



Measurement and Verification Plan

UNIVERSITY OF UTAH

DESIGN STANDARDS SUPPLEMENT

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Measurement and Verification Plan

1. Introduction

In order to encourage better project design, enable better building operation and account for increased energy savings and reduced emissions, the University developed this Measurement and Verification (M&V) Plan. The purpose of this M&V Plan is to establish a consistent method for quantifying the performance of energy conservation measures by comparing actual energy consumed by a building, its systems and subsystems to the predicted energy consumption developed during project design.

The basis of this M&V Plan is the Efficiency Valuation Organization's International Performance Measurement and Verification Protocol (IPMVP). *IPMVP Volume 1: Concepts and Options for Determining Energy and Water Savings* (available at www.evo-world.org) outlines four options (Options A through D) for measuring and reporting a project's savings. Option B: Retrofit Isolation: All Parameter Measurement is the only option allowed under this M&V Plan.

Compliance with this M&V Plan will provide a path for projects registered under LEED v3 to earn EA Credit 5: Measurement and Verification and for projects registered under LEED v4 to earn the Advanced Energy Metering credit. Additionally, compliance with this Plan will assist the University as it works to meet its commitments to sustainability and energy efficiency including the American College and University President's Climate Commitment (climate neutrality by 2050) the Better Buildings Challenge (20% reduction in energy intensity by 2020).

2. Project Specific Measurement and Verification Plan Requirements

A project specific Measurement and Verification Plan must be developed by the design team along with the development and design of energy conservation measures. All design strategies and devices needed to fulfil the M&V Plan must be budgeted in the project and included in project documents. Details of the Plan must be coordinated with Facility Operations/Energy Management. The following outline represents the minimum requirement for a project specific M&V Plan and is designed to meet the needs of LEED v3 EA Credit 5.

- 1) Table or listing of project's energy end uses
- 2) Indication of which of the energy end uses are monitored and if the monitoring is permanent or temporary
- 3) Indication of the location of all monitoring devices
- 4) Specific information regarding the baseline conditions established for the project
- 5) Specific information regarding the method/frequency for data collection and analysis against the documented baseline conditions
- 6) Specific information regarding the corrective action strategy if measured data deviates from the anticipated performance

- 7) Confirmation that the M&V period covers a minimum of one year post-construction occupancy

3. Metering Requirements

Energy and water meters are fundamental to meeting the requirements of this M&V Plan. Utility grade meters must be installed at the building level for each utility feeding each building or major subunit of a complex. Submetering must be installed on each subsystem as required by the project specific M&V Plan. Submetering must also be installed to isolate any functional and/or billable subdivision within a building. In addition to metering devices, data acquisition devices must be installed in each building to enable communication between each metering device and the University's Energy Information System (EIS) and/or Building Automation System (BAS). Details of the required metering and meter communications must be coordinated with Facility Operations/Campus Utility Services and Energy Management.

Following is an outline of basic metering and data requirements. This is a general list; exact metering must be based on specific building requirements as outlined in the project specific M&V Plan. (See Design Standard for specific meter requirements.)

- Primary metering (utility grade meters)
 - Building level. This also applies to separate programmatic spaces (spaces requiring individual energy accounting or billing)
 - Electricity
 - Gas
 - Chilled Water
 - High Temperature / Hot Water
 - Water
- Submetering (utility grade meters not required if alternative means are available)
 - Electricity
 - Lighting
 - Interior Lighting
 - Exterior Lighting (walkways, parking lots, etc.)
 - Special use lighting (athletic fields, etc.)
 - Plug loads
 - High Intensity/Process Loads (data centers, specific equipment)
 - HVAC System Equipment (fans, pumps, etc.)
 - Thermal Energy
 - Primary Heating (boilers (gas), heat exchangers (btu))
 - Domestic Hot Water (water heaters (gas), heat exchangers (btu))
 - Primary Cooling (chillers (electrical), heat exchangers (btu))

- Pressure/temperature ports on hydronic equipment, such as cooling and heat coils.
 - Water
 - Irrigation
 - Domestic
 - Mechanical water usage (makeup/feed water)
- Data Requirements
 - Meters to provide instantaneous data to BAS for operational monitoring of HVAC system
 - Meters to provide 15 minute interval data to EIS for trending and analysis
 - Electrical meters to report volts, amps, power (kW), energy (kWh), etc.
 - Gas meters to report pressure and temperature compensated volume in hundred cubic feet (CCF) or thousand cubic feet (MCF)
 - Chilled and High Temp/Hot Water meters to report flow in gallons per minute (gpm), supply and return temperature, energy (kBtu or MMBtu)
 - Water meters to report volume in cubic feet (CF) or gallons

4. Responsibility and Accountability

It is the responsibility of the design team to develop the project specific M&V Plan. The design team must ensure all required metering devices are budgeted and included in the design documents. It is the responsibility of the project team (design team, contractors, commissioning agent) to verify that all metering devices are reporting, recording, and communicating prior to project substantial completion.

It is the responsibility of the University (Facilities Management/Facility Operations) to provide coordination and information to the design team in support of developing the project specific M&V Plan. Upon substantial completion, the University will take ownership of Measurement and Verification Plan and the process of collecting and reporting data.