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MEASUREMENT AND VERIFICATION FOR ENERGY-EFFICIENT COMMUNITY BUILDINGS

INTRODUCTION

Making community buildings more energy efficient is an essential part of municipal efforts to reduce carbon emissions and operational costs while also improving occupant comfort. To ensure that energy-saving measures and building operations are achieving their intended energy-efficiency targets, well-executed measurement and verification (M&V) is crucial. M&V methods and processes are used to evaluate energy savings from retrofits in a defined, disciplined and transparent way. This guide introduces the M&V process, explains the benefits of a robust M&V plan and provides additional M&V resources.

UNDERSTANDING THE MEASUREMENT AND VERIFICATION PROCESS

The M&V process is a systematic approach used to evaluate and validate energy savings achieved by implementing energy-efficiency measures in buildings. Following best practices set out in standards such as the [International Performance Measurement and Verification Protocol \(IPMVP\)](#) can help ensure consistency and credibility in results.



Some key steps of the M&V process include:

- 1 Baseline data collection:** Collect current (pre-retrofit) energy-consumption data using direct measurement, modelling, estimation or other methods to understand energy use within targeted community buildings. Where possible, invest in reliable metering equipment and data-logging systems to capture accurate data.
- 2 Post-implementation data collection:** Gather energy-consumption data after energy-saving measures have been implemented.
- 3 Normalization and adjustments:** Account for external factors that could influence energy consumption, such as weather changes or occupancy fluctuations.
- 4 Performance analysis:** Compare post-implementation data with baseline data to determine the actual energy savings achieved.
- 5 Verification report:** Present findings in a comprehensive report to communicate the effectiveness of the energy-efficiency measures. Implement continuous monitoring and periodic reporting to track performance over time and promptly address any discrepancies or problems.

Some challenges that can occur as part of the M&V process include:

- + Data availability and quality:** Limited access to accurate and reliable energy use or savings data due to insufficient meters, sensors, software or records.
- + Data analysis and interpretation:** Challenges in isolating the impact of specific retrofits or demand-reduction actions from other factors affecting energy usage.
- + Data management and reporting:** Difficulty in managing and storing large, complex data sets. A lack of necessary skills or appropriate tools can also affect data handling.
- + Cost and time constraints:** Insufficient budget or time allocated for a comprehensive M&V process.

Meticulous planning, energy management expertise and adaptability are required to overcome these challenges and ensure accurate and credible assessments of energy savings and building performance.

MEASUREMENT AND VERIFICATION PLAN

An M&V plan outlines how the energy savings analysis will be conducted. By documenting the measurement process before retrofits take place, savings can be measured and analyzed objectively during the later stages of the M&V process.

Note: An M&V plan is essential to access FCM's **Community Building Retrofit (CBR) funding streams**, which support CBR projects that have a robust measurement system to demonstrate expected benefits, particularly quantifiable environmental benefits such as GHG emissions reduction.

The benefits of implementing an M&V plan include:

- + **Early detection of performance issues:** A well-executed M&V plan can quickly identify any underperformance or deviations from expected energy savings, allowing building owners or operators to take corrective actions promptly.
- + **Data-driven decision-making:** An M&V plan provides reliable data on energy performance, enabling building managers to make informed decisions.

- + **Validation for investments:** Accurate M&V results provide elected officials, building managers and other stakeholders with confidence that energy-efficiency investments are paying off.
- + **Continuous improvement:** Regular M&V assessments allow for ongoing optimization, leading to continuous improvements in building performance.

CONCLUSION

A well-executed M&V process substantiates the business case to undertake retrofits, validates investments and is crucial for assessing the success of energy-efficiency projects. When designed and implemented correctly, the M&V process can appropriately allocate risks, reduce the uncertainty of savings estimates, assess cost and energy savings accurately and potentially identify operations and maintenance issues. By following M&V best practices, stakeholders can achieve concrete, measurable energy-efficiency outcomes, leading to community buildings that are more sustainable.



RESOURCES FOR MEASUREMENT AND VERIFICATION

+ **International Performance Measurement and Verification Protocol (IPMVP)**: The International Performance Measurement and Verification Protocol (IPMVP) defines standard terms and suggests best practices for quantifying the results of energy-efficiency investments and of increasing investment in energy and water efficiency, demand management and renewable energy projects.

+ **Measurement and verification courses from the Canadian Institute for Energy Training (CIET)**: CIET's measurement and verification courses aim to enhance the knowledge and skills of energy professionals by focusing on the various aspects of measuring and verifying energy savings. Courses include:

- Measurement and Verification Essentials
- Certified Measurement and Verification Professional (CMVP)
- Advanced Measurement and Verification



+ **Guide to Measurement and Verification of Heat Pump Retrofits**: This guide is intended to help building owners, condominium board members and property managers ensure that heat pump installations are generating the expected energy savings, thus increasing heat pump adoption and encouraging electrification.

+ **Project Measurement and Verification Procedures**: This document guides municipal energy managers in selecting approaches and methods to estimate energy and demand savings for projects. It also includes templates of basic and enhanced M&V plans.