Measurement & Verification Process for Calculating and Reporting on Energy and Demand Performance - General Guidance

Existing/Retrofit & Greenfield Projects or Programs

August 2014
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# ACRONYMS

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<th>Description</th>
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<tr>
<td>DSM</td>
<td>Demand Side Management</td>
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<tr>
<td>ECM</td>
<td>Energy Conservation Measure</td>
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<tr>
<td>EE</td>
<td>Energy Efficiency</td>
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<td>EEDSM</td>
<td>Energy Efficiency and Demand Side Management</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
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<tr>
<td>ESCO</td>
<td>Energy Service Company</td>
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<td>KPI</td>
<td>Key Performance Indicator</td>
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<td>M&amp;V</td>
<td>Measurement and Verification</td>
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<tr>
<td>PD</td>
<td>Project Developer</td>
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<td>VFD</td>
<td>Variable Frequency Drive</td>
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SECTION I: INTRODUCTION AND BACKGROUND

1. PURPOSE

This document is a valuable decision-making resource for M&V practitioners, especially those assessing the impacts of energy efficiency projects and encourages industry to adopt energy efficiency measures. By providing a methodology that enables practitioners to credibly assess energy performance impacts, the document facilitates more comparable M&V reporting across the Global Superior Energy Performance Partnership (GSEP) countries and globally. International comparability of results not only enables countries to more effectively share results with one another, it also facilitates improved knowledge sharing regarding the challenges and successes a facility or country may face while implementing M&V. Accordingly, the target audience for this document includes all M&V practitioners within the GSEP countries, as well as the wider global M&V community.

The purpose of this document can be summarised as follows:

1. Explain what is meant by the term M&V as it applies to EEDSM projects.
2. Explain the basic M&V process, where and when M&V integrates (fits) into the EEDSM implementation process of projects.
3. Provide a “roadmap” (methodology, process or decision tree) that can be used to develop consistent, impartial, reliable and repeatable project-specific M&V plans to be used for credible and accurate reporting of energy performance impacts.1

2. SCOPE

This document aims to provide a framework to develop consistent project-specific M&V plans that can be used towards accurate reporting of energy performance. The desired outcome of each of these project-specific M&V plans is to quantify the impact, or performance, to a stated degree of certainty, as a result of a particular EEDSM measure implemented. Reporting performances which are deemed credible and acceptable is dependent on following appropriate M&V processes, as well as applying the correct protocol and methodology (combined forming the M&V plan). The first part of this document clarifies the relationships between stakeholders then covers the basic M&V process, the EEDSM process and the integration between the two processes. It should be noted that these processes may need to be changed minimally to accommodate the requirements specific to the type of funding applied to implement the EEDSM project, e.g. for Performance Contracting, Standard Offer, Standard Product, Tax Incentives, Self-funding, etc. The basic processes covered in this document is however a very good starting point for any of these solutions and form a solid base for credible M&V reporting. This guideline can be used by organizations of any size or type (commercial, industrial, etc.), M&V practitioners, or any interested parties in order to apply M&V for the reporting of energy performance results for any type (e.g., existing/retrofit or Greenfield) of energy efficiency or demand side management project or program.

It should be appreciated that the applicable energy tariff can have significant impact on the value of saving generated. This document DOES NOT make provision for the impact of tariffs – the impact is

quantified in terms of the energy reduction (or increase) during a specified period. These measures can however be converted to, or from, whatever unit of measure are preferred or applicable. Once this is done, the prevailing tariff structure can be applied to these figures in order to obtain the monetary value of the saving.

In addition to the primary energy impacts (e.g. kWh consumption and kW demand during a certain period), an Energy Conservation Measure (ECM) often has secondary impacts. These typically include factors such as extending equipment life cycles (increased lamp life is a good example), increased worker productivity (this may, for example, be due to better lighting conditions), increased quality control, etc. While it is strongly encouraged that the secondary impacts or performance be taken into consideration in order to determine financial viability, the quantification of secondary performance/impacts does NOT form a part of the Scope of this document. These secondary impacts are discussed in more detail in reference [9].

Although M&V practitioners may be well qualified and experienced enough to accurately forecast the future impacts of planned EEDSM measures or facility activities, M&V would typically NOT be forward-looking, i.e. NOT account for emerging trends in load or opening hours. For example, VFDs might be installed in response to increased market volatility or erratic weather trends.

The Scope of this document does NOT deal with a number of other matters which normally are considered most important for doing M&V. This includes the negotiation and content of any contracts related to an EEDSM initiative, detailed information on confidence levels and precision, the M&V reporting formats, etc. These matters must however be considered and agreed to with stakeholders upfront, to ensure acceptable, correct and credible reporting.

3. MEASUREMENT AND VERIFICATION OF EEDSM PROJECTS

3.1 Aim of M&V

The aim of measurement and verification (M&V) is to quantify the impact of implemented EEDSM projects. This impact is quantified by comparing the energy use before and after the intervention of EEDSM. The “before” case is referred to as the baseline; the “after” case is referred to as the post-intervention or modified (actual) consumption pattern (refer to Figure 1 below).

![Figure 1: Comparing Baseline to Modified consumption to Establish Performance [simplified]](image-url)
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For Greenfield (also referred to as new build) EEDSM projects, the baseline energy use must be modelled, as no energy use data exists prior to implementation. The baseline energy use must be inferred with due consideration of the following on energy usage:

- **Energy Regulations, Codes and Standards** – The use of available energy regulations, codes, and standards is encouraged in order to provide a convenient, clearly defined, and consistent baseline energy use.
- **Common Practice** – under certain circumstances, the use of “standard practice” or “market standard” may be more appropriate for baseline development. The key issue is to have the actual baseline development process well-documented and replicable.
- **Performance of similar systems (or buildings) without any of the proposed energy savings measures implemented** – The use of standard technologies are often documented for use in similar systems or facilities and in similar economic sectors. A similar system or facility which already exists in close proximity or with comparable conditions to the Greenfield project would likely have been duplicated if not for the EEDSM project planned for implementation.
- **A benchmark determined by a national policy, regulation of administration and/or jurisdiction** – This case is especially important when a grant for a new (Greenfield) project is introduced.

The Calibrated Simulation M&V option (refer to sections 6.4 and 7.4 of this document) could typically be used if baseline or reporting period data are unreliable or unavailable, as is the case for a Greenfield EEDSM. When using the Calibrated Simulation option:

- In all cases, the project baseline energy use must be determined by energy use simulation, calibrated to assessment period measured energy use. The baseline energy use shall represent the energy use which would have occurred if the EEDSM project had not been integrated into the design;
- This means that the baseline for Greenfield projects should be developed using comparable data in a simulation representing conditions if the EEDSM was not integrated into the design.

Greenfield project energy impacts are determined by comparing the assessment period energy use to the projected baseline energy use under similar operational conditions. For a mixed Brownfield and Greenfield project, the M&V plan needs to clearly define M&V activities and metering strategies to separate the scope and to quantify the interactions of the two.

Energy data from a calibrated simulation option can take the place of the missing data, for either part or all of the facility. But the use of the calibrated simulation option is not only restricted to where data availability is problematic. The measurement boundary could, in some instances, be changed to the extent that sufficient data may be available to use the specific option. The use of this option would usually also apply where the number of energy governing factors influencing the energy savings measure is too many to use any other option.

### 3.2 Baseline Adjustments

To accurately quantify the true impact, adjustments (to the baseline) should be made for factors that are not caused by the EEDSM intervention but which do affect the energy use (external factors). These could be factors like variations in weather, occupancy, production, extensions to the plant or building, etc. The adjustments to the baseline should account for these “external factors” and should then enable an “apples to apples” comparison. (Refer to Figure 2 below).

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Note: Savings resulting from implementation of an energy savings measure that is mandatory when considering any regulation, code or standard would typically not be eligible for accessing financial incentives. The relevant regulation, code or standard should be consulted as to the mandatory requirements.
In general, the impact or saving is given by the following equation:

\[
\text{Impact or Savings} = (\text{Baseline Energy Usage} \pm \text{Baseline Adjustments}) - \text{Modified Energy Usage}
\]

Routine baseline adjustments include any energy-governing factors expected to change routinely during the reporting period, such as weather or production volume. Adjustment techniques may range from constant value (no adjustment) to several multiple parameters non-linear equations each of them correlating energy with one or more independent variables. Appropriate mathematical techniques should be used to derive the adjustment method for each case.

Non-routine baseline adjustments include energy-governing factors that are not usually expected to change. Such factors include the facility size, the design and operation of installed equipment, the number of weekly shifts, and the occupancy. These factors should be monitored throughout the reporting period and adjustments should be considered where a change occurs to equipment or operations (static factors) within the measurement boundary after the baseline period. To do this accurately, baseline conditions should be fully documented so that changes in static factors can be identified and appropriate non-routine adjustments made. Changes in static factors should be measured and recorded.

### 3.3 Stakeholders Roles and Relationship

There are a number of stakeholders in any EEDSM project. These stakeholders include the funder (bank, government agency, private investor, etc.), the client and the ESCO or project developer. The clients expect at least a reduction in their monthly energy bill when they reduce the peak demand and/or energy consumption. The EEDSM funder needs to protect its investment in the EEDSM project with an expectation of a return. The ESCO or project developer wants to implement the DSM and energy-efficiency projects and get paid for the services provided (Figure 3). This situation makes
it necessary that the project impacts be determined to a certain level of accuracy that is acceptable to all stakeholders.

The ESCO/PD or the client usually identifies the need or a potential for a project and performs performance calculations as part of the preliminary design phases of the EEDSM project. A proposal is then submitted to Eskom for DSM funding. Once project funding is approved, the ESCO/PD can proceed and implement the project on the client’s site. After the DSM intervention has been fully implemented, these impacts and performances need to be quantified to determine the effectiveness of the intervention for the stakeholders. Since contractual agreements usually rely, and it is preferred, on accurate and impartial performance and impact information, the task of saving assessment and quantification need to be performed by a party outside the group of principal project stakeholders. The primary questions that all project stakeholders want answered are: How much are we saving and are the performance being sustained? The dynamics in DSM projects make it difficult, and certainly not preferable, to assign any one of the principal stakeholders to deliver an objective assessment of the performance. The quantification and assessment of the performance must remain impartial and the complete process transparent. The long-term success of many projects is often hampered by the inability of project partners to agree on the quantity of performances that have been achieved. For this reason, another party needs to be included in the process to determine and verify the performance, hence the M&V Body. Figure 3 shows a picture representation of the interaction between the principal stakeholders and the M&V team. The M&V Body is active on all the levels between the various project stakeholders. The M&V body, however, stands apart from the project environment in order to ensure impartiality. However, the project parameters are measured, baselines are developed and the performance calculated by the M&V body within the project environment. The purpose of M&V is thus to facilitate agreement between the stakeholders on the project outcomes through accurate reporting of results. Accurate measurements, a replicable methodology, as well as a consistent and reliable process are some of the basic requirements to determine the performance that results from EEDSM projects.

To ensure that the decisions made and M&V are performed in a manner which would be acceptable, it is necessary to understand the roles and responsibilities of the various parties involved in the process of establishing the performance to be reported. The various parties involved have specific knowledge and information relevant towards achieving the objectives of credible M&V results. The client, Facility or Operations owner understand the operations, processes or facility requirements best and are therefore an important contributor towards ensuring a suitable M&V methodology. The ESCO/PD is the specialist on the new technology or process(es) to be implemented and should contribute to the M&V methodology from this perspective. Lastly, and most importantly, the Project Funder normally has specific requirements which the M&V reporting needs to address. Although the M&V Body may often have the most experience and knowledge on the existing or intended project, the technologies or processes involved, this body is only responsible for, and should be accepted as the M&V specialist. It is therefore important to ensure that the M&V body does not get conflicting roles, specifically in instances where it supports the initial project proposal and then ultimately having to report (possibly a lower) performance thereon, or where M&V is paid for based on the performance of the project. A typical Flow Diagram of the Relationship between Stakeholders can be represented as follows:
It should be clear that the each party has essential contributions to make towards the successful implementation, planned M&V and the ultimate reported performance of the project. The relationships, roles, activities and sharing of information therefore needs to be transparent, clearly defined and not in conflict with the ultimate objectives of the project implementation and that of another stakeholder.

3.4 Reported Performance Always in Alignment to Agreed Protocols and Methodologies (M&V Plans)

Although the concept of comparing the actual or modified usage after project implementation to the usage that “would have been” without intervention is very simple, the implementation can become fairly complex. The (potential) complexities arise because the “would have been” scenario cannot be (directly) measured, it does not exist and consequently needs to be stated, inferred or calculated. This means that modelling will be involved which always brings a degree of uncertainty with it. The usual question then arises as to how “accurate” (or “wrong”) is the reported performance due to the model (methodology) being used to perform M&V?

The fact that the “would have been” baseline cannot be measured has an important implication:

- The saving or impact reported by any EEDSM M&V program is ALWAYS based on an agreed or negotiated protocol and methodology. It is critically important that all parties concerned understand this distinction.
- Agreement and consensus on how performance and/or baselines will be calculated, referred to as the M&V Plan, consequently play a vital role in the M&V process – without it, there can be no effective or credible M&V.
- A methodology (framework) to consistently develop impartial, reliable and repeatable project specific M&V plans is therefore very important. This document aims to provide such a framework.
4. INTEGRATING THE M&V PROCESS INTO EEDSM PROJECT IMPLEMENTATION PROCESS

4.1 Typical Stages of an EEDSM Project

Energy conservation/EEDSM projects typically go through the following eight stages:

- Project Identification
- Energy Audit/Assumptions
- Preliminary approval
- Detailed design
- Approval for Funding/Implementation
- Implementation
- Commissioning
- Operation and Maintenance

4.2 Typical Stages of an M&V Process

Measurement and Verification (M&V) typically has the following stages:

- Understanding of the planned Scope of Work
- Development of the M&V Plan
- Secure agreement for the M&V Plan
- Pre-Implementation Measurements (in order to obtain the baseline)
- Development of baseline according to the M&V Plan
- Secure agreement for the Pre-Implementation (initial) baseline (Correct protocol and methodology used?)
- Post Implementation Verification/Audit
- Post Implementation Measurements
- Adjustment of Baseline and Calculation of Performance
- Produce and Submit M&V Performance Report
- Repeat Cycle for Project or Contract Duration

Note the strong emphasis placed on transparency and securing buy-in/consensus throughout the M&V process. As stated previously, this is an essential characteristic of any successful M&V process. The stages of the M&V process are shown in Figure 4:
It should be noted that some of the mentioned M&V stages may be combined depending on the type of EEDSM project, available measurement data or M&V protocol and methodology to be applied to the project. The Scoping and M&V Plan stages can typically be combined with due consideration that both would need to be redone if the scope of the intended project was misunderstood. It may even be possible to combine all the stages up to the initial baseline stage if the relationship, knowledge and understanding of M&V and the intended project allows for such. However, agreement to at least the M&V Plan MUST always be secured in writing, BEFORE implementation of the project, irrespective the relationships, knowledge levels, M&V protocol or methodology to be used.

The question that then needs answering is where and how the M&V process fits into the “normal” EEDSM implementation process and the stakeholders involved. A flow-diagram representation of this integration between M&V and EEDSM project stakeholders is presented in Figure 5 below.
Note that buy-in, or agreement, is only required for the M&V Plan and possibly the Initial (adjusted) Baseline. The M&V Plan describes the protocol and the methodology to be used and agreement to such should therefore lead to undisputable results, provided the agreed upon M&V plan was applied. In some instances the Initial Baseline provides a further opportunity to test the M&V Plan for reporting performance accurately. Changes can still be made if the EEDSM project has not been implemented as yet – however, stakeholders should understand that this requires additional M&V work and possibly additional payments.

5. STANDARD ELEMENTS OF ALL EEDSM PROJECTS

All EEDSM projects have the following three standard elements:

- Operating hours.
- Load/Requirement. Note that this does not refer to the energy load, but to the level of service provided by the system. The load/requirement of, for example, a lighting system, is consequently not the electrical kW but the level of illumination (lux) required at desktop-level.
- System efficiencies.
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It is through changing any one, or any combination, of these three standard elements that savings are generated.

Depending on the project, each of these three standard elements is affected by a unique set of parameters, or Key Performance Indicators (KPIs). The operating hours of a lighting system can, for example, be influenced by the following set of parameters:

- Occupancy hours.
- Daylight hours (or night-time hours).
- Timer switch settings.
- The after-hours schedule of the cleaners.

In a similar fashion, the load requirements of an air-conditioning system may be influenced by the following set of parameters:

- Outside air temperature.
- Time of year.
- Time of day.
- Relative humidity.
- Number of occupants (internal heat load).
- Office equipment utilisation (internal heat load).
- Utilisation of the lighting system (internal heat load).
- Etc.

6. METHODOLOGIES TO OBTAIN PARAMETERS

There are four principal ways (methods) in which parameters affecting energy usage of a system may be determined:

1. Stipulation.
3. Inference.
4. Simulation.

6.1 Stipulation

“Stipulation” means that this is a highly probable assumption (preferably a known fact) that has been agreed on in writing by all relevant stakeholders, as part of the M&V Plan.

Example (given as illustration):

The time period in which lighting systems will be operational can be stipulated due to it being controlled with timers or building management systems.

6.2 Measurement

This implies that the parameter in question will be physically measured using approved, calibrated measurement instruments and appropriate measurement periods. The measurement period should be long enough to capture the major energy-governing factors within the facility/boundary. i.e., the measurement period should fairly represent all operating conditions of a normal operating cycle. The
length of the reporting period should be determined with due consideration of the life of the energy efficiency measure and the likelihood of degradation of originally achieved savings over time.

6.3 Inference

A parameter is inferred when its value is determined by relating this (unknown) parameter to some other (known) parameter or parameters. There are two circumstances under which this method (inference) can be used:

- When the fundamental relationship(s) is/are known.
- When a relationship may be extracted from a data set.

**When the fundamental relationship is known**

Consider the following situation:

- Parameter x is being measured.
- Parameter z is known.
- The value of parameter y is required.
- There is a known (fundamental) relationship between parameters x, z and parameter y.

In such cases, the known physical relationship between parameter x, z and parameter y may be used to determine the value of y.

**Example (given as illustration):**

Consider a situation where the voltage across a resistor is a required parameter. The value of the resistance R is known and the value of the current (I) is measured. The value of the voltage (V) may now be determined using Ohm’s Law: \( V = I \times R \).

**When the relationship may be extracted from a data set**

It may be possible to use regression techniques in order to obtain the relationship between parameters.

It is important to note that the use of techniques such as multivariate regression is limited by, and dependent on the availability of quality data. Provided that the data requirements are met, and that the model developed meets certain specified requirements (these requirements will be defined in a later section), regression analysis may be used.

6.4 Simulation

The fourth method is a detailed computer simulation of the system (or components of the system) using commercially available simulation packages.³ Simulation can be particularly useful in cases where the interaction between variables is present and required.

In cases where simulation is used the accuracy of the simulation model should be confirmed (verified) using actual data.

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³ For some larger industrial projects a simulation may be developed using generic software systems such as MatLab, or computational fluid dynamics or 3D modelling packages with simulation capabilities. For example, modelling customised heat recovery tubing for a large industrial furnace or oven, or power station boiler retubing.
7. METHODS TO DEVELOP THE M&V BASELINE

Based on the four basic methodologies that can be used to determine parameters, there are four methods that can be used to determine the baseline. These methods are:

7.1 Method SA-A – (Stipulation)

Under this method, the baseline is determined using stipulation with, or without partial measurement. Good M&V practice and most M&V Standards (SABS:SANS 50010:2011) and guidelines requires that measurements shall always be used, be it key parameter measurement with stipulation, or all parameter measurement.

7.2 Method SA-B – (Measurement)

Method SA-B1 – (Comprehensive measurement)

Under this method, the baseline is determined by making use of comprehensive measurements.

Method SA-B2 – (Comprehensive measurement of a control group)

Under this method, the baseline is determined by measurement of (only) a control group. The composition (statistical validity) of the control group is something that is agreed on as a part of the M&V plan. This method is typically required where no known relations exist and stipulations present too great an uncertainty for the baseline model.

7.3 Method SA-C – (Inference)

Under this method the baseline is inferred by using a multivariate regression model. This method is typically used to model a system rather than single individual equipment pieces.

7.4 Method SA-D – (Simulation)

Under this method the baseline is determined by means of a detailed computer simulation. This method is best applied when no baseline data exists for measurements. The reasons for no data being available may vary from it being a Greenfield (new build) project, the measure having a large number of energy governing factors which would be difficult to deal with in another method or the project scope being too large to adequately cover all the baseline measures. Thus, a simulation is built and calibrated based on post-implementation measurement results and the baseline determined through an agreed set of pre-implementation conditions. These conditions could be measured weather patterns, dam levels, etc. which has a direct effect on the energy usage of the affected system. Fixed-conditions basis or normalized savings as the basis for a Greenfield baseline does not fall into the category of Calibrated Simulation, and is not method to use when high credibility is required.

8. TRADE-OFF BETWEEN ACCURACY AND M&V COST

Owing to the fact that performances reported by any M&V process are always based on an agreed protocol and methodology, there is a trade-off that needs to be made between the level of accuracy required and the cost to perform the M&V. The objective of M&V is NOT necessarily to derive a precise energy performance number, but rather to ensure that the actual energy performance reported are reasonably close to, but not more than, the performance claimed.

Generally, the level of uncertainty can be reduced by increasing the detail of the M&V approach. Note that in certain cases increasing the level of detail can actually increase the uncertainty and will increase the cost of performing M&V. Increasing the level of detail might increase uncertainty
because additional detail might provide conflicting results, create confusion as to the most important measures to consider, etc.

In most cases, the cost to perform M&V will increase as the level of detail required by the M&V process increases.

Note that the intersection of the two lines in Figure 6 is of no particular consequence – it does NOT represent an optimum point.

The “best” M&V approach is the approach that provides the required level of confidence and precision at an acceptable cost. Also keep in mind that the higher the level of detail of an M&V approach, the greater the number of potential issues that can be disputed later on – simpler may often be better.

SECTION II: DEVELOPING A PROJECT-SPECIFIC M&V PLAN

In some instances it may be of value to consider the aspects mentioned within sections 10 (Develop a List of Parameters for Each Standard Element), 11 (Define Responsibilities), and 12 (Specify the Methodology Used to Determine Each Parameter) of this document before proceeding with section 9 below.

9. CLASSIFICATION OF PROJECT

This section is designed to guide the user through the process of project classification. A number of questions need to be answered and the answers recorded on the “Project Classification Sheet” provided – see Page19.

Once all the relevant questions have been answered, the user will use the “Project Classification Sheet” to determine the project classification. The various flow-charts are broken up into sections under this heading, dealing with each separately. However, a complete flowchart, from start to finish is attached as Appendix B: Complete Project Classification Flowchart.
## Global Superior Energy Performance

### 9.1 Project Classification Sheet

**Blocks**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<td></td>
<td>ECM</td>
<td>Fuel Switching</td>
<td>Load Shifting</td>
<td>Load Shedding</td>
<td>Whole facility</td>
<td>Sub-System WITH Interactive effects</td>
<td>Sub-System WITHOUT Interactive effects</td>
</tr>
</tbody>
</table>

**Columns**

<table>
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<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<th>H</th>
<th>I</th>
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</tbody>
</table>

- **Operating Hours**
- **Requirement/Load**
- **Operating Hours**
- **Requirement/Load**
- **Efficiency**
- **Operating Hours**
- **Requirement/Load**
- **Operating Hours**
- **Requirement/Load**

**Fold along this line**

- **Fixed pattern(s)**
- **No Pattern (variable)**
- **Fixed value or fixed pattern(s)**
- **Variable value or no pattern(s)**
- **Does the measure change the operating hours?**
- **Does the measure change the Requirement/load?**
- **Does the measure change component efficiencies?**
- **Can the post-operating hours be used for the baseline?**
- **Can the post-requirement/load be used for the baseline?**
- **Fixed pattern(s)**
- **No Pattern (variable)**
- **Fixed value or fixed pattern(s)**
- **Variable value or no pattern(s)**
9.2 ECM or Pricing Response

The user is referred to Page 19. Use this sheet to complete the following succession of flow charts.

Note to figure 7: Usually all EEDSM measures would be implemented to benefit from pricing signals, i.e. an increase in energy cost. However, in many instances huge benefits can be achieved by implementing measures which only move the usage to other less expensive periods (load shifting) or by not using energy in expensive periods (load shedding or ECM). It may also be more beneficial just to switch to another and less expensive energy source (fuel switching). None of these measures or activities can be defined as energy efficiency measures.

9.3 Project Description

Provide a short description of the proposed EEDSM project. The following should be included:

- Site identification and description.
- Total annual energy cost.
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- A short description of the measure(s) to be implemented (what is going to happen – i.e. retrofit of the lighting system, chiller replacement, etc.).
- The expected EEDSM implementation cost.
- Estimated annual performance.

An estimate of a reasonable and acceptable M&V budget can now be made.

- The cost of M&V should (preferably) be between 2-15% of the implementation cost. This rule applies to the initial set-up cost of M&V in year 1 (acquisition of meters, development of M&V Plan, link-up to M&V center for data-warehousing, etc.).
- In addition, the subsequent annual M&V costs should ideally not exceed roughly 10% of the expected annual saving.

Note that a reasonable overall cost for performing M&V is usually deemed to be 5% or less than the total EEDSM or ECM project costs. M&V activities can however often contribute in many additional ways such as in improvements to operations, identification of other performance opportunities (ECMs), carbon footprint calculations, etc. and the stakeholder(s) may therefore agree to higher M&V costs with the subsequent additional benefits.

9.4 Definition of Boundaries

A proper definition of the system boundary for which the baseline needs to be developed is essential. There are three main categories:

1. Whole facility.
2. Sub-System, with interactive effects\(^4\) taken into consideration.
3. Sub-System, disregarding interactive effects.

Use the flow chart provided in Figure 8 to complete the first table of the “Project Classification Sheet” provided on Page 19.

---

\(^4\) Interactive effects include energy effects outside the M&V measurement boundary that result from actions that take place within the measurement boundary. For example, replacing incandescent lights with LED lighting in a building will reduce lighting energy consumption. But the repercussion outside the measurement boundary is that less heat will be radiated into the building rooms, which changes the building heating, ventilation, and air conditioning (HVAC) requirements. Because the original measurement boundary was the lighting system energy consumption only, the effect on the HVAC system energy consumption is considered an interactive effect.
Consider the “Project Classification Sheet”:

I  **If block 5 is ticked (Whole Facility):**

   Important to note that expected savings must be more than 10% of the facility profile being measured, for considering the whole facility method. This is because the savings would then not be visible on the profile (hidden in the noise).
   
   - Describe the facility.
   - Provide reasons why the baseline should be developed for the whole facility.
   - Describe the energy supply points and energy flows to the facility for which the baseline needs to be developed.

II  **If block 6 is ticked (Sub-system WITH interactive effects)**

   - Describe the Sub-system.
   - Provide reasons for the choice of system boundaries – (why not larger, why not smaller).
   - Provide reasons why interactive effects need to be included.
   - Describe the energy supply points and energy flows to the system boundary for which the baseline needs to be developed.

III  **If block 7 is ticked (Sub-system WITHOUT interactive effects)**

   - Describe the Sub-system.
   - Provide reasons for the choice of system boundaries – (why not larger, why not smaller).
Provide reasons why interactive effects can be disregarded.

Describe the energy supply points and energy flows to the system boundary for which the baseline needs to be developed.

9.5 Analysis of Standard Elements

Make use of the second table provided on page 19 to complete the following series of flow charts.

Figure 9: Project Classification Flow Chart #3
Figure 10: Project Classification Flow Chart #4

The operating hours for the before (pre-) and after (post-) implementation periods may be used in the baseline establishment process should it be found to be the same (no change). However, if for some reason the post operating hours cannot be used to establish the baseline then the load requirement or equipment efficiencies would need to be considered. The “Project Classification Sheet” on page 19 provides for this.
9.6 Selecting the Correct Category

The second table on page 19 should now be complete.
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Fold (or cut) the sheet where indicated. Use this sheet to select the correct Project Group from the list of possibilities provided in Appendix A (Also provided as a separate MS Excel document).

**Group A**

Projects that fall into this group have the following characteristics:

1. Both the "post" Operating Hours and the "post" Load/Requirement may be used to determine the baseline.
2. The implementation of the EEDSM measure has resulted in a change in system efficiencies.

This may be done in cases where the measures implemented are considered to have no impact (do not change in anyway) either the Operating Hours or the Load/Requirement.

It is consequently accepted that any variation in either the Operating Hours or the Load/Requirement, occurring after the implementation of the EEDSM measure(s), would have occurred anyway.

An M&V plan for these kinds of projects needs to focus its efforts in three prime areas:

- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre-and post-system efficiencies.

**Group B**

Projects that fall into Group B have the following common characteristic:

1. In all cases, the "Post" Load/Requirement may be used for the baseline.

This may be done in cases where the measures implemented are considered to have no impact (do not change in anyway) on the Load/Requirement of the system.

It is consequently accepted that any variation in Load/Requirement occurring after the implementation of the EEDSM measure would have occurred anyway.

**Group B1**

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. In all cases the "Post" Operating Hours may NOT be used for the baseline.
2. The system efficiencies remain unchanged.

This implies that the measures implemented are considered to have impacted (changed) the Operating Hours of the system.

It is consequently necessary to determine a baseline for the Operating Hours.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
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Group B2

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. In all cases the "Post" Operating Hours may NOT be used for the baseline.
2. The implementation of the EEDSM measure has resulted in a change in system efficiencies.

This implies that the measures implemented are considered to have impacted (changed) the Operating Hours of the system.

It is consequently necessary to determine a baseline for the Operating Hours.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system-efficiencies.

Group B3

Although the EEDSM measure implemented is NOT considered to change the Operating Hours, you have specified that the "Post" Operating Hours may NOT be used for the baseline. Carefully re-consider whether this is correct.

If you find that the "Post" Operating Hours MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why the "Post" Operating Hours may NOT be used for the baseline, continue.

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. In all cases the "Post" Operating Hours may NOT be used for the baseline.
2. The implementation of the EEDSM measure has resulted in a change in system efficiencies.

This implies that the measures implemented are considered to have impacted (changed) the Operating Hours of the system.

It is consequently necessary to determine a baseline for the Operating Hours.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why the "Post" Operating Hours may NOT be used for the baseline.
- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system-efficiencies.
Group C
Projects that fall into Group C have the following common characteristic:

1. In all cases, the "Post" Operating Hours may be used for the baseline.

This may be done in cases where the measures implemented are considered to have no impact (do not change in anyway) on the Operating Hours of the system.

It is consequently accepted that any variation in Operating Hours occurring after the implementation of the EEDSM measure would have occurred anyway.

Group C1
In addition to the common characteristic shared by all projects in group C (see above), projects that fall into this category are characterised by the following:

1. In all cases the "Post" Load/Requirement may NOT be used for the baseline.
2. The system efficiencies remain unchanged.

This implies that the measures implemented are considered to have impacted (changed) the Load/Requirement of the system.

It is consequently necessary to determine a baseline for the Load/Requirement.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.

Group C2
In addition to the common characteristic shared by all projects in group C (see above), projects that fall into this category are characterised by the following:

1. In all cases the "Post" Load/Requirement may NOT be used for the baseline.
2. The implementation of the EEDSM measure has resulted in a change in system efficiencies.

This implies that the measures implemented are considered to have impacted (changed) the Load/Requirement of the system.

It is consequently necessary to determine a baseline for the Load/Requirement.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system-efficiencies.

Group C3
Although the EEDSM measure implemented is NOT considered to change the Load/Requirement, you have specified that the "Post" Load/Requirement may NOT be used for the baseline.
Carefully re-consider whether this is correct. If you find that the "Post" Load/Requirement MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why the "Post" Load/Requirement may NOT be used for the baseline, continue.

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. In all cases the "Post" Load/Requirement may NOT be used for the baseline.
2. The implementation of the EEDSM measure has resulted in a change in system efficiencies.

This implies that the measures implemented are considered to have impacted (changed) the Load/Requirement of the system.

It is consequently necessary to determine a baseline for the Load/Requirement.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why the "Post" Load/Requirement may NOT be used for the baseline.
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system-efficiencies.

**Group D**

Projects that fall into Group D have the following common characteristic:

1. In all cases, it is specified that neither the "Post" Operating Hours, nor the “Post” Load/Requirement may be used for the baseline.

This is the case where the measures implemented are considered to have impacted (changed) both the Operating Hours and the Load/Requirement of the system.

It is consequently necessary to determine baselines for both the Operating Hours and the Load/Requirement.

**Group D1**

In addition to the common characteristic shared by all projects in group D (see above), projects that fall into this category are characterised by the following:

1. The system efficiencies remain unchanged.

This implies that the measures implemented are considered to have impacted (changed) the Load/Requirement as well as the Operating Hours of the system, but not the System Efficiency(s).

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
Group D2

In addition to the common characteristic shared by all projects in group D (see above), projects that fall into this category are characterised by the following:

1. The implementation of the EEDSM measure has resulted in a change in system efficiencies. This implies that the measures implemented are considered to have impacted (changed) the Load/Requirement, the Operating Hours as well as the Efficiencies of the system.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system efficiencies.

Group D3

Although the EEDSM measure implemented is NOT considered to change the Load/Requirement, you have specified that the "Post" Load/Requirement may NOT be used for the baseline.

Carefully re-consider whether this is correct. If you find that the "Post" Load/Requirement MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why the "Post" Load/Requirement may NOT be used for the baseline, continue.

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. The implementation of the EEDSM measure has NOT resulted in any change to system efficiencies.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why the "Post" Load/Requirement may NOT be used for the baseline.
- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.

Group D4

Although the EEDSM measure implemented is NOT considered to change the Load/Requirement, you have specified that the "Post" Load/Requirement may NOT be used for the baseline.

Carefully re-consider whether this is correct. If you find that the "Post" Load/Requirement MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why the "Post" Load/Requirement may NOT be used for the baseline, continue.
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In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. The implementation of the EEDSM measure HAS resulted in a change to system efficiencies.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why the "Post" Load/Requirement may NOT be used for the baseline.
- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system-efficiencies.

**Group D5**

Although the EEDSM measure implemented is NOT considered to change the Operating Hours, you have specified that the "Post" Operating Hours may NOT be used for the baseline.

Carefully re-consider whether this is correct. If you find that the "Post" Operating Hours MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why the "Post" Operating Hours may NOT be used for the baseline, continue.

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. The implementation of the EEDSM measure has NOT resulted in any change to system efficiencies.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why the "Post" Operating Hours may NOT be used for the baseline.
- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.

**Group D6**

Although the EEDSM measure implemented is NOT considered to change the Operating Hours, you have specified that the "Post" Operating Hours may NOT be used for the baseline.

Carefully re-consider whether this is correct. If you find that the "Post" Operating Hours MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why the "Post" Operating Hours may NOT be used for the baseline, continue.

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. The implementation of the EEDSM measure HAS resulted in a change to system efficiencies.
An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why the "Post" Operating Hours may NOT be used for the baseline.
- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system efficiencies.

**Group D7**

Although the EEDSM measure implemented is NOT considered to change either the Operating Hours, or the Load/Requirement, you have specified that neither the "Post" Operating Hours, nor the "Post" Load/Requirement may be used for the baseline.

Carefully re-consider whether this is correct. If you find that either the "Post" Operating Hours, or the “Post" Load/Requirement MAY be used for the baseline, STOP, return to section 0 and re-classify this project.

If there are valid reasons why neither the "Post" Operating Hours, nor the “Post" Load/Requirement may be used for the baseline, continue.

In addition to the common characteristic shared by all projects in group B (see above), projects that fall into this category are characterised by the following:

1. The implementation of the EEDSM measure HAS resulted in a change to system efficiencies.

An M&V plan for these kinds of projects needs to focus its efforts in the following areas:

- Stipulate why neither the "Post" Operating Hours, nor the "Post" Load/Requirement may be used for the baseline.
- Determine a baseline for the Operating Hours of the system -- (pre implementation).
- Determine a baseline for the Load/Requirement of the system -- (pre implementation).
- Determine the Operating Hours of the system -- post implementation.
- Determine the Load/Requirement of the system -- post implementation.
- Quantify the change between the pre- and post- system efficiencies.

10. **DEVELOP A LIST OF PARAMETERS FOR EACH STANDARD ELEMENT**

Consider the Standard Elements of the current project. The most significant elements will be highlighted by referring to the appropriate Project Group (defined in section 0 above).

Proceed to the flow charts below – Figure 12 followed by Figure 13.
Figure 12: What causes the saving & what can go wrong?
Figure 13: Key parameters associated with each Standard Element
11. DEFINE RESPONSIBILITIES

Define responsibilities per individual or entities, e.g., gathering and supplying the required parameters for the M&V verification. Use the flow chart provided in Figure 14 below to complete the responsibility matrix provided below.

NOTE:

This should be done for each of the Standard Elements. Make use of the list of parameters that was developed using the flow chart in Figure 13 above.

![Figure 14: Defining responsibilities](image-url)
12. SPECIFY THE METHODOLOGY USED TO DETERMINE EACH PARAMETER

Each of the parameters listed in section 11 needs to be determined according to some methodology. Use the flow chart provided in Figure 15 to decide upon the methodology to be used.

Complete a matrix similar to the one below for each parameter.

<table>
<thead>
<tr>
<th>Standard Element</th>
<th>Responsibility</th>
<th>Methodology used to obtain parameter</th>
</tr>
</thead>
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<td>ESCO</td>
<td>Client</td>
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<tr>
<td>Parameters that can influence</td>
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</tbody>
</table>
Figure 15: Methodology to determine parameters

Note to figure 15: Measurement would almost in all instances be the preferred option. However measurement may not be preferable in the following cases:

- If the data it would provide, increases the workload for M&V to the extent where the time and cost involved goes beyond that available or accepted as reasonable; or,
- Where the data quality is unacceptable for use.
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NOTE: Good and credible stipulations can lower the cost of performing M&V while not impacting on the credibility of the saving results reported. However using only stipulations carry high risk and using some measurements are not only advisable but highly desirable. The same approach and measurement points and measurements decided upon as part of the process defined in Figure 15, should be used for the baseline, baseline adjustments and actual energy usage for all reporting periods (pre- and post-).

13. **SPECIFY THE M&V METHOD SELECTED**
The M&V method used to determine the baseline should now be specified. Use Figure 15 and the understanding of the project gained by following this process to determine the best option.

14. **SPECIFY CALCULATIONS TO BE USED**
Specify all calculations used to determine parameters, the baseline as well as the energy performance impacts generated.

15. **SPECIFY THE M&V REPORTS**
Any and all planned M&V reports needs to be defined in the M&V plan. Specify the following for each planned report:

- **Content** - Specify what the report will contain.
- **Format** - Specify the reporting format.
- **Implementation/Timeline** - Specify the delivery time of the report as well as the projected cost to deliver the report.
- **Reporting Intervals** - Specify and agree on the intervals between reports till project contract completion. Annual reports are usually sufficient; however these may need to be issued more regularly should the client want to use the reports to keep the ECM operating at optimum levels.

For the M&V plan itself the next sections are crucial to inform all stakeholders of the planned actions, requirements and responsibilities expected to eventually ensure a successful M&V evaluation.

16. **SPECIFY PRE-IMPLEMENTATION REPORT**
The purpose of the Pre-report is to:

- Determine (verify) stated baseline conditions.
- Gather data required to develop the baseline.

The following aspects need to be addressed in the Pre-report.

16.1 **Content**
Specify what the report should contain.

The baseline parameters identified in section 10 should be included in this report.

16.2 **Format**
Specify the reporting format. This includes the format of data that should be collected (electronic formats).

16.3 **Quality Assurance**
Specify how quality assurance would be done. Aspects that should be included are listed below.
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Metering Specifications
- How and where metering will be done.
- Duration of metering.
- Metering intervals.
- Accuracy requirements (including calibration of meters).
- Metering schedule (time frames).

Sampling Requirements
This should include all aspects related to sampling (sample sizes used (where appropriate), the representativeness of the sample, the sampling interval, etc.).

Energy Accounting
Deals with calculation methodologies, accuracy and confidence levels of energy performance impacts reported on and would include the interactive effects which have an influence on the projects and its results.

Checks and Balances
Specify what methods will be used to ensure that the data capturing process and the results of the Pre-installation report is reliable.

16.4 Implementation Schedule
Provide an implementation schedule and estimated budget cost for the completion of the pre-report.

17. SPECIFY POST-IMPLEMENTATION REPORT
The purpose of the Post-Implementation report is to:
- Determine (verify) the proper installation of EEDSM measures.
- Determine (verify) that the expected changes (reductions, modifications, etc.) have been achieved.
- Verify that elements that should not be affected (e.g. system performance, comfort conditions, etc.) are at similar levels to pre-installation conditions.
- Gather the data required to calculate the baseline as well as the project performance.

The purpose of the Post-Implementation report is NOT to:
Represent a legal or contractual representation of the before and after implementation statuses, which is usually acknowledged to be part of the formal project management activities/processes. It merely represents a picture of the before and after statuses and confirms that the implementation has been done to a level where M&V can proceed with the next stage.

The following aspects need to be addressed in the Post-Implementation report.

17.1 Content
Specify what the report should contain.

The baseline and post-installation parameters identified in section 10 should be included in this report.

17.2 Format
Specify the reporting format. This includes the format of data that should be collected (electronic formats).

---

5 A useful resource for M&V practitioners: “Using Excel for M&V and Data Analysis”. 
17.3 Quality Assurance
Specify how quality assurance would be done. Aspect included is listed below.

**Metering Specifications**
- How metering will be done.
- Duration of metering.
- Metering intervals.
- Accuracy requirements (including calibration of meters).
- Metering schedule (time frames).

**Sampling Requirements**
This should include all aspects related to sampling (sample sizes used (where appropriate), the representativeness of the sample, the sampling interval, etc.) and the ultimate impact thereof on the precision and confidence levels of the energy performance impacts being reported.

**Checks and Balances**
Specify what methods will be used to ensure that the data capturing process and the results of the Post-installation report is reliable.

17.4 Implementation Schedule
Provide an implementation schedule and estimated budget cost for the completion of the Post-Implementation report.

18. SPECIFY THE M&V REPORTS

18.1 Type
Specify the reports to be issued per M&V project stage as defined in figure 5.

18.2 Content
Specify what each report will contain.

18.3 Format
Specify the reporting format.

18.4 Implementation/Timeline
Specify the delivery time of each report as well as the projected cost to deliver the report.

18.5 Reporting Intervals
Specify and agree on the intervals between reports till project contract completion. Annual reports are usually sufficient for performance Assessment of the ECM; however these may need to be issued more regularly should the client want to use the reports to keep the ECM operating at optimum levels.

19. OBTAIN BUY-IN
Submit the reports for review. To be noted that reports should only be revised if it can be shown, and accepted, that reporting is not aligned to the agreed upon M&V Plan. Therefore, reports may be revised or adjusted to align with the M&V Plan and buy-in should not pose a problem.
20. **GENERAL CONSIDERATIONS**

Typical M&V specifications may be:

- **When do we request what?**
- **When do we want it?**
- **What should it contain?**
- **How would it be evaluated?**
- **Which costs is which?**
- **Measurement data: where should it go?**
- **The project info?**
- **The baseline?**
- **The performance impacts?**
- **The emissions?**
- **Approval process?**
- **Order measurement equipment?**
- **Who will be the suppliers?**
- **Delivery times?**
- **Delivery address?**
- **Installation / installation costs?**
- **Maintenance on M&V equipment?**
- **Data requirements / data flow?**
- **Equipment specification?**
- **Data formats for the M&V to M&E centre?**
- **Verification of the energy performance vs agreement?**
Global Superior Energy Performance

21. REFERENCES


APPENDIX A: PROJECT CLASSIFICATION

NOTE: THIS PROCESS HAS BEEN AUTOMATED USING MICROSOFT EXCEL TO GENERATE THE DESIRED RESULT WHEN THE “TICKS” HAVE BEEN SUPPLIED AS INPUT. THIS AUTOMATED SPREADSHEET IS SHOWN HERE:

www.cleanenergyministerial.org/Portals/2/pdfs/Option_Selector_using_the_classification_sheet_v1r4b.xlsx
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### M&V Process for Calculating and Reporting on Energy and Demand Performance

#### Global Superior Energy Performance

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**Columns:**
- **A:** Fixed pattern(s)
- **B:** No pattern (variable)
- **C:** Fixed value or fixed pattern(s)
- **D:** Variable value or no pattern(s)
- **E:** Does the measure change the operating hours?
- **F:** Does the measure change the requirement/load?
- **G:** Does the measure change component efficiencies?
- **H:** Can post-operating hours be used for the baseline?
- **I:** Can post-requirement/load be used for the baseline?
- **J:** Fixed pattern(s)
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- **M:** Variable value or no pattern(s)
## Global Superior Energy Performance

### M&V Process for Calculating and Reporting on Energy and Demand Performance

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**Columns:**
- A: Project ID
- B: Operating hours
- C: Requirement/Load
- D: Operating hours
- E: Requirement/Load
- F: Efficiency
- G: Operating hours
- H: Requirement/Load
- I: Operating hours
- J: Requirement/Load
- K: Operating hours
- L: Requirement/Load
- M: Can post-operating hours be used for the baseline?
- N: Can post-requiring load be used for the baseline?
- O: Fixed pattern(s)
- P: No pattern (variable)
- Q: Fixed value or fixed pattern(s)
- R: Variable value or no pattern(s)
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## M&V Process for Calculating and Reporting on Energy and Demand Performance

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## Global Superior Energy Performance

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APPENDIX B: COMPLETE PROJECT CLASSIFICATION FLOWCHART (START TO FINISH)
Note: This complete classification flowchart is best viewed under high document zoom settings (300% - 400%).
The Global Superior Energy Performance (GSEP) initiative was launched in 2010 by the Clean Energy Ministerial (CEM) and International Partnership for Energy Efficiency Cooperation (IPEEC).

Through GSEP’s Energy Management Working Group (EMWG), government officials worldwide share best practices and leverage their collective knowledge and experience to create high-impact national programs that accelerate the use of energy management systems in industry and commercial buildings. For more information, please visit: http://www.cleanenergyministerial.org/energymanagement