ENERGY TRANSITION PARTNERSHIP

Powering Prosperity and Enabling Sustainability in South East Asia

Demand Side Management for the Philippines

DSM Monitoring and Evaluation Framework

By

IIEC
International Institute for Energy Conservation

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UNOPS
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Children's Investment Fund Foundation
Sequoia Climate Foundation
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1 INTRODUCTION

1.1 Background

This technical assistance, under the ETP, for the Philippine Department of Energy (DOE) will establish a Demand Side Management (DSM) Program for the electric power industry for the reduction of energy demand by promoting a range of strategies that influence and encourage end-users to reduce electricity consumption, shift load patterns, and reduce peak demand. DSM will enhance distribution grids' efficiency, enhance system flexibility and reliability, and delay the need for additional power plants. The TA will strengthen the implementation of the policy by delivering capacity building and developing a DSM toolkit. The Implementation Plan developed under the TA include a 5-year program towards achieving a sustainable DSM program in the Philippines and opportunities to benefit all electricity consumers. The combined impact of reduced energy consumption and increased penetration of variable renewables to the grid will result in more significant GHG emissions reduction and displace fossil-fuel based power generation.

1.2 Overview of Monitoring and Evaluation

Monitoring and evaluation (M&E) help improve performance and achieve results. The overall purpose of M&E is the measurement and assessment of performance in order to more effectively manage the outcomes and outputs of the interventions. Traditionally, M&E focused on "implementation" assessing inputs and implementation processes as well as monitoring and assessing how well a project, program, or policy is being executed. Today, the focus of M&E is on the results, assessing the contributions of various factors to a given development outcome. The M&E handbook published by the United Nations Development Programme (UNDP)[1] describes the following definitions for M&E.

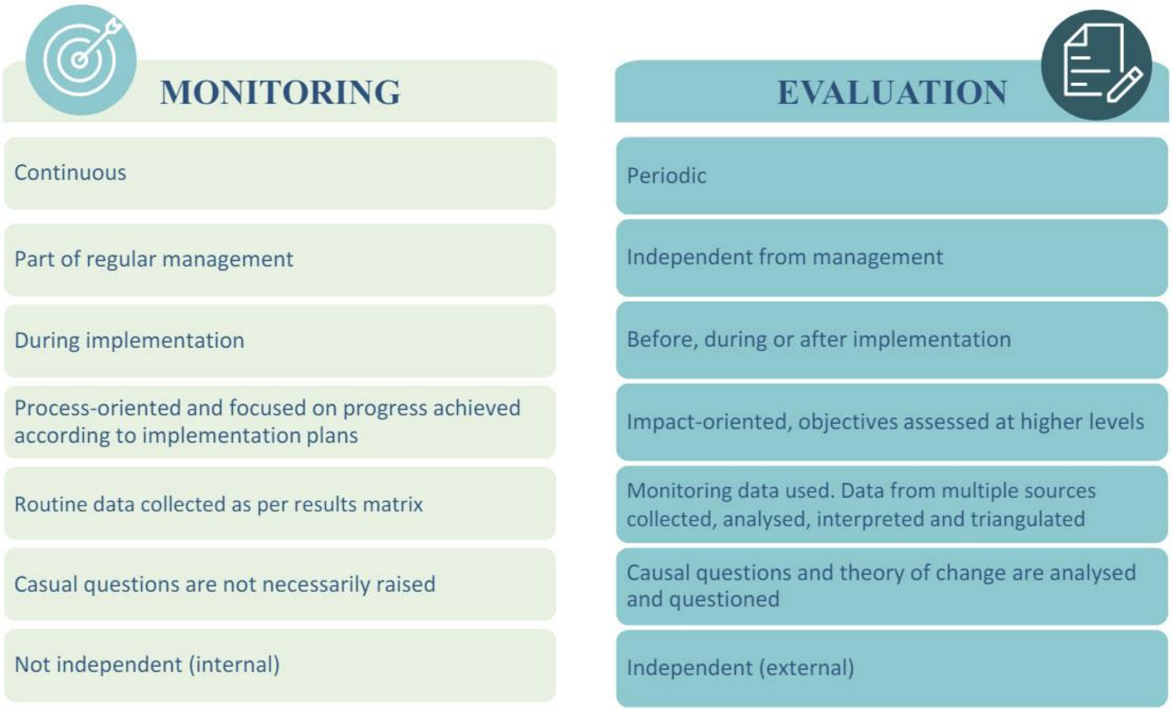
- **Monitoring:** A continuing function that aims primarily to provide managers and main stakeholders with regular feedback and early indications of progress or lack thereof in the achievement of intended results. Monitoring tracks the actual performance or situation against what was planned or expected according to pre-determined standards. Monitoring generally involves collecting and analyzing data on implementation processes, strategies and results, and recommending corrective measures.

- **Evaluation:** A time-bound exercise that attempts to assess systematically and objectively the relevance, performance and success of ongoing and completed programs and projects. Evaluation can also address outcomes or other development issues. Evaluation is undertaken selectively to answer specific questions to guide decision-makers and/or program managers, and to provide information on whether underlying theories and

[1] http://web.undp.org/evaluation/documents/handbook/me-handbook.pdf

assumptions used in program development were valid, what worked and what did not work and why. Evaluation commonly aims to determine relevance, efficiency, effectiveness, impact and sustainability. Evaluation is a vehicle for extracting cross-cutting lessons from operating unit experiences and determining the need for modifications to the strategic results framework. Evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process.

The importance of monitoring for evaluation resides in the availability of relevant and reliable data which can and should be used for evaluation. The differences between monitoring and evaluation are illustrated in the Figure 1-1 below.



Source: UNDP Evaluation Guidelines, revised edition June 2021

Figure 1-1: Differences between Monitoring and Evaluation

M&E take place at different levels of a project design framework as illustrated in Figure 1-2. At the output level, the focuses are on the specific products and services that emerge from processing inputs through program, project and other activities. At the outcome level, the focuses are on the changes in development conditions achieved through projects and programs. Outcomes incorporate the production of outputs and the contributions of partners. It should be noted that UNOPS has adopted the results-based management framework (RBMF) for this TA. Considering this, the proposed DSM M&E framework in the context of RBMF encompass both monitoring and evaluation of implementation and results of DSM programs.

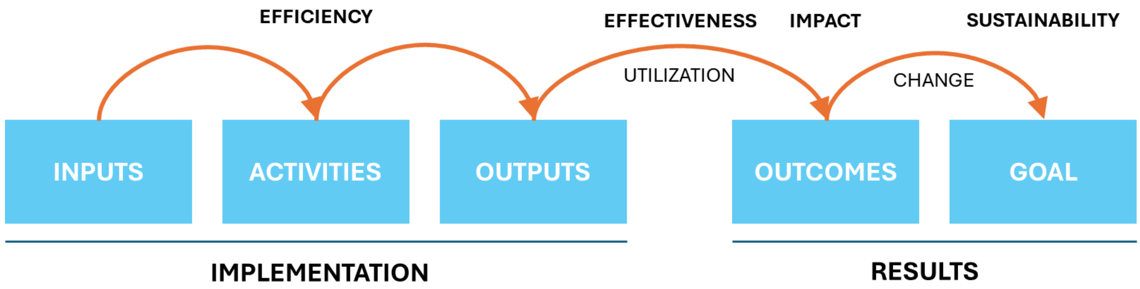


Figure 1-2: Project/Program Result Chain

1.3 DSM Program Design and Logical Framework

During the DSM program design phase, key elements of the program including a set of indicators that are SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) shall be specified in the project result framework or logical framework which also include assumptions based on local circumstances and international. In most program designs, there are usually provisions to revise the logical framework following the completion of baseline data collection and inputs from implementing agencies, partners and stakeholders. The key performance indicators specified in the design report serve as the targets for M&E. Shown in Table 1-1 are the examples of key performance indicators of a DSM program for M&E.

Table 1-1: Examples of Key Performance Indicators of DSM Program in Malawi

Parameter	Description
Goal	Sustained economic growth through increased reliability of electricity in Malawi
Purpose	20% reduction in current peak demand for electricity through the increased use of energy saving lighting and other energy saving measures
Output 1	Direct installation of 1.3 million CFLs free-of-charge in residential, public building and small enterprises in exchange for operating incandescent light bulbs (IBs), with an expected 47MW reduction in peak demand.
Output 2	Sale of 0.7 million CFLs through ESCOM and selected retail outlets at subsidized price (with an expected 13 MW reduction in peak demand)
Output 3	Revolving Fund established from the proceeds of CFL sales, and being used to fund additional Energy Efficiency (EE) Program
Output 4	Introduction of energy performance standards and policies to phase out Incandescent bulbs (IBs)
Output 5	Increased public awareness of CFLs and other energy efficiency measures through promotion and marketing campaigns

Source: Final Monitoring & Evaluation Report, Energy Efficient Lighting Project - Malawi, IIEC, November 2003

2 M&E PLANNING AND DATA COLLECTION

A robust M&E framework is essential to assess the impacts of the DSM programs and, as highlighted in the previous section, *monitoring checks the sound management of operations and regularly analyses the state of progress of outputs*, while *evaluation assesses the validity of the intervention by examining the direct and indirect impact on the target sectors and the society*.

The M&E framework discussed in this report encompasses both monitoring and evaluation of implementation and results of DSM programs. Considering that each DSM program can be unique in terms of load shape objectives, technologies, and implementation strategies, the M&E framework shall guide the baseline measurement for the DSM program data and provide the methods by which the data will be collected and the responsible parties. In addition, a bespoke M&E plan needs to be designed and deployed for each DSM program to ensure the correct tracking of the DSM program and evaluation of the program results.

2.1 M&E Planning

Each DSM program design should include a detailed M&E plan and the associated costs for M&E activities should also be included in the overall program costs. Planning for the M&E during the program design phase is the best way to ensure that the data required for a thorough and useful evaluation will be there when you need it. In principle, a DSM program should be monitored throughout the implementation period and evaluated upon completion. The DSM programs should also be subjected to an annual evaluation.

Good M&E planning should clarify:

- What is to be monitored and evaluated
- The activities needed to monitor and evaluate
- Who is responsible for monitoring and evaluation activities
- When monitoring and evaluation activities are planned (timing)
- How monitoring and evaluation are carried out (methods)
- What resources are required and where they are committed

In addition, relevant risks and assumptions in carrying out planned M&E activities should be seriously considered, anticipated and included in the M&E plan. Development of a M&E plan for a DSM program usually requires:

- **Specification of program objectives**. Depending upon the specific objectives of the DSM program, different monitoring approaches, data collection efforts, monitoring report output content and schedule will be more or less appropriate.
- **Selection of program performance measures**. Once the program objectives are defined, specific measures of program performance relative to meeting these objectives can be developed. Implicit in the selection of the program performance measures is the definition of the data items that will be required to support those measures, as well as

the analytic procedures needed to transform the data into useful information for program management decision-making.

- **Prepare data collection plan.** Once the data needed for M&E has been defined, appropriate data sources and data collection methods (including a timeline for the data collection effort) can be prepared. Data storage issues, and the assignment of specific responsibility for data collection, can also be addressed at this stage.

A planning document for DSM M&E activities should be prepared to provide details pertaining to M&E, including but not limited to DSM objectives, monitoring activities, types of evaluation, baseline and program data sources and collection approaches, methods to be used for the analysis, and responsible parties for different M&E activities. The M&E plan should allow for review and modification of the original performance indicators, milestones and targets specified in the program design document. Provided below is the basic outline of the M&E plan for a DSM program.

- DSM Program Description
- M&E Objectives
- Monitoring Plan (indicating what data will be tracked and reported on a regular basis, and what data will be tracked and maintained for later periodic evaluation)
- Impact Evaluation (including calculation, definition and assumptions, as well as sources of data for impact evaluation)
- Process Evaluation
- Market Evaluation
- Program Cost Effectiveness
- Information Requirements
- M&E Schedule

2.2 Data Collection Method

Several sources of information are generally relied upon for collecting data to support DSM monitoring and evaluation activities. The most commonly used data collection methods include the followings:

- **Interviews with participating and non-participating targeted customers.** These interviews can be used to address customers' motivations and barriers regarding both the program and targeted technologies, as well as their reactions to use of and satisfaction with program materials and services.

- **Interviews with trade allies that interacted and did not interact with the program.** These interviews can be used to get another point of view on the program's impact on customer attitudes and behaviour, as well as to investigate trade ally motivations towards, and barriers to, the program and the targeted technologies. The interviews can also identify trade ally reaction to, use of and satisfaction with the program materials and services.

- **Equipment supplier sales records.** If available, equipment sales records and other inventory information can be very useful in establishing whether, and the degree to which, stocking, price and sales levels, of the targeted technologies has changed due to implementation of the program. Obtaining use of this information generally requires careful advance work with the equipment suppliers and measures for ensuring the confidentiality of their information.

- **Interviews with utility staff.** Interviews with utility staff with program implementation and/or general customer contact responsibilities can provide a valuable source of information on how well the program implementation process is meshing with other utility services and requirements, as well as suggestions for improvements. These interviews can also provide another "window" on how well program materials and services are meeting customer needs.

- **Program records.** A set of program databases should be set up to track program costs, program marketing activities undertaken and customer response to them, as well as the data and outcome of each step in the delivery of program services to targeted customers.

- **Utility billing and/or customer files.** The utility billing system offers a comprehensive set of electricity consumption and cost data per customers. Depending on types of customers and practices of distribution utilities, the utility billing system could also provide information on electricity demand and power factor.

- **Engineering estimates.** While not a data source per se, engineering estimates can provide a valuable means for assessing program impacts and cost-effectiveness, and are often much easier to use than billing records. They can also be used earlier than billing data to provide an estimate of program performance. Key inputs to the engineering estimate must be gathered through equipment suppliers and end-users and include: type of equipment replaced and installed, equipment specifications, usage pattern.

- **On-site monitoring of program participant energy end-use.** A small number of sites can be monitored to help validate the engineering estimates

A centralized platform or database on DSM programs could be established to streamline the tracking and reporting of DSM program performance. The centralized platform/database should be equipped with a user-friendly interface for better appreciation and understanding of the consumers (particularly, the possible savings that may be attained) to encourage wider and more active participation from utilities and end-users.

3 DSM PROGRAM MONITORING FRAMEWORK

Multiple tools can be used for monitoring a DSM program, however, the key performance indicators included in the DSM program design and logical framework should serve as the basis of the DSM program monitoring. Ongoing monitoring and tracking of program data should be used as an indicator of potential problems — it can provide early identification of areas that need attention and that should be addressed in later evaluation. This information will assist in making sure that a program is on track, as well as providing information for a full evaluation which should be conducted once every year or two (or longer, after programs are well underway). Some basic performance indicators for DSM program monitoring are given below.

- **Customer participation** — to see how well it matches market participation projections over time
- **Program implementation processes** — to improve the efficiency and effectiveness of program delivery mechanisms
- **Program expenditures** — to verify that programs are within budget, and to provide suitable data to support program cost-effectiveness analysis
- **Tracking progress** — in accordance with timeline and market penetration projections and overall achievements versus expectations and budget.
- **Ongoing opportunities** — Identifying opportunities for improving program design features and implementation procedures in order to improve (1) program take-up by targeted customer segments, and (2) efficiency of program delivery
- **Analysis** — providing suitable data to support program cost-effectiveness analysis.

Basic monitoring activities would include periodic review meetings and preparation of progress reports to enable review of the performance indicators. Basic monitoring frameworks are outlined in the Table 3-1 below.

Table 3-1: Basic Monitoring Framework

Quarterly Progress Report/Meeting	Half Yearly Progress Report/Meeting	Annual Report/ Assessment
• Compare quarterly expenditure reports with the annual budget • Use budget as an input to measure rate of implementation	• Use the annual work plan as a basis to track implementation progress • Assess any emerging issues and identify solutions to address them	• Assess objective achievements • Evaluate implementation progress and risks • Identify and address specific cross-cutting issues (e.g., stakeholder engagement, gender mainstreaming, etc.)

4 DSM PROGRAM EVALUATION FRAMEWORK

The DSM programs are evaluated to identify ways to make the programs better and the primary objectives of the DSM program evaluation usually include:

- To determine whether the program is meeting its goals and objectives
- To assess participant satisfaction with the program
- To determine whether the program design and implementation processes are effective and efficient

An important aspect of evaluations is to have timely information that can be used to improve current program implementation as well as information for improving future programs. An evaluation indicates if the DSM resources can be relied upon and also indicates how well the program has worked, what has been its impact, can the program be replicated, and should it be adjusted. In addition, there can be other process and market evaluations indications, such as customer satisfaction with new energy efficient products, number of new vendors of DSM technologies, which marketing approaches are the most effective, potential for more DSM, and actual values that can be used in future estimates of DSM savings - for example, estimates of savings per home. A full DSM program evaluation should be externally conducted by the independent evaluator once every year or two (or longer, after programs are well underway).

4.1 Types of DSM Program Evaluation

There are three basic types of DSM program evaluation:

- **Impact Evaluation** – Evaluate how much energy (and demand/capacity) was saved? This type of evaluation measures actual energy savings and program cost-benefits. Factors considered include energy savings verification (kWh and kW), persistence of savings over time, costs to utility and customer and external impacts (environmental, societal and political).

- **Process Evaluation** – Process evaluation determines how well is the program working, can it work better? The process evaluation examines program marketing, administration and operations and measure customer awareness, participation and satisfaction. Factors such as program design and delivery mechanisms, participation levels, barriers to participation and customer satisfaction are examined.

- **Market Evaluation** – Market evaluation identify what changes have occurred in the market? It measures the potential for energy savings by assessing the target market prior to program implementation, and the remaining market potential periodically throughout the program. Customer characteristics (e.g., demographics and energy use), market features (e.g., building characteristics and fuel type) and trade ally support (e.g., from developers, contractors, architects, retailers and wholesalers) are considered.

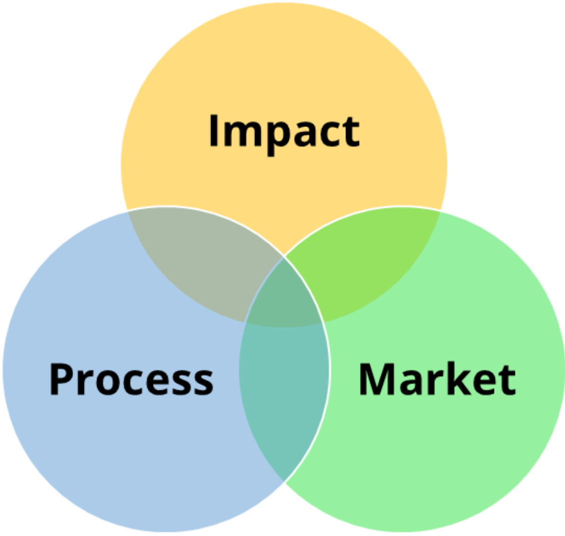


Figure 4-1: Three Basic Types of Evaluation

Although the three types of evaluation are distinguished, they are related in a variety of ways:

- questions may overlap
- data sources may overlap
- analytical techniques may be shared, and
- skills may be similar.

Because of this, it is often easier and more cost-effective to combine one or more of the evaluation efforts in a single project.

4.2 Evaluation Framework and Methods

M&E of a DSM program can cover multiple types of DSM program evaluation and the M&E plan should provide details on the evaluation method and how data will be collected and analyzed for each performance indicator.

Table 4-1: Basic Evaluation Framework with Details on Evaluation Methods

Evaluation Objective	Evaluation	Method
Energy and Peak Savings - Determine energy (MWh) and peak demand (MW) savings associated with the program.	Impact	Engineering Calculations using manufacturer electrical appliance specifications and estimates for other factors such as operating hours of lamps from survey data and measurements of selected distribution feeders

Evaluation Objective	Evaluation	Method
Environmental benefits – determine reduced pollutant emissions - such as GHG emissions	Impact	Engineering estimates – reduction in use of stand-by generators, pending availability of valid data
Improve customer service - evaluate how consumers have responded to the DSM program and their satisfaction with the program	Process	Surveys of customers (post-implementation)
Assist poor communities – evaluate benefits to poor customers	Process	Surveys of low-consumption customers
Build market for DSM technologies - evaluate how distributors and retailers of DSM technologies responded to the program and possibly changed their way of selling the products	Market	Surveys of distributors and retailers
Encourage use of energy efficient appliances – evaluate current products and determine marketing strategies for promotion	Market	Surveys of distributors and retailers
Prepare recommendations on how the program could be improved	All	Analysis of overall evaluation results

4.3 Additional Data Collection for Evaluation

Usually, during an evaluation, a thorough analysis of monitored data is performed. However, to fully assess how well a program is doing in terms of both impact and process, additional information is usually required.

- **Customer satisfaction with the technology** — to assess whether a DSM program is meeting the needs of participants and to ensure that customers continue to like and use the technology. (Programs have failed because customers who don't like a technology after it has been installed find ways around its energy saving characteristics, for example, they move a CFL to a cupboard where it is rarely used.)

- **Customer satisfaction with the program** — to identify opportunities for improving program design features and implementation procedures to increase program take-up by the targeted customer segments, and

- **Energy and demand savings** — to verify that technologies work as well as expected — and last as long as expected — once installed in the field, and that the savings have the same impact on the utility load shape as expected.

Example of evaluation questions that would lead to additional data collections are as follows:

Table 4-2: Example of Evaluation Questions

Example of Evaluation Questions			
	Impact Evaluation	**Process Evaluation**	**Market evaluation**
Stakeholder	Effectiveness	Efficiency	Efficiency
Participants	Participant kW and kWh savings	Ease of participation, Satisfaction, Service problems	Cost per participant, Participation rates, Marketing effectiveness
Utility	Net system kW and kWh savings	Administrative efficiency, Management functions, Information systems	Savings per participant, Competitive position
Trade Allies	Unit Sales, Profits	Administrative and inventory costs	Market share, consumer demand
Customers	Reliability, Rates	Perception of utility, Awareness of service and barriers	Non-program barriers, Responsiveness and unfulfilled needs

4.4 Factors Affecting Impacts of DSM Program

DSM programs will result in overall energy and demand savings for both customers and the utility. However, the net impact of each DSM program will depend on several factors, such as program participation, Number of units adopted by each participant, average annual use of equipment, Average loading of equipment.

4.4.1 Program Participation

The program participation refers to the number of customers adopting the DSM program or number of customers replacing the base technology with the alternative DSM technology. The program participation rate will determine the impact in the form of energy and demand savings.

The program participation rate will depend on several factors, such as demographic characteristics of customers, market potential, attributes of the DSM technology, marketing and promotional activities.

The market potential refers to the total number of customers, number of eligible customers and number of willing customers. Often not all of a particular market are eligible for the DSM idea either because they have it installed already, or there are some technical limitations to its installation, or because the use pattern does not justify the investment among all customers, or because there are some program rules concerning participation.

Again out of the eligible customers not all will be willing to participate because of their value perception of the program. The actual participants will be among the willing customers who would find the DSM program well in line their needs, value perception or other similar factors.

The attributes of the DSM technology may also play an important role in determining the participation rate. The participation rates will be higher if the attributes of the DSM equipment match more closely with the needs and value perception of a large number of customers.

The manner, in which the DSM equipment is offered is most important for achieving higher levels of participation. In order to maximize customer value perception, the marketing and promotional activities should focus on establishing close relationship between customer needs and the attributes of DSM offering; product or service.

In this regard it is probably important to fragment customer population into different segments according to varied needs. Based on the level of match between the attributes of DSM offering and the need and value perception of customers, each segment can be targeted separately for different DSM products. As a result, different DSM products may be offered with different promotional approaches to best meet expectations and needs of customers in different segments.

4.4.2 Number of Units Adopted by Each Participant

The number of units of DSM equipment, adopted by the participants, will also affect the impact of DSM program. Again higher the number of DSM equipment used by the participants higher will be the impact in the form of energy and demand savings.

The total number of units of equipment used by the customers will be the product of total number of participating customers and the average number of units used by each customer.

The number of units of DSM technology adopted by each participant will depend on the number of base technology units currently being used by the participating customer. Unit price of DSM equipment may also affect the number of units adopted by the participating customer.

4.4.3 Average Annual Usage of Equipment

The amount of energy saved will depend on the period of operation of the DSM equipment adopted by the customers. Generally, the usage of equipment is measured in number of hours of operation in a year. For example, it is generally assumed that on average household lighting equipment operates for around 1,095 hours in a year.

A very large-scale diversity may be found with the estimates of the use of different types of equipment by different types of customers. Engineering estimates generalize these diversities into reasonably closer average values that can reliably be used for estimating the overall impacts of DSM programs.

4.4.4 Average Loading of Equipment

The equipment rating or operating load of the equipment is a readily available value for all equipment. The average loading for many types of equipment (e.g., undimmed lamps) is 100%. However, other types of equipment may be able to operate at part-load values. For example, motors generally operate at around 60% - 90% loading.

Use of 100% loading or nameplate rating of all DSM units, to estimate the impact on energy and demand, can give misleading results. Again using the engineering estimates the average value of equipment loading over its average annual operation should be used.

4.5 Impact Evaluation Approach

Impacts in terms of energy and demand savings for the customers, participating in a program, could be estimated in a fairly straightforward manner. For example, a householder replaces 3 out of 10, 36W lamps, each operating for an average of 1,095 hours per year, with 18W lamps. The annual energy and demand savings for the household can be calculated as;

Annual Energy Savings = 3 x (36 - 18) x 1095 / 1000 = **59.13 kWh**

Demand Reduction = 3 x (36 - 18) / 1000 = **0.054 kW**

The above calculation of the net annual energy savings is just a simple engineering estimates, based on the following formula.

The calculation for ***Annual Energy Savings*** is:

Total Energy Savings (kWh) = (number of lamps installed) x (wattage of new lamp–wattage of old lamp) x average annual operating hours / 1,000

The calculation for ***Demand Reduction*** is:

Demand Reduction (kW) = (number of lamps installed) x (wattage of new lamp–wattage of old lamp) / 1,000

However, estimation of impacts on utility is more complicated since not all lamps will be used during the system peak demand and distribution network losses need to be considered in the estimation. Considering this, the calculation for ***Net Energy Savings*** for utility is:

Net Energy Savings = Annual Energy Savings / (1-Network Loss Factor)

The ***Network Loss Factor*** is used to calculate reduction in energy/ peak load due to reduced network loading and hence reduced network losses. Note that magnitude of network losses is proportional to the square of line current. Consequently, a greater loss factor is generally used at the time of system peak.

While the calculation for ***Peak Demand Reduction*** is:

Demand Reduction (kW) = (number of lamps installed) x (wattage of new lamp–wattage of old lamp) / 1,000 x coincidence factor

The ***Coincidence Factor*** is an estimate of the percentage of DSM technologies that are operating during the system peak demand in the utility's franchise area.

Box 1: What is the Coincidence Factor?

Coincidence Factor

The term "coincidence" factor is related to the time-of-use or load shape characteristics of the particular end use equipment in question and are used for calculating the demand effects on the electricity system.

It is important to remember that the technology-level economic calculations apply to an imaginary "average" unit of technology from a population of similar units. For most types of electrical equipment, individual units may be either on or off at any instant. However, the load from an entire population of such units tends to vary continuously as individual units are switched on and off throughout the day. This gives rise to a load shape or load profile, as in the example shown here.

The average demand of the various pieces of end use equipment represented by the curve D fluctuates throughout the day, consuming energy represented by the area under the curve E. If all of the equipment in the population represented by the curve D was turned on at once, the curve would reach the maximum capacity, C. In other words, the value of the curve D represents the proportion of load in the population that is operating at any given instant.

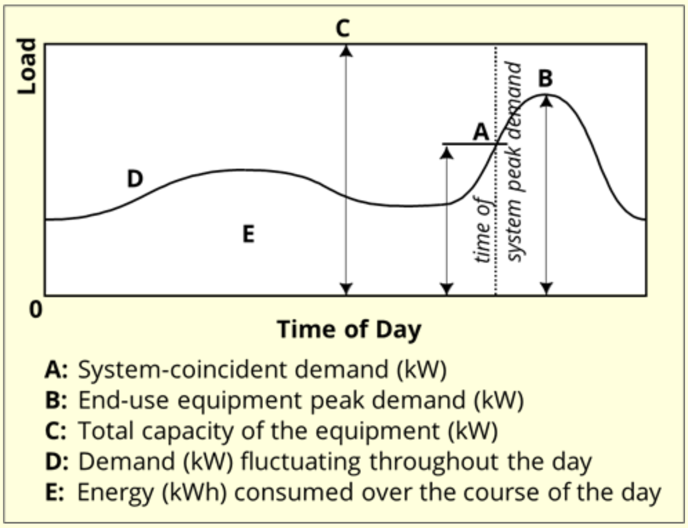


Figure 4-2: Typical Load Profile

In the economic cost-effectiveness calculation, the system demand impact is calculated as the product of the equipment rating, the coincidence factor, which is equivalent to A/C. This number is the answer to the question: at the time of the system peak, what proportion of the end use load in question is turned on?

In addition to the abovementioned engineering calculations, there are various methods and tools that can be adopted for evaluation of impacts of DSM technologies at the facility and project/program levels. Some of these methods are subsequently discussed in this section.

4.5.1 IPMVP

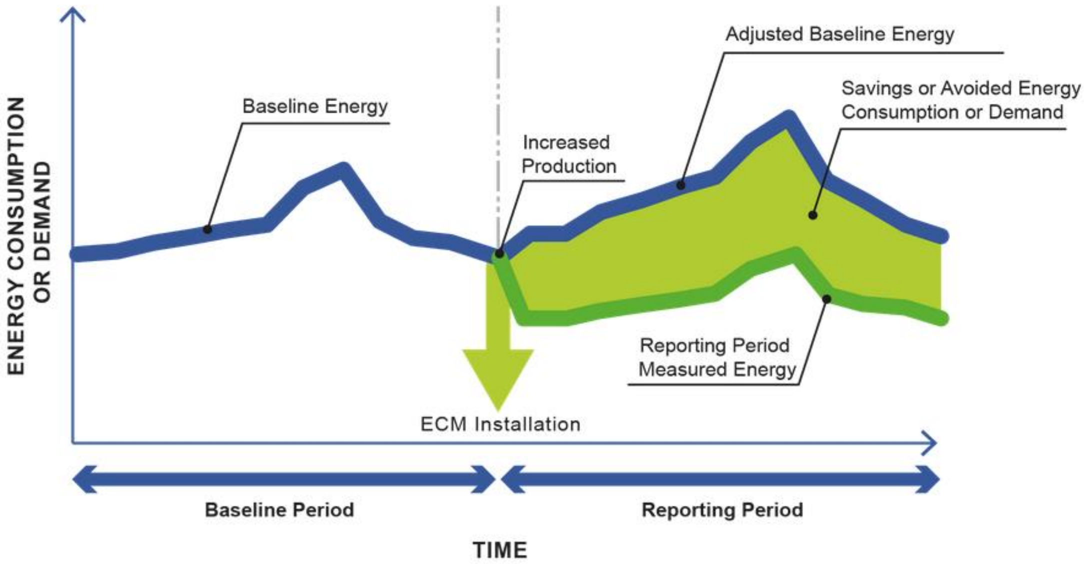
The International Performance Measurement and Verification Protocol (IPMVP) published by the Efficiency Valuation Organization (EVO)[2] is an international Measurement and Verification (M&V) protocol describing different methods to determine water and energy savings of energy efficiency projects. IPMVP is one of the most comprehensive frameworks for M&V at the facility level, and has been used as the de-facto M&V standard in many countries.

Since energy or GHG savings cannot be directly measured, because savings represent the absence of energy consumption, savings are determined by comparing measured consumption before and after the implementation of a program. The comparison of before and after energy consumption should be made on a consistent basis, using the following general M&V equation:

$$\text{Savings} = (\text{Baseline Period Energy} - \text{Reporting Period Energy}) \pm \text{Adjustments}$$

The energy baseline is defined with the information from the initial energy baseline assessment and with the data that has been collected in an appropriate period of time. All changes to the energy-related performance must be measured and assessed on this basis. GHG baseline is easily calculated from the energy consumption baseline using the official grid emission factor of the country. The overall IPMVP framework for baseline establishment and determination of savings are illustrated in **Error! Reference source not found.**.

[2] www.evo-world.org



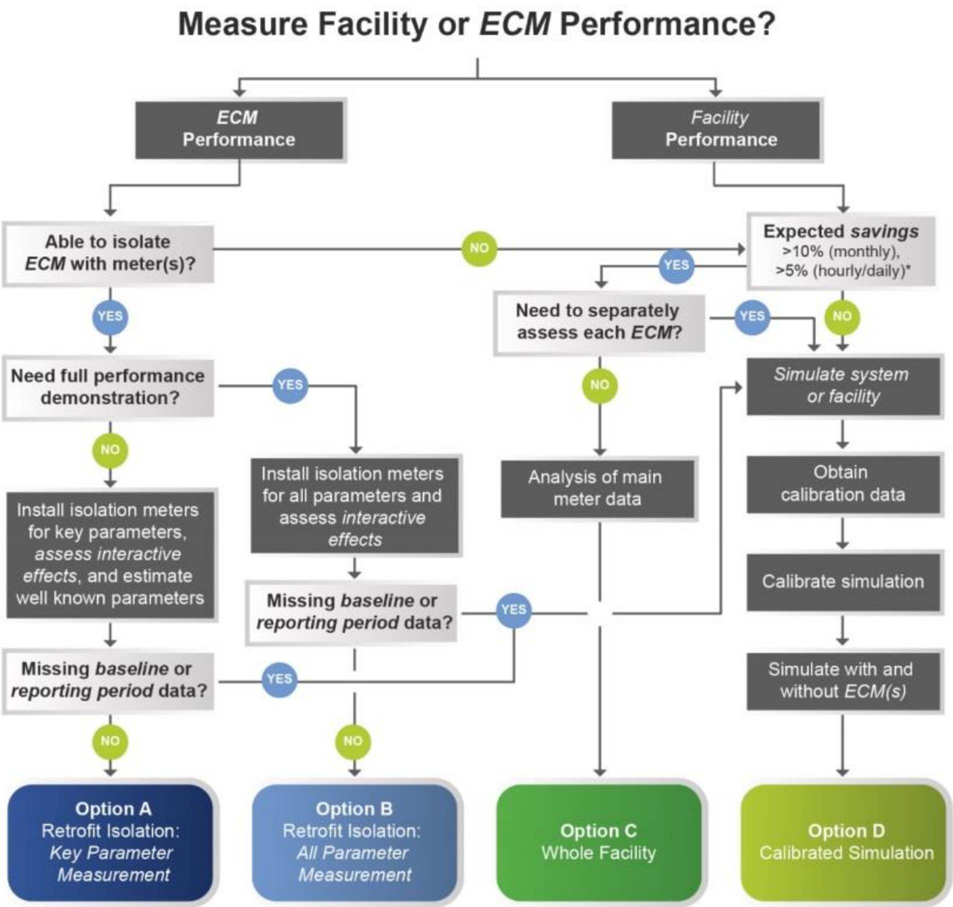
Source: www.evo-world.org

Figure 4-3: IPMVP Framework

IPMVP presents four M&V options for baseline establishment and savings estimations, including:

- Option A: Retrofit isolation with key parameter measurement
- Option B: Retrofit isolation with measurement of all parameters
- Option C: Whole facility
- Option D: Calibrated simulation

The IPMVP documents provide detailed guidelines and examples on to apply different IPMVP options for Energy Conservation Measures (ECMs), as shown in Figure 4-4.



Source: Measurement & Verification – Issues and Examples, IPMVP, EVO 10300-1:2019, February 2019

Figure 4-4: IPMVP Options

4.5.2 CDM Methodology

The Clean Development Mechanism (CDM) requires the application of a baseline and monitoring methodology in order to determine the amount of Certified Emission Reductions (CERs) generated by a mitigation CDM project activity in a host country. Methodologies are classified into five categories:

- Methodologies for large-scale CDM project activities;
- Methodologies for small-scale CDM project activities;
- Methodologies for large-scale afforestation and reforestation (A/R) CDM project activities;
- Methodologies for small-scale A/R CDM project activities;
- Methodologies for carbon capture and storage (CCS) project activities.

CDM defines energy efficiency as all measures aiming to enhance the energy efficiency of a certain system. Due to the project activity, a specific output or service requires less energy consumption. According to the CDM Methodology Booklet, published in December 2020, there are various CDM methodologies related to measurement of emissions in the power sector. However, the three most relevant CDM methodologies for DSM program are the three following small-scale CDM methodologies:

1. AMS-II.C. Demand-side energy efficiency activities for specific technologies
2. AMS-II.E. Energy efficiency and fuel switching measures for buildings
3. AMS-II.L. Demand-side activities for efficient outdoor and street lighting technologies

AMS-II.C provides guidelines for measurement of emission impacts from implementation of specific energy efficiency technologies which are relevant to the IPMVP Option A and B. While the AMS-II.E's guidelines look at the impacts of energy efficient at the facility level, which are more relevant to the IPMVP Option C. Projects that involve fuel switching and/or the installation of renewable energy technologies to generate electricity for self-consumption (e.g., rooftop solar PV panels) are eligible under the AMS-II.E methodology. These CDM methodologies require different data sets which shall be reflected in the M&E plan if they are adopted.

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