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New recommendations for monitoring and follow-up of energy efficiency measures implementation

CCMC will prepare and attach the official title page.

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Foreword

This CEN-CENELEC Workshop Agreement (CWA XXXX:YYYY) has been developed in accordance with the CEN-CENELEC Guide 29 "CEN/CENELEC Workshop Agreements – A rapid way to standardization" and with the relevant provisions of CEN/CENELEC Internal Regulations - Part 2. It was approved by the Workshop CEN-CENELEC "New recommendations for monitoring and follow-up of energy efficiency measures implementation", the secretariat of which is held by UNE consisting of representatives of interested parties on 2026-04-15, the constitution of which was supported by CEN following the public call for participation made on 2026-03-06. However, this CEN-CENELEC Workshop Agreement does not necessarily include all relevant stakeholders.

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Introduction

This CEN-CENELEC Workshop Agreement developed through this workshop aims to support energy-intensive industries, which are essential for achieving the European Union's climate and energy objectives, by addressing the persistent gap between the identification and effective implementation of energy efficiency measures despite existing regulations such as Directive 2023/1791 and the EU Emissions Trading System.

The CWA provides voluntary, non-legally binding guidelines and best practices focused on technical guidance for post-audit implementation, helping overcome barriers such as technical knowledge gaps, limited management engagement, lack of information on funding options and the absence of structured action plans, while harmonizing approaches and facilitating the implementation of energy efficiency measures across different industrial sectors.

In particular, Article 11 of Directive (EU) 2023/1791 places the follow-up of audit recommendations at the centre of compliance by requiring a concrete and feasible Action Plan, submission of the Action Plan to enterprise management, and publication of the implementation rate, subject to applicable confidentiality rules. This CWA therefore focuses on the practical governance, monitoring and verification steps needed to close the gap between the audit report and implemented, persistent energy savings.

The industrial sector, one of the largest energy consumers in the European Union, accounted for 24.6% of final energy consumption in 2023 (source: Eurostat), as well as 20.3% of greenhouse gas emissions in 2022 (source: European Environment Agency). These figures confirm that industry remains one of the most energy-intensive sectors within the European Union.

In response, the European Union has launched a series of measures aimed at achieving climate neutrality by 2050. These measures, set out under the European Green Deal, include the "Fit for 55" package adopted in 2021, which comprises a set of legislative proposals intended to enable the EU to reduce greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. These initiatives have a direct impact on the industrial sector, notably through the extension of the scope of the EU Emissions Trading System, the introduction of the Carbon Border Adjustment Mechanism, and the tightening of requirements related to the use of renewable energy. In addition, in 2022 the European Commission presented the REPowerEU plan, introducing further measures aimed at diversifying energy supply, promoting energy savings and accelerating the transition towards clean energy sources.

The EU's ambitious climate objectives, combined with energy supply instability and price volatility, highlight the urgent need to reduce overall fuel consumption volumes, decrease the industry's dependence on fossil fuels, and increase the potential for transitioning towards more environmentally sustainable alternatives across all industrial sectors.

1 Scope

The present document aims to establish guidelines and good practices for the implementation of energy efficiency measures in industries, based on the results obtained from energy audits and Energy Management Systems (EnMS). Its purpose is to provide a best-practice framework enabling organisations to identify and implement energy improvements and energy transition path in a systematic, efficient manner and in alignment with the applicable energy efficiency and climate regulatory framework.

This document applies to industries across all sectors, and particularly to energy-intensive sectors. That is, sectors and companies carrying out mandatory energy audits or Energy Management Systems in accordance with national, European standards and International standards. It includes reference legislation and methodologies, as well as good practices and recommendations for the implementation of energy efficiency and energy transition measures, the monitoring of the implementation process, and the evaluation of the results obtained.

This document is intended for use after energy audits carried out under applicable national requirements or recognised standards such as EN 16247 and ISO 50002-1, and can also be used by organisations operating, implementing or considering an Energy Management System according to ISO 50001.

This document does not replace legal obligations, certification requirements or sector-specific permitting requirements. It provides practical recommendations to support decision-making, implementation control, measurement and verification, and management review.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp/

— IEC Electropedia: available at http://www.electropedia.org/

3.1
energy
electricity, fuels, steam, heat, compressed air, and other similar media

Note 1 to entry: For the purposes of this document, energy refers to the various types of energy, including renewable, which can be purchased, stored, treated, used in equipment or in a process, or recovered.

[SOURCE: ISO 50001:2018, 3.5.1]

3.2
energy efficiency
ratio or other quantitative relationship between an output of performance, service, goods, commodities or energy, and an input of energy

EXAMPLE Conversion efficiency; energy required/energy consumed.

Note 1 to entry: Both input and output need to be clearly specified in quantity and quality and be measurable.

[SOURCE: ISO 50001:2018, 3.5.3]

3.3

energy savings

amount of saved energy determined by measuring or estimating consumption, or both, before and after the implementation of an energy efficiency improvement measure, whilst ensuring normalisation for external conditions that affect energy consumption

[SOURCE: Directive (EU) 2023/1791, Article 2, (9)]

3.4

energy efficiency improvement

an increase in energy efficiency as a result of any technological, behavioural or economic changes

[SOURCE: Directive (EU) 2023/1791, Article 2, (10)]

3.5

management system

Set of interrelated or interacting elements of an organization to establish policies and objectives and processes to achieve those objectives

Note 1 to entry: A management system can address a single discipline or several disciplines.

Note 2 to entry: The system elements include the organization's structure, roles and responsibilities, planning and operation.

Note 3 to entry: In some management systems, the scope of a management system can include the whole of the organization, specific and identified functions of the organization, specific and identified sections of the organization, or one or more functions across a group of organization. The EnMS scope includes all energy types within its boundaries.

[SOURCE: ISO 50001:2018, 3.2.1]

3.6

energy management system (EnMS)

management system to establish an energy policy, objectives, energy targes, action plans and process(es) to achieve the objectives and energy targets

[SOURCE: ISO 50001:2018, 3.2.2]

3.7

audit

systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled

Note 1 to entry: An audit can be an internal audit (first party) or an external audit (second party or third party), and it can be a combined audit (combining two or more disciplines).

Note 2 to entry: An internal audit is conducted by the organization itself, or by an external party on its behalf.

Note 3 to entry: "Audit evidence" and "audit criteria" are defined in ISO 19011.

Note 4 to entry: The term "audit" as defined here and as used in this document means the internal audit of an energy management system. This is different from an "energy audit". In this definition, "audit evidence" means evidence from an internal audit of the energy management system, and not evidence from an energy audit.

[SOURCE: ISO 50001:2018, 3.3.8]

3.8

organization

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO 50001:2018, 3.1.1]

3.9

energy management team-Energy manager

person(s) with responsibility and authority for effective implementation of an energy management system and for delivering energy performance improvement

Note 1 to entry: The size and nature of an organization and available resources are taken into account when determining the size of an energy management team. A single person can perform the role of the team.

[SOURCE: ISO 50001:2018, 3.2.5]

3.10

energy baseline (EnB)

quantitative reference(s) providing a basis for comparison of energy performance

Note 1 to entry: An energy baseline is based on data from a specified period of time and/or conditions, as defined by the organization.

Note 2 to entry: One or more energy baselines are used for determination of energy performance improvement, as a reference before and after, or with and without implementation of energy performance improvement actions.

Note 3 to entry: See ISO 50015 for additional information on measurement and verification of energy performance.

Note 4 to entry: See ISO 50006 for additional information on EnPIs and EnBs.

[SOURCE: ISO 50001:2018, 3.4.7]

3.11

energy performance indicator (EnPI)

measure or unit of energy performance, as defined by the organization

Note 1 to entry: EnPI(s) can be expressed by using a simple metric, ratio, or a model, depending on the nature of the activities being measured.

Note 2 to entry: See ISO 50006 for additional information on EnPI(s).

[SOURCE: ISO 50001:2018, 3.4.4]

3.12

measurement and verification (M&V)

process of planning, measuring, collecting data, analysing, verifying, and reporting energy performance or energy performance improvement for defined M&V boundaries

[SOURCE: ISO 50015:2014, 3.13]

3.13

relevant variable

quantifiable factor that significantly impacts energy performance and routinely changes

Note 1 to entry: Significance criteria are determined by the organization.

EXAMPLE Weather conditions, operating conditions (indoor temperature, light level), working hours, production output.

[SOURCE: ISO 50001:2018, 3.4.9]

3.14

static factor

identified factor that significantly impacts energy performance and does not routinely change

Note 1 to entry: Significance criteria are determined by the organization.

EXAMPLE Facility size; design of installed equipment; number of weekly shifts; range of products.

[SOURCE: ISO 50001:2018, 3.4.8]

3.15

action Plan

concrete activities intended to achieve the objectives

[SOURCE: ISO 17298:2025, 3.2.1]

4 Good practices for post-energy audit implementation and follow-up of energy efficiency measures.

4.1 Establishment of an internal Energy Manager role

Following the energy audit or EnMS, organisations that do not already have this role in place should designate an Energy Manager responsible for the effective implementation, coordination and follow-up of the identified energy efficiency measures.

NOTE In some countries the role of Energy Manager is defined by national legislative provisions and certification schemes.

The energy manager should act as the central element ensuring continuity between the outcomes of the energy audit and EnMS, their practical implementation within the organisation and the measurement, monitoring and reporting of the energy efficiency improvement and other non energy performance indicator (multiple benefits).

For Energy-Intensive Industries (EIIs), the establishment of this role shall be considered essential, given that the energy consumption represents a significant share of operating costs.

In energy-intensive contexts, this role should have sufficient authority, access to energy and production data, and a direct reporting line to management. The role may be assigned to one person or to an energy team, depending on the size, complexity and maturity of the organisation.

Table 1 — Key roles and responsibilities of an Energy Manager

Role / Function	Description
Energy planning	Define the organisation's energy strategy and objectives, aligned with the overall business strategy, in coordination with the managing board.
Energy monitoring and performance analysis	Implement monitoring systems for energy consumption at equipment or process level and analyse performance indicators (kWh/year, kWh/unit, kWh/t, etc.).
Measurement and verification of savings	Define the baseline, EnPIs, M&V approach, data sources and verification method for significant measures before implementation starts.
Development of improvement plans	Identify, assess and prioritise energy efficiency measures using structured and transparent methodologies.
Coordination of energy audits	Ensure energy audits are properly conducted and that identified measures are integrated into operational and strategic planning.
Economic management of energy use	Review energy tariffs, optimise supply contracts and forecast plant-level energy costs, in coordination with the purchases manager.
Training and awareness	Promote an energy-conscious culture through targeted training and awareness actions for staff.
Communication and reporting	Report periodically to management and relevant stakeholders on energy performance, achievements and deviations.
Implementation and maintenance of Energy Management System (EnMS)	Coordinate the implementation and upkeep of energy management systems such as ISO 50001.
Innovation and digitalisation	Promote the adoption of digital tools such as monitoring platforms, data analytics and artificial intelligence, and assess emerging technologies.
Liaison with external stakeholders	Act as the interface between the organisation and public authorities, associations, research entities and technology providers.

4.2 Integration of the energy plan

The organisation shall define and maintain an energy strategy and energy objectives that are aligned with its overall business strategy. This alignment shall ensure that energy management is integrated into the organisation's framework and decision-making processes.

Energy planning shall contribute to increasing the visibility of energy management within the organisation, shall reinforce internal accountability, and shall support the development and maintenance of an energy-aware organisational culture.

The energy plan should be linked with budgeting, capital expenditure, maintenance planning, procurement, operational planning and decarbonisation roadmaps, so that energy efficiency measures are not treated as isolated technical actions.

4.3 Monitoring and analysis of energy consumption

The organisation shall establish, implement and maintain procedures to monitor and analyse energy consumption in order to obtain a reliable understanding of actual energy use and energy performance.

Monitoring and analysis shall be based on the principle that effective energy management requires systematic measurement. Appropriate monitoring and measurement systems shall be developed to identify inefficiencies and improvement opportunities, shall support energy planning and compliance with applicable requirements, shall enable data-driven decision-making, and shall contribute to emissions reduction and sustainability objectives.

4.3.1 Definition of energy baselines, EnPIs and M&V approach

Before implementation starts, the organisation should define how the savings of each significant measure will be measured or verified. The M&V approach should specify the measurement boundary, baseline period, reporting period, relevant variables, static factors, adjustment method, data sources, metering requirements, calculation method and reporting frequency.

Monitoring should distinguish between total site consumption and significant energy uses, and should include process-level or equipment-level indicators where this is necessary to identify deviations, verify persistence of savings or separate the effect of the measure from changes in production, weather, product mix or operating hours.

In order to ensure that the monitoring process provides reliable and actionable information, the organisation should define appropriate energy performance indicators (EnPIs) and, where relevant, establish energy baselines representative of normal operating conditions. These indicators should be selected according to the main energy uses, production variables, operating schedules and other relevant influencing factors, such as weather conditions or product mix. Energy consumption data should be collected with sufficient frequency and level of detail to allow the identification of deviations, abnormal consumption patterns and potential inefficiencies at process, system or equipment level. Where significant energy efficiency measures are implemented, the baseline should be reviewed and adjusted when necessary, so that subsequent performance evaluations reflect comparable operating conditions and provide a reliable basis for assessing achieved energy savings.

4.4 Development of an action or improvement plan

Following the identification of energy efficiency measures, the organisation should develop an action or improvement plan to ensure that the measures are assessed, prioritised, implemented and evaluated in a structured and traceable manner. The plan should provide a clear link between the outcomes of the energy audit, the available resources, the operational constraints of the organisation and the expected energy performance improvement.

4.4.1 Phase 1: Assessment of the current situation

The organisation shall develop and maintain a structured assessment matrix or equivalent tool to classify and evaluate potential energy efficiency measures based on defined and objective criteria.

The assessment shall include, as a minimum:

- Quantitative criteria such as estimated energy savings, greenhouse gas emission reductions, implementation cost, and expected return on investment
- Qualitative criteria such as technical feasibility, operational impact and ease of implementation

- Additional prioritisation criteria may include expected technical lifetime, persistence of savings, maintenance and reliability impacts, effects on product quality, health and safety implications, interaction with other measures, implementation risk, risk of fossil-fuel lock-in and eligibility for financial incentives.

The criteria and associated evaluation methodology shall be documented and applied consistently to ensure comparability between measures.

Based on the results of this assessment, the organisation shall establish implementation priorities and define indicative timelines for the deployment of the identified measures, taking into account available resources, operational constraints and strategic objectives.

For measures affecting significant energy uses, the assessment should also identify the proposed M&V method and the minimum evidence required to demonstrate implementation and savings.

See example in Annex A, Table A1.

4.4.2 Phase 2: Implementation of measures and follow-up

Where an Energy Manager is in place, this role shall centrally coordinate the implementation and follow-up of energy efficiency measures.

For each identified measure, the organisation shall assign a specific responsible person to ensure clear accountability, effective execution and appropriate monitoring of progress and results.

Table 2 — Table of responsibility allocation for the implementation of measures

Measure	Implementation start date	Implementation period (months)	Responsible person
A			
B			
C			
…			

Once responsibilities have been assigned, the organisation shall establish an implementation schedule for the identified energy efficiency measures.

The implementation schedule shall include, as a minimum, the definition tasks, milestones, and associated timelines. It shall also include coordination meetings involving management and the personnel responsible for the implementation of each measure.

These meetings shall be used to review the status of ongoing actions, shall support the monitoring of progress, and shall enable the adjustment of priorities where necessary, taking into account operational needs and performance results.

The organisation should retain implementation evidence, including technical specifications, procurement records, installation and commissioning records, calibration certificates, photographs, operating procedures, training records and records of changes to operating conditions. These records support traceability, internal reporting, external verification and future audits.

See example in Annex A, Table A2.

4.4.3 Phase 3: Evaluation of achieved results

Following the implementation of energy efficiency measures, the organisation shall carry out a post-implementation evaluation to compare the initially estimated energy savings with the savings actually achieved:

This evaluation shall enable the organisation to:

- Verify achieved savings against the defined baseline and M&V method, applying adjustments for relevant variables and documented changes in static factors where necessary.
- Confirm whether savings persist over time and define corrective actions where savings are lower than expected.
- Assess the real economic performance of the implemented measures and determine whether the investment is justified.
- Calculate the actual return on investment (ROI). Net Present Value (NPV) and actual cash flow are recommended as primary indicators. Additional indicators, such as Simple Payback Period and Internal Rate of Return (IRR), may be applied in accordance with EN 17463. The use of other financial indicators is optional.
- Identify any deviations, issues or failures associated with the design, installation or operation of the measures and define corrective measures.
- Strengthen shareholders and stakeholder confidence in the implementation of energy efficiency improvement actions, assessing and addressing risk mitigation strategies thereby supporting the development of future initiatives
- Capture and document lessons learned to support the design and implementation of future measures

The evaluation results should be documented in a concise savings report that includes the implemented action, implementation date, baseline and reporting period, calculation method, data used, adjustments applied, achieved savings, economic results, deviations and lessons learned.

4.5 Provide training and communication plans

The organisation shall promote awareness and competence in energy efficiency by providing appropriate in-house training to operational staff on the influence of their activities on energy performance.

Such training shall aim to enhance employee engagement and shall support the timely achievement of energy performance objectives.

Training should be role-specific. Operators, maintenance personnel, procurement staff, engineering teams and management may require different content, ranging from operational control instructions and metering practices to investment appraisal, M&V interpretation and energy performance reporting.

Once results have been achieved, the organisation shall communicate the outcomes to management, supervisory personnel and staff, as appropriate. This communication shall contribute to reinforcing internal motivation, shall increase transparency and shall support the continuous improvement of energy management practices.

4.6 Implement an Energy Management System (EnMS)

The organisation shall implement and maintain an Energy Management System (EnMS) to systematically control, optimise and reduce energy consumption through a structured and continuous approach.

The EnMS shall be based on recognised principles of continuous improvement, such as the Plan-Do-Check-Act (PDCA) cycle. This approach shall provide a consistent framework for planning actions, implementing measures, monitoring performance, and taking corrective actions, thereby ensuring the ongoing improvement of energy performance.

The EnMS should be regularly supervised by the energy manager to ensure that all measurements are correct and to detect possible deviations. The data collected by the EnMS should be the basis for the calculations of energy savings when an energy saving action is implemented, as it contains historic data before and after the measure is implemented.

Where full certification according to ISO 50001 is not feasible, the organisation can still apply selected EnMS practices, including energy review, significant energy use identification, EnPIs, energy baselines, operational control, competence, internal communication, monitoring and management review.

4.7 Identify financial incentives

The organisation shall identify and assess available financial incentives that may support the implementation of energy efficiency measures.

The identification of financial incentives is important, as it reduces upfront investment requirements, improves project viability and may enable the adoption of innovative or higher-efficiency technologies that would otherwise be economically unfeasible. Such incentives may originate from public or private funding sources and shall be evaluated as part of the overall financial and technical assessment of proposed measures

Incentive screening should be performed before irreversible investment decisions are made, because many schemes require prior application, specific technical documentation, demonstration of additionality, avoidance of double funding or double counting of savings, and retention of evidence for a defined period.

4.8 Engage external consultancies or service providers

Where internal resource, competencies or capabilities are limited, the organisation may engage external consultancies, technological institutes or service providers to support the implementation of energy efficiency measures. In these situation Energy Performance Contracting according to EN 17669 may be considered as derisking and enabling tools.

Such external support may contribute to the effective implementation of measures, the monitoring of progress, and the alignment of activities with applicable legislation, recognised sectoral best practices, available incentives, and sustainainability requirements (taxonomy, CSRD-ESRS-CSDDD).

The organisation, through the energy manager, shall ensure that the roles and responsibilities of external parties are clearly defined and that their activities are appropriately coordinated and monitored.

Contracts or work orders with external parties should define deliverables, data access rights, confidentiality, ownership of models and monitoring data, independence requirements where relevant, expected evidence, responsibilities for M&V and procedures for resolving deviations or non-conformities.

Annex A
(informative)

Tables

Table A.1 — Assessment table of potential energy efficiency measures to be applied in the organization

Measure	Estimated energy savings [a] (kWh/year)	Estimated implementation cost or required investment (€)	Payback period (years)	Ease of implementation[b]	Dedication (h)[c]	Priority[d]	Year of implementation[e]
A							
B							
C							
…							

NOTE The first three columns to be completed (i.e., estimated energy savings, estimated implementation cost or required investment, and payback period) correspond to objective data derived from technical calculations performed by qualified staff. The subsequent columns (i.e., ease of implementation and priority) contain subjective data to be completed following an internal analysis of the organisation by those responsible for implementing the measure.

[a] In the "estimated energy savings" column, where the implementation of an energy efficiency measure results in a modification of the baseline used as a reference for other measures, the savings shall be recalculated using the updated baseline data.

[b] Ease of implementation may depend, among other factors, on the characteristics of the production process, the layout and design of the facilities, or the resources required to deploy the measure.

[c] estimated dedication of internal staff to implement the energy saving measure.

[d] Priority can be determined as the outcome of a combined assessment of all the preceding criteria.

[e] The year of implementation column is intended to define a time horizon for deployment and to support effective planning.

Table A.2 — Example of an implementation and follow-up schedule for an energy efficiency measure

SCHEDULE	Year 1					Year 2				
	Month					Month				
	1	2	3	…	n	1	2	3	…	n
Measure A			☼					☼		
Task 1			Δ							
Task 2						Δ				
…								Δ		
Task n										Δ

NOTE The row highlighted in dark grey adjacent to Measure A indicates the total duration until full implementation of the measure. The cells highlighted in light grey indicate the duration of the individual tasks required to achieve the implementation of Measure A.

☼ Meeting with senior management to review the status of measure implementation.

Δ Intermediate milestone or objective in the implementation of the measure.

Additional checklist for measurement and verification planning

The assessment and follow-up tables in Annex A may be complemented with an M&V checklist including the following fields:

— Measure and boundary: affected equipment or process, energy carriers and metering boundary.

— Baseline: baseline period, baseline data, calculation method, relevant variables and static factors.

— Reporting period: period used to evaluate achieved savings and expected frequency of follow-up.

— Data and meters: data sources, meter identifiers, accuracy or calibration requirements and data quality checks.

— Calculation and adjustment method: formula or model used to calculate savings, including treatment of production, weather, operating hours or product mix.

— Evidence and responsibilities: implementation records, person responsible for data collection, review and reporting.

NOTE The level of detail of the M&V plan should be proportionate to the expected savings, investment, technical complexity and risk of the measure.

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[5] Directive 2023/2413 — Renewable Energy Directive (RED III)

[6] Regulation 2021-1119 — European Climate Law

[7] Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics

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