

# Evolution of Energy Audits and Energy Management Systems: Legislation, Tools and Professionals at the Service of Energy Efficiency

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**Abstract.** For several decades, Energy Audits have been recognised as a key tool for designing and implementing interventions to improve the overall efficiency of systems, sites and fleets. This concept has gained both European and international recognition for understanding and identifying situations that can yield efficiency gains. This has been re-affirmed with the recent publication of the “*Directive (EU) 2023/1791 13 09 23 on energy efficiency*” As far as regulatory tools are concerned, the European standards UNI CEI EN 16247 *Energy Audits: 1,2,3 e 4* have recently been revised, while at international level, the current revision of ISO 50002 “*Energy Audits - Requirements with guidance for use (1-2-3)*” aims to replace the European standards for an unambiguous international reference. Regarding the professionals involved, the revision of 'UNI CEI 11339 *Energy Management Experts...*' will include the competences of the Energy Auditor, as 16247-5. This contribution aims to illustrate the most recent state of the art at the date of its publication. It will be useful to guide practitioners on how to prepare themselves in the short and medium term to comply with the regulations, enabling them to organise themselves effectively and offer energy efficiency solutions calculated and guaranteed by certified professionals or organisations to their customers and users.

## 1 Introduction

Energy saving, energy efficiency, sustainable energy management have in recent years gone from being very specialised topics reserved for insiders, to everyday topics we read about in the media on social media etc. More than half a century has passed since the first major energy crisis in 1973 - due to conflicts in the countries of production - which triggered principles of austerity that were showered on all people. Lately - some-what with the same problems of wars - and a new environmental awareness, these issues have gradually been taken up again and we can summarise them in a worldwide and for us, especially Europeans, obligation to use energy sustainably.

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The issues from being a common theme involving all of us (who use and pay for energy), given its complexity, highlighted the need to be handled with high quality methodologies and specialists.

Hence the emergence of legislative provisions - often taken from detailed European Directives, including the first around the turn of the millennium - Directive 2006/32/EC [1], and various national legislative provisions starting with Legislative Decree No. 115 of 30 May 2008 [2]. In these provisions, reference was then made to transactional, or gradually more local, bodies in charge of establishing procedural rules - through standards - to regulate a detail of what was required.

Using a classic, scientific, medical methodology, the first step in understanding a phenomenon is to carry out a Audit, and in our case an Energy Audit, which starts from a need, regulated by the legislator and obviously reiterated by the legislator, defining it as *“energy audit” means a systematic procedure with the purpose of obtaining adequate knowledge of the energy consumption profile of a building or group of buildings, an industrial or commercial operation or installation or a private or public service, identifying and quantifying opportunities for cost-effective energy savings, identifying the potential for cost-effective use or production of renewable energy and reporting the findings;*

Of this we first point out a typically Italian problem, fortunately not present in English-speaking countries: in Italy we have had - and to some extent also currently have - extensive debates between the words *“Diagnosi Energetiche”* and *“Energy Audit”* aimed at making a difference between the two. It has been clarified many times - including by the standard UNI EN 16247 [3] and related particles are only the name in Italian and that in English without differences; hopefully, with the complete adoption of international texts, there will be no more confusion.

Therefore, from the above definition of energy audit we must highlight certain parts: *the systematic procedure aimed at obtaining an adequate knowledge of the energy consumption profile* - this is the starting point, in some cases quite simple, in many cases axially complex, especially when the 'site', then identified as *“a building or group of buildings, of an industrial or commercial activity or facility, or of public or private services”*, is particularly large and articulated. It must be borne in mind that energy measurements are neither simple nor cheap, if one wants (and one must/should) unbundle overall consumption into sub-consumptions, and oversimplified tools and method-ologies give errors of the same order of magnitude as the potential energy efficiency then proposed.

But we must well remember that the Energy Audit must not stop at knowledge, which could be of interest almost for statistical purposes or for mega-programming of the territory and global consumption, but must of necessity *“identify and quantify effective energy saving opportunities' in a rigorous manner, even if in some cases estimated above all 'from a cost perspective”*.

And then it is indicated that one must, identify - and verify - *“the possibilities of using or producing renewable energy”* and ultimately *“report on the results”* from there measures, verifications up to guarantees of results e.g. with EPC contracts.

Audit is therefore a very demanding, rather complex subject and only precise legislative indications, methods and unambiguous standards give the user the guarantee of having homogeneous and reliable results, enabling him to reduce energy and obviously economic expenditure.

## **2 Revision of the energy efficiency directive**

The EU legislative landscape is also being revised in order to achieve the decarbonisation targets set out in the 'Fit for 55'. A fundamental role is in fact played by the Energy Efficiency Directive (EED), which on 20 September saw the publication in the Euro-pean Journal of

Directive (EU) 2023/1791 [4] on energy efficiency, approved by the European Council on 25 July, which is the revision of Directive 2017/27/EU [5] and which provides for new provisions to ensure that member states, as a whole, guarantee a reduction in final energy consumption of 11.7% by 2030 compared to the forecasts made in 2020. This translates into a cap of 763 million tonnes of oil equivalent (TOE) for final energy consumption and 993 million TOE for primary consumption, where final energy consumption represents the energy consumed by end users, while primary energy consumption also includes energy used in production and distribution. The limit for final energy consumption will be binding for all Member States (each Member State will calculate it according to the procedure indicated in Annex I of the directive [4]), while the target for primary energy consumption will remain indicative.

## **2.1 National Integrated Energy and Climate Plans**

All Member States will contribute to the achievement of this overall EU target by setting indicative national contributions and pathway plans to achieve it in their integrated national energy and climate plans (NIPECs). Updated plans should be ready by June 2023, with final plans due in 2024.

The Commission will verify that all contributions reach the target of 11.7%. If this is not the case, corrections will be made to the national contributions below this level, using the correction mechanism provided. The formula for calculating national contributions, which will be indicative, with a tolerance of 2.5%, will be based on several factors, including energy intensity, GDP per capita, development of renewables and energy saving potential.

## **2.2 Annual energy savings**

The annual energy savings target for final energy consumption will progressively increase from 2024 to 2030. Member States will have to ensure an average annual energy saving of 1.49% on final energy consumption during this period, reaching 1.9% by 31 December 2030.

Member States will have the option to include in the calculation policy measures already taken under the current and revised Energy Performance of Buildings Directives, those related to the EU Emissions Trading Scheme (for installations, buildings and transport) and energy emergency measures.

## **2.3 Public Sector**

The specific obligation for the public sector to achieve an annual reduction in energy consumption of 1.9 per cent includes some exceptions for public transport and the armed forces; furthermore, the directive does not consider the energy consumption of public bodies in local administrative units, until 31 December 2026 for municipalities with less than 50,000 inhabitants and until 31 December 2029 for those with less than 5,000 inhabitants.

Member States will also be required to renovate each year at least 3 per cent of the total floor area of publicly owned buildings, understood as the total covered area of publicly owned buildings larger than 250 m<sup>2</sup> that, as of 1 January 2024, do not meet the NZEB requirement. These buildings will then have to be included in an accessible public inventory prepared ad hoc.

## 2.4 Energy management systems and energy audits

The directive stipulates that in order to seize energy saving opportunities in specific market sectors that are usually not subject to energy audit requirements, such as small and medium-sized enterprises (SMEs), Member States should create programmes to encourage and support them in carrying out energy audits in order to implement energy saving opportunities.

Thus, it is expected that companies with an average annual energy consumption (referring to the previous three years and taking into account all energy carriers) of more than:

- 85 TJ (*approx. 2030 TOE*) implement an energy management system to be adopted by 11 October 2027;
- 10 TJ (*approx. 239 TOE*) and which do not implement an energy management system are subject to an energy audit.

This audit will have to be carried out in an independent and cost-effective manner by qualified or accredited experts (for Italy by EGEs and ESCos), or carried out and supervised by independent authorities according to national legislation. The diagnoses must be carried out by 11 October 2026 and renewed periodically every four years.

The Directive requires that energy audits comply with the relevant European or international standard, e.g. UNI CEI EN ISO 50001 [6] or UNI CEI EN 16247 [3], or, if they include environmental aspects, UNI CEI EN ISO 14001 [7], and comply with the new Directive, without exceeding its requirements.

In addition, specific mechanisms and schemes set up to monitor emissions and fuel consumption of certain transport companies, e.g. the EU ETS, can be considered compatible with energy audits, even as part of an energy management system, as long as they meet the minimum requirements of the directive.

For companies that already fulfil the energy audit obligation, this audit must continue to be carried out at least every four years.

## 3 UNI CEI EN 16247 ON ENERGY AUDIT

As instructed by the legislature, the regulator has for many years been tasked with developing detailed rules, so that simple, single methodologies are used in consensus on a case-by-case basis.

In Italy we already had a good guideline: UNI CEI/TR 11428 [8] issued on 06 October 2011 and later withdrawn on 01 March 2018, this guideline defined the requirements and common methodology for energy diagnoses as well as the documentation to be produced and applied to all energy systems, all energy carriers and all energy uses

From 06 September 2012 to 17 November 2022, the standards of Group EN 16247, which started out as EN standards, then transposed nationally as UNI CEI EN 16247 of which:

- Part 1 (from September 2012): General requirement [9];
- Part 2 (from August 2014): Buildings [10];
- Part 3 (from August 2014): Processes [11];
- Part 4 (from August 2014): Transport [12], and
- Part 5 (UNI. 2015b) (from June 2015): Competencies of the energy auditor [13].

These are well known by the sector also because they have been repeatedly referred to by the legislator as an obligation - or recommended reference - to fulfil European/Italian obligations such as the drawing up of Energy Audit compulsory from 5 December 2015, pursuant to Article 8 of Legislative Decree 102 [14].

Finally, as of 17 November 2022, the new EN 16247 for parts 1 to 4 took over.

### 3.1 UNI CEI EN16247 part 1: Generalities

The biggest differences between the previous version (2012) are strongly noticeable starting with the first part of the standard package: UNI CEI EN16247 part 1 [15], and this also “*at a glance*” by changing it from 10 to 23 pages. In detail, the most significant changes in this revision are:

- a) *Updated terms and definition to be compliant with the ISO 50001 standard*; this is the common effort that leads to a univocity, first of all, in terms of terminology, which is then directed towards uniformity with the "50xxx family" standards towards which there is an attempt to direct all energy efficiency standardization. For example, interesting is the univocal definition of "EnPI (Energy Performance Indicator) [par. 3.4.4. of UNI CEI EN ISO 50001] or EPIA (Energy Performance Improvement Action) (par. 3.5 of UNI ISO 50015 [16]) - no acronyms are then provided in Italian.
- b) *Added new Annex A Flow Chart the energy audit process*; and also, this with a view to uniformity and uniqueness in parts 2-3-4 that will refer to said flow; note also that although "informative" it is cogent as an index of the normative paragraphs.
- c) *Added the new Annex B Examples of energy audit levels*; although in an in-formative annex, 3 levels with various insights were introduced. On these, we cannot but remember that at the European Commission level we Italians fought a lot, especially because first of all level 1 was not such that it could be called Energy Audit: it did not have - in the draft - the minimum essential contents. As of now, level 1 is the “*level of conformity to UNI CEI EN 16247-1*”, level 2 has more detailed measurements and analysis, and finally level 3 essentially provides for a financial analysis supported by accurate and demanding quotations (typical perhaps of an Energy Audit by an ESCO, not an EGE).
- d) *New Annex C Sampling (based on UNI EN ISO 19011 [17]) i.e.*, as indicated, is the methodology of sampling when it is not practical or cost-effective to ex-amine all information.

There is then at the end of the paragraph a conclusion of the European standard with Italian references: *Note: in different countries there are various sampling methods for multi-site companies. The Italian model, for example, is available at this link: [www.ufficienzaenergetica.enea.it](http://www.ufficienzaenergetica.enea.it)*. In fact, the clustering methodology, already proposed by ENEA in 2018, has found wide use at the Italian level and has already been tested at the European level, without the other countries having a reliable way of identifying the essential uses in a representative manner.

The UNI CEI EN 16247-1 in its breadth, is now the first part that must be well known and used for the subsequent parts, which will not repeat concepts and schemes already set out here.

### 3.2 UNI CEI EN 16247 part 2: Buildings

The recent revision of UNI CEI EN 16247 part 2 [18], which focuses on energy audits of buildings, has introduced significant innovations, highlighting the most relevant aspects compared to the 2014 version. Firstly, the terminology has been carefully revised and aligned with other standards, such as UNI EN ISO 52000 on energy management systems and UNI EN ISO 52000-1, a framework standard for the energy performance of buildings.

One of the most salient innovations concerns the optimisation of the stages of the audit process, with the aim of ensuring greater alignment between the different parts of the 16247 series. This update aims to improve the overall cohesion and effectiveness of building energy audits by ensuring greater uniformity in the methodologies and criteria used.

It should be noted that the new UNI CEI EN 16247-2 on buildings cannot be considered completely self-supporting. The standard closely integrates with the general part, i.e. UNI CEI EN 16247-1, expanding and referring to the various stages of the audit process. The identity in the table of contents and in the subdivision of the chapters between the two standards shows that, where the specific part (part 2) does not add any new elements compared to the general part (part 1), part 2 simply refers to the corresponding point in part 1, highlighting that each part is supplementary to the others.

Going into the details of UNI CEI EN 16247-2, in addition to the introductory chapters shared with other standards, such as purpose, normative references and definitions, the standard is mainly divided into two chapters.

After Chapters 1 to 3, Chapter 4 details the requirements that the energy auditor and the audit process must fulfil. In particular, the standard emphasises the competence of the energy auditor, emphasising qualifications and experience in relation to the scope and complexity of the audit. Further details on the auditor's competence are also provided in the specific UNI CEI EN 16247 part 5. Other quality requirements include confidentiality, objectivity and transparency, the latter being crucial to avoid potential conflicts of interest.

The following chapter (Chapter 5) lists and describes in detail the steps and characteristics of the audit process. The standard emphasises the importance of a meaningful representation of the analysed parts, if a sampling method is used. Data collection is recognised as a crucial step, where consumption data, in addition to bills, can come from any available energy meter, contributing to a complete reconstruction of the building's status quo.

The subsequent steps in the process, such as fieldwork, the analysis phase and reporting, are outlined in chronological order. The analysis is emphasised as a time when the energy auditor should use all the information gathered to make considerations and proposals for energy efficiency, favouring those interventions with the greatest potential from a benefit/cost perspective. The use of building modelling and calculation simulations is proposed to assess the impact of proposed actions on energy performance indicators.

The final report must include actions and recommendations for energy efficiency, together with indications for the subsequent monitoring of results. The final meeting is emphasised as crucial for the clear and concise communication of the results and savings potential that emerged from the detailed analysis carried out by the energy auditor.

In conclusion, it is worth mentioning that Part 2 in its annexes provides a number of examples, identifying actors that could be involved in the audit process, providing checklists both to support the field work of the energy auditor and for the measurement of energy efficiency measures, providing analysis of energy uses in a building, providing a list of energy performance indicators for buildings; energy saving opportunities, analysis and calculation of energy savings: providing templates for reporting the results of an energy audit, and finally how to verify that the implemented energy saving opportunities have been achieved.

Also at the Italian level, the standard is further supported by UNI/TR 11775 [19], which provides guidelines for drawing up an energy audit for buildings, which although in small parts may be outdated, as it refers to 16247-2 of 2014, is most current and useful.

### **3.3 UNI CEI EN 16247 part 3: industrial sector**

UNI CEI EN 16247 part 3 [20], like its predecessors, has undergone a major revision. Let us see what the features and main new features of the revision are compared to the previous version of 2014: the most significant changes in this revision are:

- updated terms and definition;
- structure aligned with UNI CEI EN 16247-1 [15];
- sampling method allowed as an energy audit process;

- new Annex D with an example of a methodology for multi-site audit sampling in industrial companies.

In the Scope it is clarified that this part of the standard applies to sites or parts of sites where a significant part of the energy use is due to processes, and that “*This part provides additional material to Part 1 for the process sector and is to be used in conjunction with the latter*”.

As far as terms and definitions are concerned, as in Part 1, many definitions from EN ISO 50001 are widely and uniformly used. In Chapter 4 on quality requirements, and in particular in point 4.1 “*Energy auditor*” interesting is the statement: “*The quality of the energy audit depends on the knowledge of the processes, the site and the available data and information. Close cooperation between the energy auditor and the organisation is essential. When a sampling method is used, the samples selected must be representative of the audited objects as a whole*”. In point 5.3.2 “*Request for information*”, in addition to the information required in UNI CEI EN 16247-1 [15], the energy auditor shall also request from the organisation specific conditions and constraints for the process and environment (safety, pollution, health, etc.).

Already at the preliminary analysis stage, it is then important to identify the independent variables and static factors. Subsequently, point 5.4 “*Measurement plan*” refers to what is already defined in UNI CEI EN 16247-1 [15], point 5.4. As well as in 5.5 “*Sampling methods*” in connection with UNI CEI EN 16247-1 [15], point 5.5. Interesting and in line with the Italian ENEA and Ministry of Economic Development (MiSE) (now Ministry for the Environment and Energy Security) prescriptions is the indication regarding the energy balance and breakdown, having to provide a breakdown of the consumption of energy vectors in a company’s energy structure (e.g. main activities, auxiliary services, general services) on a cost-effective level.

In Annex B (informative) as data that could be collected, the following is added as energy sources: size and annual energy production of on-site photovoltaic plants, size and annual energy production of on-site solar thermal plants, and on-site biogas production.

The biggest change is found in the addition of Annex D (informative) on the minimum criteria for representative energy sampling for multi-site organisations. “*The sampling of sites to be audited could be applied to multi-site organisations when they are too numerous, geographically dispersed and/or their energy consumption is too low to justify the audit*”. This is in line with ENEA and MiASE guidance. In summary, when it is not practical or convenient to examine all available information during an audit, e.g. when the audited objects are too numerous or too geographically dispersed, multi-site companies may perform an energy audit on a representative sample of their entire number of sites. The scheme is almost the same as that of ENEA, already announced in UNI CEI EN 16247-1, i.e. taken from Energy Audit Article 8 of Legislative Decree 102 Guidelines and Operational Manual Clustering of February 2019.

In conclusion, UNI CEI EN 16247-3 is a revision that is not particularly impactful at national level for those who have kept up to date with the 500xx series of standards and the requirements of ENEA and MiASE, which even more so with this regulatory framework.

Also at the Italian level, the standard is further supported by UNI/TR 11824 [21], which provides guidelines for drawing up an energy audit for buildings, which although in small parts may be outdated, as it refers to 16247-3 of 2014, is most current and useful.

### **3.4 UNI CEI ISO 16247 part 4: Transport**

The revision of UNI CEI EN 16247 part 4 [22] has introduced significant innovations in the field of energy audits, offering practitioners, in particular energy auditors, an updated and improved framework.

As for the other parts in the most salient innovations, the convergence of the energy audit process towards Energy Management Systems according to UNI EN ISO 50001 [6] emerges. This integration was achieved through the incorporation of key concepts such as energy performance and its improvement, extending the concept of 'energy efficiency' to other energy areas. In addition, concepts from UNI ISO 50015 [16], such as energy performance improvement actions (EPIA), and UNI CEI EN 17463 [23], concerning the valuation of investments in the energy sector (VALERI), including Net Present Value, have been incorporated.

The main differences from the previous version of the standard can be summarised in the following points:

- The article on the 'Kick-off meeting' (5.2) was considerably detailed in terms of objectives and qualifying points, bringing more clarity to the path of the entire audit, being a critical stage of audit.
- In the description of the factors involved in data collection (5.3), data from the telemetry records of the transport fleet, an increasingly important component in modern road fleet management, has been added.
- In the fieldwork (5.4), the concept of 'energy reduction opportunity' was re-placed with 'EPIA energy performance improvement action', greatly expanding the intervention options available to the Energy Auditor.
- In the content of the report (5.3.6.2), 'savings in terms of CO<sub>2</sub> equivalent' were explicitly included as a criterion to be considered in the context of transport fleet renewal actions, further expanding the possibilities for improving energy performance.

The most obvious difference is found in the introduction of two information annexes, making the data collection work for the energy audit in the transport sector, characterised by the diversity of means and modes of transport, clearer and more replicable. Annex B provides specific indications for data collection, mainly addressed to road transport fleets, while Annex C presents examples of audit report indices dedicated to different transport categories.

Despite these improvements, some shortcomings persist, such as the lack of specific guidelines for road, rail, maritime and intermodal freight transport. Therefore, although the latest update represents progress, it is to be hoped that future revisions of the standard will more comprehensively address the structural and management peculiarities of the different modes of transport, ensuring a more complete standardisation adapted to the various realities of the sector.

## **4 ISO 50002 “ENERGY AUDITS - REQUIREMENTS WITH GUIDANCE FOR USE (1-3)”.**

While the previous European standards UNI CEI EN 16247 were about to be re-leased, already at a global level, on the ISO tables, the previous ISO 50002 [24], in place since June 2014, was being revised. Let us remember that Europe (EN) never accepted this ISO standard, in particular because of the possibility of carrying out various levels of audit, the first of which was considered too light and without energy measurements and energy models such that it could not (in EN's opinion) be considered an Energy Audit.

The work on the revision of ISO 50002 started already inspired by CEI EN16247 in particular - on a case-by-case basis, depending on the state of progress - by the best drafts circulating in standardisation circles. This is already evident from the fact that the drafts, which as of January 2024 are still in the investigation phase, based on "DRAFT INTERNATIONAL STANDARD ISO/DIS" documents, are structured on 3 draft standards:

Part 1: General requirements



Part 2: Buildings

Part 3: Processes

And all this in analogy with EN 16247.

NB: there is - at least for now - no mention of transport (part 4) although there is a mention of 'fleets' in part 1; there is also no mention of part 5 - energy auditors - primarily by framing auditors in some of the pages proposed in part 1 (50002-1).

At the Italian level, there was no active participation in the work until a few months ago, when we urged CTI to participate in the work of commenting on the DIS documents. These were sent in January 24 and in March 24 there will be the first joint meetings.

Despite a certain affinity between the 16247 of 2022 and the drafts of the 50002, there are of course differences that partly stem from the previous ISO 50002-14. In Italian revision requests, attempts were often made to trace ISO 50002 back to UNI CEI EN 16247, also because in several cases ISO 50002 had itself started from drafts of UNI CEI EN 16247, which were then commonly corrected.

Part 1 of ISO 50002 also has an important setting, a general framework: it is a reference for the following 2 and 3, but it still has in its appendix, the proposal of 3 levels of audit with the first level still too light. This will be a key point of collegial discussion; in fact, we believe that the 3 levels already included in UNI CEI EN 16247-1 can be maintained, but we also call for firm rigour in the first level.

Another point that is generally quite different is the very 'advice' approach, i.e. with indications of 'should' and rarely 'shall': it is often considered to be an overly possibilistic approach that could lead to over-interpretation and thus to too little rigorous and uniform drafting.

Lastly, as has been pointed out, is the proposal in ISO 50002 that it is the client who can decide on the level of audit, which for us does not correspond to a fair allocation of roles and responsibilities. Obviously it is the client's full right to emphasise his wishes and needs - on a voluntary basis or also obliged by law - but he cannot interfere on the method that will be decided by the specialist: the energy auditor.

It will not be easy to try to fit the ISO 50002 drafts into the EN / UNI settings, but if a good compromise can be reached, it will be desirable to then transpose them at EN level and then UNI and go for a repeal of UNI CEI EN 16247 parts 1, 2 and 3.

As already indicated, there will be no ISO 50002 standards on energy auditors in the near future, but reference will be made to the footnote in para. 6.3 *NOTE Where a national or local energy auditor certification scheme, or equivalent, is available, certified energy auditors can be considered* (and this does not close us in Italy to the use of UNI CEI 11339 [25], referred to in the next paragraph).

The draft of ISO 50002-2 was certainly inspired by UNI CEI EN 16247-2 and refers extensively to ISO 50002-1 so it will also be very important here to see how ISO 50002-1 will change. In the comments, it was recommended that reference be made to the latest definitions in UNI CEI EN 16247-2 (they were lacking in fact also because they started from drafts of UNI CEI EN 16247). We asked for an amendment requesting that *“The responsibility for the definition of the level of detail of the energy audit between type 1 and type 3 cannot be assigned to the organisation only but agreed by the parties”*. It also seemed necessary to indicate that *“The modelled energy use must be validated”*.

When it comes to building services systems, the definition already agreed upon in 16247 was reiterated, i.e. that *“The use and operation of buildings requires the provision of services such as heating, cooling, humidification, dehumidification, ventilation, lighting, domestic hot water, transportation systems (e.g. elevators, escalators and moving walkways) in buildings, information systems, including building automation and control systems, and processes”*.

As far as ISO 50002-3 is concerned, this does not differ much from UNI CEI EN 16247-3; at the Italian level, it seemed useful to propose the introduction of the flow diagram

(already present in the UNI CEI EN 16247-3 2015 version), which gives an un-ambiguous outline of the various phases and which is even more desirable in a world-wide standard then translated into the various languages of the globe. Lastly, a proposal was made to explicitly reintroduce the clustering mode for multi-site companies according to the ENEA model, which had proved useful not only in Italy, but in other European countries, so much so that, as already described in the section on UNI CEI EN 16247-3, it was introduced in the EN version a year ago.

## **5 UNI CEI 11339 ENERGY MANAGEMENT EXPERTS**

On 30 November 2023, the new UNI CEI 11339 was published, which stands as an important tool to best ground the actions required for energy transition and decarbonisation

The new version of the UNI CEI led to the withdrawal of the pre-existing 2009 text.

After a long regulatory and even more legislative path, the role of the EGE can be referred to by Legislative Decree No. 73 [26] of 14 July 2020, which modifies the definition of Expert in Energy Management defined by Legislative Decree 115. This was confirmed by Legislative Decree 102, establishing that it must be understood as “*a natural person certified according to the UNI CEI 11339 standard is-sued by an accredited body that, among other things, performs energy diagnoses in compliance with the UNI CEI EN 16247 standard*”. The “*figure coinciding with that of the EGE for the activities envisaged by the decree, in relation to carrying out energy diagnoses*” was also added to the definition of Energy Auditor. It can be considered that this was another important motivation behind the amendment of the UNI CEI 11339 version 2015 was Law no. 4 [27], which contains provisions on unorganised professions, which the 2023 version now takes into account.

The first novelty of the new UNI CEI 11339 starts with the title “*Non-regulated professional activities - Expert in energy management - Requirements of knowledge, skills, autonomy and responsibility*”, the latter in relation to Law No. 4 and the EQF approach that brings some fundamental definitions into the new standard:

*Knowledge - Ability - Autonomy - Competence.*

Furthermore, it distinguishes the ways in which knowledge learning takes place:

*Formal learning - Informal learning - Non-formal learning.*

It is then unequivocally clarified that a professional who fulfils the requirements of the new UNI CEI 11339 also fulfils the requirements of UNI CEI 16247-5 on energy auditors and performs energy diagnoses in accordance with UNI CEI EN 16247 parts 1 - 4.

The structure of the new standard has changed significantly compared to the previous one. For example, the tasks that the EGE must be able to perform have been re-formulated in greater detail. This is essentially a remodelling and reorganisation of the same tasks as in the previous standard, reinterpreted in a more up-to-date key to today's context and brought down to 8 areas of intervention.

Extensively, it is clarified that among the EGE's primary tasks is the implementation and maintenance of an energy management system (EMS) that complies, of course, with UNI CEI EN ISO 50001. This is the main role of the EGE, which differentiates it, for example, from an energy auditor focused solely on diagnoses.

A special task of the EGE is the management of the technical content of contracts.

In fact, the EGE manages energy use in a rational manner by combining knowledge in the energy field (including energy diagnostics, energy storage and the environmental effects of energy use) with technical-analytical, management, economic-financial and

communication skills, keeping continuously and constantly updated on the evolution of technologies, methodologies and energy-environmental regulations.

In this way, the EGE aims to improve the level of energy efficiency and/or to reduce primary energy consumption and climate-altering gas emissions related to energy use, to increase in quality and/or quantity the services provided in any case related to the rational use of energy.

ACCREDIA in any case reports that

*Accreditations previously granted to Personnel Certification Bodies will have to complete the transition to the new requirements in Appendix A within one year of the publication of the standard. (i.e. November 2024)*

*Upon completion of the accreditation transition, Certification Bodies shall exclusively apply the requirements of UNI CEI 11339 for all new certification, maintenance and renewal of existing certifications issued to Energy Management Experts.*

*At the end of the certification transition period, scheduled to last two years from the date of publication of the standard, (i.e. November 2025) certificates already issued under accreditation that have not completed the transition to the requirements of UNI CEI 11339 will lose their validity and will have to be revoked by the certification body that issued them.*

*Existing certificates that successfully complete the transition will be reissued with reference to the applicable technical standards, i.e. UNI CEI 11339 and, as provided in Appendix A, UNI CEI EN 16247-5.*

*The certificates issued under accreditation will therefore attest to the professional's competence also for carrying out energy diagnoses in accordance with UNI CEI EN 16247 parts 1,2,3 and 4.*

*The explicit reference to the European certification standard in addition to the guarantees offered by the international mutual recognition agreements of accreditation mean that accredited certifications issued to Energy Management Experts in accordance with UNI CEI 11339 can be recognised as equally reliable abroad, allowing certified professionals new job opportunities.*

## **6 CONCLUSIONS**

In conclusion, the analysis carried out clearly shows that the energy audit is confirmed not only as an indispensable tool for planning energy efficiency measures, but also as a crucial element in the context of the new European legislative landscape. Regulatory developments and the growing challenges in terms of reducing energy consumption, increasing energy efficiency and decarbonisation are promoting the wide-spread adoption of energy auditing, positioning it at the forefront of energy management strategies.

In the context of this transformation, the central role of the Energy Management Expert emerges strongly. With increasingly stringent regulations and the accentuated focus on decarbonisation, specialists in this field become key players in the design, implementation and monitoring of interventions aimed at improving energy efficiency. The complexity of today's challenges requires specialised skills, and the figure of the energy management expert is a catalyst for the success of sustainability-oriented initiatives.

Looking to the future, it is clear that energy auditing, in synergy with energy management systems, will take centre stage in corporate strategies to address energy and climate challenges. Widespread adoption of these practices will not only enable organisations to comply with regulatory obligations, but also represent a fundamental step towards a more sustainable and resilient energy model. The professionalism of the energy management expert therefore becomes a strategic investment for professionals and organisations wishing to drive change towards efficient and responsible energy management.

The regulatory landscape also plays a key role in this context, providing support and pouring into the revisions the experience gained and the additions required by the European legislative plan, with the new decarbonisation targets for 2050.

## REFERENCES

1. European Union. Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and re-pealing Council Directive 93/76/EEC. Brussels. European Official Journal. (2006).
2. Italian Government. Legislative Decree no. 115 of 30 May 2008. Implementation of Directive 2006/32/EC on energy end-use efficiency and energy services and repeal of Directive 93/76/EEC. Rome. Poligrafico dello Stato. (2008).
3. UNI. Energy Audit. Standard UNI CEI EN 16247. Milan: Ente Italiano di Normazione. (2022).
4. European Union. Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast). Brussels. European Official Journal. (2023).
5. European Union. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Brussels. European Official Journal. (2012).
6. UNI. Energy management systems - Requirements and guidelines for use. UNI CEI EN ISO 50001 standard. Milan: Ente Italiano di Normazione. (2018).
7. UNI. Environmental management systems - Requirements and guidance for use. UNI EN ISO 14001 standard. Milan: Ente Italiano di Normazione. (2015).
8. UNI. Energy management - Energy audits - General requirements for energy audit service. UNI CEI/TR 11428 standard. Milan: Ente Italiano di Normazione. (2011).
9. UNI. 2012. Energy Audit - Part 1: General requirements. UNI CEI EN 16247-1 standard. Milan: Ente Italiano di Normazione. (2012).
10. UNI. 2014a. Energy Audit - Part 2: Buildings. UNI CEI EN 16247-2 standard. Milan: Ente Italiano di Normazione. (2014).
11. UNI. 2014b. Energy Audits - Part 3: Processes. UNI CEI EN 16247-3 standard. Milan: Ente Italiano di Normazione. (2014).
12. UNI. 2014c. Energy Audit - Part 4: Transport. UNI CEI EN 16247-4 standard. Milan: Ente Italiano di Normazione. (2014).
13. UNI. Energy audits - Part 5: Competences of the energy auditor. UNI CEI EN 16247-5 standard. Milan: Ente Italiano di Normazione. (2015).
14. Italian government. Legislative Decree No. 102 of 4 July 2014. Implementation of Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Rome. Poligrafico dello Stato. (2014).
15. UNI. Energy Audit - Part 1: General requirements. UNI CEI EN 16247-1 standard. Milan: Ente Italiano di Normazione. (2022).
16. UNI. Energy management systems - Measurement and verification of the energy performance of organisations - General principles and guidelines. UNI ISO 50015 standard. Milan: Ente Italiano di Normazione. (2015).
17. UNI. Guidelines for management system audits. UNI EN ISO 19011 standard. Milan: Ente Italiano di Normazione. (2018).
18. UNI. Energy Audit - Part 2: Buildings. UNI CEI EN 16247-2 standard. Milan: Ente Italiano di Normazione. (2022).

19. UNI. Energy Audit - Guidelines for the energy audit of buildings. Standard UNI/TR 11775. Milan: Ente Italiano di Normazione. (2020).
20. UNI. Energy Audits - Part 3: Processes. UNI CEI EN 16247-3 standard. Milan: Ente Italiano di Normazione. (2022).
21. UNI. Energy Audit - Guidelines for the energy audit of process. Standard UNI/TR 11824. Milan: Ente Italiano di Normazione. (2021).
22. UNI. Energy Audit - Part 4: Transport. UNI CEI EN 16247-4 standard. Milan: Ente Italiano di Normazione. (2022).
23. UNI. Valuation of investments related to interventions in the energy sector (VALERI). Standard UNI CEI EN 17463. Milan: Ente Italiano di Normazione. (2022)
24. ISO. Energy audits - Requirements with guidance for use. ISO 50002 standard. Milan: Ente Italiano di Normazione. (2014).
25. UNI. Non-regulated professional activities - Energy management expert - Requirements for knowledge, skills, autonomy and responsibility. UNI CEI EN 11339 standard. Milan: Ente Italiano di Normazione. (2023).
26. Italian Government. Legislative Decree No. 73 of 14 July 2020 Implementation of Directive (EU) 2018/2002 amending Directive 2012/27/EU on energy efficiency. Rome. Poligrafico dello Stato. (2020).
27. Italian Government. 2013. Law No. 4 of 14 January 2013. Provisions on unorganised professions. Rome. Poligrafico dello Stato. (2013).
28. CTI. Energia e Dintorni. Novembre 2022. Milano. Comitato Termotecnico Italiano energia e ambiente. (2022).
29. CTI. Energia e Dintorni. Dicembre 2023. Milano. Comitato Termotecnico Italiano energia e ambiente. (2023).

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