IPMVP IN A NUTSHELL

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Introduction

The International Performance Measurement and Verification Protocol Volume 1 (IPMVP) is a widely-accepted authoritative framework for fairly and transparently evaluating the effects of energy-saving projects. This concise description is unofficial and intended only as an introduction for those who need to understand IPMVP's broad principles. Anyone intending to apply IPMVP in practice should refer to the current definitive full version[1], which is supported by optional training and a certification scheme for professionals.

The fundamental aims

When energy-conservation measures are carried out, there are typically two parties, a client and a solution provider, whose interests are complementary (or even in some senses opposed) but who share the common aim of reducing energy consumption to a level demonstrably below what it would otherwise have been. IPMVP seeks to ensure that such energy-saving works are evaluated in such a manner that both parties can trust the conclusions and agree how much, if anything, has been saved. This is not a trivial exercise because circumstances change and measured energy consumption is usually influenced by factors unrelated to the project being evaluated.

The basic precepts of IPMVP can be summarized thus:

(a) **evaluations should be as accurate as possible**. IPMVP does not stipulate any particular degree of accuracy, but merely requires the parties to decide each case on its own merits, keeping the cost of M&V in proportion to the savings anticipated in each case.

(b) **interactive effects should be taken into account**. For example if a project to save fuel by heat recovery incurs additional electricity costs for fans and pumps (an adverse effect), or equally if reduction in electricity consumption in office spaces decreased the need for air conditioning (beneficial) it would be unfair to ignore these secondary impacts;

(c) **the analysis should be conservative**; IPMVP demands that where there is uncertainty, conservative assumptions should be made; and it even includes an appendix dealing with the statistics of uncertainty and error in estimates.

(d) **all significant and relevant factors are measured**; for example, if daylight availability were thought to be important in determining electricity consumption it needs to be recorded;

(e) **data are recorded and analysed in an open manner**; if necessary a third party should be able to repeat the analysis, using data provided in the evaluation report or attached to it.

Two cardinal concepts underpin IPMVP. One is the idea of comparing post-project consumption not with some fixed baseline quantity, but with an estimate of what consumption would have been under the actual conditions prevailing after implementation of the project. The comparison is with what consumption would have been without implementation of the project. We expand upon this concept in the next

[1] *IPMVP Volume I, 2012 edition. The later 'Core Document' and associated annexes are not definitive.*

section. The other is the concept of a measurement and verification (M&V) plan—also described later.

Treatment of baseline consumption

If a building or piece of energy-using equipment consistently used the same amount of energy every month, regardless of circumstances, there would be no difficulty working out how much less it was using after an energy-saving project. However, in the vast majority of cases factors like the weather, production throughputs, attendance figures and daylight availability (to name but a few) will have a discernible effect of consumption. Any evaluation of savings needs to account for the effects of these 'natural' variations which would otherwise distort, mask or exaggerate the results.

IPMVP recommends that this problem is addressed by evaluating sufficient pre-project data to find out what mathematical relationship linked consumption with the relevant independent factor or factors. This mathematical relationship is expressed as a formula in which the unknowns are the values of, for example, production outputs or weather indices, and the result is an estimate of 'expected' consumption—in other words, an estimate of what consumption would have been in the absence of the energy-conservation measure. This adjusts the baseline consumption in a fair manner. For example if the post-project weather were colder in the summer, the model for chiller consumption would reduce the baseline consumption. If production levels were higher, the baseline consumption for production machinery would be adjusted upward by the appropriate margin. IPMVP does not prescribe any particular model; it merely lays down that actual consumption~~ns~~ should be compared with baseline consumptions that have properly adjusted to account for known distorting factors.

The M&V Plan

IPMVP insists on there being an M&V plan, partly to eliminate the unsatisfactory and contentious practice of making up evaluation procedures after the event, and partly to avoid the situation where key data are found to be missing when the evaluation begins. The M&V Plan must therefore be agreed well before the energy conservation measure (ECM) is implemented, with the explicit understanding that both parties will abide by the conclusions of an evaluation carried out in accordance with that plan. It can thus be seen that a sound M&V Plan is the very foundation of an IPMVP-adherent evaluation.

So central is the M&V Plan that it makes sense to summarise the contents of IPMVP by reference to the Plan's thirteen mandatory elements, which are:

1. ECM Intent

The plan should describe the ECM and its intended result. If the ECM will result in any changes to service levels (for example, reduction in light levels) the details must be recorded under this heading.

2. Measurement boundary and evaluation option

Evaluations can be carried out at the facility level (Option C), or for equipment taken in isolation (Options A and B). Option A allows for some parameters to be estimated if they are not going to change as a result of the ECM—for example when lighting is replaced but the hours of operation will be unaffected, it can be acceptable to agree an assumed figure for running hours. Evaluation option D, finally, is designed for situations where there are no pre-project data, either because there was previously insufficient metering or because the installation has not yet been built.

3. Baseline Period, Energy and Conditions

Here the Plan must identify the baseline period, and record all energy consumption and demand data, together with associated data for those routinely-varying factors, such as the weather, identified as having an effect on consumption.

In addition, the Plan should catalogue any other factors which could skew the results but which would not routinely vary: things such as floor areas of buildings or the types and quantities of energy-using appliances. These are called ‘static’ factors.

The Plan may also need to record other material facts, such as the extent to which desired service levels were not being met during the baseline period, or the incidence of plant non-availability, since things of this sort may well change after the ECM and distort the analysis if not properly accounted for.

4. Reporting Period

The Plan must identify the reporting period. This may be as short as an instantaneous measurement or as long as the time required to recover the investment cost of the ECM programme. It is important to understand that the savings estimate given in an IPMVP-adherent report is valid only over the span of the reporting period; extrapolation is not permitted.

5. Basis for Adjustment

When we mentioned earlier that post-ECM consumption is compared against an adjusted baseline. we spoke of adjusting the baseline to the conditions actually prevailing during the post-ECM reporting period. This yields a measure of savings called “avoided energy use” in IPMVP parlance. The alternative is to do the evaluation against an agreed standard set of conditions (for example, twenty-year average weather). This slightly more complex analysis yields a measure called “normalized savings” which has the advantage that is shows how well the ECM worked even if post-project conditions varied wildly from the pre-ECM norm. For instance a solution provider would thus not be unfairly penalized through savings being lower than expected because an industrial customer had decided to reduce production levels dramatically.

The Plan must state which basis is to be used, and if opting for the normalized-savings basis, it must state what standard set of conditions will be used to generate the adjusted baseline.

6. Analysis Procedure

The Plan must specify the exact data analysis procedures, algorithms and assumptions to be used in each savings report. For each mathematical model used, it should enumerate all of its terms and the range of values of each variable factor over which it is valid.

7. Energy Prices

Whether or not the evaluation is ultimately to be expressed in financial terms, the Plan should specify the energy prices that will be used to value the savings, and whether and how savings will be adjusted if prices change in future. Indicative prices can be used if the real prices are commercially sensitive.

8. Meter Specifications

The Plan should specify the metering points, and the periods of measurement if metering is not continuous. Depending on the thoroughness of the evaluation, it should tabulate meter characteristics, meter reading and witnessing protocol, meter commissioning

procedure, routine calibration processes, and method of dealing with lost data. IPMVP does not actually require that meters be calibrated: it merely requires the details to be recorded in the plan if applicable.

9. Monitoring Responsibilities

The Plan must assign responsibilities for reporting and recording the energy data, independent variables and static factors within the measurement boundary during the reporting period.

10. Expected Accuracy

Estimations of savings can never be completely accurate, and IPMVP recommends that they should be stated in terms of the range of outcomes which can be stated with a given degree of confidence. Usually, either increasing the degree of confidence or reducing the spread between upper and lower estimates will increase the cost of the evaluation (see below). The Plan should say what accuracy is expected, considering proposed measurement, data capture, sampling and data analysis. This assessment should include qualitative and any feasible quantitative measures of the level of uncertainty in the measurements and adjustments to be used in the planned savings report.

IPMVP does not prescribe any particular level of accuracy.

11. Budget

The plan must define the budget and the resources required for the savings determination, both initial setup costs and ongoing costs throughout the reporting period.

IPMVP suggests a typical range of costs relative to anticipated savings, but does not prescribe any particular value.

12. Report Format

The Plan must specify how results will be reported and documented. IPMVP does not prescribe any particular format, but it does require a sample of each report to be included in the Plan.

13. Quality Assurance

The Plan must specify the quality-assurance procedures that will be used for savings reports and for any interim steps in preparing the reports.

In conclusion

Objective, transparent and conservative evaluation of energy-conservation measures is a critical element in ensuring that resources are effectively applied. IPMVP helps to facilitate this by setting the ground rules. Anybody can download the Protocol and apply its principles, and achieve full adherence by consulting and following the full current version, and in particular by ensuring that a mutually-acceptable M&V Plan is agreed between the interested parties.

A key element of adherence is the production of a report in accordance with this agreed M&V Plan. Because the requirements of the Plan are explained above, this synopsis can help anybody who needs to check whether an evaluation is IPMVP-adherent or not.