



Section: Continual Improvement

Task 15: We have an energy measurement plan, reviewed periodically, which defines, organizes and documents our monitoring and measurement activities, and ensures they are accurate and repeatable.

Getting It Done

- Use the [Energy Measurement Plan Worksheet](#) to provide guidance on the requirements for adequate collection of data for determining energy performance. Ensure that all key characteristics that determine energy performance are addressed in the measurement plan.
- Set the frequency for periodically reviewing your organization's measurement needs. Implement the review and update the measurement plan as needed.
- Establish and implement a calibration program to ensure that monitoring and measurement equipment is properly maintained and provides accurate data.
 - Use the [Calibration Plan](#) to list monitoring and measurement equipment that require calibration. Describe the method, calibration personnel, frequency, and basic equipment information.
 - Use the [Calibration Record](#) to document the results of equipment calibration.
 - Use the [Equipment Calibration Record](#) to provide a continuous record that combines information similar to the Calibration Plan and Calibration Record, per piece of monitoring and measurement equipment.

Task Overview

Good data relies on good measurement, so it is no surprise that ISO 50001:2011 requires an energy measurement plan. The energy measurement plan is developed to define, organize, and document the monitoring and measurement activities. Each of the key characteristics is evaluated to determine the appropriate qualities that should be measured or monitored so appropriate data can be collected for analysis. Requirements for monitoring, measuring, and analyzing performance metrics focus on the “key characteristics” of operations that determine energy performance.

Periodically reviewing measurement needs helps to ensure the energy measurement plan stays up-to-date and reflective of modified energy performance requirements such as new energy objectives, targets, action plans, and EnPIs. This review should occur at a regular basis (e.g., monthly or quarterly) and should be integrated into your organization's “real-time” change management processes.

The equipment used to monitor and measure the key characteristics of operations that determine



energy performance must provide data that are both accurate and repeatable. Software used for monitoring and measurement needs also must provide accurate and repeatable data confirmed through verification. Accuracy and repeatability are necessary to validate energy performance and verify the results of improvement actions.

At the completion of this task, you will have...

- Defined and implemented an energy measurement plan
- Developed a process to periodically review measurement needs
- Ensured accuracy and repeatability of measurements
- Retained records of calibration

This guidance is relevant to Section 4.6.1 of the ISO 50001:2011 standard.

Associated Resources	Short Description
SEU Control Chart	A template spreadsheet form to track, record, and validate the implementation process for SEUs.
SEU Control Chart Example	An example of what an SEU control chart can look like and may be used to track/record/document/validate the PDCA process.
Energy Measurement Plan Worksheet	A worksheet to assist in the development an energy measurement plan for their facility
Equipment Energy Measurement Plan	This resource provides guidance on developing an equipment energy measurement plan.
Equipment Energy Measurement Plan Example	This worksheet shows an example of an Equipment Energy Measurement Plan.
Calibration Plan	This worksheet is a reference for users who wish to develop a calibration plan.
Calibration Record	This reference may be used as documented evidence of implementation of the facility calibration plan.
Equipment Calibration Record	This resource can be used as documented evidence of an implemented Equipment Calibration process within the facility.
Monitoring and Measurement of Key Characteristics Planning Worksheet	A worksheet to assist users in identifying, planning and documenting key characteristics.
Monitoring and Measurement of Key Characteristics Planning Worksheet (example)	This worksheet helps to understand key characteristics needed in during the monitoring and measurement planning cycle.
ENERGY STAR Guidelines for Energy Management	ENERGY STAR Guidelines for Energy Management guidance document.



Full Description

Define and implement an energy measurement plan

ISO 50001 requires an energy measurement plan. The energy measurement plan is developed to define, organize, and document the monitoring and measurement activities. Each of the key characteristics is evaluated to determine the appropriate qualities that should be measured or monitored so appropriate data can be collected for analysis.

At a minimum, the “key characteristics” include the following:

- Past and present energy consumption
- The significant energy uses (SEUs) and their associated relevant variables
- Energy performance improvement opportunities and action plans
- Energy performance indicators (EnPIs)
- Effectiveness of action plans in achieving the energy objectives and targets
- Actual versus expected energy consumption

Learn More: **Key characteristics planning best practice**

A resource such as the [Monitoring and Measurement of Key Characteristics Planning Worksheet](#) can be used to identify and record the key characteristics and their monitoring and measurement requirements for your organization as you work through the tasks below. The [Monitoring and Measurement of Key Characteristics Planning Worksheet \(example\)](#) is provided to illustrate the types of information that can be captured in planning for monitoring, measurement, and analysis of the key characteristics.

Items to include in the plan will vary depending on the size and complexity of the organization and its monitoring and measuring equipment. Typically, the plan would include at a minimum the following:

- What is being measured (systems, processes, or equipment)?
- When or how often are the measurements taken?
- How are the data collected (methods and procedures)?
- Where are the data stored?
- Who is responsible for collecting the data?
- How will the data be analyzed and the responsible party?
- How is accuracy and repeatability maintained (i.e. calibration)?

Once the key characteristics and monitoring and measurement requirements are identified, the [Energy Measurement Plan Worksheet](#) provides a guide to the details required to ensure adequate



collection of data for determining energy performance. This form encompasses the relevant key characteristics. If more detailed information is required for some equipment or systems, the [Equipment Energy Measurement Plan](#) can be used for additional detail. An [Equipment Energy Measurement Plan Example](#) illustrates a completed version.

Periodically review measurement needs

Periodically reviewing your organization's measurement needs ensures that as the key characteristics that determine energy performance change over time, any needed adjustments are made to the energy measurement plan. Inform relevant personnel of the changes. A practical approach to periodic review of measurement needs and updating the measurement plan involves two elements:

- Defining a minimum frequency for the review (e.g., monthly, quarterly, semi-annually)
- Integrating the review as part of your organization's "real-time" change management processes (mainly communication)

Learn More: **Importance of periodically reviewing measurement needs**

For example:

Changes to monitoring and measurement methods, equipment, procedures, and personnel may be needed in response to changes in the energy uses identified as SEUs. Measurement needs also can change as a result of new or modified energy performance requirements (e.g., new energy objectives, targets, action plans, EnPIs). Changes in any of the energy planning outputs of the EnMS can lead to changed measurement needs. They can also result from changes to equipment, procedures, personnel, and monitoring and measuring methods.

Ensure accuracy and repeatability of measurements

A calibration program provides the means to ensure monitoring and measuring equipment is properly maintained to provide accurate data. Basic components of a calibration program involve the following:

- Identifying the equipment to be calibrated – key characteristics
- Specifying the method of calibration to be used – reference
- Establishing calibration tolerance and frequency – deviation
- Defining and assigning calibration responsibilities – multiple elements
- Maintaining appropriate documentation – plan and records

Learn More: **Components of a calibration program**



Identify equipment to be calibrated – First, identify the equipment to be calibrated. For ISO 50001, the focus is on accurate and repeatable data from equipment used to monitor and measure the key characteristics of operations that determine energy performance. This monitoring and measuring equipment should already be identified within the energy measurement plan. Review the energy measurement plan and identify and record the equipment that requires calibration.

Specify the calibration method – Specifying the calibration method involves determining the appropriate document, procedure, standard, or other reference to be used for each piece of monitoring and measuring equipment. Calibration can vary from a complicated process using multiple documents with defined procedures and tests to a simple comparison with a standard calibrated reference. Trade associations, equipment manufacturers, and metrology labs may be sources of assistance for determining the appropriate calibration reference. The reference(s) or standard(s) specify calibration frequency, methods, traceability, and personnel qualifications. They may also provide guidance information on tolerances.

Establish calibration tolerance and frequency – The calibration tolerance is the permissible deviation from a specified value. The tolerances are specified to ensure the equipment is calibrated to the required accuracy within acceptable limits. Consider the following factors when establishing the tolerances:

- **Equipment capability.** The monitoring or measurement equipment must have the capability to measure within the required accuracy. Equipment cannot be calibrated to a tolerance for which it is not capable of measuring.
- **Process or product requirements.** Customer requirements, subassembly requirements, or final use can dictate the tolerances required.
- **Manufacturer's specifications.** Manufacturers can specify tolerances for equipment used in the organization's processes. Again, the equipment must have the capability to measure within the required accuracy.
- **Standards/regulatory.** Tolerances may be dictated by standards associated with the product or as required by regulatory agencies.

Hand in hand with the tolerance is the frequency of calibration. While the manufacturer's recommendations are one source for calibration frequency, the purpose and use of the equipment must also be considered. Harsh environments and measurements that have a very close tolerance may require more frequent calibration. Equipment history is important also; monitoring and measuring equipment with a history of losing accuracy may require more frequent calibrations. Such equipment should also be recalibrated when there is reason to doubt the equipment's accuracy. Change or modify the methods, schedule, or equipment as required to satisfy tolerance requirements.

Define and assign calibration responsibilities – To ensure equipment is properly calibrated and



will provide accurate data, define and assign responsibilities to the appropriate personnel. Consider, for example:

- **Who will do the calibration?** Will this be done in-house or contracted? If done in-house is the expertise, equipment, and necessary documentation available? If contracted, can one contractor calibrate all equipment? Can the calibration by a contractor be performed on-site or must it be conducted off-site? Are there relevant legal requirements?
- **Who will maintain calibration records?** Will this be done in-house or contracted? What records will be maintained and in what form? What record access is required?
- **Who will maintain and use the equipment?** Will training be required? Are there calibration requirements associated with maintenance? Can operators make adjustments? What do operators need to know about calibration?
- **Who will be responsible for ensuring calibration is conducted?** Who will maintain or be responsible for regular review of calibration schedules? Who will ensure equipment is available for timely calibration?
- **Who will verify proper calibration?** Will this be done in-house or contracted? What is required to verify calibration? Are the resources available or is equipment or personnel training required?

Maintain appropriate documentation – Accurate documentation is needed to verify the calibration status of the monitoring and measurement equipment and provide guidance on calibration needs and responsibilities. There is no prescribed type or format for the documentation. Develop what works for your organization. Some available resources for templates include the [Calibration Plan](#), and [Equipment Calibration Record](#).

A [Calibration Plan](#) can be used to list the monitoring and measuring equipment that requires calibration and describe the method, calibration personnel, frequency, and basic equipment information. The [Calibration Record](#) can be used to document the results of equipment calibration. Both the Calibration Plan and the Calibration Record can accommodate calibration information on several pieces of monitoring and measuring equipment. The [Equipment Calibration Record](#) provides a continuous record that combines information similar to the Calibration Plan and Calibration Record but is used for only one piece of monitoring and measurement equipment. This document shows the history of the equipment, which is useful for analyzing trends and indicating when equipment needs to be replaced.



Making SEU Connections – The [SEU Control Chart](#) introduced in [Relevant Variables](#) and again in [Operational Controls](#) and [Monitoring](#) is also intended to capture basic information about calibration for monitoring and measurement equipment used for SEUs. If using this chart, complete column 7 by entering the equipment (or software) to be calibrated (or verified) for each SEU. Also, add to column 8 the calibration (or verification) records to be maintained. The [SEU Control Chart Example](#) shows a completed SEU Control Chart.

Maintain appropriate records for monitoring and measurement

The results of the monitoring and measurement activities must be recorded. This can be done in a variety of ways, including the use of spreadsheets, databases, log sheets, or other formats. Records are also needed to demonstrate periodic review of the organization's measurement needs. This can be accomplished by recording the dates of review and/or updating that information on the measurement plan. Records of calibration or other means used to ensure the accuracy and repeatability of collected data are needed to verify the effectiveness of the calibration program.