



Economic Commission for Europe

Committee on Sustainable Energy

**Steering Committee of the Energy Efficiency 21 Project
Group of Experts on Energy Efficiency
Investments for Climate Change Mitigation****Sixteenth session**

Geneva, 20-22 October 2010

Item 6 of the Provisional Agenda

Seminar on Policy Reforms to Promote Energy Efficiency and Renewable Energy Investments**Seminar on Policy Reforms to Promote Energy Efficiency
and Renewable Energy Investments****Background paper on measurement and verification of energy
efficiency and renewable energy projects****Note by the secretariat****I. Introduction**

1. In accordance with the Work Plan (ECE/ENERGY/WP.4/GE.1/2010/3) and the Project Document on Financing Energy Efficiency and Renewable Energy Investments for Climate Change Mitigation (FEEI), the capacity building trainings on project development, finance and business planning will be conducted in all participating countries.
2. The trainings on measurement and verification process for energy efficiency and renewable energy projects are a part of the energy efficiency business development course programme. The guiding tool for measurement and verification techniques and common practices is the International Performance Measurement and Verification Protocol (IPMVP).

II. Background

3. In the context of the FEEI project, the trainings on Measurement and Verification of energy efficiency and renewable energy projects will be conducted as part of the Business Development Course Programme, which was developed based on the results of the

assessment missions to participating countries in 2008. The objectives of the assessment missions were, *inter alia*, to determine the local capacity and training needs of local experts to prepare investment projects and to appraise their knowledge of equity and mezzanine financing for projects, other types of third party financing, energy service companies (ESCOs), and performance contracting.

4. The international experts participating in assessment missions agreed that there is a need to conduct capacity building trainings on financial engineering and business planning skills to develop and prepare bankable project proposals for energy efficiency and renewable energy investment projects, business development skills to prepare equity and/or mezzanine finance participation of an investment fund in local companies, manufacturers of energy efficient technology, energy service company, and skills to develop an indicative project pipeline to a standard project identification format.

III. Measurement and verification process

Definition

5. Measurement and Verification (M&V) is the process of using measurement to reliably determine actual savings created within an individual facility by an energy management, energy conservation or energy efficiency project or programme.

6. The definition of savings includes the reduction in energy use or cost. Physical savings may be expressed as avoided energy use or normalized savings. Monetary savings may be expressed similarly as “cost avoidance” or “normalized costs savings”. As savings cannot be directly measured, the savings can be determined by comparing measured use before and after implementation of a project, making appropriate adjustments for changes in conditions. While a retrofit project may reduce energy consumption on a campus, a thorough M&V process is essential for two reasons: 1) M&V assesses resource savings in regards to the performance guarantee; and 2) M&V helps ensure that savings will persist over time.

7. The expression “what cannot be measured cannot be managed” is particularly relevant in the context of energy efficiency initiatives. There is thus an important need to “measure and verify” savings generated by a project. Without such measurement and verification one will not be able to value the results of an investment in energy efficiency (therefore not inviting recognition, duplication, continuous investments, etc.); and energy reduction gains achieved through the initiative or project will likely disappear in part or completely over time.

Objectives

8. Facility owners or energy efficiency project investors can use M&V techniques to mitigate various risks that can arise after project completion. Energy efficiency practitioners are using M&V for the following purposes:

(a) *Improve engineering design and project costing*: The preparation of a good M&V plan encourages comprehensive project design and costing by including all M&V activities and costs in the project’s economics. Good M&V also provides feedback for future project designs.

(b) *Increase energy savings through proactive adjustments in facility operations and maintenance*: After project implementation, a good M&V plan helps managers discover and manage maintenance and operating problems so they can run their facilities more

effectively, improve savings, achieve greater persistence of savings over time, and lower variations in savings.

(c) *Document financial transactions:* For some projects, the energy efficiency savings are the basis for performance-based financial payments and/or a guarantee in a performance contract. A well-defined and implemented M&V Plan is the recommended basis for documenting performance in a transparent manner that can be subject to independent, third party verification.

(d) *Enhance financing for efficiency projects:* A good M&V Plan increases the transparency and credibility of reports on the outcome of efficiency investments. It also increases the credibility of projections for the outcome of efficiency investments. This credibility can increase the confidence that project capital providers have in energy efficiency projects, enhancing the chances of projects receiving financing under the best terms possible.

(e) *Manage energy budgets:* Even where savings are not planned, M&V techniques help managers evaluate and manage energy usage to account for variances from budgets. M&V techniques are used to adjust for changing facility-operating conditions in order to set proper budgets and account for budget variances.

(f) *Enhance the value of emission-reduction credits:* Accounting for emission reductions provides additional value to efficiency projects. Use of an M&V Plan for determining energy savings improves the accuracy and reliability of emissions-reduction reports. Thus documented, those reductions could possibly be sold in carbon markets, providing an opportunity to recover some portion of M&V and other project costs.

(g) *Support evaluation and development of broader efficiency programmes:* Utility or government programmes for managing the usage of an energy supply system can use M&V techniques to evaluate the savings at selected energy user facilities. Using statistical techniques and other assumptions, the savings determined by M&V activities at selected individual facilities can help predict savings at unmeasured sites in order to predict/report on the performance of a broader programme.

(h) *Increase public and marketplace understanding of energy management as a public policy tool:* Improving the credibility of energy management projects provides proof that such projects yield real reductions in energy use. One of the benefits of such proof is increased marketplace acceptance of such projects. It therefore encourages investments in energy efficiency.

9. Any of the parties involved in a project can design and implement an M&V Plan. In the specific case of a performance contracting project, the beneficiary of a project (the client), the project implementer (the ESCO), a combination of both of these parties, and/or a third party, are all good and acceptable options for creation and implementation of a solid M&V Plan.

Main principles

10. There are some fundamental principles of measurement and verification:

(a) M&V reports should be as accurate as the M&V budget will allow. M&V costs should normally be small relative to the monetary value of the savings being evaluated. M&V expenditures should also be consistent with the financial implications of over-or under-reporting a project's performance. Accuracy tradeoffs should be accompanied by increased conservativeness in any estimates and judgements.

- (b) The reporting of energy savings should consider all effects of a project. M&V activities should use measurements to quantify all the significant measurable effects, while estimating all others.
- (c) Where judgements are made about uncertain savings quantities, M&V procedures should be designed to underestimate savings.
- (d) The reporting of a project's energy effectiveness should be consistent among:
- different types of energy efficiency projects;
 - different energy management professionals for any one project;
 - different periods of time for the same project; and
 - energy efficiency projects and new energy supply projects.
- (e) "Consistent" does not mean "identical," since it is recognized that any empirically derived report involves judgments which may not be made identical by all reporters. By identifying key areas of judgment, it is possible to avoid inconsistencies arising from lack of consideration of important dimensions.
- (f) The determination of savings should measure the performance parameters of concern, or least well known, while other less critical or predictable parameters may be estimated.
- (g) All M&V activities should be clearly and fully disclosed. Full disclosure should include presentation in the M&V Plan and M&V savings reports of all of the elements defined in chapters 5 and 6 of the IPMVP.
- (h) The balance of these principles enable an M&V expert to present a flexible framework of basic procedures for achieving M&V for energy efficiency projects.

IV. The International performance measurement and verification Protocol

11. The International Performance Measurement and Verification Protocol (IPMVP)¹ is a guidance document describing common practice in measuring, computing and reporting savings achieved by energy or water efficiency projects at end-user facilities. The IPMVP presents a framework and four M&V Options for transparently, reliably and consistently reporting a project's saving. M&V activities include site surveys, metering of energy or water flows, monitoring of independent variables, calculation, and reporting.

12. The IPMVP promotes efficiency investments by documenting common terms and methods to evaluate performance of efficiency projects for buyers, sellers and financiers. It provides methods, with different levels of costs and accuracy, for determining savings either for the whole facility or for individual energy conservation measures. IPMVP specifies the contents of the M&V Plan and applies to a wide variety of facilities including existing and new buildings and industrial processes.

¹ The IPMVP is supported by the Efficiency Valuation Organization (EVO), a non-profit private organization, which mission is to develop and promote the use of standardized protocols, methods and tools to quantify and manage the performance risks and benefits associated with end-use energy efficiency, renewable energy, and water efficiency business transactions. EVO envisions a global marketplace that correctly values the efficient use of natural resources and utilizes end-use efficiency options as a viable alternative to supply options. EVO's Mission is carried out by many volunteers, affiliates and "in-kind" supporters.

13. The IPMVP is intended to be used by professionals as a basis for preparing savings reports. Each user must establish its own specific M&V Plan that addresses the unique characteristics of the project. The IPMVP provides a users guide to helps different types of readers to understand common ways of its application, defines M&V techniques, underlying the principles of good M&V, presents basic methodologies and adjustments to energy or water measurements needed to properly report savings.

14. The implementation of the IPMVP will help increase energy savings, document financial transactions and enhance financing for energy efficiency projects. Using this protocol will increase the confidence level of investors and project sponsor knowing that projects performance will be measured, monitored and verified according to an internationally recognized protocol.

15. The IPMVP use brings the following benefits:

(a) Substantiation of payments for performance. Where financial payments are based on demonstrated energy or water savings, adherence to IPMVP ensures that savings follow good practice. An IPMVP-adherent savings report allows a customer, an energy user or a utility, to readily accept reported performance. Energy service companies whose invoices are supported by IPMVP-adherent savings reports, usually receive prompt payments.

(b) Lower transaction costs in an energy performance contract. Specification of IPMVP as the basis for designing a project's M&V can simplify the negotiations for an energy performance contract.

(c) International credibility for energy savings reports, thereby increasing the value to buyer of the associated energy savings.

(d) Help national and industry organizations promote and achieve resource efficiency and environmental objectives. The IPMVP is widely adopted by national and regional government agencies and by industry organizations to help manage their programmes and enhance the credibility of their reported results.
