Performance Guarantee Monitoring

M&V Plan Overview

Implementing measurement and verification (M&V) strategies in energy performance contracts is required for the contractor to verify the achievement of energy cost savings "guaranteed" in the contract. Beyond satisfying the law, properly applied M&V can accurately assess energy savings, allocate risks to the appropriate parties, reduce uncertainties to reasonable levels, monitor equipment performance, find additional savings, improve operations and maintenance, verify cost savings guarantee is met, and allow for future adjustments as needed.

This M&V plan is prepared by Energy Systems Group (ESG) for Howard County to help both parties agree on the methodologies to justify savings for the Energy Conservation Measures (ECMs) proposed. The International Performance Measurement & Verification Protocol (IPMVP, Revised April 2007) is used as the basis of determining energy savings in this M&V plan. This M&V plan specifies the approach to monitor the actual energy savings associated with the project, provide sample energy savings calculation documents, describe the methodology, measurement, and monitoring format of actual energy savings, and define the conditions to adjust the energy consumption baseline throughout the contract period.

M&V Approach Summary

IPMVP Option C[1] is the approach used in this M&V process with consideration of the characteristic of the overall impact of the project at the utility meter. Lighting retrofits, chiller, RTU and boiler plant retrofits, AHU, RTU and other mechanical system upgrades, control system upgrades and renewable energy technology are the significant ECMs proposed in this project.

The option C compares annual baseline utility meter data with comparable performance-period meter data to calculate the energy savings. The approach makes adjustments for weather, number of billing days and other parameters that vary from the baseline to the specific performance-period year. The proposed Option C methodology is for the whole program and is not building specific. The offered energy and cost guarantee applies to the total electrical (kWh and kW), thermal (natural gas and oil) and associated cost reductions.

Global Assumptions

Risk & Responsibility

Performance of equipment, both before and after a retrofit, can be measured with varying degrees of accuracy. However, it is important to allow for changes in energy cost savings that may result from factors outside either party's control. All key risk and responsibilities will be identified and clarified in this M&V plan.

[1] Excludes operational and construction-period savings; and the water measure is proposed as Option A

Major Changes in Facilities

ESG will not be responsible for any changes in the facility. The actual savings will be adjusted according to the changes if applicable.

Operating Hours

The Howard County generally has control over the operating hours. Increases and decreases in operating hours can show up as increases or decreases in "savings" depending on the M&V methods. ESG and Howard County will determine and agree on the operating hours. Any changes of that afterwards would result in the adjustment of the contractual savings.

Equipment Performance

ESG will have control over the selection of any equipment installed and is responsible for its proper installation and performance.

Operation and Maintenance

Operation and Maintenance activities can impact the equipment performance. The responsibilities will be negotiated between both parties and specified in the contract.

Equipment Replacement

Responsibility for replacement of contractor-installed equipment is negotiable; however, it is often tied to an ECMs performance. Howard County is responsible to inform ESG about any replacement of such equipment.

Utility Rate

Baseline Utility Rate

The utility rates used to develop the baseline model for the verification activities are the most current rate applied to the facilities, which will be in the final contract. These baseline utility rates will be used to adjust the historical billing data (12 to 24 months) if there are any changes during that period. The utility rates used for the post-installation report and the following annual report will be those defined in the new energy policy affected by the retrofits.

Schedule & Reporting for Verification Activities

After the approval of the M&V plan by Howard County, the M&V procedure and schedule are accepted by both parties. The measurement activities will be done under the witnessing of a representative of Howard County and all collected data need to be reviewed and accepted by Howard County. The data will be used for the baseline development and the verification report. Howard County is responsible to facilitate such processes and any delays will result in the corresponding delay about the reporting activities.

ECM Specific M&V Plan

Overview of ECM and M&V Plan

Scope of Work

ESG will implement the lighting retrofits, mechanical system retrofits, control system upgrades and other ECMs as outlined in the Scope of work at the Howard County buildings.

M&V Guideline and Option Used

International Performance Measurement and Verification Protocol (IPMVP 2007) is the guideline to develop this M&V plan. With consideration of the characteristic of the specific ECMs, acceptable accuracy, reasonable cost, and Howard County's demand, Option C is used to verify the energy savings for this project.

Option C involves comparison of annual baseline utility meter data with comparable performance-period meter data to calculate the energy savings. The approach makes adjustments for weather, number of billing days and other parameters that vary from the baseline to the specific performance-period year. The adjustments are discussed in detail else where in the M&V section.

Intent of M&V Plan

This M&V plan is prepared by ESG for Howard County to help both parties agree on the methodologies to justify savings for energy conservation measures (ECMs) proposed for the project. This M&V plan specifies the approach to establish the baseline models, define the performance conditions that are currently in place and those required once the ECMs are in place and the conditions to adjust the energy consumption baseline throughout the contract period, and test statistical validity of regression models.

Energy Baseline Development

Variables Affecting Baseline Energy Use

- Lighting systems and operating hours: Fixtures type and quality with the ballast information, foot-candle value, operating hours, actual occupancy from the data loggers, and a count of burned out lamps.
- HVAC systems and operating hours: Efficiency (kW/ton), kW, actual volts and amps information from the nameplate for chillers and air conditioners, temperature and humidity setting for each unit, control sequence, quantity of minimum ventilation air and total air, and operating hours by installation of data loggers.
- Fans and operating hours: Efficiency (%), kW, actual volts and amps information from the nameplate for motors, static pressure set point for fans, and operating hours by installation of data loggers or consistence with that for the corresponding equipment
- Pumps systems and operating hours: Efficiency (%), kW, actual volts and amps information from the nameplate for motors, static pressure set point for pumps from the gauges, and operating hours by installation of data loggers or consistence with that for the corresponding equipment.

- Hot water systems: Efficiency (%), kbtu/h, and GPH information from the nameplate of hot water heaters, supply hot water temperature setpoint, and average monthly hot water amount by installation of data loggers.
- Electrical systems: measurement of voltage, amperes, measured power factor, electrical power (kW), electrical apparent power (kVA) and electrical reactive power (kVAR) values

Requirement for Howard County's Witness of Pre-Measurements

Howard County should provide necessary information, and facilitate and witness the pre-installation measurement processes defined in this M&V plan which will be conducted by Energy Systems Group. All measured/collected data and calculation procedures need Howard County's review and acceptance.

Post—Installation M&V Activities

Variables Affecting Post--Installation Energy Use

This is similar to the baseline condition.

Requirement for the Howard County's Witness of Post-Measurements

Howard County should provide necessary information, and facilitate and witness the post-measurements processes defined in this M&V plan which will be conducted by Energy Systems Group.

Post--Installation Data Collected

This is similar to the baseline data collection.

Schedule of Periodic Verification Activities and Inspections

Periodical on-site surveys will be conducted by ESG to verify any changes in the site data.

Energy Savings Calculations

The energy savings calculations are based on a comparison of pre and post installation consumption loads for the specific measures. In General:

Pre-installation energy usage – Post-installation energy usage = Energy Savings (for M&V Option A)

Option C methodology incorporates adjustments for weather, number of billing days, and other variables listed else where in the report. For Option C:

Adjusted Baseline – Current Usage = Energy Savings

Total Annual Energy Cost Savings for ECMs

Total annual energy cost savings for ECMs is the sum of the calculated dollar value of energy savings.