

# Weatherization & Intergovernmental Program

## WHAT IS EM&V?

Evaluation, Measurement and Verification (EM&V) is the collection of methods and processes used to assess the performance of energy efficiency activities so that planned results can be achieved with greater certainty and future activities can be more effective.

### Objective of EM&V

The main objective of an EM&V process is to assess the performance of an energy efficiency program or project and to measure the energy or demand savings and verify if the program is generating the expected level of savings. EM&V data can inform recommendations for improvements in program performance. Having a clear understanding and description of how the program is expected to deliver results is critical to an effective EM&V process. The distinct components of EM&V provide the framework to ensure a successful program implementation and are discussed below in that context.

The EM&V process is analogous to the evaluation of business or employee performance. For example, did the company meet its profit or growth objective? What can be done to improve performance? In the energy efficiency market, the EM&V process answers the question of whether the investments in energy efficiency achieved the objectives expected or required.

### Terminology

The following terminology requires clarification because it is used throughout the energy efficiency and utility industry:

- **Program:** Closely related delivery activities targeted to a class of energy user (e.g., Residential, Low-Income, Commercial, Industrial, Government)
  - Residential Audit and Weatherization programs offer residential customers a home audit and weatherization measures
  - Municipal Energy Efficiency programs offer participants specific technical and decision-making assistance as well as a rebate based on estimates of annual energy savings for projects that involve numerous energy efficiency upgrades
- **Measure:** Specific energy efficiency activities or equipment that are identified in the program design. For example, the Residential Audit and Weatherization programs will install, where appropriate, measures such as attic, wall, or duct insulation, setback thermostats, or low flow showerheads
- **Project:** Specific location in which program measures are installed

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As an example, a municipality could both upgrade the lighting in its own facilities and weatherize homes in designated neighborhoods. One **program** would install lighting **measures** in its facilities through a series of **projects**, and a residential weatherization **program** would install air sealing and duct sealing **measures** at individual homes, each of which considered a **project**.

### Methods and Processes of EM&V

**Measurement** activities include the data collection, monitoring and analysis necessary to document the energy and demand savings and expected costs of the energy efficiency project. Initial measurements should be estimated during the program planning stages and reviewed at regular intervals after installation is completed to determine if the program is generating the expected levels of energy savings. Measurement activities involve recording or estimating:

- Equipment specifications for both existing equipment (the baseline) and the new energy efficient equipment installed
- Actual energy usage of the baseline equipment and the installed energy efficient measure(s)
- Total cost of the new equipment being installed, including material, labor, shipping and taxes and any other costs incurred
- Additional data that may also be needed to document the utilization of the equipment in order to reasonably estimate savings
- Other factors affecting the measure's energy usage such as weather for temperature sensitive uses

For example, a retrofit of lighting fixtures (and no other changes) would entail recording the hours the fixtures are used as well as the measured change in wattage in order to calculate savings.

**Verification** activities occur after a program has been in place for a period of time, typically a year, and seek to validate the savings expected using the data collected from the measurement activities documented for the program. This includes confirmation that the measures are properly installed and functioning as expected.

**Evaluation** refers to a review of the entire program including the implementation process, program cost effectiveness, and the attainment of its stated objective and savings.

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Governmental organizations should keep mind that the selected EM&V approach should be cost effective. Much of the EM&V literature describes a formal process developed for the regulated utility energy efficiency programs, and while that literature can guide governmental organizations in their EM&V efforts, it is important to keep in mind that the level of effort to perform EM&V should be a function of the investment in the project being evaluated.

The following websites offer guidance for governmental organizations and provide more detailed information for those projects requiring more sophisticated EM&V plans. These websites provide guidelines developed by industry subject matter experts on M&V measurement options and standards defining specific processes, as well as additional information that would add value to the EM&V process.

[http://www1.eere.energy.gov/wip/pdfs/eecbg\\_evaluation\\_guidelines\\_10\\_017.pdf](http://www1.eere.energy.gov/wip/pdfs/eecbg_evaluation_guidelines_10_017.pdf)

[http://www.calmac.org/events/EvaluatorsProtocols\\_Final\\_AdoptedviaRuling\\_06-19-2006.pdf](http://www.calmac.org/events/EvaluatorsProtocols_Final_AdoptedviaRuling_06-19-2006.pdf)

Another tool used in the energy efficiency industry to manage energy efficiency initiatives is the development of an Energy Performance Management (EPM)<sup>1</sup> Plan which establishes energy management goals across an organization and the strategy for implementing those goals. This differs from the EM&V process, which evaluates the effectiveness of the process and energy efficiency measures actually installed in the organization. While the EPM planning process includes many of the same tasks performed in the EM&V process, the EPM plan helps define a holistic approach to the way an organization manages its facilities by collecting data, establishing an energy usage baseline, comparing building performance, prioritizing facilities for action and helps support the EM&V process by monitoring the long-term energy performance of buildings.

### **Energy Savings**

Energy savings reflect the difference in energy usage (gas or electric) between the existing equipment or product and the energy efficient measure(s) installed in its place, adjusting for any significant changes that would impact the savings estimate.

Suppose a program designed to replace a major HVAC system performed M&V that included direct metering of the existing HVAC unit during the cooling period, and subsequent metering of its replacement in the next year. The direct metering of the old and new unit provides excellent data, but without taking into consideration changes in weather between the two

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<sup>1</sup>Also referred to as Energy Master Planning in the industry.

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years, the savings estimate will be biased. If the weather in the year the new unit was installed was warmer than the year before, without adjusting for weather the savings estimate would be understated. If, in addition to replacing the HVAC system, the structure was enlarged and the HVAC size remained the same, one would also have to compensate for the increase in building size to get a more accurate estimate of energy savings attributable to the more efficient HVAC system.

Energy savings attributed to the installation of energy efficiency measures can be determined using different methods that vary in the level of certainty of the resulting energy saving estimate. There are numerous measurement tools available to assist in the calculation of energy savings, including energy savings calculators designed to work with standard, frequently used measures; technical resource guidelines that present energy savings for newer technologies or more complex commercial and industrial equipment or measures; and even more rigorous equipment monitoring processes that include monitoring the baseline equipment before it is replaced.

### *Who is TAP?*

*The Department of Energy's (DOE) Technical Assistance Program (TAP) supports state, local and Tribal communities in both the Energy Efficiency and Conservation Block Grant Program (EECBG) and the State Energy Program (SEP). TAP provides direct technical assistance, aggregated products like workshops and webcasts, tools and resources needed to implement successful and sustainable clean energy programs.*