

How To Determine Baselines and Estimated Savings with M&V;

Canonical: <https://northmoregordon.com/articles/calculate-savings-with-m-v/>

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Published: August 2, 2022.

Energy Savings = Baseline Energy Use - Post-retrofit Energy Use +/- Adjustments. This equation is central to measurement and verification because energy savings reflect the absence of energy use or demand. The baseline establishes representative pre-project conditions, while adjustments account for differences between baseline and reporting periods - such as weather, production volume, or operating hours - that would otherwise obscure the true effect of the equipment improvement. Our M&V; services include baseline modelling and savings calculation to ensure accurate application of this approach.

Publication context: This article reflects its publication date. Market prices, program rules, reporting duties and deadlines may have changed. Confirm current official guidance before making a decision.

Measurement and verification (M&V;) is critical to accurately assess energy savings from an energy conservation measure (ECM). Because energy savings reflect the absence of energy use or demand, determining accurate calculations requires an understanding of the baseline energy use as well as the pertinent factors that influence energy demand across the project scope.

In a nutshell, the energy savings equation is the following:

Energy Savings = Baseline Energy Use - Post-retrofit Energy Use +/- Adjustments

Under a well-structured M&V; process, the conditions before and after ECM implementation are well understood and documented to ensure reliable comparisons that incorporate factors with significant influence on energy consumption.

Establishing a Baseline

The baseline represents the energy usage prior to ECM implementation and is compared against the post-retrofit energy usage to determine savings. To follow M&V; best practices, the baseline period should cover a complete operational cycle- from minimum energy demand and consumption to the maximum- that immediately precedes the commissioning of the new ECM.

The length of the baseline period depends on the scope of the ECM project and the purpose of M&V; reporting. Under the International Performance Measurement and Verification Protocol (IPMVP), M&V; options range from an isolated equipment retrofit to integrated whole facility energy processes. Therefore, the various M&V; options have different measurement boundaries to address the scope of the specific project. It is important that the baseline period be an appropriate timeframe to incorporate all of the significant factors that influence the M&V; measurement boundary. For instance, whole facility energy consumption can be heavily influenced by weather, necessitating a baseline period of an entire year. On the other hand, a lighting retrofit that is more so dependent on hours of operation may only require a baseline period of a couple of weeks to capture all the parameters affecting its measurement boundary.

It is vitally important to document the baseline period conditions because they will likely differ from those during the reporting period that follows ECM installation. The collected data should encompass information on equipment impacted by the ECM as well as the independent variables and static factors involved in the M&V; process. This should include specs on equipment and operational procedures as well as factors like ambient temperature and production volume. Documenting these baseline conditions enables reliable comparisons between baseline and reporting periods, and highlights areas where adjustments may need to be included in energy savings calculations.

Incorporating Adjustments

Including adjustments in the energy savings calculation ensures consistency between the baseline period and the reporting period that follows ECM installation. Adjustments are divided into two categories: routine and non-routine adjustments.

Routine adjustments are factors impacting the measurement boundary that is expected to change routinely during the reporting period. To be included in the energy savings calculation, the factor should have a significant impact on energy consumption. Example factors include weather and production volume and should be evaluated to determine their influence on energy demand over the reporting period.

Non-routine adjustments involve factors expected to stay static. This includes adjustments such as facility size or building occupancy. When such changes occur, their statistical significance needs to be assessed to determine whether or not to include the factor in the energy savings calculation.

Calculating Savings

Energy savings can be classified into a couple of categories depending on the impact and incorporation of adjustments. The first category is Avoided Energy Consumption , evaluated as the savings in energy consumption compared to what would have been had the ECM not been implemented. For this approach, it is most common to make regular adjustments to the baseline period to reflect conditions throughout the reporting period. This is known as forecasting. Less common is to employ backcasting, where the reporting period is adjusted to mirror baseline conditions.

The second category is Normalized Energy Savings . This strategy utilizes standardized conditions other than those from the baseline or reporting periods as the basis for adjustment. This involves regular adjustment to both the baseline and reporting periods to an agreed-upon condition set, such as a typical meteorological year for weather data.

M&V; Is Critical To Evaluate Savings

With all of the factors and variables involved in energy usage, it is pivotal that businesses incorporate a strong M&V; process to accurately determine savings from their energy efficiency initiatives. A verified M&V; process will require that a facility undergo thorough documentation of conditions before and after project installation in order to calculate accurate, reliable energy savings.

With each M&V; process tailored to a specified project, businesses often feel more confident in their approach with the support of an expert. Northmore Gordon and our credentialed M&V; team members are available to assess your energy needs and assist in the development and implementation of an effective M&V; process.

Procurement context

Check the current market date, contract term, meter and load data, instrument ownership and retirement evidence before making a purchasing or public claim.

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What is the basic energy savings equation used in M&V;?

Energy Savings = Baseline Energy Use – Post-retrofit Energy Use +/- Adjustments. This equation is central to measurement and verification because energy savings reflect the absence of energy use or demand. The baseline establishes representative pre-project conditions, while adjustments account for differences between baseline and reporting periods—such as weather, production volume, or operating hours—that would otherwise obscure the true effect of the equipment improvement. Our M&V; services include baseline modelling and savings calculation to ensure accurate application of this approach.

Why is establishing a complete baseline critical to M&V; accuracy?

The baseline must cover a complete operational cycle—from minimum to maximum energy demand—immediately preceding ECM commissioning to represent typical facility conditions. A year of data may be necessary for whole-facility consumption heavily influenced by weather, while shorter periods suit isolated equipment retrofits. Without representative baseline conditions, comparisons between pre- and post-project energy use cannot reliably separate equipment performance from external variables like weather or production changes, rendering savings estimates unreliable for investment decisions or certificate claims.

What are routine adjustments in M&V;, and why do they matter for calculating savings?

Routine adjustments account for factors expected to change during the reporting period, such as weather and production volume. These variables directly influence energy consumption and must be evaluated to determine their magnitude of impact. Routine adjustments allow the baseline to be forecasted forward to reporting-period conditions, or enable backcasting of reporting-period data to match baseline conditions. Accurate routine adjustments distinguish equipment performance improvements from changes in operating circumstances, essential for credible savings documentation and certificate eligibility.

How do non-routine adjustments differ from routine adjustments in M&V; analysis?

Non-routine adjustments address factors expected to remain static, such as facility size or occupancy levels, that change unexpectedly during the reporting period. Their statistical significance must be assessed to determine whether inclusion in the savings calculation is justified. Unlike routine adjustments that are anticipated and modelled systematically, non-routine adjustments require investigation and documented reasoning. Proper treatment of non-routine changes ensures that facility modifications unrelated to the energy improvement are not confused with ECM performance.

Why is an electricity bill alone insufficient evidence for determining energy savings?

An electricity bill can decline for multiple reasons unrelated to equipment improvements: production decline, shortened operating hours, weather changes, or price changes. These variables must be separated from the actual effect of the ECM to calculate credible savings. The NSW M&V; guide explains that choosing the correct period, operating variables, and data quality is essential to explain the claimed effect. Our M&V; approach specifies instruments, measurement intervals, and data quality checks to isolate equipment performance from operational and external variables.

What is the difference between Avoided Energy Consumption and Normalized Energy Savings in M&V;?

Avoided Energy Consumption compares actual reporting-period use to forecasted baseline conditions, typically using regular adjustments for weather and production. Normalized Energy Savings applies

standardized conditions—such as typical meteorological year data—to both baseline and reporting periods rather than actual conditions. Avoided Energy Consumption is more common and reflects real-world savings; Normalized Energy Savings provides a standardized comparison independent of actual weather or operations. The choice affects which factors are adjusted and how savings are presented for investment decisions or certificate schemes.

How should measurement boundaries be defined to support accurate M&V; analysis?

The measurement boundary identifies the equipment, meters, energy streams, and interactions included in the M&V; assessment. It may range from isolated equipment (such as a boiler) to whole-facility processes. Defining the boundary early determines what data must be collected, which variables to monitor, and how to interpret results. The boundary must align with the project scope and the question being answered. Our M&V; brief structure includes boundary specification as a foundational step, ensuring that collected data supports the intended analysis and that stakeholders agree on what is being measured.

What role does documentation of baseline conditions play in measurement and verification?

Baseline documentation captures equipment specifications, operating procedures, production volumes, occupancy, and environmental factors that influence energy demand during the pre-project period. This documentation enables reliable comparison with reporting-period conditions and identifies where adjustments are necessary. It also preserves evidence of the baseline state, essential for explaining performance differences and supporting certificate applications or internal accountability. Our approach includes recording baseline conditions and defining how operating changes will be treated, ensuring the analysis can be reviewed and verified by other competent practitioners.

How does early measurement planning preserve funding and evidence options in M&V; projects?

Early measurement planning—before equipment commitment—allows selection of the appropriate M&V; method, definition of baseline data requirements, and establishment of data responsibilities. Different schemes (Victorian Energy Upgrades, NSW ESS) have specific M&V; prerequisites; waiting until after installation can make baseline establishment impossible or disqualify the project from certain pathways. Early planning captures representative baseline data, identifies measurement gaps while they can still be resolved, and ensures the project evidence aligns with the chosen funding or certificate scheme. Our project brief template guides early definition of measurement needs and timelines.

What support does Northmore Gordon provide for implementing a tailored M&V; process?

Our M&V; services include project-boundary selection, baseline modelling, savings calculation, and reporting. We assess energy needs and assist in developing M&V; processes tailored to the specific project, operating context, and intended use of results—whether for internal performance, investment contracts, reporting, or certificate schemes. The practical M&V; brief structure addresses purpose, boundary, baseline, measurement, implementation record, and reporting, ensuring all parties understand responsibilities and analysis methods. This structured approach produces credible, defensible savings documentation that can withstand professional review.