



Body of Knowledge

This document outlines the required competencies for an AEE 50001 Certified Professional (50001 CP). These are the competencies that AEE deems required for an individual to apply ISO 50001 within an organization. It focusses on the requirements that any individual deemed competent in ISO 50001 would be required to have to demonstrate competencies across all aspects of the standard and its application into organizations of a “general nature”. Therefore, the competencies span across multiple “disciplines” requiring the individual to have a “general” understanding of all forms of energy and its applications. Some of the competencies outlined may have enhanced levels of competence required where an individual is operating in a particular area of ISO 50001 implementation. E.g., where an individual is implementing ISO 50001 in a power station, they would require an enhanced technical understanding of Electrical power generation and in the case of an individual being employed as an ISO 50001 Lead auditor for a Certification Body they would likely require an enhanced level of competence in communication. The 50001 CP assesses competence across all areas to allow a declaration of competence to be made. This allows the power station organization to limit their assessment of the consultant to their area of expertise (power generation) and the Certification Body to the area of Communication.

50001 Certified Professional (50001 CP) Global Body of Knowledge		Percent of Exam
1	Personal Competencies	Pre-requisite
2	General Understanding Competencies	17%-25%
3	Management Systems Competencies	18%-28%
4	Analysis Competencies	17%-25%
5	Technical Analysis Competencies	17%-25%
6	Technical Competencies	11%-17%

1	Personal Competencies
101	Communicate with individuals orally
102	Communicate with individuals in writing

In-depth explanation of Personal Competencies:

These are pre-requisite competencies and required to a level for an individual to communicate in general conversation and general writing skills.

The requirements of a 50001 CP in relation to these competencies are at a reasonably “generic” level. It is understood that 50001 CP engaged in some roles may require an enhanced level of communication skills (e.g., a Certification Body Lead Auditor) but this is not a requirement of all 50001 CP and therefore the more basic skill level is appropriate to the certification.

The competence of communication, both written and verbal, will be required for an individual to undergo the process of applying for and completing the certification process.

2	General Understanding Competencies
201	Demonstrate their understanding of energy management systems terminology and energy management systems principles

In-depth explanation of General Understanding Competencies:

The 50001 CP will be able to demonstrate understanding of the following:

- The basic principles of operation of management systems standards in general
- The plan, do, check, act cycle.
- The High-level Structure (HLS) as outlined in ISO document Annex SL.
- The interaction between the "definitions" in the standard, the "requirements of the ISO 50001: 2018 Energy Management Standard" and the guidance in the annex.
- The ways in which the different components of the management systems standard interact with one another.
- The meaning of normative and non-normative references.
- The classes of findings that arise from a certification audit and the requirements in closing out such findings.
- The interaction between the ISO 50001: 2018 Energy Management Standard and the 50001 "family of standards" including ISO 50002, 50003, 50004, 50006, 50015, 19011.
- The ability to form integrated management systems with other standards.
- The difference between types of certification audits.
- The certification audit process and the requirement for independence in relation to auditors.
- The difference between internal and external audits in relation to consultancy.
- All definitions outlined in the definitions section of ISO 50001 Energy principles and how to apply them. including, at a minimum: types of energy, energy uses, energy conversion, and conversion of energy and power, in different units (e.g., kWh to TJ).

- Application of typical NDT techniques used in energy audits (e.g., Thermography, Vibration analysis etc.)
- The law of conservation of energy.
- How each type of energy applies to the energy management system scope.
- How to calculate the time required for a certification audit, conforming to the requirements of ISO50003 given a set of information about an organization.
- Understanding and application of international energy nomenclature (e.g., CDD, HDD).

The 50001 CP shall have knowledge of the principles of:

- Fuel combustion
- Energy flow
- Energy losses
- Energy efficiency
- Energy balance
- Thermal energy
- Mechanical energy
- Energy in transport
- Electrical energy
- Renewable energy (thermal and electrical)

The requirements of a 50001 CP in relation to General Understanding competencies is such that every 50001 CP needs to understand energy and understand ISO 50001 and an ability to combine the requirements of the Management System Standard with the requirements of an energy system. Whilst the application of ISO 50001 applications will require specialist knowledge (e.g., Nuclear Power Station), such specific knowledge is not required of all 50001 CP. Therefore, the outlined competencies are seen as competencies that will typically be required for the application of ISO 50001 in all organizations. (e.g., Transport Energy may not be a large component of a nuclear power station, but the 50001 CP needs to know enough to make the basic analysis to know if this is the case or not, and therefore needs knowledge of the principles to make this assessment). The requirement in relation to the various standards is in relation to understanding the interaction of the standards and the associated “priorities”, what are “requirements”, what is “guidance” etc. and their application. It does not require an in-depth knowledge of the content of each standard.

It is intended that the assessment of these competencies would be undertaken in an assessment of practical implementation. E.g., a question in the exam could present a scenario of a water heating system operating in a particular way and presenting the information in such a way that the applicant is asked to assess the heat lost in the room. This might therefore have assessed the knowledge of law of conservation of energy, energy balance, thermal and electric energy, and heat loss. The preference would be questions worded in a practical application as opposed to simplistic questions simply requiring the application of a formula available in a folder.

3	Management Systems Competencies
301	Demonstrate their understanding of the context of an organization and the needs and expectations of interested parties, when determining the scope and boundaries of an organization's EnMS.
302	Demonstrate their understanding of the requirements of Top Management within an EnMS and the relevance to the EnMS roles, responsibilities and authorities within the organization and the stated energy policy.
303	Demonstrate their ability to identify potential conflicts with organization context and unintended consequences with different proposed energy management system approaches and /or potential energy performance improvement opportunities.
304	Demonstrate their ability to assess a given approach in relation to communication and awareness for a particular situation and assess for conformance, or otherwise, against EnMS requirements.
305	Demonstrate their ability to assess documented information against EnMS standard requirements
306	Demonstrate their ability to review a given set of circumstances in relation to Legal Obligations & Other obligations and determine conformance or otherwise (comparison of the facts (data) v/s legislation stated). (This does not imply that an individual has an in-depth knowledge of all legal requirements,)
307	Demonstrate their ability to assess an internal audit plan for a given set of circumstances and identify shortfalls, or otherwise, in the plan, in relation to the EnMS Standard
308	Demonstrate their ability to assess a management review set of notes and identify shortfalls, or otherwise, in EnMS standard conformance
309	Demonstrate their ability to review non-conformities and associated actions taken, and to assess for conformance, or otherwise, to the EnMS standard.
310	Demonstrate their ability to identify relevant legal and other requirements related to energy and to conclude whether these have been appropriately considered in each set of circumstances in an energy management application.

In-depth explanation of Management Systems Competencies:

ISO 50001/2018 Clause 3, 4, 5, 6, 7, 8, 9, 10.

The 50001 CP will be able to apply these in the situation of a single facility management system, a management system covering multiple facilities and a management system where the work is carried out in various locations (i.e. temporary sites).

The type of organization, that the management systems the 50001 CP might be required to assess against, include an organization whose activities are office based in a single commercial office facility, an organization that manufactures products, an organization that provides services (such as a courier or an office cleaning firm) and a retail type organization. (Note - assessment of competencies will be at a general level – not requiring in-depth understanding of a particular industry or organization).

The requirements of a 50001 CP in relation to these competencies are that the 50001 CP needs to have the knowledge to assess the most appropriate approach to implement an EnMS within an organization and therefore needs all the competencies required associated with the implementation. That said, a

50001 CP should not need to have a detailed understanding of the operation of every type of industry where ISO 50001 can be applied, but every 50001 CP will require the competence to assess the conformity of a given set of circumstances against a given set of requirements (from the standard) and make the required judgement; or given a set of requirements (clauses of the standard), and the knowledge of an organization (context of the organization), and a set of options as to how to meet the requirements, make a judgement as to which approach is more appropriate. To allow for a consistent assessment of competence in this regard, and to allow for most applications where ISO 50001 will be applied, assessment of competence may be against applications in the given areas of manufacturing/services/ retail and should not require a specialist knowledge of the operations of these types of organization above that commonly understood by individuals or provided in the details given to allow the assessment of competence to be made.

4	Analysis Competencies
401	Demonstrate their ability to use and interpret basic statistics. This shall include the use of control charts and similar approaches to display and analyze data (e.g., Sankey, Pie, Poisson Distribution, Heatmaps etc.).
402	Demonstrate their ability to predict potential improvements, or assess the level of proposed energy improvements, when presented with a set of different stated opportunities and associated savings potential. This would include the context of where the savings will be delivered (i.e., identification and recognition of interactive effects).
403	Demonstrate their ability to assess provided data and other relevant information, along with stated objectives and targets, and to assess the level of energy performance improvement delivered or not delivered.
404	Demonstrate their ability to review provided energy data from monitoring and measurement against stated EnPI's and Baselines and to identify potential anomalies between actual and expected energy data and possible causes.
405	Demonstrate their ability to identify alignment or misalignment with different sets of opportunities for improvement and a given set of objectives, targets, and action plans and EnMS requirements.
406	Demonstrate their ability to assess data collection plans for robustness, related to a particular set of organization circumstances and to assess against EnMS standard requirements.

In-depth explanation of Analysis Competencies:

The management system can come from any type of organization outlined for management system competencies above (single site, multi-site, temporary site, office, manufacturing, services, and retail).

The 50001 CP shall be required to demonstrate an understanding of and the application of statistical terms such as mean, mode, variance, standard deviation, error, regression analysis (single variable and 2-variable), Coefficient of Variance, in analysis of energy consumption and energy performance.

The 50001 CP may be asked to undertake the analysis where data is given to them in written form (report) or requested to assess the data outlined in tables, graphs, and control charts. This analysis may require an individual to assess information from multiple charts, or graphs and to form conclusions.

All analysis will be undertaken on processes limited to the process activities outlined in the technical competencies below. Alternatively, this could be accompanied by a written description of the process in sufficient detail for an individual to understand what represents efficient or inefficient operation and which does not require an in-depth understanding of the process involved.

5	Technical Analysis Competencies
501	Demonstrate their ability to assess an energy review (or part thereof) against the requirements of the EnMS standard.
502	Demonstrate their ability to assess EnPI's and baselines given a set of circumstances and determine if they are appropriate for assessing the existence of energy performance improvement.
503	Demonstrate their ability to analyze energy data and other relevant information; to identify potential variables and static factors; and to determine relevant variables.
504	Demonstrate their ability to identify different appropriate energy performance indicators and baselines, given the objectives and targets of an organizations EnMS and / or assess the relevance or appropriateness of a set of EnPI's and baselines for a set of given circumstances.
505	Demonstrate their ability to use different basic energy analysis approaches to identify potential improvements for a standard set of energy systems. This will include the ability to interpret potential energy improvement opportunities, and/ or estimate energy improvement potential from stated opportunities, when presented with relevant data and applying basic energy and engineering principles.
506	Demonstrate their ability to assess the relevance of selected competence criteria for a given set of circumstances related to energy management.
507	Demonstrate their ability to assess operational criteria related to typical SEUs (as outlined in competency 7) under a given set of circumstances and to identify weaknesses or strengths in the operational control approach undertaken.
508	Demonstrate their ability to review a given set of circumstances related to design and/ or procurement and identify weaknesses and/ or conformance with the EnMS Standard.

In-depth explanation of Technical Analysis Competencies:

The management system can come from any type of organization outlined for management system competencies above (single site, multi-site, temporary site, office, manufacturing, service, and retail).

The 50001 CP shall demonstrate their understanding and ability to apply analysis as outlined in ISO 50006 against a range of processes and systems as outlined below in "technical competencies."

6	Technical Competencies
601	<p>Demonstrate their ability to assess proposed opportunities for improvement and form a judgement as to whether they will deliver energy performance improvement under a given set of circumstances. This ability is fundamental to an individual operating as an ISO 50001 CP, whether:</p> <ul style="list-style-type: none"> a) Operating as a consultant in delivering an Energy review to the client in accordance with ISO 50001 requirements. b) Reviewing an SEU in terms of Current Energy Performance and able to correlate energy performance values (e.g. EnPI's) with the existence or otherwise of significance opportunities for energy performance improvement . c) When acting in a position of an auditor. d) Assessing the work of others to assess the appropriate nature of an action plan, its alignment with the projected energy improvement targets and the general reasonable nature of the energy calculations that support the projected improvement target.
602	<p>Demonstrate their ability to review proposed Measurement & Verification approaches against proposed opportunities for improvement, objectives, and targets; and determine if improvement in performance has been demonstrated and /or the level of improvement demonstrated.</p>

In-depth explanation of Technical Competencies:

Technical competence ability will be limited to the following list of processes and systems unless sufficient detailed explanation is given meaning that knowledge and experience of that type of system is not required to complete the task.

- Internal lighting
- External lighting
- HVAC (including temperature control as well as temperature and humidity control)
- Boilers (oil & gas)
- Chillers (air and water cooled)
- Building envelope
- Electrical distribution
- Electric motors
- Electric motor drives
- Pumping
- Fans
- Compressed air (basic level)
- Transport (basic level - cars, light commercial, truck)
- Basic plug loads (e.g., computers, printers, etc.)
- Steam systems (basic)
- Heat loss and its components and drivers
- Heat exchangers
- Cooling towers
- Waste heat recovery

- Controls
- Financial analysis

The 50001 CP shall be able to understand and use the following: steam tables, pump curve, refrigerant table, psychrometric chart and shall be able to determine the potential savings from opportunities given the necessary information.

The focus here is to ensure that the 50001 CP has the competencies to assess systems based on sound engineering principles so that in the event of encountering a user of energy that they have not come across before would be able to apply sound engineering judgement to allow a reasonable assessment of current energy performance to be carried out. Therefore, the assessment of competence should be focused on assessment of competence in these areas as opposed to areas where an in-depth knowledge or extensive experience of particular systems would be required. As an example it could be appropriate to provide a sample scenario of a cooling tower system in operation (e.g. as displayed on a BMS screenshot) and an individual applying general knowledge where supplied with all the necessary data (temperatures, set points, basis of control, air temperature and relative humidity, psychrometric chart etc.) should be able to form an opinion that the tower is being operated inefficiently because the set point of the cooling tower is below the wet bulb temperature of the external air and fans are therefore at 100% speed irrespective of cooling load. The 50001 CP should not need an in-depth experience of cooling towers to spot this because the relevant information to allow the judgement to be formed would be provided.