



An introduction to the International Performance Measurement and Verification Protocol (IPMVP)

What is IPMVP?

IPMVP is now the most widely used and recognised M&V protocol in the world. Originally developed in the mid-1990s by the US Department of Energy, IPMVP provides a standardised, transparent approach that ensures all parties can understand the parameters to be used in evaluating the performance of an energy saving project and hence can have confidence in the result.

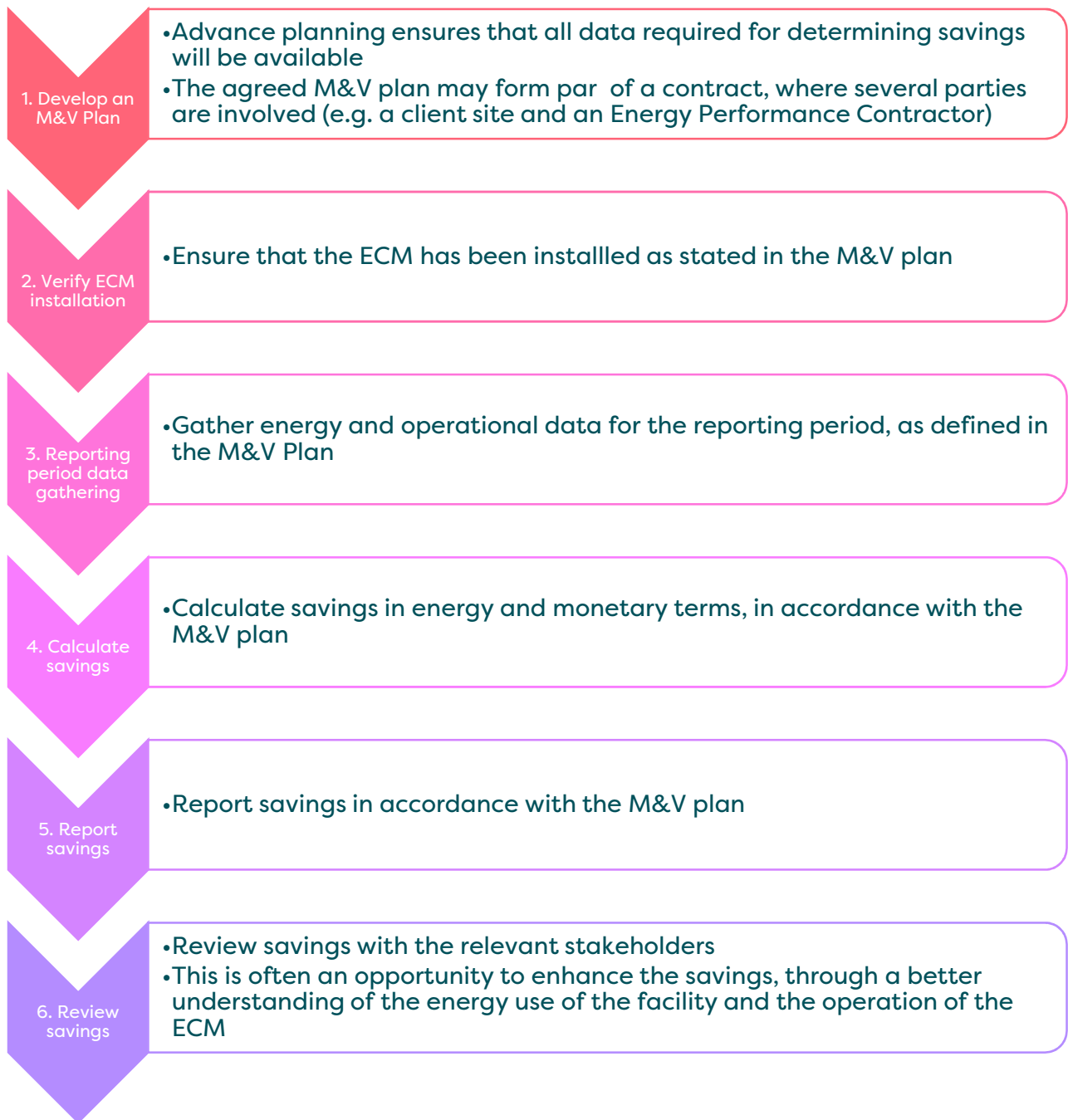
IPMVP is founded on a simple governing equation as follows:

$$\text{Savings reported for any period} = \text{baseline period energy} - \text{reporting period energy} \pm \text{adjustments}$$

An overview of an IPMVP adherent M&V process

An M&V process adhering to the IPMVP can be considered in six steps as shown in the diagram below. A key point is that an M&V plan is established up front, which sets out the methodology by which savings are to be measured and calculated. This allows (if necessary) arrangements to be made to collect baseline data prior to the installation of the 'Energy Conservation Measure' (ECM). Furthermore, where M&V is required as part of a contractual agreement, such as a performance guarantee or an Energy Performance Contract, it allows stakeholders to agree an M&V solution and include it within contracts.

The resources required for the M&V activity should also be agreed at this stage. There is a trade-off between accuracy and cost, but a general rule is that M&V costs should not exceed 10% of the project savings, and ideally be a good deal less.



IPMVP M&V Options (A-D)

IPMVP sets out four generic M&V options which are suited to different situations. The best option will depend on a number of factors, including the technology type, context, data availability and required accuracy. Retrofit isolation (Options A and B) means that the measurement boundary is drawn around the ECM, reducing or eliminating the ‘noise’ of other energy uses in the measurement. In Option C, the measurement boundary is the whole site, allowing site fiscal meters to be used. Option D is for cases where no baseline data exists.

Option	ECM examples	Comment
A. Retrofit Isolation: Key Parameter Measurement	LED lighting Motor replacement Fixed load equipment	Suitable for situations where a variable (such as power consumption or running hours) can be reasonably estimated rather than measured.
B. Retrofit Isolation: Key Parameter Measurement	As per Option A plus VSDs, boilers, heating systems and process machinery	Suitable for ECMs with variable loads. This may require additional sub-metering to be installed. Alongside energy data, it is usually necessary to have data for ‘driving factors’ (e.g. degree days, production, etc.) to allow the energy saving to be calculated.
C. Whole Facility	Multiple ECMs on the same site ECMs that overall account for a significant proportion of site consumption	This may be the only option if sub-metering is not available to isolate the ECM. The challenge is usually to isolate the impact of the ECM from variations in demand caused by other energy uses on site, and thus the ECM savings need to be a reasonable proportion (e.g. >10%) of the site consumption.
D. Calibrated	New buildings or processes	This is most suitable for a new building or process, where it is not possible to obtain baseline data. The construction and calibration of a model can be time intensive.

IPMVP provides further guidance on the available options and important considerations such as calculating metering error, determining confidence intervals and identifying approaches for sampling which can reduce the M&V effort if many identical ECMs are installed, e.g. LED lighting at multiple sites.

IPMVP also sets out minimum contents of an M&V Plan and eventual Savings Report(s). The protocol allows flexibility on the approach and level of detail to match the resources available. This flexibility leads to a common criticism of IPMVP: that it does not prescribe a set 'confidence interval' in the savings result (e.g. '100kWh/yr \pm 10kWh with 95% probability'). It is left to the practitioners to determine what is appropriate for them. Verco has certified M&V practitioners to set and deliver an effective M&V plan.

The body that maintains the IPMVP, The Efficiency Valuation Organisation¹ (EVO), seeks to ensure quality and rigour through a professional qualification in M&V – the 'Certified Measurement & Verification Professional' (CMVP®). A CMVP® is a person trained to design and implement M&V processes that meet the requirements of IPMVP, and must be able to demonstrate substantial experience in doing so. In the UK, training courses and CMVP® exams are facilitated by the Energy Services and Technology Association (ESTA) as the UK affiliate of EVO.

Verco has three fully-qualified CMVPs. IPMVP is used as a basis for energy saving calculations performed using Verco's Carbon Desktop software tool, as used by clients such as JCB, Arla and TH Real Estate. Since 2014 we have also been providing extensive M&V services to the UK Department of Energy and Climate Change's Electricity Demand Reduction Pilot, the M&V of which is founded on IPMVP.

Can IPMVP adherent M&V savings calculations be automated?

Clients sometimes ask us whether IPMVP adherent savings calculations can be fully automated, where savings for a particular energy asset can be calculated at the push of a button. Unfortunately, the answer is no – there is always an element of judgement in developing an M&V Plan, in deciding parameters such as measurement boundaries, time period of assessment, routine and non-routine adjustment factors. IPMVP is a protocol rather than a standard. The accuracy of the assessment is left to the stakeholders to

¹ <http://evo-world.org/en/>

decide. This allows M&V Plans to be tailored to the scale of the project so that the M&V effort remains proportionate to financial value at stake. The effort involved in M&V can however be greatly reduced by using software tools such as Carbon Desktop to automatically collect data, analysis and produce bespoke reports.

Do IPMVP adherent M&V Plans always give the same result (i.e. quantified energy savings) for identical projects?

No, the flexibility of approach allowed by IPMVP means it is possible for IPMVP-adherent plans to arrive at different results for an identical situation. This could be due to choices over variables such as the baseline and reporting period, adjustment factors and accuracy of metering equipment.

This does not matter, however, if all relevant stakeholders are satisfied with the M&V Plan approach. The way that the results are displayed will also allow stakeholders to understand the statistical confidence of the findings. For example, a result may be expressed as energy savings of 80 MWh a year +/- 4 MWh with 95% confidence, meaning that 95% of the time, the energy savings will be between 76 and 84 MWh/year.

For this reason, where the energy savings have contractual consequences, such as triggering incentives or penalties as part of an Energy Performance Contract (EPC), it is essential that an M&V Plan be signed off by a competent person on behalf of each party. The Certification Measurement & Verification Program exists to provide, train and certify energy professionals to perform this role. It is good practice to use an independent 3rd Party CMVP to avoid conflicts of interest, rather than experts employed solely by one or other of the parties.

For more information on how an effective M&V strategy can support your business in delivering cost-effective projects with reduced risk, please contact Verco and ask to speak to one of our M&V specialists.



Solutions for a zero carbon world

Verco helps companies reduce their environmental impact and save money through data driven analysis, grounded advice and real-world solutions.