

Measurement and Verification (M&V) FAQ

What is Measurement and Verification (M&V)?

M&V refers to a systematic set of activities designed to verify resource (like energy, water, waste) savings. These savings cannot be measured directly because the goal is to evaluate the absence of something. M&V is a structured process to accurately verify resource savings, with reasonable certainty, while ensuring that the process conditions are not negatively affected.

Adjustments are made to ensure a fair, apples-to-apples comparison between baseline and post implementation periods, including to account for events such as:

- Weather normalization: Adjusting baseline energy use to actual heating/cooling degree days in the reporting period.
- Production/occupancy changes: Correcting for differences in manufacturing output or building occupancy.
- Operational schedule shifts: Accounting for longer/shorter hours of operation.

What is the purpose of M&V within the DOE's Industrial Technology Validation (ITV) Program?

ITV validates the performance of emerging industrial technologies in real operating environments. M&V is used to document technology performance, resource impacts, and operational benefits through a systematic process. The ITV program shares the results of these performance assessments through publicly available technical reports. This approach aims to address barriers to adoption of emerging technologies like uncertainty in real-world performance and viability, and the lack of credible, independent performance data.

Why is M&V considered important for industrial technology adoption?

M&V drives informed decisions and supports U.S. industrial competitiveness by:

- Providing credible validations that lead to better market decisions, fostering market confidence to increase adoption and drive down costs to enhance U.S. competitiveness.
- Enabling technology developers to gain credibility, access to a wider market, and data to improve their offerings.
- Allowing sites to safely pilot before adopting novel technologies more broadly, thereby mitigating risks.

What protocol does the ITV program follow for its M&V approach?

ITV's M&V approach and process follows the International Performance Measurement and Verification Protocol (IPMVP). To learn more about IPMVP, please see the links in the table below for more details:

- Efficiency Valuation Organization (EVO). EVO: International Performance Measurement and Verification Protocol (IPMVP) – Core Concepts. Efficiency Valuation Organization, Washington, DC (2022)
- Bonneville Power Administration (BPA). n.d. "Measurement & Verification." <https://www.bpa.gov/energy-and-services/efficiency/measurement-and-verification>.

- Northwest Strategic Energy Management (NW SEM) Collaborative. 2019. SEM Energy Modeling Method Selection Guide. <https://semhub.com/assets/resources/SEM-Energy-Modeling-Method-Selection-Guide.pdf>.

What are the primary objectives of the M&V plan?

The M&V plan is an agreement: it defines what will be measured, how savings/performance are verified and calculated, and how results are reported.

- Define scope and boundaries in terms of what systems are included and excluded to reasonably assess the impact of the technology.
- Specify data collection points, metering requirements, data collection periods, data analysis procedures to characterize the baseline and post installation assessment to assess the impact on performance.
- Identify risks and responsibilities and identify risk mitigation strategies

What are the key phases in the M&V process? The M&V process, which aligns with IPMVP, consists of three main phases:

1. **Phase 1- Planning:** During this phase, an understanding of the new technology, site conditions, and baseline incumbent technology and system will be developed. An M&V plan based on a technology's key performance indicators (KPI), and site conditions will also be established that forms the basis for all the M&V activities. This entails putting together a tailored monitoring plan, based on existing data collection capabilities, identifying additional equipment, and outlining data collection, transfer, storage, and analytical approaches. During this phase, baseline data will be collected through securing and installing monitoring equipment, to collect relevant utility/energy consumption data, weather data, independent variable data, and operating schedules. Collected data will be analyzed to formulate the baseline, documenting key assumptions, calculations, and analysis procedures.
2. **Phase 2- Implementation:** During this phase, implementation of the technology will be completed along with the commissioning and monitoring activities, including installing additional M&V equipment (as needed). After which, continued detailed monitoring of post implementation performance and related data analysis will be completed.
3. **Phase 3- Analysis:** After data collection is complete, this phase involves data analysis that summarizes technology performance impact by comparing baseline with post-retrofit energy consumption, accounting for necessary adjustments. The final report evaluates and documents the resource performance, viability, and functionality of the technology. This report projects potential savings and benefits across broader industrial sectors and documents M&V practices and lessons learned.

What types of publicly available reports are generated from ITV M&V activities?

M&V reports will typically include:

- A detailed M&V report.
- A four-page, high-level summary.

Note: Additional DOE communications materials may be developed based on content in these reports.

What are some common challenges encountered in M&V, and how are they addressed?

Challenges in M&V include, but are not limited to:

- Data limitations
- Sensor failures
- Operational changes (to the technology or the broader system/facility)

Addressing these challenges requires making appropriate adjustments to the analysis to account for the impacts of these unexpected events.

Who is involved in the M&V process?

Multiple entities collaborate in the M&V process:

- **Lawrence Berkeley National Laboratory (LBNL):** Technical lead providing oversight, development of M&V objectives, approaches and plans, hosts data, conducts all analysis, and leads the development of the final technical report.
- **Technology Developer:** Provides physical equipment and technical documentation and conducts the commissioning process for their technology.
- **Demonstration Site:** Hosts the technology installation, provides site access, site data, qualified personnel for equipment installation, and feedback.
- **U.S. Department of Energy (DOE):** Oversees the Industrial Technology Validation (ITV) program, provides funding support for projects.

What are some examples of how M&V is applied in an ITV project?

You can learn more about how M&V is applied in an ITV project by checking out completed validations that explore emerging technologies in the library at this [link](#).

What if I do not have/ or cannot provide data despite my best efforts?

M&V analysis relies heavily on obtaining complete and quality datasets, so all projects will be required to submit data to DOE/LBNL, as defined in the M&V plan. However, we recognize that providing all desired data for a “perfect” M&V analysis may not always be feasible or cost-effective, and in some cases unexpected events can lead to data issues (e.g., sensor failure). M&V offers some flexibility to address data limitations, ensuring viable evaluation strategies within the technology's scope and boundaries. If there are data constraints either during the baseline or post implementation period, the evaluation team will work with you to devise an approach that effectively balances evaluative rigor while taking into account practical considerations. It is imperative that any potential data challenges are raised immediately with the DOE/LBNL team in order to address them as quickly as possible and ensure a successful validation can still be performed.