Test your webinar functionality

1. Test **Audio** and **Microphone** 
2. Test **Chatroom** functionality 
3. Please **mute** yourself when you call in to avoid interference 
4. Please note this webinar will be **recorded** 

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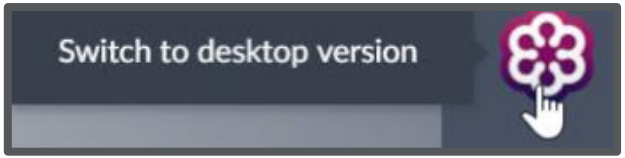
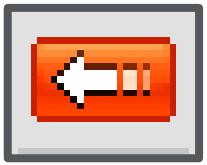
GoToTraining Tools

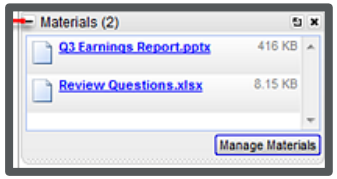
Use the Desktop App (If possible)



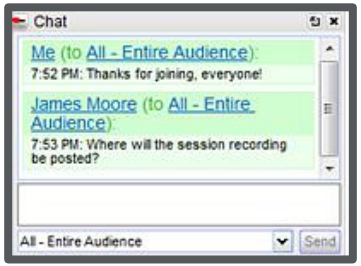
Expand the toolbar to see the full dashboard



Select the Materials button to access supplementary documents



Open up the Chat to chat with the Meeting Organizers



Save on Energy Retrofit Program

M&V Reporting Essentials and Samples

Tips, tools, and best practices for creating and submitting M&V Reports

October 7, 2020

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This webinar will demonstrate…

1. Review of M&V General Principles
2. Detail on M&V Plans and Reports
3. Pump VFD Basic M&V Reporting example
4. Lighting Controls Enhanced M&V Reporting example
5. Identifying commonly missed items on M&V Plans and Reports
6. What support is available

REMEMBER:

- Program deadlines
- Retrofit Projects must be Pre-Approved before December 31, 2020
- It is recommended that applications are submitted by the end of **October** to ensure sufficient time for pre-approval
- Retrofit Projects must be In-Service before December 31, 2021

Note: This webinar pertains to M&V requirements for projects in the Interim Framework. Reports shown in this webinar are sample cases only and not guaranteed accurate

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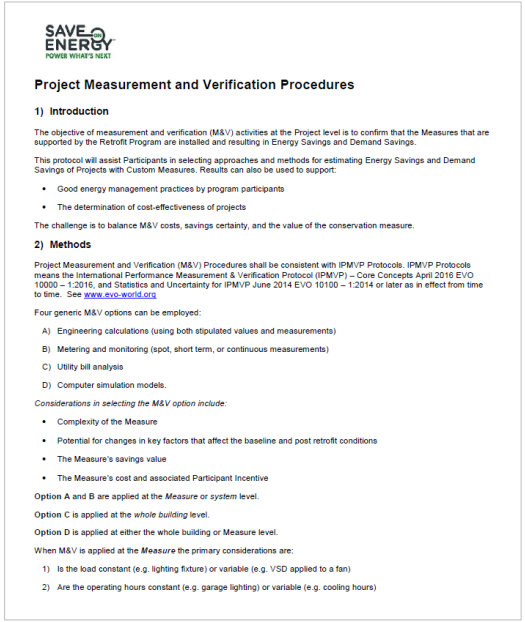
Support resources are available online

M&V Procedures



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Project Measurement and Verification Procedures

1) Introduction

The objective of measurement and verification (M&V) activities at the Project level is to confirm that the Measures that are supported by the Retrofit Program are installed and resulting in Energy Savings and Demand Savings.

This protocol will assist Participants in selecting approaches and methods for estimating Energy Savings and Demand Savings of Projects with Custom Measures. Results can also be used to support:

- Good energy management practices by program participants
- The determination of cost-effectiveness of projects

The challenge is to balance M&V costs, savings certainty, and the value of the conservation measure.

2) Methods

Project Measurement and Verification (M&V) Procedures shall be consistent with IPMVP Protocols. IPMVP Protocols means the International Performance Measurement & Verification Protocol (IPMVP) – Core Concepts April 2016 EVO 10000 – 1:2016, and Statistics and Uncertainty for IPMVP June 2014 EVO 10100 – 1:2014 or later as in effect from time to time. See www.evo-world.org

Four generic M&V options can be employed:

A) Engineering calculations (using both stipulated values and measurements)

B) Metering and monitoring (spot, short term, or continuous measurements)

C) Utility bill analysis

D) Computer simulation models.

Considerations in selecting the M&V option include:

- Complexity of the Measure
- Potential for changes in key factors that affect the baseline and post retrofit conditions
- The Measure's savings value
- The Measure's cost and associated Participant Incentive

Option A and **B** are applied at the *Measure* or *system* level.

Option C is applied at the *whole building* level.

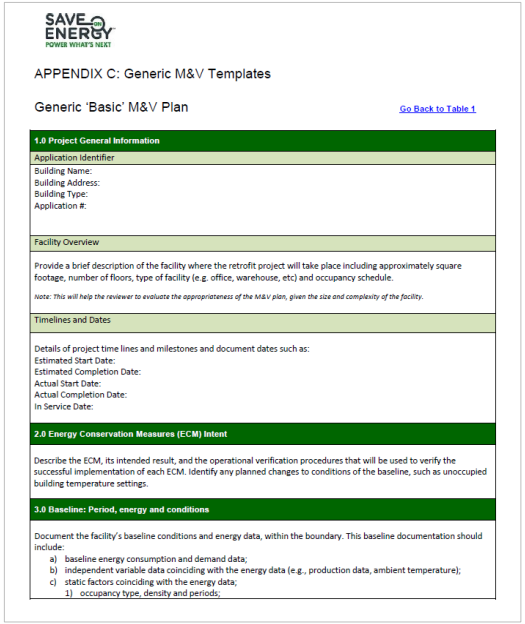
Option D is applied at either the whole building or Measure level.

When M&V is applied at the ***Measure*** the primary considerations are:

1) Is the load constant (e.g. lighting fixture) or variable (e.g. VSD applied to a fan)

2) Are the operating hours constant (e.g. garage lighting) or variable (e.g. cooling hours)

Plan Templates



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APPENDIX C: Generic M&V Templates

Generic 'Basic' M&V Plan

Go Back to Table 1

1.0 Project General Information
Application Identifier
Building Name: Building Address: Building Type: Application #:
Facility Overview
Provide a brief description of the facility where the retrofit project will take place including approximately square footage, number of floors, type of facility (e.g. office, warehouse, etc) and occupancy schedule. *Note: This will help the reviewer to evaluate the appropriateness of the M&V plan, given the size and complexity of the facility.*
Timelines and Dates
Details of project time lines and milestones and document dates such as: Estimated Start Date: Estimated Completion Date: Actual Start Date: Actual Completion Date: In Service Date:
2.0 Energy Conservation Measures (ECM) Intent
Describe the ECM, its intended result, and the operational verification procedures that will be used to verify the successful implementation of each ECM. Identify any planned changes to conditions of the baseline, such as unoccupied building temperature settings.
3.0 Baseline: Period, energy and conditions
Document the facility's baseline conditions and energy data, within the boundary. This baseline documentation should include: a) baseline energy consumption and demand data; b) independent variable data coinciding with the energy data (e.g., production data, ambient temperature); c) static factors coinciding with the energy data; 1) occupancy type, density and periods;

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Review of M&V General Principles

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Review of M&V Essentials and Sample M&V Plans Webinar

1. M&V Benefits and Where it Belongs in the Review Process
2. Difference between the M&V Plan and the M&V Report
3. Definition of Key Terms
4. Pump VFD Basic M&V Plan Samples
5. Lighting Controls Enhanced M&V Plan Samples

Webinar 1 provided general information on M&V and details on M&V planning, useful to understanding the process that comes before the Report

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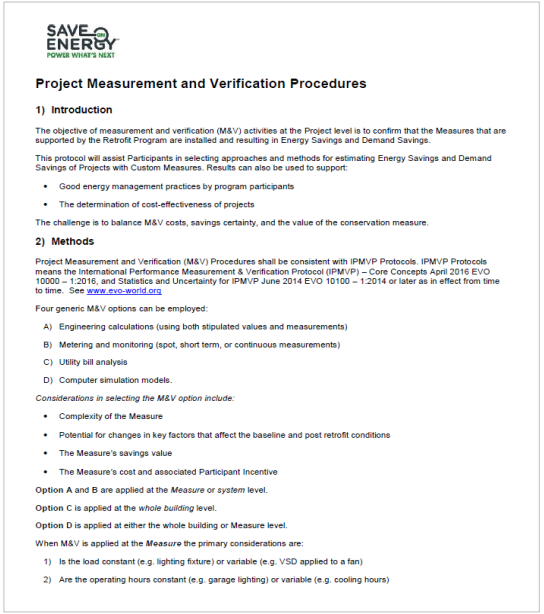
Requirements are outlined in the Retrofit Program M&V Procedures

Retrofit Program Project M&V Procedure is a document that lists the Measurement and Verification procedures for common Energy Conservation Measures (ECMs)

Procedures can be found under the Retrofit Application Documents



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M&V involves documenting project energy use

A ***Project M&V Plan*** describes measurements and data to be gathered, analysis methods employed, and verification activities that are conducted to evaluate the performance of a measure or a project (EVO, 2016, 35).

A ***Project M&V Report*** is provided at the end of the project and it documents the overall performance (measured and verified Energy and Demand Savings) of the measure and project using procedures outlined in the M&V Plan (EVO, 2016, 42).

Efficiency Valuation Organization (EVO). *Core Concepts International Performance Measurement and Verification Protocol*. EVO, 2016.

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The difference between Option A and Option B

Which option is chosen will almost always depend on the extent of measurement

IPMVP Option selected (select only one):

☐ Option A Retrofit Isolation: Key Parameter Measurement
■ Option B Retrofit Isolation: All Parameter Measurement
☐ Option C Whole Facility: Utility Bill Analysis
☐ Option D Calibrated Simulation

Select Option B if you are metering large amounts of data

Select Option A if you are not metering as much

Option C and D are almost never used in the Retrofit Program

This webinar focuses on M&V Reporting

An M&V Report is developed <u>after the completion of the project</u>

- The M&V Report must be completed and reviewed **before post-approval**
- The M&V Report must follow the **Approved M&V Plan**
  - Summarizing the Scope and intent of the project:
    - **Basic M&V –** Stipulated values must be accurately supported and calculated
    - **Enhanced M&V –** Baseline and Retrofit case consumptions must all be measured and summarized in the Report

Note: The M&V Report requires specific parameters to capture savings (refer to Retrofit Measurement and Verification Procedures)

Details on M&V Plans and M&V Reports

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General M&V Plans and M&V Reports Overview

Basic M&V ($10,000 - $40,000)

- ✓ Using engineering calculations (stipulated and rated values, measurements)
- ✓ Supporting/Reference Documents

  E.g., nameplate data, DLC listings
- ✓ Mandatory QA/QC

Enhanced M&V (>$40,000)

- ✓ Using metering and monitoring (spot, short term or continuous measurements) for pre-project and post-project
- ✓ Mandatory QA/QC

M&V Plan	M&V Report
Pre-Project Stage • The scope of the project • The proposal to measure and verify the savings **For Basic M&V** • What assumptions were made? • Which values were rated or stipulated? **For Enhanced M&V** • What parameters will be metered and how?	**Post-Project Stage** • Follows the approved M&V Plan • Must summarize the scope and intent of the Project **For Basic M&V** • The stipulated values must be adequately supported **For Enhanced M&V** • Base case variables and retrofit case variables must have all been measured per the M&V Plan and summarized

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M&V Reports follow a similar structure to M&V Plans after a project is completed

M&V Plan		M&V Report
The estimated savings	›	The actual savings
Proposed method of calculating the energy and demand savings	›	Actual and implemented method of calculating the energy and demand savings
Proposed method to account for routine and non-routine adjustments	›	Actual calculations implemented for routine and non-routine adjustments if applicable
Proposed method of metering (if applicable) with approved sample sizes	›	Comparing results from metered data

Prepare early for M&V Reporting to ensure a smooth post-project submission

1. Review project scope and outline of M&V Plan
2. Collect any outstanding information on base case (metered data if applicable, nameplate photos) before starting the retrofit
3. Collect the required retrofit data in the identified sampling period
4. Create an M&V Report and data set/calculations to submit with post-project documents
5. Prepare to include M&V Report with post-project submission for review

M&V Reporting is composed of two key items in the post-project submission

The **M&V Report** and the **post-project data** files are distinct documents that need to be submitted, and work complementary to each other

M&V Report

- Reiteration of project scope, facility information, and static factors
- Data analysis (including assumptions and calculations)
- Baseline adjustments (if required)
- Summary of the Energy and Demand Savings

Post-project data

Basic M&V

- Calculations/Engineering Worksheets

Enhanced M&V

- Metered data of retrofit (and of base case if not provided in pre-stage)

  Tip: Data assists with adjusting calculations (if required) or confirming savings

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M&V Report content summarizes project scope and how energy consumption was verified

If there is any **significant deviation** from the original M&V Plan that impacts savings, an **explanation must be provided**

Example: Metering could not be installed at the planned location and had to be installed elsewhere

The base case and retrofit case variables should have all been **measured and summarized** in the Report (if required)

For Basic M&V: Stipulated values should be adequately supported

The **methodologies and calculations** of obtaining the consumptions and subsequent Energy and Demand Savings must be outlined in the Report

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Enhanced M&V Reports require post-project data measurements to verify savings

- ✓ Remember to collect **data parameters** specified in the M&V Plan
- ✓ Ensure data collected is for the correct **(a)** equipment, **(b)** sample size, and **(c)** sampling period; per M&V Plan
  - ✓ Make sure to collect any outstanding data needed for the baseline prior to commencing the retrofit
  - ✓ Once retrofit is complete, collect metered data for the retrofit case.
  - ✓ Check M&V Procedures for specific time requirements (e.g., lighting requires 100 burn in hours before metering can be collected)

DATA TIPS…

- ✓ Provide complete measurement periods, representative of normal operation with no data gaps
- ✓ Label columns with units measured and label rows with appropriate time stamps
- ✓ Clearly label different data sets
- ✓ Reference assumptions and equations used in data analysis

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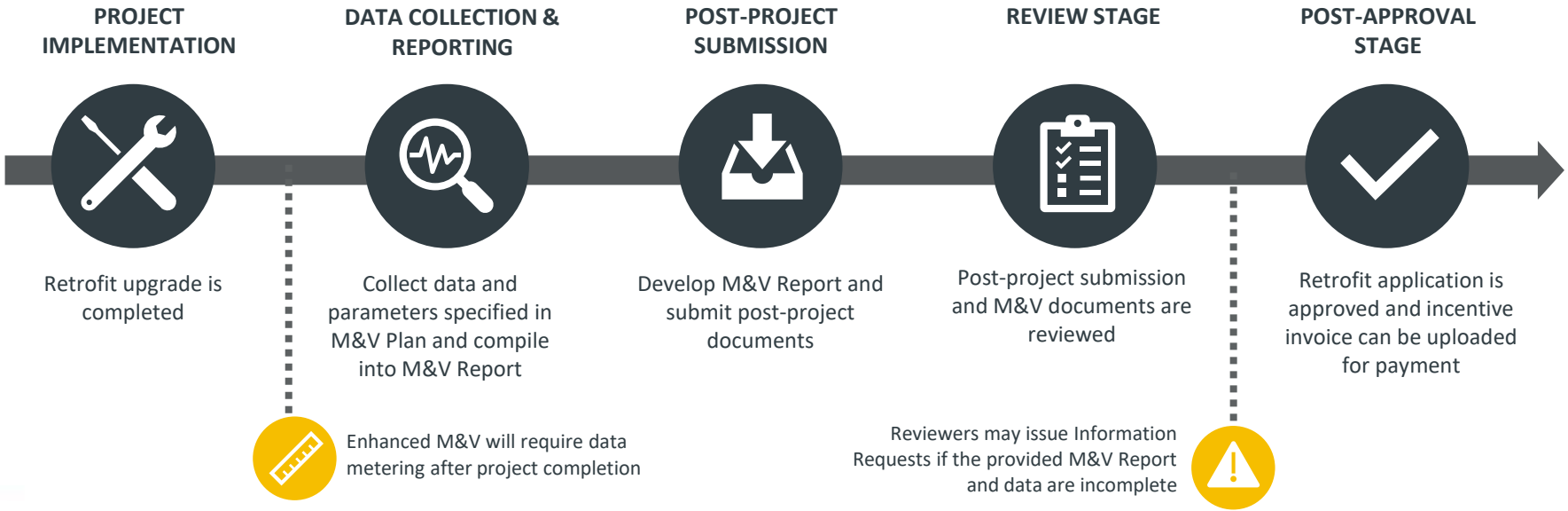
M&V Reports and post-project data are submitted in the post-project stage



Provide complete and accurate M&V documents to achieve faster post-approval

- ✓ Upload the completed **M&V Report** at the time of submission with equipment invoice, proof of payment, and disposal documentation (if applicable)
- ✓ Submit **metered data** with M&V Report
- ✓ Include **QA/QC photos** of the retrofitted equipment
- ✓ Include **calculations** (mandatory for Basic M&V)
- ✓ Include any applicable pre-project requests deferred to the post-submission (e.g., missing base case photos)

TIPS:

- Reach out to Save on Energy representatives for any questions regarding metering/post-approval timelines
- Refer to our post-project checklist or webinar for non-M&V post-submission guidance

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What your contractors need to know when starting the work for a project

Take any **missing base case photos** that are required
Follow the photo **requirements** for retrofit equipment

Follow the **Metering Parameters** and **Duration Approved** in the M&V Plan

- E.g., Fixture vs. Panel Readings
- Keep in mind certain ECMs will have specific requirements on when to meter the retrofit (lighting, 100 burn in hours)

When billing the customer, ensure the invoice includes an itemized list of equipment purchased

Knowledge check

- What should an M&V Report summarize?

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Knowledge check

- Correct answers:
  a) Base case and retrofit case variables
  b) Substantial variations from the M&V plan, if any
  c) Methods and calculations pertaining to savings amounts being claimed

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Pump VFD Basic M&V Reporting Samples

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Reminder: Information collected during M&V Plan

The approved M&V Plan outlines how savings will be quantified

Options to quantify the savings include:

1. Custom Calculations
2. Variable Speed Drive on Pump Engineering Worksheet

Motor and pump information collected from nameplate photos

Operating hours and flow profile estimated for the baseline and retrofit periods

Note: If the Reviewer requested additional measurements, this would need to be satisfied with resultant data incorporated in the savings analysis.

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Ensure changes during project implementation are accounted for in the calculations

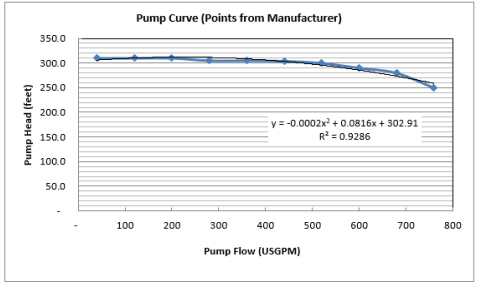
Changes must be reflected in the following:

CUSTOM CALCULATIONS

- **(a)** Operation
- **(b)** Equipment Specifications

VSD – PUMP ENGINEERING WORKSHEET

- **(a)** Pump curves – if unavailable the worksheet has a generic one
- **(b)** Pump and motor information
  - E.g., speed, horsepower, design head, static head
- **(c)** Operating profile



%Flow	Pump Head (ft)	Corresponding Pump Efficiency (%)	Operating Profile (%)
0-10%	310.0	58.0	0.0
10-20%	310.0	60.0	0.0
20-30%	310.0	60.0	0.0
30-40%	305.0	65.0	0.0
40-50%	305.0	65.0	0.0
50-60%	304.0	74.0	0.0
60-70%	300.0	75.0	20.0
70-80%	290.0	80.0	50.0
80-90%	280.0	81.0	20.0
90-100%	250.0	78.0	10.0
Design	**250.0**	**94**	**100**
Operating Profile sum equals 100%:			YES

Note: It is recommended that the Engineering Worksheet is used for ease of approval as it has been tested and approved.

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Overview of the Basic M&V Report

1. Project General Information
2. Energy Conservation Measures intent
3. Baseline: Period, energy, and conditions
4. Reporting: Period, Energy and Conditions
5. Basis for Adjustment
6. Analysis Procedure
7. Cost Savings
8. Facility Operating Staff Input

What needs the most attention: Energy Conservation Measures intent, Baseline, Analysis (including savings) and Basis for Adjustment in cases where adjustments are required.

Efficiency Valuation Organization (EVO). *Core Concepts International Performance Measurement and Verification Protocol*. EVO, 2016, Section 7.4 (page 50) provides an overview of this procedure

Before submitting the M&V Report, check that required information has been collected

- ✓ **Refer to the M&V Plan** for specific guidance around the information that was **to be provided** with the post-project submission
- ✓ Provide **engineering calculations** (or Engineering worksheet) to assist technical reviewer in verifying the energy savings
  - ✓ **Reference your assumptions** on motor efficiency, power factors and load factors (same as the M&V Plan)
- ✓ Collect retrofit **photos for QA/QC**
- ✓ Note: Metered data **may be needed for Basic M&V depending on the project**

Common Pump M&V Report Information Requests

- **Missing** QA/QC photos (base case or retrofit equipment, this is related to M&V as it is mandatory for large projects)
- **Confirmation:** Operating profile did not change from pre-approved scope
- **Regarding Custom Calculations…**
  - ? Missing references or explanations for assumed motor information/data
  - ? Missing reference for engineering equations and calculations
  - ? Reasoning or explanation for unusual flow profiles or operating hours based on the facility use
  - ? Confirmation of data representing year-round operations

Knowledge check

- Which of the following are components of a Basic M&V Report?

Knowledge check

- Correct answers:
  a) Project general information
  b) Baseline: Period, energy and conditions
  c) Reporting: Period, energy and conditions

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Lighting Controls Enhanced M&V Report Samples

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Reminder of information collected in Lighting Controls Enhanced M&V Plan

Review the Approved Enhanced M&V Plan
Look for required information that was committed to being provided in the post-project M&V Report

Were the Requirements Fulfilled?
Double-check that metering requirements were fulfilled, and that sampling size and period are captured

If any changes in project scope or report procedures occur, document this in the report

- **Update energy consumptions** based on metered data
- **Routine/Non-Routine Adjustments to Collected Data**

  E.g., Unscheduled shut down periods, changes to control strategy of lights, dimming levels
- **Minor Changes to Project**

  E.g., Model number of equipment purchased and installed

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Overview of Enhanced M&V Report

Some content is repeated from the M&V Plan

- Project General Information
- Energy Conservation Measures intent
- Reporting Period
- Measurement Results
- Basis for Adjustment
- Analysis Procedure
- Energy Prices
- Energy Savings
- Input from Operating Staff
- Accuracy and Uncertainty for M&V
- Quality Assurance

LEGEND

- Included in Basic M&V
- Specific to Enhanced M&V
- May require changes from Plan to Report

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Planning and metering required to complete Enhanced M&V for lighting control projects

- **Verify/Update inventory** of lamp/ballast fixture type defined in scope during the pre-project phase
- **Meter the operating hours** (before and after installation) to verify the reduced operating hours

  If required, metering of fixture wattages as outlined in the approved M&V Plan.
  For more information, go to M&V Procedures under Application Documents
- **Complete the savings calculations** and submit with the M&V Report

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Avoid the common mistakes found in lighting control application submissions

- ✓ Not updating the scope if it changes from pre-project phase (i.e., types of lamps, location of lamps)
- ✓ Missing metered data for the specified baseline as agreed upon in the pre-stage
- ✓ Not logging operating hours
- ✓ Not including QA/QC photos of the installed lighting controls measure during post-submission and not providing missing nameplate photos of the base case
- ✓ Not including the M&V Report during the post-submission

Commonly missed items in the M&V Report that Technical Reviewers will request

1 How was the retrofit measure verified?

Tip: Be specific in the M&V Report on what is measured and how it is used in the methodology to verify energy savings.

2 Missing baseline adjustments due to change in operating conditions

Tip: Be specific in the M&V Report on the operating conditions in the post-project phase and the necessary baseline adjustments required.

Knowledge check

- What is the threshold that determines if Enhanced M&V is required for a project?

Knowledge check

- Correct answer:

  b) Greater than $40,000

Conclusion

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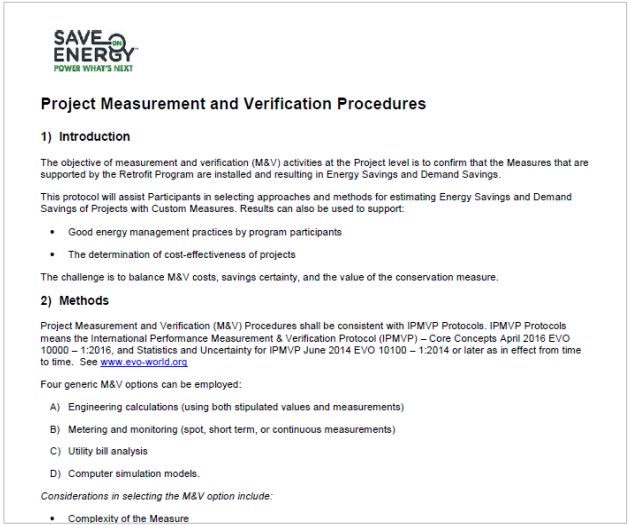
Understanding M&V can expand your incentive options and help you meet deadlines

- ✓ M&V is a core activity in energy efficiency
- ✓ Pump VFD Basic M&V Report overview
- ✓ Lighting Controls Enhanced M&V Report overview
- ✓ Sample M&V documents are available
- ✓ Guide for M&V Procedures

M&V Procedures



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C) Utility bill analysis

D) Computer simulation models.

Considerations in selecting the M&V option include:

- Complexity of the Measure

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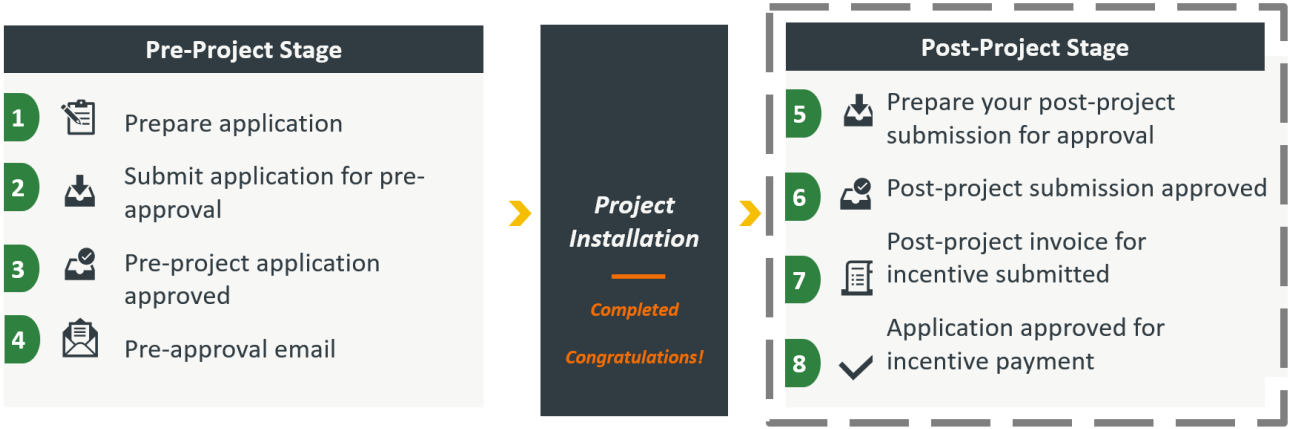
M&V Report Process: Next Steps

1. M&V Report is submitted
2. M&V Report will be reviewed along with the application
3. The application will receive post-approval if all documents are in order



Reminder of Retrofit program timelines

To be eligible for a project incentive through the Retrofit program, applications must **receive pre-approval by December 31, 2020**, and projects must be **completed by December 31, 2021**

- Applies only to projects submitted during the Interim Framework

Achieving pre-approval includes a technical review process, which typically takes 2 – 8 weeks to complete, depending on the size and complexity of the project and completeness of the project application. **It is recommended that applications are submitted by the end of October to ensure there is sufficient time to obtain pre-approval**.

Applicant representatives are encouraged to help applicants use fast-track processes, where available, for certain projects in the prescriptive track with incentives less than $6,000, as pre-approval can occur in one or two days

- Contact your Save on Energy representative to see if your project is eligible for the fast-track process

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2021-2024 CDM Framework

- The IESO has received a Ministerial directive to implement a **new 2021-2024 Conservation and Demand Management (CDM) framework** to **launch the week of January 4, 2021**

- The new framework focuses on cost-effectively meeting the needs of Ontario's electricity system, including achievement of provincial peak demand reductions, as well as targeted approaches to address regional and/or local electricity system needs

- CDM programs under the new framework continue to target those who need them the most, including commercial, industrial, institutional, on-reserve First Nations and low-income consumers

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Need Retrofit Assistance?

Contact

Retrofit Support Services

Support Line 1-844-303-5542
8:30am – 5:00pm Monday - Friday

Email retrofit@ieso.ca

Tip for reporting issues:
Describe the issue thoroughly and illustrate with screenshots

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Thank you for participating!

Questions or Comments?

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