for heating).
4. All GSHP systems must be designed with a peak heating capacity between 80% and 120% of peak heating load (kBtu/hr for heating), corresponding to the Manual J calculation.
5. All GSHP systems must be installed by a licensed contractor and/or plumber, installed in accordance with the National Electric Code and manufacturer's specifications, and must conform to all applicable municipal, state and federal codes, standards, regulation, and certifications, as well as program requirements.
6. All blower motors installed for a GSHP Project must be multi-speed or variable-speed, high-efficiency motors. Motors qualify as "energy-efficient" if they meet or exceed the efficiency levels listed in the National Electric Manufacturers Association's (NEMA's) MG1-1993 publication.
7. All systems must meet the following testing and rating for performance standards. Primary Installers/dealers must demonstrate that the proposed system meets one of the following Standards:
 - a. **ANSI/AHRI/ASHRAE/ISO Standard 13256-1** for water-to-air models (open and closed loop systems).



- b. **ANSI/AHRI/ASHRAE/ISO Standard 13256-2** water-to-water models (open and closed loop systems).

Well Requirements

- 8. Vertically bored closed-loop Projects must have a minimum of 150 feet per 12,000 BTU/hr of heating capacity. Capacity must be determined using the method used to calculate rebate values (Section 3).
- 9. **Closed-loop bore grouting must have a grout conductivity equal to or greater than anticipated earth conductivity of the drill site up to 1 BTU/hr-ft-°F.**
- 10. There must be at least 15 feet of separation between closed-loop bore holes.
- 11. All Projects must comply with the Commonwealth of Massachusetts Department of Environmental Protection (MassDEP) Bureau of Resource Protection Drinking Water Program, Guidelines For Ground Source Heat Pump Wells, and Underground Injection Control Program (December 2013) <http://www.mass.gov/eea/docs/dep/water/laws/a-thru-h/gshpguid.pdf>. In addition, all open-loop GSHP wells shall be installed in conformance with MassDEP's *Private Well Guidelines* - <http://www.mass.gov/eea/docs/dep/water/laws/i-thru-z/prwellgd.pdf> (as amended) or MassDEP's *Guidelines and Policies for Public Water Systems* - <http://www.mass.gov/eea/docs/dep/water/laws/a-thru-h/glintro.pdf> (as amended), whichever is applicable. All GSHP wells shall be installed in conformance with 313 CMR 3.00: *Registration of Well Drillers and Filing of Well Completion Reports* - <http://www.lawlib.state.ma.us/source/mass/cmr/cmrtxt/313CMR3.pdf>.

Equipment and Well Recommendations (Not Required)

- 12. All compressors should use two-stage, multi-speed or variable-speed drives.
- 13. Standing column wells should include a bleed circuit and drywell to maximize thermal efficiency based on available water production.

Open and Horizontal Loop Project Requirements

- 14. Open and horizontal loop Project rebate Applications may be reviewed by an independent third-party and will be required to submit the additional information listed below:
 - a. Open loop: method for determining pressure and flow rate; **or**
 - b. Horizontal loop: file from horizontal loop design software showing inputs and system design specs.

Heat Load Calculation Requirements:

- 15. Equipment must be sized according to ACCA Manual S (Second Edition).
- 16. Primary Installers must submit the summary page of the Manual J heat load calculation of the building's peak heat load at the 99% dry bulb heating design temperature for the nearest ACCA location. All listed Massachusetts locations and their heating design temperatures are provided below. Heating set temperatures may be between 68 and 72 degrees Fahrenheit.



Massachusetts Location	Heating Design Temperature in Degrees Fahrenheit
Boston	12
Clinton	2
East Falmouth	14
Fall River	9
Framingham	6
Gloucester	5
Greenfield	-2
Lawrence	0
Lowell	1
New Bedford	9
Pittsfield	-3
Springfield	0
Taunton	9
Weymouth	11
Worcester	5

Energy Efficiency Requirements:

17. All existing residences must have an energy efficiency audit completed within the past 24 months or plan to undertake an efficiency audit within six months. MassCEC highly recommends that priority recommendations from the audit are implemented. For qualifying locations, free residential energy audits can be scheduled through MassSave at www.masssave.com.

Monitoring

18. MassCEC strongly recommends all Projects incorporate system performance monitoring technology so that system performance can be monitored throughout the year.
19. MassCEC may choose to monitor a subset of systems installed under this Program. To be eligible for an Award under this Program, the System Owner must agree to allow metering and monitoring to be conducted on their Project for up to 24 months after installation, if requested. The System Owner will be required to submit utility and fossil fuel bills for two years prior to installation (for existing buildings) and for the duration of the performance monitoring. Monitoring equipment would be paid for and installed directly by contractors to MassCEC with no direct cost to the System Owner. Data would be collected and analyzed for program evaluation purposes and will not impact the Award received by the Grantee.



3. Rebate Structure

Funding for this fiscal year’s Program is available on a first-come, first-served basis until funds are exhausted or until June 30, 2015, whichever comes first. Additional funding may be added and the Program may be extended at MassCEC’s discretion. For new the Rebate will be calculated based on the AHRI heating capacity and system COP and is subject to rebate limits. **For projects retrofitting an existing GSHP system, the rebate will be based on percentage of Project Costs.**

New GSHP Installations

The COP of each heat pump must meet the program’s minimum COP requirement. Systems that exceed this minimum requirement are eligible for an Efficiency Adder. COP is calculated based on the following equation, where closed loop systems use the AHRI GLHP COP values and open loop systems use the AHRI GWHP COP values:

$$COP = \frac{COP_{full\ load} + COP_{part\ load}}{2}$$

COP for systems with multiple heat pumps will be a weighted average (weighted by heat pump size) of all proposed heat pump COPs. System capacity (“Capacity”) is defined as the AHRI full load heating capacity in kBtu/hr. Capacity for closed loop systems is based on the AHRI GLHP heating capacity while open loop capacity is based on the AHRI GWHP heating capacity.

Rebate Levels

Rebate levels are calculated per heating ton (12,000 BTU/hr) **for the first 60,000 BTU/hr of system heating capacity** using the following equation, where the Minimum COP, Base Rebate, and Efficiency Adder are defined in the table below. The Rebate is subject to the Maximum Rebate and Maximum Total Rebate defined in the table below:

$$\text{Rebate per heating ton} = \text{Base Rebate} + \text{Efficiency Adder} * (10 * (\text{Weighted Average COP} - \text{Min. COP}))$$

	Closed Loop		Open Loop	
	Water-to-Air	Water-to-Water	Water-to-Air	Water-to-Water
Minimum COP	3.6	3.1	4.1	3.5
Base Rebate (per 12,000 BTU/hr)	\$1,500	\$1,500	\$1,500	\$1,500
Efficiency Adder (per 0.1 COP above Minimum COP)	\$100	\$50	\$100	\$50
Maximum Rebate (per 12,000 BTU/hr)	\$2,500	\$2,000	\$2,500	\$2,000
Maximum Total Rebate (per system)	\$12,500	\$10,000	\$12,500	\$10,000



Retrofit GSHP Installations

For projects that are retrofitting a GSHP system, the rebate will be calculated as 20% of eligible Project Costs, capped at \$6,250. Eligible Project Costs are defined as costs that include replacement heat pump equipment, new loop piping, well modifications and any associated labor. Internal distribution system upgrades or modifications and miscellaneous costs are not considered eligible project costs. Full replacement of an existing GSHP installation may be considered a new GSHP installation.

For questions on the Residential GSHP Program, please visit www.masscec.com/solicitations/residential-ground-source-heat-pumps or email the Ground Source Heat Pump mailbox at GSHP@masscec.com.



4. Program Definitions

Applicant: The Applicant is the Primary Installer who prepares and submits the Application on behalf of the System Owner. The Primary Installer is responsible to work with the System Owner to prepare and submit the Application.

Applicant Parties: The Primary Installer and the System Owner, who together are responsible for providing the content of and signing the Application.

Application: Application submitted on behalf of System Owner by Primary Installer for an Award.

Award: Rebate funding awarded to a System Owner under the Residential GSHP Program based on a submitted Application that has been approved by MassCEC.

Coefficient of Performance (COP): The coefficient of performance of a heat pump is a ratio of heating provided to electrical energy consumed.

Energy Efficiency Ratio (EER): A measure of efficiency in the cooling mode that represents the ratio of total cooling capacity to electrical energy input.

Grantee: The System Owner once the Award is made.

Payee: The Payee is the designee to receive the rebate for a Project that has achieved Project Completion. A System Owner may choose to have its Award paid directly to the Primary Installer. Payment is made for the work performed on the Project and does not convey ownership rights to the installed system.

Primary Installer: The Primary Installer is the primary entity responsible for the installation of the Project. The Primary Installer is directly responsible for turnkey project management, submission of the Application, and installation work, although aspects of the installation work may be sub-contracted.

Program Documents: The Program Documents consist of the Program Manual, Application, Participation Agreement, and Award Letter.

Project: The GSHP system.

Project Site: The residential building being served by the GSHP Project.

Project Completion: The status of a Project at the stage when major GSHP components have been fully installed. Supplemental service or modifications do not change the Project Completion status.

Project Completion Date: The date when major GSHP components have been fully installed. Supplemental service or modifications do not change the original Project Completion Date.



System Owner: An individual who, together with the Primary Installer, applies to MassCEC for a Residential GSHP Program rebate. The System Owner is the owner of the Project that is supported by the Residential GSHP Program rebate.



5. GENERAL CONDITIONS

MassCEC reserves the right to reject any Applications or Projects.

5.1 Notice of Public Disclosure

5.1.1 General Statement

As a public entity, MassCEC is subject to Massachusetts' Public Records Law, codified at Chapter 66 of the Massachusetts General Laws. Grantee acknowledges and agrees that all Program Documents will be public records subject to disclosure. Thus, MassCEC urges Applicant Parties to carefully consider what documents, materials, data and other information is submitted to MassCEC in connection with an Application.

5.1.2 Procedures for Handling Documents Classified as "Sensitive Information"

An Applicant Party may assert a claim of confidentiality for part or all of the information submitted to MassCEC by following the instructions on the Notice of Confidentiality Cover Letter, which can be requested from MassCEC.

5.2 Contractual Requirements

The Participation Agreement defines the legal terms that will govern the Award and sets forth the respective roles and responsibilities of the parties specifically as they relate to the Project that is the subject of the Award. The Participation Agreement is designed to be executed upon submitting an Application. This contract language is non-negotiable.

No grant funds may be used to pay rebates for Projects that reach Project Completion prior to the program launch date or after the program deadline.

5.3 Waiver Authority

MassCEC reserves the right, at its sole discretion, to waive minor irregularities in submittal requirements, to request modifications of the Application, to accept or reject any or all Applications received, and/or to cancel all or part of this Program at any time prior to Awards.

5.4 Disclaimer

This Program Manual does not commit MassCEC to award any funds, pay any costs incurred in preparing an Application, or procure or contract for services or supplies. MassCEC reserves the right to accept or reject any or all Applications received, negotiate with all qualified Applicants, cancel or modify the Program Manual in part or in its entirety, or change the Application guidelines, when it is in its best interests.

5.5 Changes/Amendments to the Program Manual

The requirements listed herein are subject to change without notice to potential Applicant Parties. This Program Manual has been distributed electronically using MassCEC's website. It is the responsibility of Applicant Parties to check MassCEC's website for any addenda or modifications to the Program Manual to which they intend to respond. MassCEC, the Commonwealth of Massachusetts, and its subdivisions



accept no liability and will provide no accommodation to Applicants who submit an Application based on an out-of date Program Manual and/or related document.