**Measurement and verification plan**

*All content called for in this outline is required (if applicable) except items noted as optional.*

1. **Executive Summary/M&V Overview and Proposed Savings Calculations**
   1. **Proposed Annual Savings Overview**

**Table 1. Proposed Annual Savings Overview**

[Include all fuels/commodities for project, e.g., electric energy, electric demand, natural gas, fuel oil, coal, water, etc.]

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CSM | Total energy savings (MBtu/  year) | Electric energy savings  (kWh/ year) | Electric demand savings  (kW/  year)\* | Natural gas savings  (MBtu/  year)\*\* | Water savings (gallons/year) | Other energy savings  (MBtu/ year)\*\* | Total energy & water cost savings Year 1 ($/year) | Energy-related O&M cost savings Year 1 ($/year) | Total cost savings Year 1 ($/year) |
|  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Total Savings |  |  |  |  |  |  |  |  |  |
| **First Year Guaranteed Cost Savings: $** | | | | | | | | | |

Notes:

MBtu=106 Btu.

\*Annual electric demand savings (kW/year) is the sum of the monthly demand savings.

\*\*If energy is reported in units other than MBtu, provide a conversion factor to MBtu (e.g., 0.003413 MBtu/kWh).

* + 1. **Site Use and Savings Overview (Optional)**

**Table 1A. Site Use and Savings Overview**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Total energy (MBtu/ year) | Electric energy (kWh/ year) | Electric demand (kW/ year)\* | Natural gas (MBtu/ year)\*\* | Water (gallons/ year) | Other energy (MBtu/ year)\*\* |
| Total proposed project savings |  |  |  |  |  |  |
| Usage for project site\*\*\* |  |  |  |  |  |  |
| % Total site savings |  |  |  |  |  |  |
|  | | | | | | |
| Project area (SF) |  |  | | | | |
| Total site area (SF) |  |
| % Total site area affected |  |

Notes:

MBtu=106 Btu

\*Annual electric demand savings (kW/year) is the sum of the monthly demand savings.

\*\*If energy is reported in units other than MBtu, provide a conversion factor to MBtu (e.g., 0.003413 MBtu/kWh).

* 1. **M&V Plan Summary**

**Table 2. M&V Plan Summary**

|  |  |  |  |
| --- | --- | --- | --- |
| CSM | CSM Description | M&V Option Used\* | Summary of M&V Plan |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

\*M&V options are IPMVP Options A, B, C, and D. No other options are acceptable.

1. **Whole Project Data/Global Assumptions**

**2.1 Risk and Responsibility**

* Summarize approach to options
* Baseline development
* Post-installation verification activities
* Performance Period
* Summarize allocation of responsibility for key items related to M&V
  + Reference location of Risk & Responsibility Matrix (if required).

**2.2 Energy, Water and Operations & Maintenance (O&M) Rate Data**

* Detail baseline energy and water rates.
* Provide performance period rate adjustment factors for energy, water and O&M cost savings, if used.

**2.3 Schedule and Reporting for Verification Activities**

* Define requirements for witnessing of measurements during:
  + Baseline development
  + Post-installation verification activities
  + Performance period
* Define schedule of verification reporting activities

**Table 3. Schedule of Verification Reporting Activities**

|  |  |  |
| --- | --- | --- |
| Item | a Recommendedtime of submission | a Entity’s review and acceptance period |
| Post-Installation Report | 30 to 60 days after acceptance | 30 days |
| Annual Report | 30 to 60 days after annual performance period | 30 days |

a Times are recommended based on industry practice; modify as needed.

* Define content and format of reports:
* Post-installation report (use Post-Installation Report Outline)
* Annual M&V reports (use Annual M&V Report Outline)
* Interval M&V reports (develop report outline if needed

**2.4 Operations, Preventative Maintenance, Repair and Replacement Reporting Requirements**

Define Entity and ESP reporting requirements

* Summarize key verification activities and reporting activities of Entity and ESP on operations, preventive maintenance, repair and replacement items from details in CSM specific M&V plans.
* Define content of reports and reporting schedule.

**2.5 Construction Period Savings**

Provide overview of how construction period savings will be calculated, if applicable.

**2.6 Status of Rebates**

(Include if applicable)

* Provide a summary of the source of any third-party rebates or incentives provided on this project.
* Provide status of any third-party rebates or incentives.

**2.7 Dispute Resolution**

Describe plan for resolving disputes regarding issues such as baseline, baseline adjustment, energy savings calculation, and use of periodic measurements.

1. **CSM [Name/#] M&V Plan and Savings Calculation Methods**

Develop section for each CSM.

* 1. **Overview of CSM, M&V Plan, and Savings Calculation for CSM**
* Summarize the scope of work, location, and how cost savings are generated. Describe source of all savings including energy, water, O&M, and other (if applicable).
* Specify the M&V guideline and option used.
  + Provide an overview of M&V Activities for CSM. Explain intent of M&V plan, including what is being verified.
  + Provide an overview of savings calculations methods for CSM. Provide a general description of analysis methods used for savings calculations.

**3.2 Energy and Water Baseline Development**

* Describe in general terms how the baseline for this CSM is defined.
* Describe variables affecting baseline energy or water use.
* Include variables such as weather, operating hours, set point changes, etc.
* Describe how each variable will be quantified, i.e. measurements, monitoring, assumptions, manufacturer data, maintenance logs, engineering resources, etc.
* Define key system performance factors characterizing the baseline conditions. Include factors such as comfort conditions, lighting intensities, temperature set points, etc.
* Define requirements for Entity witnessing of measurements if different than whole project data requirements included in Section 2.3 of this plan.
* Provide details of baseline data collected, including the following.
* Parameters monitored/measured
* Details of equipment monitored, i.e. location, type, model, quantity, etc.
* Sampling plan, including details of usage groups and sample sizes
* Duration, frequency, interval, and seasonal or other requirements of measurements
* Requirements to bring current equipment up to code standards.
* Personnel, dates, and times of measurements
* Proof of Entity witnessing of measurements (if required)
* Monitoring equipment used
* Installation requirements for monitoring equipment (test plug for temperature sensors, straight pipe for flow measurement, etc.)
* Certification of calibration/calibration procedures followed
* Expected accuracy of measurements/monitoring equipment
* Quality control procedures used
* Form of data (.xls, .csv, etc.)
* Results of measurements (attach appendix and electronic format as necessary)
* Completed data collection forms, if used
* Provide details of baseline data analysis performed, including the following.
* Analysis using results of measurements
* Weather normalized regressions
* Weather data used and source of data

**3.3 Proposed Energy and Water Savings Calculations and Methods**

* Provide detailed description of analysis method used.
* Describe any data manipulation or analysis that was conducted prior to applying savings calculations.
* Provide software name and version number for simulation software if used.
* Detail all assumptions and sources of data, including all stipulated values used in calculations.
  + Provide justification for all estimated or stipulated values.
  + Explain the overall significance of these values to the total expected savings.
  + Stipulated values are only permissible in Option A.
* Include equations and technical details of all calculations made. (Use appendix and electronic format as necessary.)
  + Include description of data format (headings, units, etc.).
  + Provide input files, output files and weather files used for simulation (Option D).
* Details of any savings or baseline adjustments that may be required.
* Detail energy and water rates used to calculate cost savings. Provide performance period energy and water rate adjustment factors if different from Section 2.2 of this plan.
* Detail proposed annual savings for this energy conservation measure for performance period. Summarize information in Table 4.

**3.4 Operations and Maintenance and Other Cost Savings**

* Provide justification for O&M cost savings, if applicable.
* Describe how savings are generated
* Detail cost savings calculations.
* Provide performance period O&M cost savings adjustment factors if different from Section 2.2 of this plan.
* Provide justification for other cost savings, if applicable.
* Describe how savings are generated.
* Detail cost savings calculations.
* Provide performance period adjustment factors if different from Section 2.2 of this plan.

**3.5 Proposed Annual Savings for CSM**

**Table 4. Proposed Annual Savings for Each Cost-Saving Measure**

[Include all fuels/commodities for project, such as: electric energy, electric demand, natural gas, fuel oil, coal, water, etc.]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total energy use (MBtu/ year) | Electric energy use (kWh/ year) | Electric energy cost, Year 1 ($/year) | Electric demand\* (kW/  year) | Electric demand cost, Year 1 ($/year) | Natural gas use (MBtu/ year)\*\* | Natural gas cost, Year 1 ($/year) | Water use (gallons /year) | Water cost, Year 1 ($/year) | Other energy use (MBtu/ year)\*\* | Other energy cost, Year 1 ($/year) | Energy-related O&M costs, Year 1 ($/year) | Total costs, Year 1 ($/year) |
| Baseline use |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Post-installation use |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Savings |  |  |  |  |  |  |  |  |  |  |  |  |  |

#### Notes:

\*Annual electric demand savings (kW/year) is the sum of the monthly demand savings.

MBtu = 106 Btu.

\*\*If energy is reported in units other than MBtu, provide a conversion factor to MBtu (e.g., 0.003413 MBtu/kWh).

**3.6 Post-Installation M&V Activities**

* Describe the intent of post-installation verification activities, including what will be verified.
* Describe variables affecting post-installation energy or water use.
* Include variables such as weather, operating hours, set point changes, etc.
* Describe how each variable will be quantified, i.e. measurements, monitoring, assumptions, manufacturer data, maintenance logs, engineering resources, etc.
* Define key system performance factors characterizing the post-installation conditions such as lighting intensities, temperature set points, etc.
* Define requirements for Entity witnessing of measurements if different than whole project data requirements included in Section 2.3 of this plan.
* Provide details of post-installation data to be collected, including the following.
* Parameters to be monitored
* Details of equipment to be monitored (location, type, model, quantity, etc.)
* Sampling plan, including details of usage groups and sample sizes
* Duration, frequency, interval, and seasonal or other requirements of measurements
* Monitoring equipment to be used
* Installation requirements for monitoring equipment
* Calibration requirements/procedures
* Expected accuracy of measurements/monitoring equipment
* Quality control procedures to be used
* Form of data to be collected (.xls, .csv, etc.)
* Sample data collection forms (optional)
* Detail data analysis to be performed.

**3.7 Performance Period Verification Activities**

* Describe variables affecting performance period energy or water use.
* Include variables such as weather, operating hours, set point changes, etc.
* Describe how each variable will be quantified, i.e. measurements, monitoring, assumptions, manufacturer data, maintenance logs, engineering resources, etc.
* Define key system performance factors characterizing the performance period conditions. Include factors such as comfort conditions, lighting intensities, temperature set points, etc.
* Describe the intent of performance period verification activities, including what will be verified.
* Provide detailed schedule of performance period verification activities and inspections.
* Define requirements for Entity witnessing of measurements if different than whole project data requirements included in Section 2.3 of this plan.
* Provide details of performance period data to be collected, including the following.
* Parameters to be monitored
* Details of equipment to be monitored (location, type, model, quantity, etc.)
* Sampling plan, including details of usage groups and sample sizes
* Duration, frequency, interval, and seasonal or other requirements of measurements
* Monitoring equipment to be used
* Installation requirements for monitoring equipment
* Calibration requirements/procedures
* Expected accuracy of measurements/monitoring equipment
* Quality control procedures to be used
* Form of data to be collected (.xls, .csv, etc.)
* Sample data collection forms (optional)
* Detail data analysis to be performed.
* Define operations, preventive maintenance, repair, and replacement reporting requirements.
* Detail verification activities and reporting activities of Entity and ESP on operations, preventive maintenance, repair, and replacement items.
* Define contents of report and reporting schedule.