

Regional Greenhouse Gas Initiative  
CO<sub>2</sub> Budget Trading Program



**Massachusetts  
Department of Environmental Protection**

**Massachusetts CO<sub>2</sub> Budget Trading Program**

**Offset Project Monitoring and Verification Report  
Instruction Packet**

**Building Sector Energy Efficiency**

Version 1.0

## Contents

1. Overview .....	3
1. Submission Instructions .....	3
2. Instructions for M&V Report Forms .....	4
Part 1. General Information Forms .....	5
Part 2. Category-Specific Information and Documentation Forms .....	7
Part 3. Independent Verification Form .....	12

## 1. Overview

To demonstrate the achievement of carbon dioxide (CO<sub>2</sub>)-equivalent (CO<sub>2</sub>e) emissions reductions from a building sector energy efficiency offset project that has received a consistency determination from the Massachusetts Department of Environmental Protection (MassDEP), a Project Sponsor must submit to MassDEP in accordance with these instructions a fully completed *Massachusetts Offset Project Monitoring and Verification Report – Building Sector Energy Efficiency Version 1.0 (M&V Report)*, consisting of the coversheet and all forms and related attachments. Following these instructions will ensure that the *M&V Report* contains all necessary information and is submitted properly.

The Project Sponsor should review the Massachusetts CO<sub>2</sub> Budget Trading Program regulations, 310 CMR 7.70(10), for information regarding offset projects and the award of CO<sub>2</sub> offset allowances. All offset project submittal materials and documents are available at <http://www.rggi.org/offsets>.

## 1. Submission Instructions

The Project Sponsor should submit the completed *M&V Report*, and all attachments, via the Regional Greenhouse Gas Initiative (RGGI) CO<sub>2</sub> Allowance Tracking System (COATS) at <http://www.rggi-coats.org> under the established general account identified in the Massachusetts *Consistency Application* for the project. For additional information, consult the RGGI COATS User's Guide, available at <http://www.rggi-coats.org>.

The *M&V Report* has three (3) parts, as described below. Each part comprises specified forms and required documentation. The *M&V Report* has been created as a Microsoft Word document with editable fields. Enter information directly in the fields provided or submit information or documentation as an attachment, as instructed. Include headers on all attachments indicating the form to which each is attached, and the offset project name, and offset project ID code. If attachments are being submitted as separate electronic documents, please include the form numbers in the file names of the documents.

When submitting documents electronically via RGGI COATS, it is not necessary to submit a scanned or paper hardcopy of the application forms. The Project Sponsor must retain the completed original copy of the *M&V Report* with the original signed documents. MassDEP reserves the right to request the original signed application documents at any time.

A completed hardcopy and/or CD of the *M&V Report* may also be mailed to: Climate Strategies Group, Massachusetts Department of Environmental Protection, Bureau of Waste Prevention, 6<sup>th</sup> Floor, One Winter Street, Boston, MA 02108-4747.

Questions about this form and how to submit it should be directed to [climate.strategies@state.ma.us](mailto:climate.strategies@state.ma.us) or 617-574-6815.

## **2. Instructions for M&V Report Forms**

The *M&V Report* consists of eight (8) forms divided into three (3) parts, as follows:

### **Part 1. General Information Forms**

- Form 1.1 – Coversheet
- Form 1.2 – General Information
- Form 1.3 – Attestations
- Form 1.4 – Project Sponsor Statement
- Form 1.5 – Disclosure of Greenhouse Gas Emissions Data Reporting

### **Part 2. Category-Specific Information and Documentation Forms**

- Form 2.1 – Demonstration of Conformance with M&V Plan
- Form 2.2 – Determination of Emissions Reduction

### **Part 3. Independent Verification Form**

- Form 3.1 – Independent Verifier Certification Statement and Report

The following instructions address each of the forms in numerical order. Note that some of the forms include embedded instructions.

## Part 1. General Information Forms

The five (5) forms in Part 1 of the *M&V Report* address general requirements applicable to building sector energy efficiency offset projects. Instructions for the Part 1 forms are provided below.

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### Form 1.1 Coversheet

Enter the requested information in the editable text fields in the form. Check the boxes to indicate that all forms are being submitted. For information about entering the Project Sponsor, offset project name and offset project ID code, and Regional Greenhouse Gas Initiative (RGGI) CO<sub>2</sub> Allowance Tracking System (COATS) account name and number, see instructions below for Form 1.2, General Information.

Submission of all forms, including the Coversheet, is required. If a form is not submitted, the *M&V Report* will not be considered complete for commencement of review by MassDEP.

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### Form 1.2 General Information

Enter the requested information in the editable text fields in the form. If a text field is not applicable or is unanswerable, enter "NA." Note the following:

Offset Project ID Code: Enter the offset project ID code. The offset project ID code is the alphanumeric code generated when the Project Sponsor creates a record of the offset project in the RGGI CO<sub>2</sub> Allowance Tracking System (COATS). See the RGGI COATS User's Guide for more information about creating an offset project record in RGGI COATS, available at <http://www.rggi-coats.org>.

Project Information: Enter project information. The name of the offset project should be the same name entered by the Project Sponsor when creating a project record in RGGI COATS. The project location entered should be the primary location of the project if the project consists of actions at multiple locations. The summary narrative of the project should indicate all locations where project actions occur or will occur.

Project Sponsor: Identify the Project Sponsor and provide his or her contact information. The Project Sponsor is the natural person who is the Authorized Account Representative for the RGGI COATS general account identified in the *Consistency Application*.

Project Sponsor Organization: Provide the full legal name of the organization the Project Sponsor represents, including any alternative names under which the organization also may be doing business (e.g., John Doe Enterprises, Inc., d/b/a JDE). If the Project Sponsor is representing himself or herself as an individual, enter "NA".

RGGI COATS General Account Name and Number: Enter the RGGI COATS general account name and number. The RGGI COATS general account identified in the *Consistency Application* is the RGGI COATS account into which any awarded CO<sub>2</sub> offset allowances related to the offset project will be transferred.

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### **Form 1.3      Attestations**

Sign and date the form. Submit the originally signed form via RGGI COATS as directed in the submittal instructions above. Note that the Project Sponsor must retain the completed original copy of the *M&V Report* and attachments with all original signed documents. MassDEP reserves the right to request the original signed application documents at any time.

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### **Form 1.4      Project Sponsor Statement**

Sign and date the form. Submit the originally signed form via RGGI COATS as directed in the submittal instructions above. Note that the Project Sponsor must retain the completed original copy of the *M&V Report* and attachments with all original signed documents. MassDEP reserves the right to request the original signed application documents at any time.

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### **Form 1.5      Disclosure of Greenhouse Gas Emissions Data Reporting**

Check the appropriate box in the form to indicate whether greenhouse gas emissions data related to the offset project have been or will be reported to any voluntary or mandatory programs, other than the Massachusetts CO<sub>2</sub> Budget Trading Program. For each program for which data have been or will be reported, provide the program name, the program type (voluntary or mandatory), program contact information (website or street address), the categories of data reported, the frequency of reporting, when the reporting began or will begin, and reporting status (prior, current, future). The Project Sponsor must disclose future reporting related to current commitments made to voluntary programs as well as future reporting mandated by current statutes, regulations, or judicial or administrative orders.

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## Part 2. Category-Specific Information and Documentation Forms

The two (2) forms in Part 2 of the *M&V Report* address category-specific requirements and documentation for building sector end-use energy efficiency offset projects.

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### Form 2.1 Demonstration of Conformance with M&V Plan

Provide documentation as an attachment to Form 2.1 to demonstrate conformance with the M&V Plan. Each attachment must include a header that indicates it is an attachment to Form 2.1 and includes the offset project name and offset project ID code. If attachments are being submitted as separate electronic documents, please include the form numbers in the file names of the documents. The following documentation must be provided, as applicable:

1. Documentation of Project Implementation. (*Note: Only applicable to first M&V Report for offset projects that were not completed at the time of Consistency Application submittal.*) Attach documentation that all energy conservation measures (ECMs) were implemented as specified in the *Consistency Application*. The following documentation must be provided, as applicable:

- a. Documentation of Equipment and Materials Specifications. Provide final post-installation equipment and materials specifications for the as-installed offset project. See the documentation specifications provided in the instructions for Form 2.1, section 6. of the *Consistency Application*.
- b. Building Plans and Project Technical Schematics. Provide final post-installation building plans and technical schematics representing the as-installed offset project. See the documentation specifications provided in the instructions for Form 2.1, section 7. b. and c. of the *Consistency Application*.
- c. Documentation of ECM Installation. Provide final post-installation documentation of ECM installation for the as-installed offset project. See the documentation specifications provided in the instructions for Form 2.2, section 1. of the *Consistency Application*.
- d. HVAC Installation Best Practice. If applicable, provide documentation confirming application of the design intent statements provided in the *Consistency Application*. See the documentation specifications provided in the instructions for Form 2.2, section 2. of the *Consistency Application*.

2. Quality Assurance/Quality Control (QA/QC) Report. Provide a QA/QC report documenting the activities conducted during the reporting period for QA/QC of project monitoring data and documentation in conformance with the QA/QC procedures specified in the M&V Plan and summarizing findings and any remedial actions taken.

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### Form 2.2 Determination of Emissions Reduction

Provide documentation of reporting period energy use and CO<sub>2</sub> emissions reductions where requested in Form 2.2 or as an attachment, as directed. Each attachment must include a header that indicates it is an attachment to Form 2.2 and includes the offset project name and

offset project ID code. If attachments are being submitted as separate electronic documents, please include the form numbers in the file names of the documents.

For each fuel type, enter baseline year and reporting year energy use, reporting year energy savings relative to baseline year energy use, and associated CO<sub>2</sub> emissions reductions (in pounds (lbs) CO<sub>2</sub>). Enter the following in the form:

- **Baseline Energy Use:** Enter total annual baseline energy use by fuel type for all isolated end-uses or building systems targeted by eligible ECMs in million British thermal units (MMBtu).
- **Reporting Period Energy Use:** Enter total annual reporting period energy use for all isolated end-uses or building systems targeted by eligible ECMs (MMBtu).
- **Energy Savings:** Enter total annual reporting period energy savings relative to the baseline year for all isolated end-uses or building systems targeted by eligible ECMs (MMBtu).
- **Emissions Reductions:** Enter total annual reporting period CO<sub>2</sub> emissions reductions due to total annual energy savings (in pounds (lbs) CO<sub>2</sub>, by applying the appropriate emissions and oxidation factors shown in the example table below.

An example table is provided below.

	<i>Natural Gas</i>	<i>Propane</i>	<i>Fuel Oil</i>	<i>Kerosene</i>	<i>Other</i>
baseline fuel use					
post-installation use					
annual energy savings					
emissions factor	116.98	139.04	161.27	159.41	
oxidation factor	0.995	0.995	0.99	0.99	
emissions reductions					

Attach documentation supporting calculations of reporting year energy use and CO<sub>2</sub> emissions reductions. Documentation must include the following:

1. **Documentation of Energy Monitoring Approach.** Provide narrative documentation of the energy monitoring procedures used to determine reporting period energy use, including demonstration of conformance with the appropriate guidelines and standards applicable to the building types included in the offset project, as follows:

- Commercial Buildings:
  - IPMVP Volume 1, Option B or D, as applicable
  - ASHRAE Guideline 14-2002
- Commercial Buildings, where the only change to the building as part of the energy efficiency project involves eligible ECMs included in the offset project:
  - IPMVP Volume 1, Option C
  - ASHRAE Guideline 14-2002
- New Commercial Buildings:
  - IPMVP Volume III, Option D
  - ASHRAE Guideline 14-2002
- Residential Buildings:
  - RESNET National Home Energy Rating Technical Guidelines, 2006

Documentation of conformance with the above-listed references must include the following:

- Clear identification of any data gaps and estimated or modeled data
- Documentation of all conditions that affect reporting period measurement (e.g., measurement process and equipment, weather, building occupancy, time of day)

Note, for projects *implementing similar measures in multiple residential buildings*, a representative sampling of buildings may be used to determine reporting period energy use, rather than measurement of each building. If sampling was employed during the reporting period, attach a copy of the sampling protocol used that provides demonstration at a 95 percent confidence interval that the reported value is within 10 percent of the true value. The sampling protocol and statistical method must include uncertainty and confidence interval calculations.

2. Reporting Year Energy Use Data. Provide documentation of reporting year energy use for each building included in the offset project, as outlined below:

- a. Commercial Buildings. For each building included in the offset project, provide total building fuel consumption data for the reporting year, by fuel type in million British thermal units (MMBtu). For each building, provide records of whole-building metered energy use by fuel type for the reporting year and records of metered energy use, if available, for individual end-uses or building systems targeted by eligible ECMs.
- b. Low-Rise Residential Buildings. For each building included in the offset project, provide total building fuel consumption data for the reporting year, by fuel type in million British thermal units (MMBtu). For each building, provide records of whole-building metered energy use by fuel type for the reporting year and records of metered energy use, if available, for individual end-uses or building systems targeted by eligible ECMs.

3. Isolation of Energy Use. Provide documentation of the isolation of energy use for each end-use or building system targeted by eligible ECMs as part of the offset project. Such isolation must ensure that each eligible ECM is isolated from all other eligible and non-eligible ECMs, as well as from overall building energy usage. There are two (2) options for isolation of energy use for end-uses or building systems targeted by eligible ECMs:

- Direct metering of end-use or building system affected by eligible ECMs (note that if the only change to the building as part of the energy efficiency project involves eligible ECMs included in the offset project, metering of whole-building energy use is sufficient under this approach)
- Use of energy simulation modeling to apportion building energy use to each end-use or building system affected by eligible ECMs

For both of these options, ECMs must be isolated from whole-building or whole-system energy use and also adjusted for areas where multiple ECMs interact with one another (required to avoid double-counting of ECM energy use) or where one (1) ECM utilizes more than one (1) eligible fuel type. Provide a narrative identifying the procedures used to isolate energy use for end-uses or building systems targeted by ECMs in conformance with the following guidelines and/or standard applicable to the building types included in the offset project, as follows:

- Commercial Buildings:
  - ASHRAE Guideline 14-2002
  - ASHRAE 90.1-2004, Section 11 and Appendix G
- Residential Buildings:
  - RESNET National Home Energy Rating Technical Guidelines, 2006

If energy simulation modeling is used to isolate energy use, provide the following documentation:

- Building simulation software input file, output file, and assumptions
- Copy of software manufacturer literature showing the modeling program name and version number
- Document demonstrating that software is BESTEST or RESNET certified, as applicable

4. Adjustments to Reporting Year Energy Use. Provide documentation of adjustments that were made to reporting year energy use to address operating and weather conditions. Provide documentation of measurement conditions during the reporting year that are unusual or that changed between the baseline period and reporting period, and adjustment factors that were applied to reporting year energy use to account for such measurement conditions. Adjustments may address issues such as weather, building occupancy, and changes in building use or function. Provide documentation of adjustments applied to reporting year energy usage in accordance with the following equation:

$$\text{Energy Usage (MMBtu)} = EU_{AECM} \times A_b$$

where:

- $EU_{AECM}$  = Annual energy use by fuel type (MMBtu) attributable to the application(s) targeted by the energy conservation measure(s).
- $A_b$  = An adjustment factor that corrects for changes to the system of interest between when the baseline data were collected and the reporting year.

Provide documentation demonstrating that the application of any adjustments are consistent with the following guidelines and/or standards:

- Commercial Buildings:
  - ASHRAE Guideline 14-2002
  - ASHRAE 90.1-2004, Section 11 and Appendix G
- Residential Buildings:
  - RESNET National Home Energy Rating Technical Guidelines, 2006

If any of the adjustments applied above required energy simulation modeling, provide the following documentation:

- Building simulation software input file, output file, and assumptions
- Copy of software manufacturer literature showing the modeling program name and version number
- Document demonstrating that software is BESTEST or RESNET certified, as applicable

5. Total Reporting Year Energy Use. Provide a spreadsheet documenting the calculation of total reporting year energy use. Reporting year energy usage is the sum of energy use, by combustion fuel type, for all the isolated end-uses or building systems that are affected by ECMs included in the offset project. Reporting year energy usage includes the application of any adjustment factors in accordance with section 3. above.

6. Reporting Year CO<sub>2</sub> Emissions. Provide a spreadsheet documenting the calculation of reporting year CO<sub>2</sub> emissions derived from energy use and associated fuel-specific emissions and oxidation factors. Use the following formula to calculate total (summed over all combustion fuel types) reporting year CO<sub>2</sub> emissions in pounds (lbs) of CO<sub>2</sub>. Calculate each combustion fuel's emissions contribution separately in accordance with the following equation:

$$Emissions (lbs CO_2) = \sum_{i=1}^n (EU_i \times EF_i \times OF_i)$$

where:

$EU_i$  = Reporting year energy use for fuel type  $i$  (MMBtu)

$EF_i$  = Emissions factor (lbs CO<sub>2</sub>/MMBtu) for fuel type  $i$  as shown below in Table 1

$OF_i$  = Oxidation factor for fuel type  $i$  as shown below in Table 1

**Table 1. Emissions and Oxidation Factors**

Fuel	Emissions Factor (lbs. CO <sub>2</sub> /MMBtu)	Oxidation Factor
Natural Gas	116.98	0.995
Propane	139.04	0.995
Distillate Fuel Oil	161.27	0.99
Kerosene	159.41	0.99

## Part 3. Independent Verification Form

The form in Part 3 of the *M&V Report* addresses requirements and documentation related to the independent verifier certification statement and report. Instructions for the form in Part 3 are provided below.

### Form 3.1 Independent Verifier Certification Statement and Report

An accredited independent verifier and licensed Professional Engineer (PE) must sign and date the form. Submit the originally signed form as part of the paper hardcopy *M&V Report*. Scan the signed and dated form for submission as part of the electronic version of the *M&V Report*. Provide the independent verifier's report as an attachment to Form 3.1. The verifier report must include a header that indicates it is an attachment to Form 3.1 and includes the offset project name and offset project ID code. If attachments are being submitted as separate electronic documents, please include the form numbers in the file names of the documents. Note that the Project Sponsor must retain the completed original copy of the *Consistency Application* and attachments, including the verifier's original signed documents and the licensed PE's original signed documents. MassDEP reserves the right to request the original signed and stamped documents at any time. The verifier report must document the following:

1. The verifier has reviewed the entire *M&V Report* and evaluated the contents of the report in relation to the applicable requirements of 310 CMR 7.70(10).
2. The verifier has evaluated the adequacy and validity of information supplied by the Project Sponsor to determine CO<sub>2</sub>-equivalent (CO<sub>2</sub>e) emissions reductions in accordance with 310 CMR 7.70(10)(e)4. and the documentation required in the *M&V Report*.
3. The verifier has evaluated the adequacy and consistency of methods used by the Project Sponsor to quantify, monitor, and verify CO<sub>2</sub>-equivalent (CO<sub>2</sub>e) emissions reductions in accordance with the applicable requirements of 310 CMR 7.70(10)(e)4. and the Monitoring and Verification Plan submitted as part of the *Consistency Application*.

The verifier report must include the following contents, in the order listed below:

- Cover page with report title and date
- Table of contents
- List of acronyms and abbreviations
- Executive summary
- Description of objective of report
- Identification of the client, including name, address, and other contact information
- Identification of the offset project
- Description of evaluation criteria (applicable regulatory provisions and documentation required in the *M&V Report*)
- Description of the review and evaluation process, including any site visits and interviews
- Identification of individuals performing the verification work, including the verification team leader and key personnel, and contact information for the team leader
- Description of the materials provided to the verifier by the Project Sponsor
- Evaluation conclusions and findings, including level of assurance provided