

Disclaimer:

The State Energy Office of North Carolina would like to thank the National Energy Services Coalition for allowing the use of this resource for USI participants. A great deal of work went into compiling this information into a single location. As you go through this program and/or have additional questions, please contact Reid Conway reid.conway@ncdenr.gov.



GESPC-U Lesson #117:

Measurement and Verification Plan – Proving the Savings

FYI: Terms and Acronyms can be found on the last page

Summary: Considerations of how to prove the anticipated or projected or calculated savings or avoidance of cost are being achieved are explored as we delve into the concepts and knowledge presenting in the IGA's M&V Plan.

It's time to turn our attention to the Preliminary Measurement and Verification Plan or M&V Plan. The IGA Schedules and Exhibits call for the Investment Grade Audit to include a Preliminary M&V plan. The plan is labeled preliminary simply because the IGA has yet to be reviewed and accepted, leaving a chance that the project measures could change. But for all other intents and purposes, this will become the project M&V plan.

Here's a simple principle to consider: If you can't prove that the projected savings are being achieved from an energy or water saving measure, then the measure should not be included in a GESEPC project.

Within the consideration of every energy and water conservation measure there should be the concept, knowledge, capability and know-how to prove that the anticipated or calculated savings or avoidance of cost, are being achieved. Within what is labeled the M&V Plan should be a description for each proposed measure as to how the savings will

be measured. The description should identify what will be measured and when, with what and how those measurements will be conducted. This description should be combined with any documented agreed to variables that will likely impact the measure and how the math of those measurements and adjustments for variables will impact and accrue to or detract from the savings proposed to be achieved. And as a reminder, the math and the engineering principles and calculations should be displayed in a level of detail so as to be able to be repeated by others to arrive at the same or very similar results. Along with the science and the math, this work should be accompanied by a laypersons description so that reviewers grow in their understanding and therefore confidence in the process that will illustrate the achievements of every measure.

The protocol for M&V plan has been developed by a global collection of industry professionals and is maintained and continuously improved by the Efficiency Valuation Organization, in a well-accepted standard known as the International Performance Measurement and Verification Protocol or IPMVP.

Here's a synopsis from the IPMVP:

Energy, water or demand savings cannot be directly measured, because savings represent the absence of energy/water consumption or demand. Instead, savings are determined by comparing measured consumption or demand before and after implementation of a program, making suitable adjustments for changes in conditions. The comparison of before and after energy consumption or demand should be made on a consistent basis. Good practice requires that M&V is well integrated into the process of identifying, developing, procuring, installing and operating energy conservation measures. IPMVP's framework requires certain activities to occur at key points in this process and describes other important activities that must be included as part of good M&V practice.

IPMVP outlines four separate and distinct protocol methodologies labeled as Options A through D along with the recommended application of each. Below we will describe each briefly.

In Option A, savings are determined by field measurement of the key performance parameters which define the energy and water use of the ECM's affected system(s) illustrating the success of the measure. Measurement frequency ranges from short-term to continuous, depending on the expected variations in the measured parameter, and the length of the reporting period meaning the number of years M&V shall be required. The number of years, or term of M&V may be specified in your state's enabling legislation.

Parameters not selected for field measurement are estimated. Estimates are typically based on historical data, manufacturer's specifications, or engineering judgment. Documentation of the source or justification of each estimated parameter is required. The plausible savings error arising from estimation rather than measurement should be evaluated and plainly stated within the plan.

One example of an Option A M&V application is a lighting retrofit where power draw and light levels are the key performance metrics that are measured periodically for a representative sampling of each fixture type. An estimate of the operating hours might be based upon facility schedules and occupant behavior and the analysis of past use as reconciled to the utility bills and even perhaps, spot measured during the IGA.

Option B, labeled Retrofit Isolation, is defined as an all Parameter Measurement methodology. In this methodology, the savings are determined by field measurements of the energy use and all variables of the system impacted by the measure.

Like in Option A, Measurement frequency ranges from short-term to continuous, depending on the expected variations in the savings and the length of the reporting period.

An example here might be, the application of a variable-speed drive and motor controls for pump flow. In this case, an Option B plan would measure electric power with a kW meter that is installed on the electrical supply to the motor, which reads the power no less than every minute. During the IGA, this meter would be put in place for a week or more to verify power draw of the *constant* loading of the pump motor, thereby establishing the Baseline energy use for the system. After completion, the meter remains in place throughout the reporting period to track actual variations in power use under all of the varying load conditions. This real-time data then is compared to the baseline energy use data and the resulting difference verifies whether savings are being met or not.

In Option C, savings are determined by measuring energy use at the whole facility or sub-facility level. This measure is sometimes referred to as a Utility Bill Guarantee as the continuous measurements of the entire facility's utility use are taken throughout the reporting period – directly from the utility meter data.

As with all of the IPMVP Options, adjustments will likely need to be made to the baseline to compensate for variables that impact projects. And finally, under Option D, Calibrated Simulation, savings are determined through computer simulation of the energy use of the whole facility, or sub-facility. Option D is defined as applicable for projects with multifaceted ECMs affecting and interacting with multiple systems in a facility and is especially useful where no meters existed in the baseline period. Using this option generally requires that utility use measurements, after the installation of meters, are used to calibrate the simulation.

This brief description of the Four Options of M&V savings doesn't begin to touch the level of detail required in a M&V plan. It is that schedule in the standardized contracts that delineates the granularity of description, methodology, frequency, quantity, assumptions considered, and how impacting variables will be accounted during three separate periods: first when the construction is wrapping up, for the first full performance year and for every year covered thereafter.

M&V plans define and illustrate the proof of projected and guaranteed savings to be achieved in order to repay the project's upfront financing. They are required to show how the work of the project and the achieved savings are impacted by variables that are likely to influence the project savings and the results they'll have on the utility bills.

The subsequent post-construction performance period formal M&V reports, following the M&V plan created during the IGA, illustrate the actual savings achieved. Or, if they haven't been achieved, why not and any necessary adjustments of financial reimbursement and remedies to prevent future shortfalls.

There's so much more that can be shared and considered about M&V plans, far more than can be covered here. But here is a quick summary of just a few of the more important points for to consider.

1. Like commissioning plans, M&V plans should be very nearly the final M&V plan unless project measures are added or deleted.
2. And, like commissioning plans, M&V plans are not optional, or to be provided later. They are a part of the IGA, part of what was identified would be required in the IGA and therefore, the work of preparing the plan is included in the price of the IGA.
3. M&V plans need to provide proof, science and math, real evidence that the savings projected and guaranteed have been achieved and why or why not.

4. Without the M&V plan proving and reporting that savings have been achieved as intended, performance guarantees have no value – they are reduced to simply claims.

Energy Services Companies typically and somewhat uniquely have the skills and expertise to provide high quality Investment Grade Audits and their reports complete with clear descriptions of what is proposed to be done, how, what it will achieve, and how to prove that the results are achieved and that they persist over the term of the contracts.

Once you feel comfortable with the information above, please scroll down and complete the quiz below. Email your answers to Reid Conway at reid.conway@ncdenr.gov. If you have additional questions, feel free to include them as well.

Lesson 17 Quiz

1. Why is the M and V plan included in the IGA considered preliminary?
2. What should be included in the M and V plan?
3. What does IPMVP stand for?
4. How are savings determined using IPMVP? List the 4 distinct IPMVP methodologies and briefly describe each.
5. What are the three periods of time which with M&V must be applied?

6. Aside from the definition of how savings will be measured, when and with what, what else are M&V Plans required to show?

7. What does the annual M&V Report illustrate?

Terms and Acronyms

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| 3 rd Party | 3 rd Party Engineer |
| COS | Council of State |
| DOA | NC Department of Administration |
| DPI | NC Department of Public Instruction |
| ECM | Energy Conservation Measure |
| ESA | Energy Services Agreement |
| ESC | Energy Services Coalition |
| ESCO | Energy Service Company could be interchangeable with QP |
| ESPC | Energy Saving Performance Contracting |
| GEPC | Guaranteed Energy Performance Contracting |
| GESPC | Guaranteed Energy Saving Performance Contracting |
| GS | General Statute |
| GU | Governmental Unit |
| IGA | Investment Grade Audit |
| IPMVP | International Performance Measurement and Verification Protocol |
| LGC | Local Government Commission (Housed in the Treasurer's Office) |
| LGU | Local Governmental Unit |
| M and V | Measurement and Verification |
| OR | Owner's Representative |
| OSBM | NC Office of State Budget and Management |
| PC | Performance Contracting |
| Pre-Bid | Meeting held prior to the bid opening |
| QP | Qualified Provider could be interchangeable with ESCO |
| QR | Qualified Reviewer |
| RFP | Request for Proposal |
| SEO | State Energy Office |
| UNC | Refers to the UNC System |
| USI | Utility Savings Initiative |