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Energy Management for Industry

Driving efficiency implementation

International Energy Agency

INTERNATIONAL ENERGY AGENCY

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Abstract

This report demonstrates the value of energy management for industry and governments. It illustrates how more systematic approaches to energy efficiency can contribute to ensure continual, durable, and increasing improvements that support competitiveness and energy security. It shows how new advances in energy management, such as increased digitalisation and artificial intelligence, can provide further benefits at speed and at scale. Building on best practices and innovative approaches, the report provides policy guidance on effective policy packages, giving insights into possible actions for policy makers irrespective of the maturity of existing programmes.

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Executive summary

Energy management programmes help achieve efficiency targets and meet policy objectives.

Recent global upheavals and uncertainties are putting increasing pressure on businesses around the world. This is prompting governments to look more and more to energy efficiency to promote industrial competitiveness, increase resilience of businesses, protect jobs, reduce strain on grids, and enhance energy security.

Providing government-led energy management programmes or policy packages for industry is one of the quickest and most cost-effective ways of ensuring fast and continual energy efficiency implementation. By encouraging and supporting companies to adopt energy management, governments can help ensure energy demand reductions and cost savings, as well as further benefits for companies and society.

Progress is slowing on the target to double the rate of energy efficiency improvement.

At the 28th Conference of the Parties (COP28) in 2023, nearly 200 countries reached a landmark agreement to collectively double the global average annual rate of energy efficiency improvements by 2030. The rate of global energy efficiency progress has actually slowed, and, as the number one driver of global energy use industry is one of the main reasons for this slowdown. This is a result from two factors happening in parallel: first, the stagnation of industrial efficiency, and second, the growth of industrial energy demand. This is the worst possible scenario for efficiency progress.

However, there is a clear advantage to investing more resources in industrial energy efficiency. While industry is acknowledged as one of the most difficult sectors to decarbonise, it yields the best results from funding.

Energy management can deliver substantial and persistent savings.

Energy management - the proactive and systematic monitoring, analysis, control, and optimisation of energy - effectively incorporates energy efficiency into business practices and provides a structured approach that effectively identifies opportunities and increases the rate of implementation.

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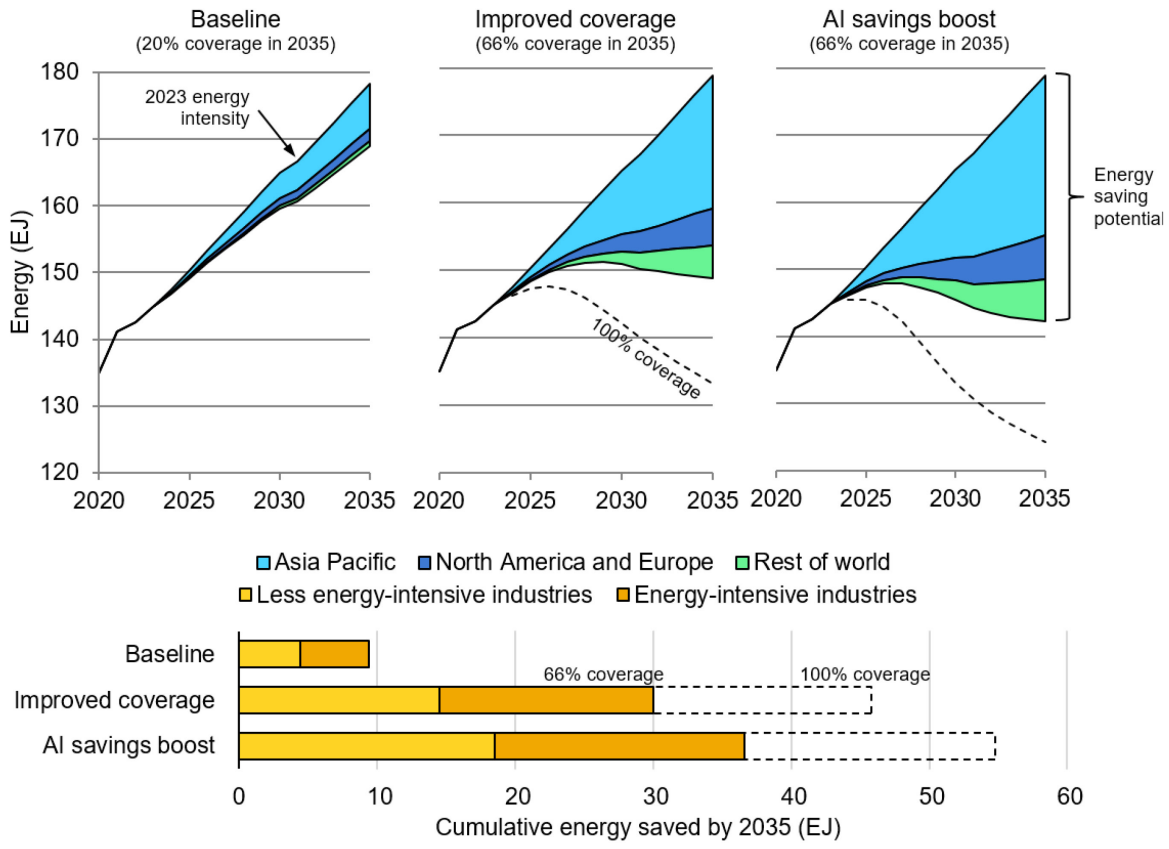
Energy management in industrial companies has been shown to deliver more than 10% energy savings on average within the first three years of implementation, well exceeding average improvements in energy intensity across industry. A growing number of companies are demonstrating even larger savings of 30% or more, with many of the measures at low- or no-cost.

In International Energy Agency (IEA) Member countries alone, aligning the energy performance of all firms with the top 25% most energy-efficient companies in their respective subsectors could reduce total industrial energy costs by up to USD 600 billion per annum. While not all firms can achieve the performance of the top 25% due to variations in product composition, specifications, and value, the magnitude highlights the significant savings potential from scaling up best practices already in use.

Energy saved by scenarios of energy management and AI uptake by world region, 2020-2035.



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Notes: AI = artificial intelligence. The baseline scenario considers only policies in force in 2023 – subsequent reductions of thresholds in some regions would come under the Improved Coverage Scenario. Energy-intensive industry refers to steel, non-metallic minerals, non-ferrous metals, pulp and paper, and chemicals; less energy-intensive industry refers to all other sectors. IEA energy saving estimate using the Lawrence Berkeley National Laboratory (LBNL) ISO 50001 Impact Estimator.

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Energy management policy packages can also facilitate the spread of energy management practices over multiple sites and along supply chains, increasing the magnitude of savings and other benefits achieved. This often requires effectively no or limited additional government support.

Despite these benefits, the adoption and effective utilisation of energy management in industry remains moderate. With further policy intervention through 2035, an Improved Coverage Scenario could unlock around 20 EJ of additional savings, which are particularly significant in light industries. This is equivalent to half the total final demand of the European Union in 2023. Adding increased uptake of AI-enabled savings could further increase savings of up to 8 EJ, resulting in 28% less energy being used to produce the same unit of value added in 2035.

Energy management can help improve competitiveness and boost energy security.

Investing in energy efficiency and energy efficiency practices has been shown to deliver many other positive impacts at both firm and country level. At firm level, energy efficiency enables increased productivity, such as higher capacity utilisation rates of production equipment, and increased production capacity as a result of more efficient processes and lower production costs. It can lead to improved resource use, a reduction of equipment downtime and unplanned shutdowns, lowered maintenance costs, and potentially reduced staff requirements for operation and monitoring. Efficiency has also been shown to increase worker health and safety, reducing the incidence of work-related accidents, healthcare, and insurance costs.

At the country level, these energy efficiency measures bundle to enable increased economic activity while using the same amount of energy, and are linked to increased labour productivity and other economic benefits. Industrial energy efficiency is an effective means of supporting power grid stability by reducing strain on grids, freeing up capacity, facilitating demand-side flexibility, and enhancing energy security. On average, energy efficiency costs less than half the cost to build new generation capacity and grid infrastructure. Energy efficiency measures can also be deployed quickly - typically in less than a year. Generation and transmission projects, however, require between one and seven years on average, or over a decade for nuclear.

Approaching energy efficiency in a systematic and continual manner - through energy management - is a more effective way of unlocking competitiveness and other associated benefits than stand-alone or ad hoc measures. Combined, these multiple benefits can more than double those of energy cost savings.

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This report provides policy makers with insights to support effective programmes.

Effective energy management policy packages include a combination of regulation, information, and incentive measures. Countries can support the uptake of energy management through voluntary programmes including information campaigns, training and capacity building, technical support, and incentives such as subsidies, awards, and recognition. Potential programmes include regulatory measures, such as audit requirements and requirements to have energy managers or energy management systems in place.

Evidence from policy implementation shows that strategically combining measures leads to better outcomes. This can deliver higher rates of savings as compared with the implementation of stand-alone industrial energy efficiency measures. For example, an energy management policy package can generate more and higher-quality projects for grant funding. Grant funding, in turn, can build momentum for continuous improvement, justifying the investment of time and resources needed to establish and maintain measures.

Recommendations

As a starting point, governments could review existing industrial energy efficiency measures, including any current energy management programmes, assessing effectiveness, uptake, and alignment with national energy and climate goals. This review could inform decisions on whether to:

a) Enhance existing energy management policy packages, by expanding coverage, increasing support, or improving design features.

b) Develop new energy management policy packages, particularly where significant gaps exist, such as in coverage of small and medium-sized enterprises, supply chains, or specific high-impact sectors.

To support this process and to design more effective measures, much can be gained from international experience. Many countries have successfully introduced, scaled, or refined energy management policy packages in ways that offer useful insights. For example:

- The United States set up effective partnerships where programmes are jointly implemented, either with national laboratories that develop free tools and deliver training or with industrial assessment centres that carry out free audits.
- Many countries have established long-term networks and agreements to support implementation, as was done in Finland and Ireland.
- Japan combined incentives to implement energy management with benchmarking systems to provide guidance and further drive implementation.

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- Tailored information, incentives, and support for small and medium-sized companies have been provided by many countries including France and Japan.
- Saudi Arabia has developed a comprehensive online platform with information and trainings for different levels of expertise to provide easy-to-access, tailored information and capacity building.
- Australia's National Greenhouse and Energy Reporting Scheme promotes energy-related data gathering, analysis, validation, and sharing in the industrial sector, with an aim of increasing the potential energy savings at industry level and helping inform governments in their design and delivery of policies.

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Introduction

Industrial energy efficiency progress has flatlined.

At the 28th Conference of the Parties (COP28) at the end of 2023, nearly 200 countries reached a landmark agreement to collectively double the global average annual rate of energy efficiency improvements by 2030. The rate of global energy efficiency progress – the rate of change in primary energy intensity – has actually slowed, from around 2% last decade to just over 1% so far in this decade.

The main reason behind this global slowdown is the stagnation of industrial efficiency, which has remained nearly unchanged for the past five years. Particularly concerning is that while global industrial growth slowed from 3% per year in 2010-2019 to about 2% per year in 2019-2023, growth in industrial energy demand accelerated from around 1% per year to just under 2% over the same period. This slower economic growth combined with faster energy demand means that industrial output and energy demand are almost moving in lockstep. This is the worst possible scenario for efficiency progress.

Industry is now the number one driver of global energy use so far this decade as a result of this shift, accounting for 80% of the increase in global total final energy demand since 2019 until 2023, or 13 EJ out of 16 EJ.

However, there is a clear advantage to investing more resources in industrial energy efficiency from both government and industry points of view. While industry is acknowledged as one of the most difficult sectors to decarbonise, it is yields the best results from funding. Only 6% of the total increased investment delivers 20% of the total intensity improvements by 2030. And there are signs of increased investment: global investment in industrial energy efficiency has been increasing since 2020.

A novel approach to support government policy making

The global imperative for urgent action on the doubling energy efficiency prompted the IEA to launch a new initiative at the end of 2024 – the Energy Efficiency Implementation Drive. This initiative aims to support energy efficiency policy makers through insights, learnings and analytics to develop increasingly effective policy packages. This project acts to facilitate co-operation between governments

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and industry to increase and accelerate energy efficiency to reap the rewards of the multiple benefits, beyond energy cost savings.

As part of this work, the IEA convened a workshop on the topic of Industrial Energy Management on 5 March 2025, including 100 leading experts, policy makers, and industry representatives from over 28 countries. This report builds on findings from this workshop combined with further analysis of data and case studies.

A menu of options across time and ambition levels

The development and implementation of energy management programmes or policy packages can be grouped into three main phases. The initial phase focuses on gathering information and garnering support. During development, the focus shifts to expansion, and incentivising implementation. The final stages focus on innovation towards deeper energy efficiency improvements and process change, systems efficiency, and stimulation of the development and uptake of advanced and innovative technologies and processes.

A wide range of existing policies and programmes provide valuable insights into what policy combinations are effective, irrespective of whether a country has some policy measures in place, has a mature policy package, or is beginning to consider what policies and measures to put in place.

These insights can enable countries that are starting out to leapfrog towards higher levels of scope and impact.

Effective combinations and success factors

This report takes a broad perspective. Rather than focusing only on policies that have been established with the purpose of driving energy management system uptake, we look at a wide range of policies that can inform and encourage energy management and support the continual implementation of energy efficiency. The report seeks to help governments identify:

- Elements or measures that can be added to existing programmes or legislation to improve uptake and effectiveness.
- Relevant lessons learned and experiences from programmes implemented to date when considering if and how to set up programmes or policy packages.
- Options on how to stage different interventions to support continual implementation of efficiency through systematic energy management.

The report focuses on the industrial sector, but much of the content is relevant to supporting energy management in commercial, transport, and public sectors.

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This report is divided into five chapters:

Chapter 1 explains what energy management is and how it is different from an ad hoc approach to industrial energy efficiency. It explores the benefits of energy management from the perspective of governments and companies. Building on multiple research strands, it provides insights into potentials of energy management across various scales of ambition and leverage of advanced technologies.

Chapter 2 builds on recent IEA work on energy and artificial intelligence (AI) and zooms into benefits and potentials that can be tapped by a more proactive use of data-driven decision-making and automation. It touches upon some of the associated risks and outlines potential actions for governments to capture opportunities and mitigate risks.

Chapter 3 looks at policy packages that use information, incentives and regulation for stimulating the uptake and effective use of energy management. Based on analysis of existing approaches and lessons learned, it explores effective combinations of measures and success factors.

Chapter 4 goes into greater detail about policy measures that use information, incentives and regulation. It provides examples of policies implemented across different jurisdictions. This chapter can serve as a reference on specific types of measures or can be looked at as a menu of options towards which existing packages can be benchmarked. It details a set of proven policy options that can help countries in early stages of policy package development to mix and match the combinations that will be most effective in their national circumstances.

Chapter 5 provides an overview of measures over time and ambition levels, allowing insights into quick wins and opportunities to develop and enhance policy packages over time.

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1. The case for energy management

Summary

- Energy demand and emissions are on the increase, driven primarily by industry.
- The inability to curb industrial energy demand has implications for competitiveness, energy security, and climate.
- Energy management delivers persistent and increasing energy savings and is more effective than ad hoc approaches.
- By embedding energy management in companies, governments can - with limited resources - foster faster and deeper progress on multiple policy objectives.

Industrial energy demand and emissions on the rise

The industrial sector accounts for 39% of energy end use and 45% of CO_2 emissions from energy. Total energy-related CO_2 emissions increased by 0.8% in 2024, hitting an all-time high of 37.8 Gt CO_2, of which industrial emissions made up more than two-thirds. The share of industry in total final energy consumption is rising and accounts for around two-fifths of the total.

Energy demand from industry increased by 2% in 2023. In 2024, industry accounted for about two-thirds of the 2.7% increase of global gas demand to reach an all-time high. Higher demand was focused on fast-growing Asian markets, with growth of over 7% in the People's Republic of China (hereafter "China") and over 10% in India. Advanced economies saw a return to growth in 2024 after two years of declines linked to higher prices. Coal demand increased by just over 1% in 2024 to also reach an all-time high. The industry sector made up nearly 40% of total growth in electricity demand in 2024. Electricity use in industry grew by nearly 4% in 2024, a step up from the pace in 2023, driven by increased activity in electro-intensive manufacturing and industrial growth more broadly. In 2022, industry in IEA member countries alone spent over USD 1.2 trillion on energy, an increase of nearly 80% from 2020 costs.

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Energy-intensive industries account for more than two-thirds of industrial energy demand. Energy use in these industries often require high temperatures to produce basic materials, such as steel, cement, primary chemicals, and aluminium. Less energy-intensive industries refer to the light industry subsectors such as food and drink, and textiles. These subsectors share many potential energy efficiency actions and produce higher-value goods. Less energy-intensive industries account for more than three-quarters of the total value added of the industry sector.

Energy intensity progress held back by industry

Global energy efficiency progress – measured by the rate of change in primary energy intensity – saw a weak improvement of about 1% in 2024, roughly half the rate achieved last decade. The slowdown in recent years is mainly due to a lack of energy efficiency progress in industry. Industry has driven 80% of the growth in final energy demand since 2019; over this time, its energy intensity has not improved.

Investment spending on industrial energy efficiency and electrification is slowly rising across the globe. China has rebounded with a threefold increase between 2023 and 2025, the European Union is on track to achieve an unprecedented 30% increase from 2024 to 2025, and the United States maintains steady growth with consistent progress since 2021. However, investment spending on industrial energy efficiency and electrification remains an order of magnitude lower than other sectors: 2025 will see an expected USD 30 billion spent on industrial energy efficiency and electrification as compared with over USD 300 billion each for the buildings and transport sectors.

An increased focus on energy management to speed up energy efficiency implementation

Energy management effectively incorporates energy efficiency into business practices and provides a structured approach that successfully identifies opportunities and increases the rate of implementation. Although energy management is a proven approach to enhancing the competitiveness of companies and raising their productivity, implementation is not typically or widely viewed as a strategic investment in future. Substantial opportunities to improve energy efficiency remain under-exploited.

By encouraging and supporting companies to adopt proactive and systematic monitoring, analysis, control, and optimisation of their energy, governments can help ensure quick, persistent, and growing savings. Further benefits for companies and society come in parallel. Government energy management policy

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packages have been shown to effectively address many of the barriers to energy efficiency and stimulate energy management in industry.

Providing government-led energy management programmes or policy packages for industry is one of the fastest and most cost-effective ways of reaching energy efficiency targets and contributing to climate change mitigation. It is also a means to improve energy security; to improve industrial productivity and profit margins, thereby protecting jobs; to reduce strain on power systems; and to reduce negative environmental impacts contributing to positive health outcomes.

What energy management is and why it is effective

While stand-alone ad hoc energy projects can lead to energy savings, these savings can be hard to maintain since a single energy project does not address the needs of an entire plant or company, and the goals are short term. Ad hoc approaches can lead to diminishing savings over time, as energy efficiency goals are overlooked in the face of other priorities. Energy programmes (with long-term commitments, goals, and broad coverage) focus on continual improvement and lead to more long-term energy savings

Energy management is the proactive and systematic monitoring, analysis, control, and optimisation of energy use. It acts to reduce energy costs and business risks and through a plethora of elements: understanding energy use at a facility, monitoring energy use and performance data on a regular basis, periodically identifying and assessing opportunities to cut energy waste and improve efficiency, implementing energy projects and efficiency measures where needed, communicating, raising awareness, and building support for energy initiatives and the programme and recognising successes.

It is an iterative long-term approach that includes the planning, implementation, and operation of technologies and techniques to optimise energy use. Implementing energy management is a cyclical process of continuous improvement that involves:

- Making and maintaining a commitment to strive for continual energy efficiency improvement.
- Establishing an energy policy.
- Creating an energy plan, including designating responsibilities and setting energy objectives.
- Assessing performance with continuous monitoring, targeting, and verification.
- Implementation of energy-saving measures, supported by formalised processes and procedures.
- Evaluation of progress incorporating feedback for continual improvement.
- Re-evaluation of the energy plan and revising energy objectives for the next cycle.
- Recognition of achievements.

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Energy management is different from ad hoc approaches to energy efficiency as it integrates consideration of energy use and savings opportunities across all production and operational functions within an organisation. It requires resourcing, procedures, and an ongoing commitment from management.

The definition of energy management is expanding and can include the management of distributed energy resources such as on-site batteries, rooftop solar, the provision of demand response, and demand-side flexibility.

Differences in approaches to energy efficiency

Ad hoc approach to energy efficiency	Energy management
Informal, localised, and divided without consistency across facilities, locations, and organisational functions	**Systematic, clear, and unified** with traceable goals and objectives
Minimal engagement relying on the enthusiasm and drive of a few individuals, with a risk that efforts that may end due to staff changes	**Full engagement** with involved top management
No formalised structure without formalised policies, procedures, or requirements, thereby hindering involvement senior management and unlikely to drive sustained change	**Established structure** with formalised policies, procedures, rules, and conventions to guide and direct the entire organisation; formalised roles and responsibilities; and integrated energy performance improvements into strategic business plans, procurement processes, engineering, and design requirements
No formalised budget allowing individuals or departments to opt out rather than put in effort	**Established funding mechanisms** with dedicated budget
Lack of clear commitment with widely varying levels among individuals	**Integrated requirements** into work processes, becoming part of normal job duties
Weak monitoring and reporting without consistent application of measurement, tracking, and reporting, resulting in poor data and information	**Assured monitoring and reporting** with systems and routines in place for data collection, monitoring, and analysis, making companies better placed to comply with environmental, energy, or climate reporting requirements
Ambiguous results stemming from a lack of data, baselines, and insights impacting the effectiveness of energy efficiency project funding proposals	**Clear outcomes** backed by the data, with clear understanding of energy use to elaborate effective funding proposals
Missed opportunities with efficiency varying in priority e.g. due to high or low energy prices	**Expanded opportunities** resulting from a focus on efficiency, providing means for broad participation across the company, expanding opportunity identification, and sustained implementation

Source: Adapted from Commission for Environmental Cooperation (2019), Supply Chain Energy Efficiency through ISO 50001: A How-to Guide for Your Company.

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Energy management definitions

- **Certified energy management system** – an energy management system that follows a standard and is audited by an external auditor on a regular basis.
- **Digital energy management systems** or **energy management information systems** – software tools and sensors that monitor, analyse, and control energy use and system performance, complementing (but not replacing) energy managers or energy management procedures and routine; these encompass more advanced tools such as digital twins that allow modelling of changes in production processes and impacts from these changes.
- Energy audits – an inspection, survey, and analysis of energy flows for identification of energy savings opportunities in a building, process, or system to establish the potential for energy saving; they are often a precursor to energy management and an integral part of energy management.
- **Energy management** – a system of proactive and systematic monitoring, analysis, control, and optimisation of an organisation's energy use that creates persistent savings by integrating energy efficiency with business practices.
- **Energy management certification audit** – an audit that inspects, surveys, and analyses the processes and routines that are put in place; not the energy usage at the company.
- **Energy management system standard** – a set of interrelated or interacting elements to establish an energy policy and energy objectives, and to solidify processes and procedures to achieve those objectives; standardised procedures for energy management include ISO 50001 from the International Organization for Standardization.
- **Energy manager** – the person(s) responsible for the effective implementation of energy management activities and for delivering energy performance improvements, normally a requirement of an energy management system; an energy manager can be required by government even when management system requirements are not in place.
- **Government-led energy management packages** – a combination of policies put in place to require, encourage, or support the uptake of energy management in industry.
- **Government-led energy management programmes** – policies put in place to require, encourage, or support the uptake of a specific element of energy management, for example grant funding for demonstration projects.

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The difference between energy audits and energy management

While energy audits and energy management are often grouped together, they serve distinct purposes. An energy audit provides a one-time assessment that identifies opportunities to reduce energy use, offering a useful snapshot of current performance and opportunities for improvement. In contrast, an energy management embeds energy efficiency into ongoing business practices by establishing leadership commitment, continuous monitoring, and other systematic processes. Energy management support sustained and long-term energy savings, whereas energy audits alone do not provide the structure needed to deliver improvements over time.

The components of effective energy management

The key features of an effective energy management approach are well established. While firms may not implement all these elements, they can still achieve valuable outcomes. The most significant and sustained results typically come from applying the full set of features. Certification processes, such as those under ISO 50001, involve a comprehensive review to ensure all components are in place. Although it is possible to implement a complete system without formal certification, certification is one way to identify and close gaps – contributing to more consistent and effective performance.

The strength of energy management is that, when properly implemented, it integrates consideration of energy efficiency across all functions within organisations.

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Successful characteristics of well implemented energy management.

Management

A designated energy efficiency champion
Energy policy
Executive management review
Energy target and plan (short term and long term)
Commitment, planning, and allocation of resources
Data sourcing strategy and data management

Organisation

Appointment of an energy manager
Energy management structure and responsibility
Staff competency and training
Organisation, awareness, and accountability
Recognition of energy management

Process

Analysis of energy use
Purchasing and procurement
Operation control
Maintenance
Corrective and preventative actions

Information

Document control
Energy records
Staff communication
Reporting

Financial

Financial plan
Budget management
Investment

Corporate responsibility

Compliance with regulations
Reporting

Achievement

Energy efficiency improvement monitoring
Internal auditing
Management review
Energy performance achievement

Source: Adapted from Energy Management Gold Standard (2024), Guidelines for Energy Management Gold Standard (EMGS) Applicants.

How it benefits government and businesses

Government investment (either in money or effort) that encourage companies to implement energy management will deliver significant savings in the short term and for decades to come. Organisational and culture change that occurs with effective energy management will support further efficiency implementation.

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Energy management is also an effective way of more systematically capturing the multiple benefits of energy efficiency, such as improved productivity, reduced risks, improved work safety, and reduced environmental and climate impacts.

Sustained operational and maintenance improvements will continue to deliver efficiency gains and other benefits at no or low cost. Companies with energy management will have a higher likelihood of making investments in energy efficiency as energy management builds companies' competencies, processes, and confidence to de-risk and increase those investments. Having reliable data on energy usage and savings potentials will also facilitate access to finance for energy efficiency investments.

Policy packages can also facilitate the spread of energy management practices over multiple sites and along supply chains effectively with no or limited additional government support, increasing the magnitude of savings and other benefits achieved.

Supporting robust data collection

Robust systems for energy and emissions data can provide organisations and governments alike with improved oversight on energy use, and a baseline against which to gauge change. Having this baseline makes it possible for companies to more accurately calculate and report energy savings, potentially benefiting government programme evaluations and informing work on energy efficiency potentials. With enhanced understanding, control of energy usage, and access to accurate data, companies will be able to strengthen applications for grants or concessional loans – increasing their chances to effectively utilise support schemes.

Additionally, the collection and use of reliable, validated data leads to more accurate reporting, enhancing the ability of companies to comply with regulation and reporting requirements and helping to improve national-level data and analysis.

Helping businesses save even more

Energy management allows firms to identify, act on, and benefit from energy savings measures. According to analysis of firms implementing ISO 50001, a significant proportion of firms achieve annual savings rates of over 5% year-on-year, across all sectors. In the first three years of ISO 50001 adoption, companies report average savings of 11%, significantly greater than the average 1% energy intensity improvement seen for industry as a whole. These saving accumulate over time, and some firms are able to reduce their energy intensity by up to 60% with long-term commitment.

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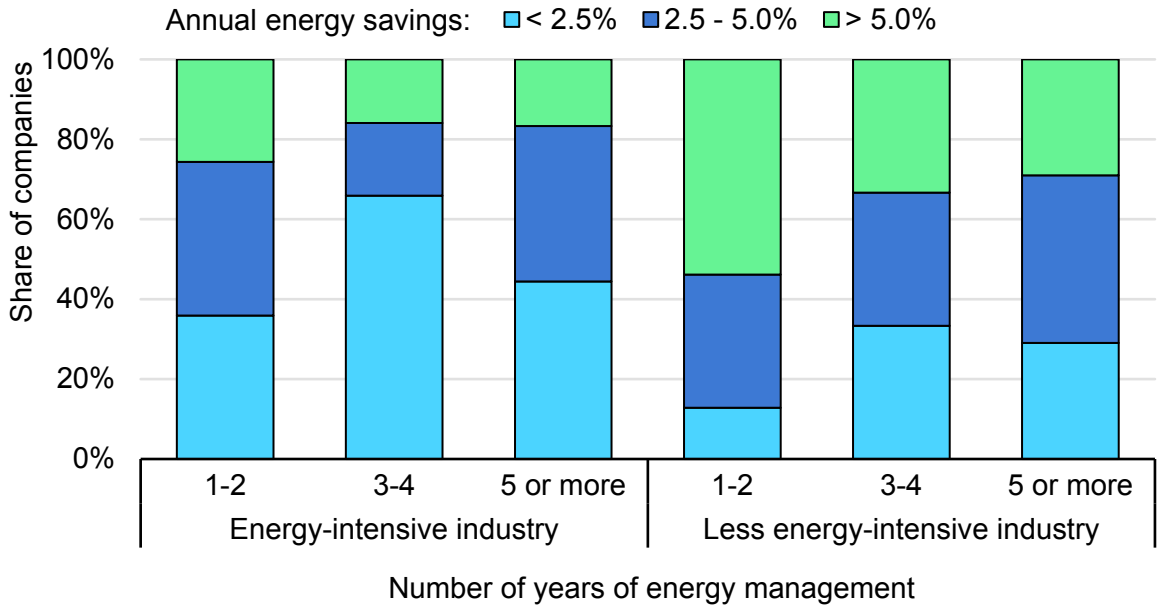
Less energy-intensive industries often see faster and more cost-effective improvements, while energy-intensive industries benefit from greater absolute savings.

Energy savings achieved by energy-intensive and less energy-intensive industrial firms by year since implementing ISO 50001, 2016-2024



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Source: IEA analysis based on Clean Energy Ministerial (2024), Energy ministerial leadership awards.

Clear improvement across the globe

Studies from around the world demonstrate again and again that firms with energy management systems achieve much higher energy savings than those without.

Analysis from **Italian** companies shows savings growing over time, well after implementing energy management. In 2021, around half of firms implementing energy management reported savings of 4-10%, up from just under one-third in 2016.

Canadian companies adopting ISO 50001 have achieved an average cumulative energy performance improvement of nearly 10% within the first two years.

Analysis of 83 **United States** manufacturing facilities implementing ISO 50001 shows continual achievement of cumulative savings for over a decade, averaging 3-4% across 12 years of implementation. Every year shows an annual energy performance improvement averaging 3-3.5% compared with an industrial annual average of 1%. Plants taking advantage of the US Energy Star Challenge for Industry have achieved 20% energy intensity reduction in two years on average, with some plants saving upwards of 40%.

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Spain's mandatory energy audits have led to significant energy savings across various industries, with audits covering 85% of obliged companies' energy demand. Companies having completed the audits report potential energy savings of up to 20-30% of their total energy consumption on average, with some identifying potential savings of over 50%.

Smarter and more cost-effective energy use

Energy management requires companies to develop a greater understanding of how their energy is used. At the firm level, robust and reliable data can enable rightsizing equipment and identification of the best solutions to deliver the most energy efficiency gains with the least investment and resources.

This facilitates not only energy savings, but also the targeted use of energy at off-peak times, particularly for electricity. Sub-metering systems allow the leveraging of on-site renewables or energy storage to enable the most cost-effective use of dynamic electricity tariffs. A facility in Spain was able to completely decarbonise its production through integrating solar electric vehicle charging and battery storage with its energy management system.

Providing good return on investment with quick payback

Energy management has relatively short payback times with attractive return on investment. With funds being freed up, companies can reinvest in further projects for efficiency, expansion, job creation, or profitability, thereby driving economic growth.

A 2025 survey of industrial facilities around the world, prepared by the IEA, also confirms that firms are realising financial returns from investments in energy efficiency. The average return on investment (ROI) for companies with an energy management system was 28% – 10% greater than companies without. In fact, 80% of respondents with an energy management system reported an ROI above 10%, with 62% reaching an ROI of 11-50% from energy efficiency measures over the past five years. Some companies had a ROI of more than 100%. As for companies without an energy management system, only 60% reported an ROI above 10%.

An Italian survey found that 70% of the participants who implemented ISO 50001 declared a payback time lower than three years and 85% reported a return of investments in line with their expectations.

A pilot project in Mexico targeting energy-intensive small and medium-sized enterprises (SMEs) helped 21 companies implement ISO 50001, reducing energy

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consumption by 7% and saving MXN 62 million (Mexican pesos)[1]. Half the measures identified had a payback period of less than a year.

Energy management can enable more systematic identification of low-cost energy saving opportunities. In both intensive and less-intensive industry, implementing "quick wins" with average payback periods of less than six months can unlock significant cost savings of 1.7% per individual measure. Actions include preventative maintenance; optimisation of utilities such as process heat, compressed air, lighting, and heating, ventilation and air conditioning; and power management of equipment.

Leading to deeper investment and more implementation

Frequently, energy efficiency investments or loans are treated by banks as on-balance sheet projects, meaning that energy efficiency investments compete with other business priorities for industrial companies' resources.

Energy management improves a company's ability to identify high-impact areas and prioritise investment by building its competencies, processes, and confidence to de-risk investments in energy efficiency. With reliable, solid data on the benefits of energy efficiency, energy consumption, and energy costs, stronger investment proposals can be developed.

Evidence shows that the strategic character of an energy efficiency investment depends on its contribution to the competitiveness of the investing company. The greater the contribution to competitiveness and the more strategic a project or investment is considered to be, the less restrictive are the financial criteria applied. Engaging senior management in the process increases the likelihood of positive decisions on investment projects.

Taking a strategic approach is crucial to unlocking the greatest savings. Analysis of energy audits in the **United States** shows that deeper upgrades have much higher cost savings - up to 6.2% - despite having longer payback periods. Deeper measures include the reuse of excess heat, advanced automation, and building insulation. When these measures were identified in energy audits, they were implemented only 30% of the time – half as much as quick wins.

[1] Exchange rate: 1 Mexican peso (MXN) = USD 0.05 (as of 4 September 2025).

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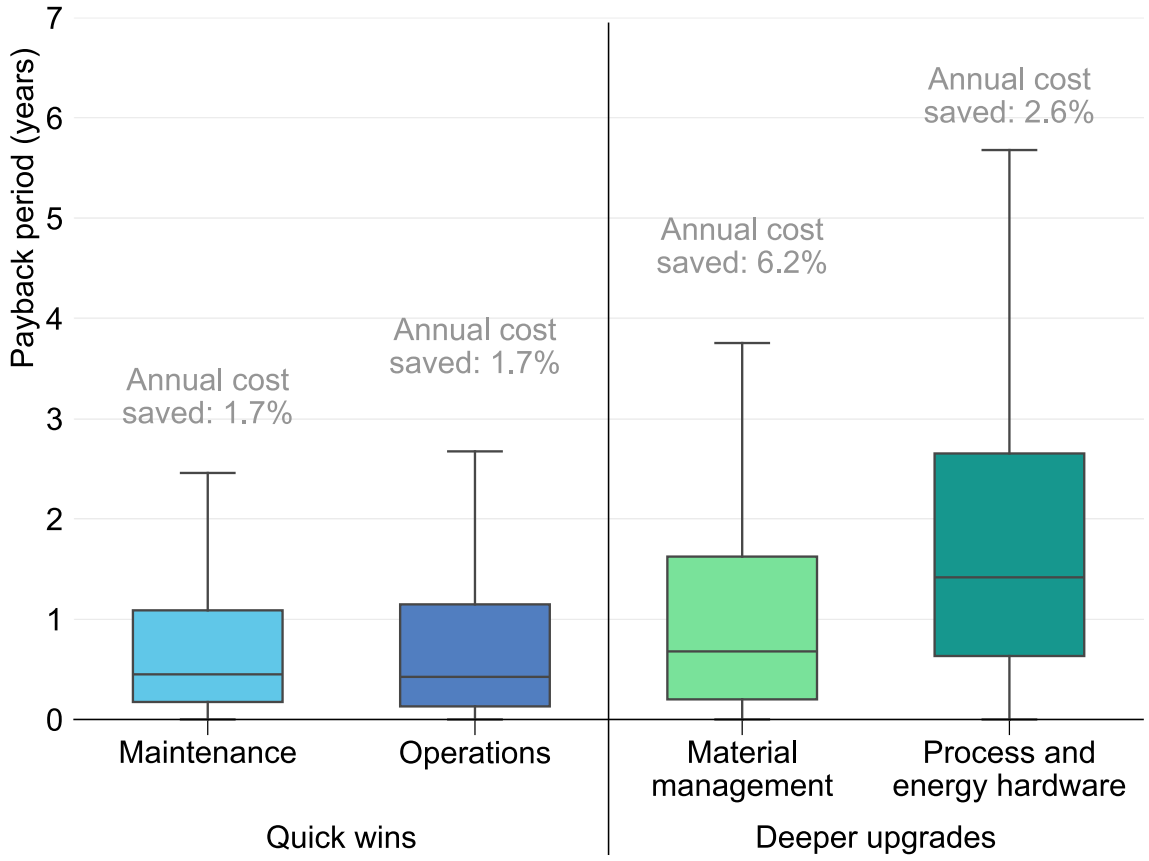
Cost savings and payback periods for energy efficiency measures grouped into quick wins and deeper upgrades, United States, 2002-2024



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Source: IEA analysis based on IAC (2002-2024), IAC database (accessed 24 April 2025).

Energy management ramps up ambition levels by providing a better understanding of energy usage and more granular monitoring. It thereby increases the likelihood of process change implementation and unlocking deeper savings. A study in Austria found that ISO-certified facilities were able to implement 165% more energy savings measures than non-certified ones after formalising the identification and decision-making process.

Companies with energy management and monitoring systems have taken more energy performance improvement actions and more investments in energy efficiency, according to analysis of the plastics and ceramics sector in **Italy**. Plastics manufacturing companies with ISO 50001 implemented over 50% more efficiency actions and invested 90% more in energy efficiency than companies without energy management systems. Plastics manufacturing companies with energy monitoring systems implemented 30% more than those without, invested 96% more, and achieved 60% more energy savings. Ceramics manufacturers with ISO 50001 implemented over 10% more actions and invested 84% more.

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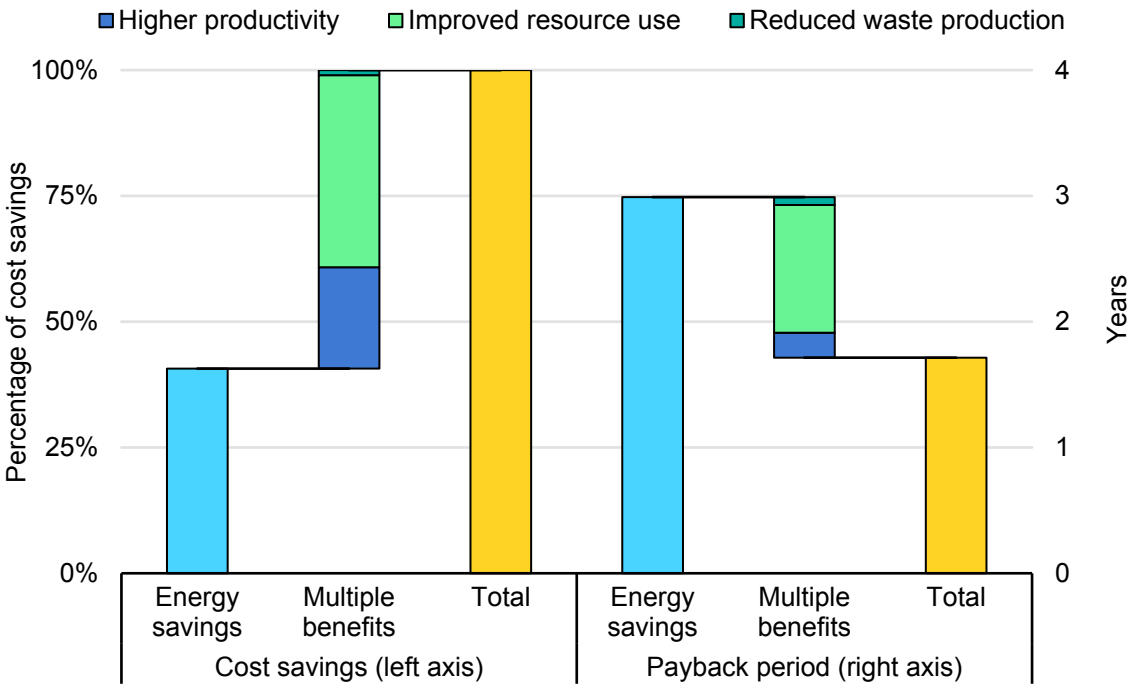
Benefiting government and businesses

Energy management policy packages can capture multiple benefits of energy efficiency more systematically. Energy efficiency provides a range of direct benefits for companies, as well as providing broader socio-economic and environmental benefits.

For many firms, these broader benefits can outweigh the direct reduction on energy bills. When all benefits are included, total savings more than double, shown by IEA analysis of 3 300 cases in SMEs. Across a range of studies, the value of efficiency was shown to increase by 40% to 250% when including the multiple benefits beyond energy savings. Energy management improves the identification and implementation of systems efficiency opportunities, such as utilisation of waste heat or cooling, demand response, and flexibility service provision.

Cost savings and payback periods of 3 300 efficiency measures in small and medium-sized enterprises, United States, 2002-2024



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Source: IEA analysis based on IAC (2002-2024), IAC database (accessed 24 April 2025).

The impacts of energy efficiency investments on competitiveness were assessed through the European H2020 research project M-Benefits, where an assessment of industrial energy efficiency investments found reduced risk of accidents or occupational illnesses in more than 50% of cases, improved product quality in 40%, and reduced downtime in 40%.

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Systematic management of energy can also positively impact other resources, often seeing a reduction of emissions and other negative environmental impacts. Since energy management can reduce direct carbon emissions, it can help facilities that are subject to a carbon trading scheme meet their obligations under the scheme and reduce compliance costs.

Energy management can lead to enhanced energy security by lowering fossil fuel dependence and enabling effective utilisation of variable energy resources. Energy demand reduction can improve power system stability, potentially providing demand response capability and flexibility, freeing capacity for critical applications without compromising production. Grid congestion is on the rise in many countries, and in some cases, economic activity is constrained as new companies are unable to connect to the power system and existing companies cannot expand capacity.

On average, energy efficiency costs less than half the amount it would cost to build new generation capacity and grid infrastructure. Energy efficiency measures can typically be deployed in under a year, while generation and transmission projects require between one and seven years to build, or over a decade for nuclear.

Energy management can also contribute to broader indirect benefits. It can improve the competitiveness of industrial firms, helping to safeguard jobs. Growth in manufacturing output (achieved through efficiency) also creates new jobs in other sectors of the economy through indirect input-output linkages. This employment generation potential is higher than the jobs it directly creates. The United Nations Industrial Development Organization (UNIDO) has calculated that every job in manufacturing creates more than two jobs in other sectors of the economy.

Multiple benefits of energy efficiency.

Competitiveness and **Economic growth**	**Emissions reductions**	**Health**	**Energy security** and **Grid investment**
• **Increased productivity** and resilience of industry • **Job protection** and **job creation** • **Market growth** of efficient technology and service providers	• **Reduced emissions** and waste • **Reduced local air pollution** • **Reduced pollution from fossil fuel extraction** and use	• **Improved conditions** for workers including reduced risk of accidents and occupational illnesses • **Reduced hospitalisation** and sick days of workers • **Reduced negative impacts** on populations near industrial areas	• **Lowered fossil fuel dependence** • Improved use of **renewable energy** • **Improved power system stability** through lowering pressure on grids and facilitating demand-side flexibility

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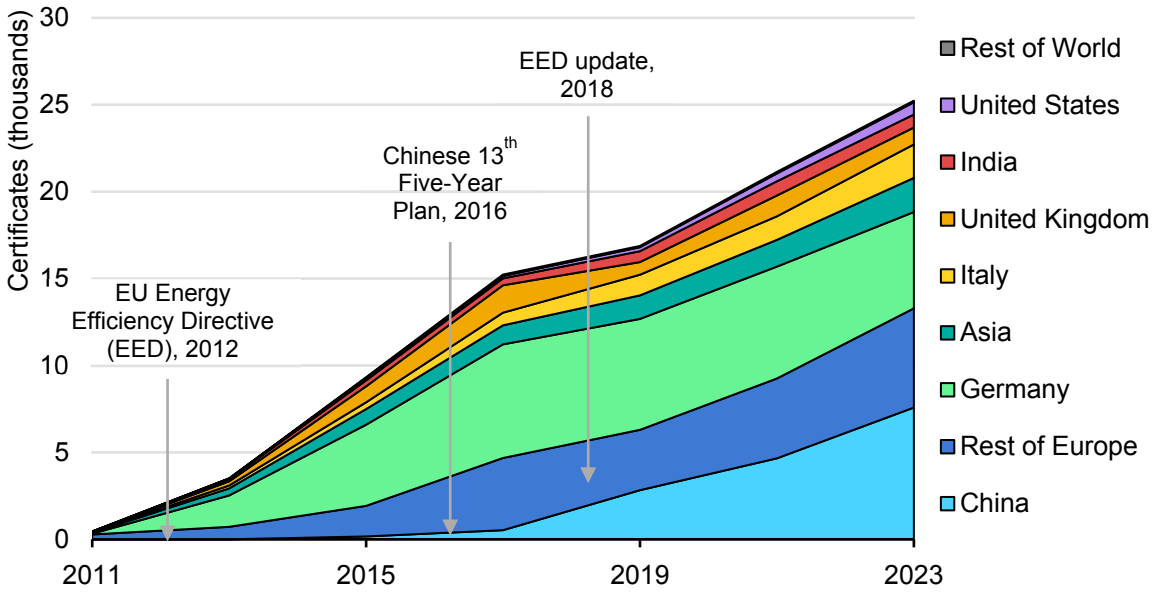
Uptake of energy management and global energy savings potentials

Despite the wide-ranging benefits of energy management to both businesses and governments, uptake of energy management is slow. Global potential energy savings for widespread adoption and effective implementation are highly significant, but these benefits would depend on the adoption of best practices. Energy management must be treated as a systemic approach to efficiency that benefits governments, companies, and workers - not as a box-ticking exercise.

Looking at the number of organisations certified in energy management as a proxy for global uptake of energy management, it becomes clear that policy can help encourage uptake. Self-reported numbers of ISO 50001 certificates by companies indicate consistent growth, punctuated by policy-driven bursts.

ISO 50001 certificates issued by year and country or region, 2011-2023



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Source: IEA analysis based on ISO (2024), Survey of certifications to management system standards..

The latest year of figures (2023) shows that only around 25 000 organisations worldwide are certified to ISO 50001. This figure is approximately 34 times lower than the number of organisations certified to the quality management systems standard (ISO 9001), and 12 times lower than the environmental management systems standard (ISO 14001).

Around three-quarters of global ISO certifications are found in China and Europe, which have some of the most comprehensive energy management regulations. Particularly steep increases can be seen to follow the adoption and subsequent

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updating of the Energy Efficiency Directive (EED) in the European Union, which mandated energy management for companies (2012, 2018), and the implementation of China's 13th Five-Year Plan (2016). Germany has almost as many certificates as the rest of Europe put together, driven primarily by having a lower threshold for energy management implementation than the EED.

Substantial potential energy savings

IEA analysis reveals that countries, and industries, could miss out on a significant amount of potential energy savings without widespread uptake of energy management. Baseline projections of historic coverage result in around 9 EJ of energy savings in the Stated Policies Scenario (STEPS) by 2035, roughly equivalent to the total energy demand of Japan or Brazil in 2023.

With further policy intervention, an Improved Coverage Scenario could unlock additional savings of more than 20 EJ by 2035, equal to around half the total final energy demand of the European Union in 2023. Industrial energy intensity would be around 25% lower than it is today.

The Improved Coverage Scenario would require all world regions to match the uptake and energy savings of the best adopters, resulting in coverage of around two-thirds with an ISO 50001 equivalent level of energy management. Some world regions are on track to achieve this coverage with pending policies. The existing threshold for China's Top 10 000 programme covered an estimated two-thirds of industrial energy. The reduced threshold for implementing energy management in the European Union will also have a similar level of coverage once it comes into force in 2027. By achieving this coverage incrementally by 2035, allowing companies time to adapt, world regions could cumulatively save around 160 EJ.

The potential savings from widespread implementation of energy management are greatest for less energy-intensive industry. By 2035, energy savings for less energy-intensive industries are approximately equal to more energy-intensive industries, a large increase from today's portion of one-fifth of industrial energy demand. Policy support would, however, be needed to support these less energy-intense industrial sectors, which frequently have a higher proportion of smaller companies with limited resources and higher barriers to implementing energy management.

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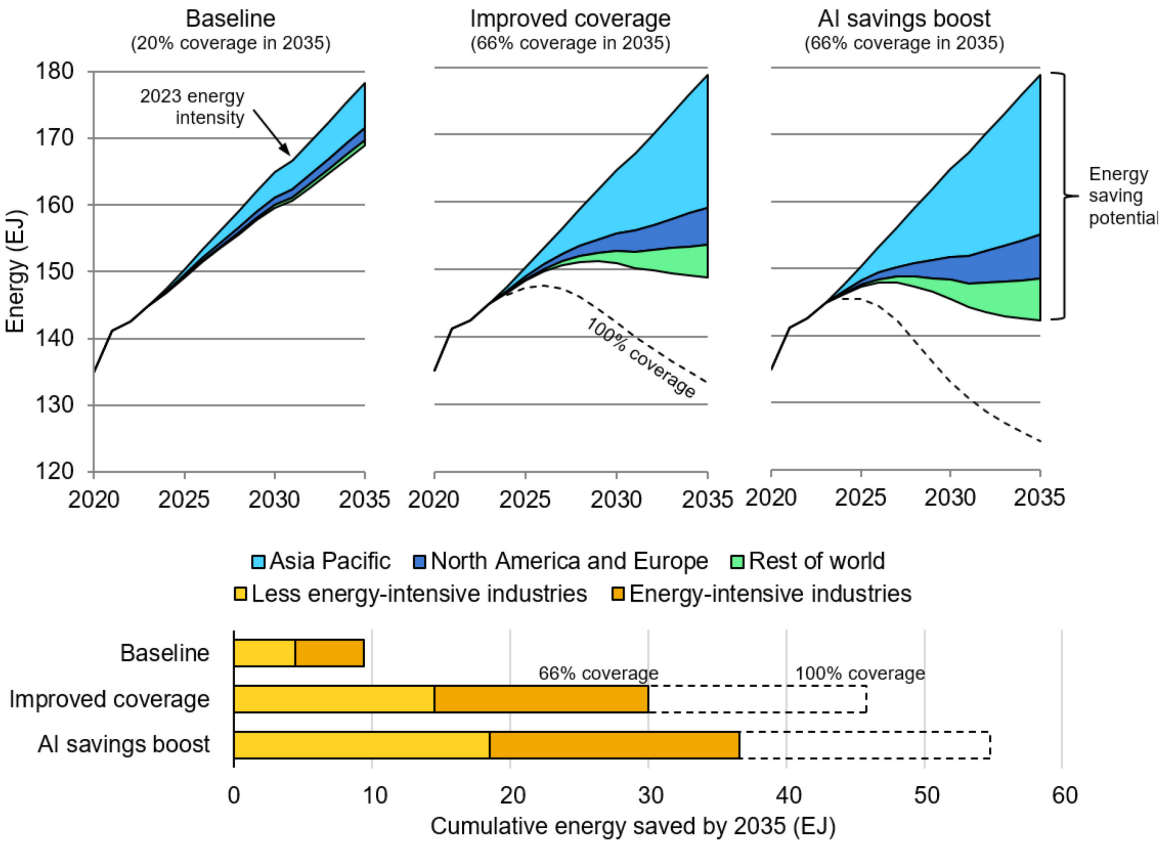
Energy saved by scenarios of energy management and AI uptake by world region, 2020-2035



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Notes: AI = artificial intelligence. The baseline scenario considers only policies in force in 2023 – subsequent reductions of thresholds in some regions would come under the Improved Coverage Scenario. Energy-intensive industry refers to steel, non-metallic minerals, non-ferrous metals, pulp and paper, and chemicals; less energy-intensive industry refers to all other sectors. IEA energy savings estimate using the Lawrence Berkeley National Laboratory (LBNL) ISO 50001 Impact Estimator.

Combining increased uptake with wider uptake of digital tools and emerging AI technologies could have even greater benefits. AI could deliver additional potential savings of up to 8% through process optimisation, with tools such as predictive maintenance, automation and control, and remote monitoring. Effective implementation of these tools, combined with well-designed policy support tailored to diverse types of companies, could unlock a further 8 EJ of energy savings if fully implemented with energy management. Widespread adoption of best practices in energy management and AI-enabled energy saving would require more ambitious policy targets, supported by policies that help companies excel in managing their energy. This greater adoption could result in 20% less energy being used to produce the same unit of value added in 2035 compared with the baseline scenario. The potential of new advances and AI is discussed in more detail in the next section.

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2. New advances in digital tools and AI

Summary

- Digital tools can support policy making through enabling analysis to generate insights about effectiveness and where to target efforts, as well as supporting resource-effective implementation.
- AI can support innovative approaches that could lead to deeper savings.
- The combination of digital tools, AI and energy management is particularly powerful, potentially unlocking large savings – and quickly.

New opportunities from breakthroughs in AI

Digital tools in industry have been considered, for over more than two decades as a very promising set of technologies that provide a myriad of benefits for industry. They can reduce production times and costs, provide greater levels of customisation, increase product quality, enable faster responses to the market, and lead to higher levels of energy and other resource efficiency.

While uptake of digital tools and systems in industry has been gradually taking place, opportunities to accelerate energy efficiency implementation with digital technologies remain untapped. So far, only early adopters have introduced industrial AI tools, but recent technological breakthroughs have raised awareness of AI's potential. The industry of the future will be increasingly digitalised and automated; countries and companies that take the lead in integrating AI into manufacturing will jump ahead.

In this context, the questions for energy efficiency policy makers are:

- Are policy interventions needed, and if so, should they be targeted at particular sectors or segments?
- Can recent advances in digitalisation support more effective policy making?
- Are there risks that require policy interventions?

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AI applications for energy management

Energy management information systems are a broad and rapidly evolving family of software tools that monitor, analyse, and control site energy use and system performance. They do not all by default include AI, but AI is increasingly being used to deliver data, analytics, and automation. AI systems can enhance energy management and offer more granular and real-time control over energy usage. A variety of AI applications can support energy management; some are relatively mature, while others are still being developed.

AI can complement existing systems, functioning autonomously or in conjunction with current technologies to increase efficiency and elevate productivity levels. By analysing operational data in real time, AI systems can identify inefficiencies that would otherwise go undetected, enabling continual adjustment and fine-tuning of industrial processes. Predictive maintenance, supported by AI-based monitoring, can prevent energy and material losses associated with equipment degradation, and reduce downtime.

AI technology allows for more precise estimation of market demand and can optimise resource utilisation by suggesting increases or decreases in production to match fluctuations. Applications can enhance energy efficiency by managing intelligent logistics and streamlining supply chains, resulting in lower energy consumption and reduced resource waste.

By predicting peak energy demand periods, AI can suggest shifting non-essential operations to off-peak hours, reducing energy costs and relieving pressure on power grids. AI can also help companies use their own or power grid renewable energy more effectively by adjusting operations to availability.

More advanced applications such as digital twins can enable companies to model the impacts of potential changes in processes and configurations, thereby identifying the most efficient solutions. Such models can also help reduce risk perceptions that can act as a deterrent to change and investments.

AI can also assist companies in exploring new materials or designs, further enhancing the energy-saving performance of products or reducing energy requirements for production.

Overall, the effective use of AI can significantly reduce the cost and complexity of implementing energy management, while also increasing its benefits. AI enables more efficient data collection, real-time monitoring, predictive maintenance, and automated analysis – helping organisations identify energy savings opportunities faster and with greater accuracy. This can be particularly important for mandatory approaches, helping to address concerns around regulatory burden or compliance costs. By reducing administrative overhead and enhancing outcomes, AI can

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make mandatory energy management requirements more cost-effective, scalable, and politically acceptable. At the same time, AI can enhance the attractiveness of voluntary approaches by simplifying implementation, lowering the resource demands on participating companies, and delivering clear, data-driven results. This can increase uptake and accelerate energy savings, especially among smaller firms that may otherwise lack internal capacity.

Relatively mature AI applications for industrial energy efficiency

Application	How	Results
Predictive maintenance	AI algorithms analyse data from machine sensors	• predicts equipment failure • schedules maintenance • reduces downtime
Quality control	AI automates the inspection process, identifies defects, and ensures the quality of products	• reduces number of errors • reduces waste
Simulation and digital twins	AI enhances digital twins with predictive insights and analytics and can facilitate the management of the large datasets needed for the development and operation of digital twins	• facilitates the management of large datasets • enables the development and operation of digital twins
Demand forecasting	AI analyses historical data and market trends	• predicts future demand • manages production plans and inventory more efficiently • optimises equipment-use
Real-time monitoring and process control	AI analyses real-time data from meters and sensors	• monitors operations • identifies bottlenecks • facilitates immediate action
	AI analyses real-time data and adjusts parameters	• optimises manufacturing processes • maintains product quality • reduces waste

Source: IEA (2025), Energy and AI.

Energy savings potential

Significant potential exist to increase energy efficiency through the use of AI, as indicated in the IEA publication on the topic of energy and AI. Widespread adoption of AI across industrial sectors could reduce global industrial energy consumption by as much as 8 EJ by 2035, an amount equivalent to Mexico's current total energy use.

Case studies based on existing AI use in the steel and cement industries, among others, have demonstrated energy savings in the range of 2% to 6% in energy-intensive industry sectors through the application of AI technologies to optimise

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production processes. Even higher saving levels are being achieved in less-intensive sectors. In sectors where energy costs constitute a substantial proportion of production costs, such efficiency improvements could provide an important competitive advantage. The high potential impact of AI means the total energy savings it can achieve in non-energy intensive industries are higher than in energy-intensive industries. Scaling up of known AI applications could reduce energy demand in "other industry" by up to 5.2 EJ by 2035, accounting for approximately 8% of total consumption.

When a large multisite company implemented an energy management system using smart meters, it saw a drop of 7.46% in average energy consumption across 87 factories. The company saved over USD 41 million per year in energy costs.

An Italian energy service company is providing AI-enhanced energy management services to 35 companies. Just through process optimisation, these companies achieved a 5% reduction of energy consumption in a steel production plant and a 4% reduction in cement manufacturing plant. The system is non-invasive, does not require plant shutdown, and can be implemented in as little as four months.

Enhancing policy with digital technologies

Digital tools can provide benefits at each stage of the policy development process, including design, development, implementation, monitoring, and evaluation.

At the policy design stage, digital tools can provide access to more granular and real-time data, while advanced analytics and modelling capabilities can help predict the impact and cost-effectiveness of programmes. Governments can create data-driven insights and identify targeted areas for energy efficiency measures.

The adoption of digital tools allow for data to be produced at a much higher frequency and larger scale, allowing for a more continual approach to evaluation. They can be used to automate processes and reduce personnel hours and related costs associated with handling large datasets and tracking efficiency measures. They can also be used to identify patterns and trends that could give indications of aspects that are working well or conversely not working well.

Machine learning can be used to analyse multiple large datasets, and provide insights to support effective energy management. Virtual audits can potentially offer speed, convenience, and cost-effectiveness that would allow for more systematic and large-scale approaches and help smaller businesses get started with energy management. Chatbots can potentially deliver guidance on industrial energy efficiency to companies at scale and low cost.

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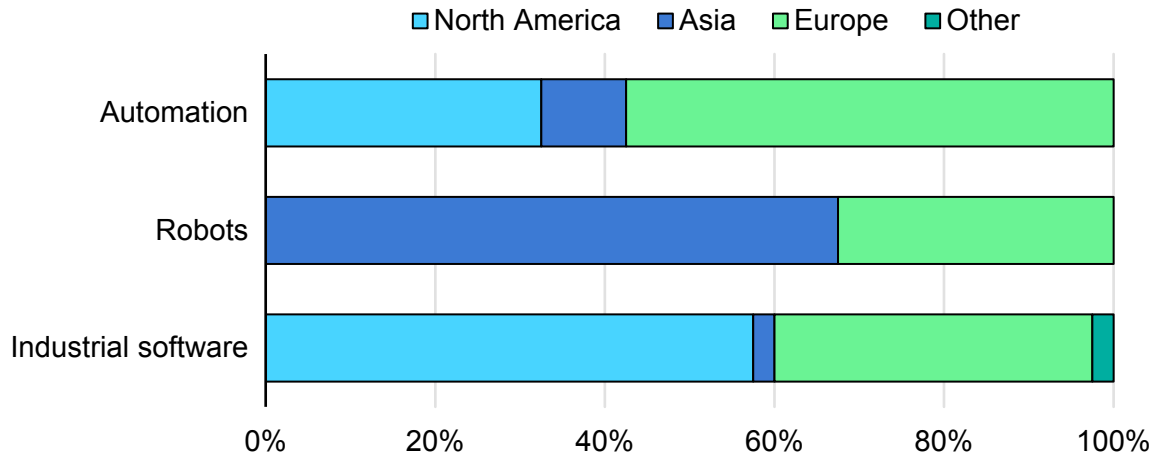
Inspectors in China use software tools, and in some cases body cameras, to reduce time and cost of checking compliance and enforcing industrial energy efficiency requirements.

Risks for AI and digital solutions

While adoption of digital and AI solutions in industry is increasing, uptake is not evenly spread across all regions. Across many developing countries, inconsistent internet access and unreliable electricity supply are hindering the adoption of digital solutions, while ageing factories and old infrastructure are a barrier across all countries.

Advanced economies currently have a competitive advantage in many of the technologies required for digitalisation and automation. Across three core segments – industrial automation, industrial software, and robotics – the vast majority of leading global companies are headquartered in advanced economies. Europe is leading on automation and North America on industrial software, with each having more than half the market share in their respective segments. Asia clearly leads on robots, hosting around two-thirds of the top 40 companies by market share. Meanwhile, the landscape for semiconductors has changed over the recent years, from the United States, Europe and Japan dominating the market in the 1990s to Chinese Taipei, Korea and China gaining increasing shares of the market. Digital technologies, including AI, rely on a wide range of critical minerals, which are subject to price volatility, supply chain bottlenecks, and geopolitical concerns, and their extraction causes substantial negative environmental impacts.

Top 40 AI companies by headquarters location and technology, 2025



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Note: The top 40 companies are defined by market share.
Source: IEA (2025), Energy and AI.

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Integrating digital solutions into manufacturing processes on a large scale raises dependency on stable electricity systems and a stable internet connection. Due to extreme weather events, power outages are on the increase. Advanced digital solutions could potentially help companies predict the risk of outages, lessen those risks, and optimise use of back-up generation or storage to mitigate the impacts of outages on production processes.

Collection, transmission, and storage of data on digital platforms can be subject to breaches and increased efforts and data management plans would need to be incorporated to protect data collected by government. AI is still in a phase of development, and some applications can be subject to bias and give false results.

Maximising government impact

By taking a more proactive stance on digitally-enabled energy management in industry, governments are better placed to identify opportunities for substantial and deep energy efficiency improvements. A proactive approach will also better map usage of these tools and identify sectors or segments where these tools could unlock significant energy efficiency potentials, but where usage is currently limited or constrained. Governments also can support the development of policies and guidelines for data protection, cybersecurity, and, increasingly, a stance on AI governance.

Some steps that governments could take:

- survey companies on uptake and plans within industry
- map existing programmes to identify opportunities where a focus on digital technologies for energy efficiency can be added, including programmes such as advanced manufacturing, Industry 4.0 or 5.0, digital transformation programmes, and innovation programmes
- integrate training on digital tools in the training programmes of auditors, including consideration and review of digital tool operation in energy audits
- raise awareness about energy efficiency opportunities, providing capacity building on how to link digital tools to energy management systems and support for demonstration projects
- provide incentives, potentially targeting specific sectors or segments
- consider ways to improve the affordability of digital solutions e.g. through bulk procurement targeting smaller companies or product development competitions
- work with industry actors to assure positive effects resulting from AI in terms of resource use, including hardware, energy consumption, and environmental impact
- raise awareness on risks and provide guidelines on how to mitigate risks.

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3. Effective policy packages for energy management

Summary

Effective policy packages combine:

- Information: awareness, training, audits, networks, benchmarking;
- Incentives: grants, tax rebates, awards, procurement advantages; and
- Regulation: mandatory audits, reporting, energy manager/system requirements.

Examples from countries such as Germany, Indonesia, Italy, Japan, and Malaysia illustrate diverse approaches.

Combining policy measures for impact

Government industrial energy efficiency programmes often take a project-level approach, offering incentives and technical assistance on equipment. Energy management programmes expand the focus to encompass people, practices, and routines. They are designed to encourage continual improvement through changing operational, maintenance, behaviour, and business practices, often with performance incentives.

To support stronger action on energy efficiency, the IEA designed a policy toolkit for governments, launched at the IEA 7th Annual Global Conference on Energy Efficiency in June 2022. The toolkit provides a pragmatic approach to accelerate action on energy efficiency by guiding governments in the design of effective policy measures, the support of policy decisions, and the delivery of policy actions.

The toolkit, which continues to evolve, is based on policy best practices and suggests a policy packages-centred approach to policy design and implementation. The toolkit is built on a foundation of three essential elements: regulation, information, and incentives.

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Effective policy combinations

Information	Incentives	Regulation
• Awareness and behaviour campaigns • Communication campaigns • Implementation tools • Sectoral guides • Access to technical capacity • Access to measurement equipment • Training and capacity building • Networks • Benchmarking • Training and certification of auditors	• Subsidies to implement elements of energy management (feasibility studies, audits, energy efficiency design, etc.) • Subsidies for energy efficiency equipment • Tax rebates • Voluntary agreements • Awards and recognition • Procurement requirements	• Reporting requirements • Mandatory requirements for regular audits • Mandatory requirements to have an energy management system in place • Requirements to publish energy efficiency plans • Mandatory requirements to reduce energy • Mandatory efficiency targets based on actual energy performance

Voluntary approaches versus mandatory requirements

Analysis of experiences and best practices across a wide range of countries shows that different combinations of measures can be effective in promoting the uptake of energy management in industry. At one end of the spectrum are the fully voluntary approaches that offer support, guidance, and recognition. Voluntary approaches to encourage energy management adoption include the United States Department of Energy's 50001 Ready programme, which has reported high levels of engagement and energy savings achieved. It relies solely on self-certification. The 50001 Ready programme, adapted to the context, is also used in other countries such as Canada and Saudi Arabia. **Germany** encouraged adoption of ISO 50001 from the International Organization for Standardization by providing an energy tax exemption, since been phased out.

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Other countries such as **China, Indonesia, Japan, Malaysia,** and **Singapore**, have opted for mandatory requirements. Countries in the **European Union** are putting in place mandatory requirements for certified energy management systems for energy-intensive companies.

Finally, some countries have adopted hybrid approaches. Joining a network or agreement may be voluntary, but upon joining, companies are obliged to implement a system, receiving benefits and concessions in return. In **Europe**, voluntary approaches linked to participation in networks or agreements, whereby participants agree to put a system in place, have been used across a number of countries, including Finland and Ireland.

Voluntary agreements that deliver continual improvements

Finland has had energy efficiency agreements since 1997, encompassing companies and municipalities and covering more than 60% of the country's total energy use. Companies develop an action plan and commit to improving their energy efficiency in accordance with the actions and targets presented in the plan. Upon joining, the energy-intensive industry companies commit to introducing an energy efficiency system as per government definitions or ISO 50001. Medium-sized companies are obliged to demonstrate continual improvement of energy efficiency, monitoring, and measurement. Companies report on progress on a yearly basis. The Confederation of Finnish Industries is also party to the agreement and commits to encouraging companies to join, helping monitor energy efficiency implementation, and supporting programme development and implementation. Additionally, the administrative burden for compliance with the EU Energy Efficiency Directive is subsequently reduced by companies with certified energy management systems.

In the period 2017-2023, participating energy-intensive industry companies reduced energy bills by EUR 480 million, and medium-sized industrial companies reduced bills by EUR 71 million. The Ministry of Economic Affairs and Employment provides subsidies to support implementation; between 2017-2023, the Ministry granted EUR 14.4 million to energy-intensive industry and EUR 32.7 million to medium-sized industry. Companies are incentivised to participate by the offer of lower regulatory burdens – they are exempt from a separate energy efficiency requirement in their environmental permits and, for the new period, granted concessions to their obligations under the New Energy Efficiency Act of 2025.

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A portfolio of measures driving innovation

Italy has developed a comprehensive approach to encouraging energy management in industry. Energy management system adoption is currently voluntary, but companies with a certified energy management system are able to avoid the requirement for mandatory audits every four years. The voluntary nature is set to change in accordance with European Union directives, making certified energy management systems mandatory in energy-intensive companies. The number of ISO 50001 certifications has increased since 2014, driven in part by preferential treatment in public tenders and the white certificate scheme. A further strong incentive was created by a gas and electricity tariff reduction opportunity, which is available to large and energy-intensive companies that conduct an energy audit or have an energy management system.

The national energy efficiency agency, ENEA, collects data from energy audits. Having a structured, robust database has allowed analysis of energy performance indicators and energy efficiency measures. More than 25 000 energy efficiency measures have been collected to date, allowing the agency to analyse potential and achieved savings.

Since 2019, Italy has intensified their focus on increasing the use of digital tools to improve the manufacturing sector's productivity and efficiency. Transition 5.0 is a EUR 6.3 billion public investment that supports the transition of production processes into an efficient, sustainable, and renewable energy system. Under the investment, energy savings will reach upwards of 0.4 million tonnes of oil equivalent (Mtoe) in the period 2024-2026. The programme offers a series of tax credits for businesses that invest in digital activities, self-production of energy from renewable sources, and staff training. The tax benefit is contingent upon a reduction in final energy consumption (at least 3%) or energy savings in processes (at least 5%) due to investments in digital activities. The tax credit also increases based on the certified improvement in energy efficiency. Projects must be certified by an independent evaluator, with ex ante and ex post certifications.

Italian industrial energy efficiency policy package

Policy category	Programme	Target	Timeframe
○ Regulation – obligation (obligated parties) ○ Incentive – target	White certificates	Large enterprises, SMEs, public sector	2005-ongoing
○ Incentive – fiscal incentive	Tax deduction scheme	Large enterprises, SMEs, residential sector	2007-ongoing

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Policy category	Programme	Target	Timeframe
Incentive – subsidy	Renewable energy for heating and cooling	Large enterprises, SMEs, public sector	2012-ongoing
Incentive – financial support *transitioning to* Regulation – audit and energy management requirements	Programme for energy-intensive consumers	Energy-intensive companies (non-SMEs and SMEs)	2013-ongoing
Information – awareness-raising campaign and technical support	Energy efficiency information and training programme	Large enterprises, SMEs, public sector	2014-ongoing
Incentive – subsidy for cost of energy management system	Support programmes for energy audits and energy management	SMEs (all sectors)	2015-2020
Incentive – subsidy for audits	Regional programme	SMEs (all sectors)	2015-2020
Incentive – variety of financial support mechanisms	National strategy for start-up and innovative SMEs	SMEs (all sectors)	2015-ongoing
Incentive – grant to cover interest paid on bank loans	Capital assets – Nuova Sabatini	SMEs (specific sectors)	2015-ongoing
Incentive – tax credit	National plan for Industry 4.0	Large enterprises, SMEs (all sectors)	2015-2020
Incentive – subsidised loans	SME Initiative Italy	SMEs (all sectors)	2016-2020
Incentive – grant, soft loans	National Fund for Energy Efficiency	Large enterprises, SMEs, public sector	2019-2023
Incentive – venture capital finance	National Innovation Fund	SMEs, start-ups	2019-ongoing
Incentive – financial support for research and development	Fund for sustainable growth	Large enterprises, SMEs (all sectors)	2019-ongoing
Incentive – tax credit	National plan for Transition 4.0	Large enterprises, SMEs (all sectors)	2019-ongoing
Incentive – financial support	Italian National Recovery and Resilience Plan	Large enterprises, SMEs (all sectors)	2021-2027

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Policy category	Programme	Target	Timeframe
Incentive – financial support mechanisms for development and sustainability	Development contracts for automotive sector	Automotive sector	2022-ongoing
Information – awareness-raising, capacity building, training	SME Awareness Plan	SMEs not covered by mandatory energy audit	2021-2023
Incentive – grant for investment in capital assets	Sustainable investments complying with environmental protection principles or Transition 4.0	SMEs (all sectors), investments	2023 (active for Southern Italy)
Regulation – requirement to achieve specific energy efficiency targets Incentive – tax credits	Italy's Transition Plan 5.0	Large enterprises, SMEs (all sectors)	2024-ongoing

Note: SMEs = small and medium-sized enterprises.
Source: Adapted from ENEA (2025), Input to IEA survey on industrial energy efficiency.

Systematic improvements to a policy package

Under the Indonesian Energy Conservation Regulation, energy producers, industrial companies, transportation companies, and commercial entities with annual energy usage over a given threshold are mandated to appoint an energy manager, develop an energy conservation programme, conduct audits, implement audit recommendations, and report to government. The regulation stipulates incentives for compliance and penalties for non-compliance. The regulation was updated in 2023 through stakeholder consultations and public hearings with various sectors. As a result, the regulation was expanded to include more companies by lowering the minimum energy consumption threshold required for compliance. This change broadened the scheme's coverage, bringing additional firms – particularly medium-sized energy users – into the scope of energy efficiency obligations.

Alongside regulation, the Indonesian government is actively strengthening local capacity for conducting energy audits, implementing energy management practices and supporting the uptake of energy-efficient technologies. Efforts are also under way to support the development of the energy service company (ESCO) market.

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The government has acknowledged key challenges, which include the need for improved training for auditors and energy managers, better access to financing, and increased awareness of benefits among smaller companies.

Several targeted initiatives have been put in place to address the challenges being faced. An integrated energy efficiency information platform (SINERGI) and a monitoring and reporting system (POME) are in place. The government is continually reviewing and upgrading these systems to ensure accuracy, support regulatory compliance, and enhance the quality of data available for policy development and evaluation. POME data are also used to assess company performance and serve as a basis for providing performance-based incentives.

Effective combinations of regulation and support

Japan has set energy saving requirements for energy-intensive and large companies based on benchmark values. Companies are required to put in place energy efficiency plans and report on target achievement, with penalties for non-compliance.

Under the Energy Conservation Law, Japan mandates energy management for the industry/business entities with annual energy consumption above 1 500 kL. Various economic incentives are provided for promoting the industry/business entities to invest in energy-efficient technologies, electrification, and digital technologies for operational energy efficiency improvement. The incentives are differentiated based on eligibility criteria and potential energy savings.

The Energy Conservation Centre, Japan, helps businesses implement energy management systems by providing training programmes, technical support, and resources. The centre also assists in energy audits, benchmarking, and certification. Energy audits for SMEs were previously free of charge and are currently still highly subsidised. Undertaking an audit also grants access to preferential treatment if the company decides to apply for an energy conservation subsidy.

The policy package has been revised in light of the need for further energy efficiency improvements, for a transition to non-fossil energy, and for optimising demand to avoid supply-side challenges. Those industry/business entities with annual energy consumption above 1 500 kL must now report on their achievements and plans for transitioning to non-fossil energy. Increasingly, focus is being placed on demand response. Efforts are also under way to promote the use of digital technologies and AI for energy efficiency, since the Ministry of Economy, Trade, and Industry is preparing for the guidelines on the use of digital technologies and AI.

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Support for energy management requirements

According to the Malaysian Energy Efficiency Conservation Act 2024, energy consumers with usage of 21 600 GJ or more per year are subject to requirements to:

- Appoint an energy manager.
- Develop and implement an energy management system.
- Submit energy efficiency and conservation reports.
- Conduct regular energy audits by a registered energy auditor and submit the resulting report to the Energy Commission.

Malaysia also has a recognition programme that awards star ratings to companies excelling in energy management. The 2024 awards ceremony organised by the Malaysian Green Technology and Climate Change Corporation showcased the accomplishments of 107 organisations that collectively reduced annual energy demand by 203 GWh and achieved cost savings of MYR 74 million (Malaysian ringgits).[2]

The government has earmarked MYR 1 billion under the Green Technology Financing Scheme 4.0 to provide financial support for energy efficiency projects, also extending to ESCOs engaged in advancing energy efficiency solutions.

The Ministry of Energy Transition and Water Transformation supports energy audits through the Energy Audit Conditional Grant Programme. The limit of minimum electricity consumption for companies to access support was recently updated from 500 000 kilowatt-hours (kWh) per month to 100 000 kWh. Industrial sector companies can get support of up to MYR 100 000 per site to carry out an audit. Companies are offered further benefits (in addition to the audit) in the form of:

- Energy management and energy audit training.
- Guidance and advice by the Sustainable Energy Development Authority (SEDA) during the energy-saving implementation phase.
- Access to SEDA's building energy data online system to help monitor energy and carbon emissions reductions.
- Potential recognition under a range of schemes.

The act came into force on 1 January 2025, with 2025 being the first 12-month reporting period. The Malaysian government also provides the Green Investment Tax Allowance and the Green Income Tax exemption.

Tailored national and territorial policy packages

Canada has developed a balanced policy package to encourage, support and incentivise energy management in the industrial sector. Beyond national policies,

[2] Exchange rate: 1 Malaysian ringgit (MYR) = USD 0.23 (as of 3 September 2025).

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provincial and territorial governments also provide additional support. With the support of national and territorial government funding, Alberta's Strategic Energy Management for Industry programme provides industrial facilities with knowledge, expertise and training in energy management. The programme provides support through four activities:

- energy assessments and audits
- energy management information systems
- strategic energy management
- capital retrofits.

The programme offers financial incentives of up to CAD 50 000 (Canadian dollars)[3] for energy audits and assessments, up to CAD 250 000 for energy management information systems, and up to CAD 1 million for energy efficiency retrofits.

The Independent Electricity System Operator of Ontario ran a programme for 11 years offering incentives to businesses to employ professional energy managers. The programme funded and supported a total of 250 energy managers through training and giving recognition. The programme resulted in a demand reduction of 27 MW and delivered market transformation by demonstrating the value of having an energy manager on site. Following the success of the programme, and with the support of Natural Resources Canada, the system operator has developed a tailored energy management through its Expanded Energy Management programme. The programme offers to cover 50% of the cost of an energy manager, funding to put in place an energy management information system, and expert-led coaching and training.

Canadian industrial energy efficiency policy package

Policy category	Programme	Purpose
Regulation	Energy efficiency regulation and minimum energy performance requirements for industrial equipment	Improve minimum energy performance of equipment used in industrial processes
Information	Canadian Industry Partnership for Energy Conservation, energy management information system guideline	Raise awareness and build capacity
Information	Energy Star for Industry: Challenge and Certification	Encourage energy performance through recognition

[3] Exchange rate: 1 Canadian dollar (CAD) = USD 0.72 (as of 3 September 2025).

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Policy category	Programme	Purpose
Information Incentive	50001 Ready Canada	Provide technical guidance and financial support for energy management implementation
Information Incentive	ISO 50001 Standard certification	Provide technical guidance and financial support for energy management system certification
Information Incentive	Industrial process studies	Identify opportunities for process change
Incentive	Capital investments through cost-shared financial assistance	Support the implementation of capital retrofits

Source: Adapted from NRCAN (2025) "Industrial energy efficiency programming in Canada" presented at IEA workshop on The Role of Energy Efficiency in Industrial Competitiveness, May 6, 2025, Paris.

Factors to ensure success

A range of success factors come to light after analysing the implementation of policy packages for energy management, irrespective of the type of policy package.

Partnerships to improve effectiveness

Strong partnerships with industry associations, training and education institutions, research bodies, sub-national governments, and utilities can help ensure success in multiple ways. Partnerships can reduce the time and resources required, as they offer the possibility to leverage existing communication channels. Industry associations and sub-national governments will have pre-existing relationships with companies – and built-up trust – that can make information and messaging more effective.

The **United States** has effectively leveraged partnerships with national laboratories and research institutions, drawing on their expertise in tool development, training, and capacity building. The United States further supported the delivery of free audits through Industrial Assessment Centres; as a result, it developed the most comprehensive open database on industrial energy efficiency measures. The United States also partnered with vocational training institutions and sub-national governments to support apprenticeship programmes and on-the-job learning opportunities.

Industry associations can provide valuable support in terms of stakeholder consultations, helping uncover the barriers for energy management and concerns of companies. The **Italian** energy agency ENEA routinely engages with industry associations and is therefore able to access data and insights and enable more effective information campaigns and outreach.

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Sub-national governments can help facilitate processes and environmental reporting. Collaboration with sub-national governments can prevent undue regulatory or reporting burdens and ensure efforts are not duplicated. **Sweden** has much experience engaging local energy advisers that has been effective in providing support to companies and unlocking system-level benefits by creating connections and interlinkages.

In most countries, policies concerning industries are spread across several ministries and departments. Continuous engagement among them will help ensure that synergies are captured, duplication is avoided, and industry is presented with a coherent, broader policy package. For instance, innovation programmes can be potentially leveraged to demonstrate digitally-enhanced energy management. Training programmes offered as part of general capacity building and development of SMEs can be expanded to include modules on energy management and energy efficiency.

Co-ordination can save resources. This has been demonstrated in **Mexico**, having implemented an effective programme for energy management - without needing to request additional public resources. The programme under the National Commission for the Efficient Use of Energy (CONUEE) operates transversally as a complement to existing programmes.

Data collection and analysis to support policy development

Regular surveying and analysis of **Japanese** SME energy audit reports provide valuable insights that have enabled the programme to adapt to changes in the energy system and business needs. The types of audits offered have been expanded, now covering distributed solar and the use of digital tools for efficiency and demand response.

Italy's ENEA energy audit database enables performance tracking, the development of performance indicators and sectoral benchmarks, and the identification of aspects that contribute to higher levels of implementation.

High-quality audits to optimise savings

Experience across a range of countries highlights the importance of high-quality technical advice and audits. Substandard technical support will deter companies from implementation and from seeking further external expertise. Auditors without understanding of the processes operating within industry may recommend generic solutions that provide limited savings options, missing the opportunity to maximise and quantify the non-energy benefits of energy efficiency measures.

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A range of options counter this: auditor training programmes, regulated certification, guidelines for auditors, guidelines and training on identifying non-energy benefits, systematic quality monitoring, evaluating audits carried out, and evaluating auditors themselves. Increasingly, the use of digital tools could also help standardise and enhance the quality of audits.

Diverse approaches for diverse companies

Companies within the industrial sector are diverse and heterogenous in terms of size, turnover, processes, and products. While any company can benefit from energy management, its ability to engage, allocate time and resources, and access finance vary. Companies at different levels of maturity have different investment cycles and differing energy efficiency opportunities. A diversified approach can mitigate some of these differences and provide a more relevant and effective policy offering.

Many countries are developing approaches targeting SMEs that include more streamlined processes and easier access to support. **Germany** provides a diversified subsidy scheme across four programmes, where smaller grants can be accessed through simpler applications. Larger subsidies are subject to more competitive requirements.

Ensuring that companies can easily navigate across requirements and support can build trust and engagement - and support implementation. **The Netherlands** has developed user-friendly online guidance to help companies understand what requirement category they are in, what they need to do, and how to comply. It also put in place extra resources in collaboration with sub-national government after many companies were unaware of the need to comply with requirements. The Netherlands also developed a technology list to guide implementation in companies without sufficient time or resources to investigate bespoke solutions.

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Further success factors to effective company engagement

Clearly demonstrate the value proposition

Use case studies and testimonials to demonstrate possible benefits in terms of energy savings, cost savings, and other benefits.

Develop long-term relationships

Provide a consistent contact person and establish a level of credibility and trust with industrial customers to enable joint identification of opportunities and analysis of savings.

Accommodate company schedules

Engage with companies and industry associations to be able to consider operational schedule, capital investment cycle, and decision-making processes to align with internal drivers.

Streamline application or participation processes

Strike a balance between meeting programme administrative needs and keeping procedures easy to understand and processes simple to facilitate participation.

Conduct targeted outreach

Conduct continual outreach using tailored communication channels to ensure that industrial companies are aware of offerings and opportunities.

Ensure top-level management is engaged

Incorporate requirements for audit results to be submitted to top management; require regular briefings on management on progress; provide management peer-to-peer exchange opportunities; provide opportunities for positive publicity.

Source: Adapted from IEA (2012), Policy Pathway - Energy Management Programmes for Industry.

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4. Individual policy measures to support energy management

Summary

This section explores individual policy measures that can combine to form an effective policy package covering instruments to provide information, incentives, and regulation. It provides examples from a range of countries showing how the measure is being used and gives an overview of how it can be combined with other policy instruments.

The section covers:

- Information tools: platforms, guidelines, and training.
- Audits: types, quality assurance, and implementation support.
- Networks: peer learning and voluntary agreements.
- Benchmarking: performance tracking and target setting.
- Incentives: financial support, recognition, and tax benefits.
- Regulation: thresholds, mandatory systems, and reporting.

Valuable information tools

According to the Energy Efficiency Movement's Energy Efficiency Investment Survey, businesses are increasingly seeking more information from governments and third parties. Requests include:

- Clear information on available energy efficiency incentives and rebate programmes
- Details on financing and investment options for energy efficiency upgrades
- Insights into emerging energy technologies and innovations.

Companies and businesses are constrained in the uptake of energy management by two main factors: a lack of awareness and information, and a lack of time to seek out information. Once informed about potential benefits or requirements, companies benefit greatly from capacity building, technical assistance, and guidance - all of which can help reduce their efforts, speed up implementation, and ensure the quality of systems put in place.

Government initiatives that break down barriers to engagement, by easing access to information for companies, increasing knowledge of any requirements, facilitating access to available tools and support, and offering tailored information,

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will save companies time and effort and will also help convey a co-ordinated and cohesive government approach.

Increased awareness and knowledge of energy management encourages more businesses to adopt these systems, while education programmes ensure that businesses have the expertise to implement them successfully. Knowledge-sharing and peer-to-peer learning help businesses feel more confident in adopting energy management, as they can see real-world examples and hear from others in similar industries. Peer-to-peer exchanges and networks have been shown to be effective in conveying benefits and best practices.

Measures in support of the information element of energy management programmes:

- awareness-raising and information campaigns
- capacity building
- training and certification of auditors
- technical assistance and advisory services
- energy audits
- Industrial Energy Efficiency Networks
- industrial benchmarking.

Awareness-raising and information campaigns

Many lessons have been learned on how to design awareness and behaviour change campaigns to achieve maximum effect. It is clear that good design matters – simply transmitting information will not change behaviour, and poorly designed campaigns often do not deliver their expected impact. The choice of message, the tone, how the campaign is designed, and the transmission channels can all fundamentally affect the resulting impact. Four key concepts are crucial:

- getting the message right
- getting the message across
- combining information with behavioural insights
- tailoring campaigns for context and purpose.

Effective campaigns or outreach efforts ensure that those receiving the information and messages can understand what they are being asked to do and easily do it. Testing messages and narratives with relevant audiences in advance gives greater understanding of what resonates with diverse groups. This can make a significant difference. Since the success of energy management lies in garnering the support of companies' top management, tailored messages with evidence that speaks to strategic value and competitive advantage can well complement more technical information.

The **United States** Department of Energy (DoE) has developed a short brochure outlining the benefits of energy management with case studies including quantification of cost savings. In addition, it has a repository of webinars and case studies, including video format case studies where companies share their

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experiences. The department has also developed content on energy efficiency that specifically targets company top management.

Luxembourg has developed KlimaPakt fir Betriber, a platform that provides information and technical step-by-step solutions to companies on what they can do to be more energy efficient. The platform eases the implementation process so companies do not need to search on multiple websites, providing information on different financial support opportunities as well as information on the various players involved.

In the **United States**, the Lawrence Berkeley National Laboratory Energy Management Systems Insights platform was set up to make case studies of ISO 50001-based energy management systems easily searchable, yielding descriptions of real-world successes and providing an avenue for sharing information within and across sectors. Each case study details an energy management system implementation and its associated energy, emissions, and cost savings.

Information
Awareness raising

What?	**Why?**
• **Awareness-raising campaigns** to highlight benefits of energy management and highlight potential savings, cost reductions, and other benefits • **Targeted information** to specific segments and subsectors • **Case studies** that demonstrate benefits of energy management and case studies that show the process of putting in place an energy management system	• **Encourages businesses** to embark on energy management, to join programmes, to start using available tools, to access external expertise, or to apply for grants • **Guides companies** to where they can find more information and resources, such as one-stop shops, guidelines, templates
• **Workshops**, **webinars**, or **meetings** to explain more about energy management and how to implement a system	• **Helps businesses get started** with energy management • **Creates networks** of interested businesses • **Informs future policy making** by addressing questions or issues raised **Alleviates concerns** about time and resource requirements

Works well with:

- Awareness raising is effective when there is a plan in place on how to guide and support companies through the process of moving towards having an energy management system. Establishing partnerships with trusted organisations such as industry associations can help outreach and limit costs and resources required to reach the target audience.

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Training and capacity building

A frequently cited barrier to energy efficiency is lack of capacity, resources and/or skills, particularly for smaller companies. Government interventions can help supply external capacity to help companies get started with energy efficiency, and more importantly, build capacity for sustained improvement.

Accurate and reliable measurement of operating data is critical in evaluating energy performance and identifying opportunities for improvement at equipment and systems levels. Governments can help bridge this information gap by providing tools and approaches towards better monitoring of energy use.

Technical support ensures that businesses have the resources they need to implement energy management systems effectively and under expert guidance, increasing their likelihood for success. Governments can also consider providing training and capacity building to installers who are integral to supporting companies with energy management tools and expertise.

The **Swedish** Energy Agency provides a short overview of energy management and its benefits. They also include a self-diagnosis tool with questions on organisation and management; energy monitoring, targets, and plans; indicators; and engagement and education, along with a basic template for an action plan and an Excel spreadsheet to start mapping and understanding energy usage.

The **United States** 50001 Ready Navigator is an online guide for establishing an energy management system comprising 25 tasks. Experience shows that implementation of the tasks can take between 6 and 18 months, after which companies are ready for ISO 50001 certification should they wish to proceed with it. A 50001 Ready Help Desk is available to assist companies through the 25 tasks.

The US DoE, together with partners, has developed a suite of free online tools to help companies monitor and measure energy use. To counteract information gaps and to address the fact that advanced monitoring tools are expensive, the DoE's Better Plants programme developed the Diagnostic Equipment Loan Program. The programme gives access to a list of instruments and assists companies select the most appropriate instruments to measure and monitor energy usage. Programme participants can lend equipment free of charge, including shipping, for 1-28 days.

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Information **Training and capacity building, and technical assistance**	
What?	**Why?**
• **Tools**, **templates**, and **guidelines** to help businesses develop and implement energy management systems more efficiently	• **Streamlines the process** for businesses • **Reduces the complexity** and administrative burden associated with implementing energy management • **Reduces cost-burden** and saves companies from needing to develop or procure tools (when utilising free tools)
• **Site visits**, **technical advice**, access to **measurement tools**, access to **external consultants** • **Training** and **capacity building** for internal staff, including design of curriculum, delivery of training programmes, ongoing support through professional development initiatives • Training, capacity building and **accreditation** of service providers, such as auditors, technical experts, energy service companies, installers, and equipment providers	• **Provides information** about energy use and energy savings opportunities • **Identifies quick wins** and no- and low-cost solutions • **Provides insights into costs** and cost savings • **Build internal and external skills** to enable energy management • **Improve existing capacity** to support deeper and broader implementation
Works well with:	
• Training and capacity building can be an effective precursor to energy audits and can help build company willingness to participate in audits and build trust. Site visits can be used to create case studies. Awards for energy managers can provide an incentive to participate in training and professional development.	

Energy audits

Energy audits are evaluations of the energy consumption of companies or sites overseen by qualified professionals. These assessments aim to identify areas where energy efficiency can be improved.

There are different types and rigours of energy audits, depending on the circumstance. For instance, **Australia** has three general classifications:

- **Type 1 audit (basic energy audit)** provides an overview of energy consumption and a broad estimate of energy savings with short payback periods. The primary target group for this type includes smaller businesses or larger businesses that have not previously assessed their energy use.
- **Type 2 audit (detailed energy audit)** is a more rigorous analysis of energy consumption and will quantify potential energy savings based on detailed data and analysis of the specific equipment and operating conditions at each site. It

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includes financial evaluation of opportunities based on agreed criteria to help business owners prioritise opportunities.

- **Type 3 audit (precision subsystem audit)** focuses on a major subsystem, such as boilers or compressed air systems. It involves additional measurements to quantify opportunities with a higher level of accuracy. The primary audience includes larger businesses with specialised equipment or major production facilities.

Audits can reveal quick wins, but deeper energy efficiency improvements require capital investments. Linking audits with financial incentives can help overcome barriers related to upfront cost and shorten payback periods. Studies across a range of different countries have found evidence that high-quality audits and trust in auditors and the auditing process increase the predisposition to implement suggested energy efficiency measures.

Setting a standardised audit process ensures greater consistency and allows for comparisons between programmes across the country and across the world. It can also be a means to ensure that audits meet a set minimum quality requirement.

Training, guidelines, and codes to assure quality audits

Following the transposition of the European Union regulation on mandatory energy audits, the Sustainable Energy Authority of **Ireland** developed minimum criteria for energy audits. The authority has also developed a 65-page step-by-step energy audit handbook that provides guidance across the entire audit process that can be used by companies considering or embarking on an audit, as well as by internal or external auditors. Natural Resources **Canada** developed an energy audit manual and spreadsheets, checklists, and templates to support companies conducting audits on their own premises.

The Energy Efficiency Council of **Australia** provides a tool to find auditors, allowing users to set criteria according to business sector, geographical area, and products, or services required. All the companies listed have agreed to a set code of ethics.

In **India**, according to the Energy Conservation Act, 2001, companies must renew their certificate for Energy Auditors and Energy Managers every five years by attending a mandatory refresher training course conducted by a Bureau of Energy Efficiency designated agency. The main objective of this course is to update professionals about the latest technologies for energy management while

refreshing knowledge on energy norms and standards. The rigour of this requirement is indicated by the 265-page learning material for the refresher course.

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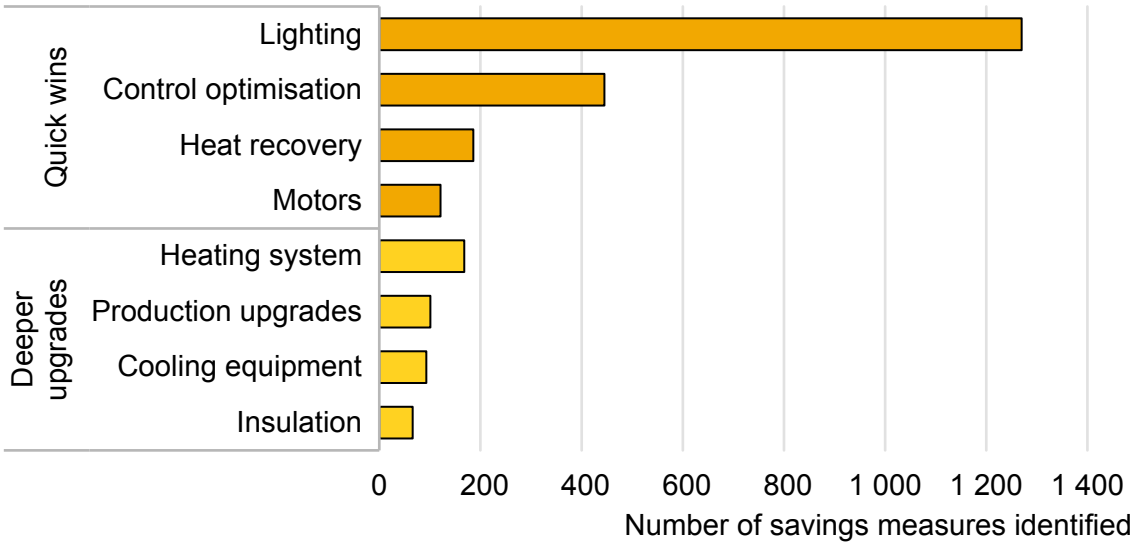
Trained and skilled auditors to support industrial electrification

One of the limitations of energy audits is that auditors, even those who are certified, often focus on familiar technologies. As a result, audits tend to emphasise individual equipment upgrades rather than broader improvements to industrial processes. Analysis of European energy audits demonstrates that quick wins such as lighting and control optimisation are by far the most recommended type of measure for all kinds of industrial sectors. They are around three times more likely to be recommended than deeper upgrades, despite the latter usually having much more significant energy and cost saving potential. This narrow scope can be especially problematic when evaluating opportunities, such as the electrification of process heat.

Transitioning from fossil fuel-based systems to alternatives such as heat pumps requires a comprehensive assessment of the entire heat delivery system. It also requires a deep understanding of both heating and cooling demands across the production process. Without auditors who possess the necessary systems-level expertise and experience, these critical and high-impact opportunities may be overlooked or assessed inappropriately. To counter this, the Energy Efficiency and Conservation Authority and the Energy Management Association of **New Zealand** partnered to develop a standard for energy efficiency auditing of direct and indirect heating systems.

Number of energy savings measures identified by technology for 1 057 energy audits, European Union, 2005-2023



Source: IEA analysis based on data from Audit2Measure database (accessed 5 August.2025).

Audits to drive energy management

Audits can be leveraged to create a drive for energy management. In **Austria**, the OekoWin programme, which provides a subsidy for audits, obliges auditors to use

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a certain template when completing the audit. The OekoWin audit template is designed to allow the direct application of the audit results, and to start developing an internationally-recognised environmental or energy management system.

Recommendations for supporting energy audits

Evidence from **Italy** shows that energy audits need to be accompanied by a monitoring plan to be most effective. The absence of robust data constrains energy efficiency implementation. Some countries require that a certain part of the identified opportunities be implemented, such as in **Italy** and the **Netherlands**.

The Audit-to-Measure project, co-funded by the **European Union**, is developing capacity and tools to support companies in the implementation of energy audit recommendations. The project has developed a benchmarking system of energy-saving measures and a database of measures including data related to multiple benefits. The addition of another tool is foreseen, which will be able to assess the maturity of energy management processes within companies and suggest steps to progress from audits to energy management and to implement energy efficiency measures.

Information **Energy audits**	
What?	**Why?**
• **Energy audits at regular intervals**, together with a wider focus on developing energy management systems	• **Provides information** about energy use, energy savings opportunities, identification of quick wins and no- and low-cost solutions, insights into costs, cost savings • **Identifies larger projects** that require investments
• **Training, certification, guidelines, templates for energy auditors** • **Training** and **guidelines on sector-specific processes**	• **Assures the ability to identify more opportunities**, including process-level changes that will lead to deeper energy efficiency improvements • **Builds trust in the company** about identified opportunities
Works well with:	
• Audits can help with environmental, energy, or climate reporting requirements as they quantify energy used. Subsidised audits can be combined with requirements to report on savings opportunities and implementation plans. Combining audits with incentives and access to finance can improve implementation rates. By collecting data from audits, governments can improve their evidence base on energy efficiency opportunities.	

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Industrial Energy Efficiency Networks

An Energy Efficiency Network (EEN) is a group of companies or public institutions whose energy managers meet regularly to share experiences on energy savings, with the aim of gaining knowledge and increasing energy efficiency. Industrial EENs come in many forms – some connect firms based on shared sectoral activities, geographic proximity, company size, or common interests. Regardless of their structure, these networks have demonstrated value across diverse sectors and organisations by enabling companies to identify, share, and implement energy-saving opportunities more effectively.

Industrial EENs can be used as levers and amplifiers to enhance industrial energy efficiency. Sparking engagement and co-operation between industrial stakeholders and policy makers, EENs result in increased levels of efficiency.

Based on experience and insights of policy makers involved in EENs shared with the IEA, networks can:

- Help build trust between governments and industry.
- Facilitate effective communication and ensure continual feedback on policy implementation from businesses.
- Address the needs of SMEs as well as large energy users.
- Break down barriers to implementation through shared case studies, site visits, and peer-to-peer exchanges.
- Help companies move from identified action to implemented project.
- Foster innovation and adoption of novel approaches and technologies, thereby contributing to modernisation.

Driving stronger energy efficiency implementation

The over 2 000 participating industries in **Germany's** Energy Efficiency and Climate Protection Networks Initiative report exceeded their savings targets by more than 10%. After three to four years, participating companies improved their energy efficiency significantly more than the industry average, reduced their GHG emissions, and increased their energy productivity twice as fast as the industry average.

Provide a basis for multiplication

The National Commission for the Efficient Use of Energy (CONUEE) in **Mexico** launched the National Programme for Energy Management Systems (PRONASGEn) in 2014 to provide capacity building for companies. The programme incorporates learning networks to facilitate the sharing of experiences

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and approaches to implementation. An early success of the first learning network saw 8 out of 11 companies deciding to continue participating as a self-funded initiative after the initial year. Twenty-one networks or groups were created, including 167 organisations with 254 facilities, direct training of 1 000 professionals, and indirect training of 4 000. The programme worked closely with experts from several countries and established partnerships with universities, institutes, and industry associations.

Driving continual improvements with voluntary agreements

Participants of the **Singapore** Energy Efficiency National Partnership commit to putting an energy management system in place. The network, which has grown to include 622 companies, provides incentives in the form of grants and offers a range of opportunities for peer-to-peer learning targeted at top management, engineers, and practitioners. The network also provides recognition in the form of awards across five categories.

The Large Industry Energy Network in **Ireland** comprises 196 companies and has been in operation for 25 years. To join the network, companies must have annual energy costs of at least EUR 1 million and be certified or pursuing certification to ISO 50001. They must develop an energy management programme and action plan, set and review energy targets, and report annually on energy performance. In 2022, the companies implemented energy efficiency projects saving 783 GWh and almost EUR 60 million on energy bills.

The Sustainable Energy Authority of Ireland (SEAI) recently developed a new strategy that increases focus and resources to target the top 15 energy-consuming companies, helping them implement certified management systems. As these 15 companies show improved energy savings and more innovation, the programme will broaden to include and encourage other companies to implement systems as well. The network will also place a stronger focus on their special working groups, in which members share experiences, problems, and challenges on energy-efficient design, specific technologies, and process improvements. The groups are facilitated by industry experts appointed by SEAI and offer opportunities to co-create innovative solutions to shared problems.

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Information **Networks**	
What?	**Why?**
• **Industry forums**, **conferences**, or **networking events**, facilitated or leveraged by government to provide opportunities for knowledge sharing and peer learning, where businesses share best practices, success stories, and challenges regarding the adoption of energy management systems	• **Helps businesses feel more confident** in adopting energy management by seeing real-world examples and hearing from others in similar industries
• **Platforms for mentorship by businesses that have successfully adopted energy management** and who can share their experiences; networks can also be more formalised and have agreed-upon energy savings targets	• **Helps organisations learn from each other** and address common barriers to implementation • Allows opportunities to **engage in joint procurement** of energy efficiency services or technologies, thereby bringing down cost • Provides potential for **site visits** as a strong motivator to demonstrate benefits and inspire action
Works well with:	
• Networks can be used to leverage and enhance the impact of the entire suite of policy measures. EENs can help to support compliance with regulation, can be used as a target for incentives, and can support the exchange of information on energy-saving opportunities. They can also be an important means of information exchange and communication on policy delivery and policy development between network members and government.	

Industrial energy benchmarking

Benchmarking can help inform policy making by pinpointing achievable levels of energy efficiency across different sectors or processes; it can help identify laggards and leaders and drive more ambitious implementation.

Energy benchmarking assesses a defined system's energy performance against a reference system. It can be used to identify energy efficiency opportunities, set targets, and track progress towards higher levels of efficiency. Benchmarks have been used in policy instruments to set targets and thresholds for energy performance, and to determine the distribution of benefits and obligations.

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Benchmarking can be developed for various levels – country, sector, plant, production line, and equipment. It can be used to track performance over time within a company, to compare similar processes within a plant or company, and to compare processes industry-wide.

Different approaches can be used:

- **Top-down:** assesses energy efficiency, helps monitor general energy savings targets, and helps evaluate policy measures, all within a country or sector; useful to track national trends but provides limited insights to individual plants; requires annually-reported energy use, production data, and cost data.
- **Bottom-up:** provides more granular insights but requires more data; useful to set targets, monitor obligations of companies, assess energy performance in relation to peers, and compare the performance of specific plants.

Considerations when developing benchmarks:

- Bottom-up approaches require both the participation of companies as well as considerable efforts from plant operational staff.
- Energy requirements are relative to products that are being processed.
- External factors such as weather, raw material quality, and product quality affect energy demand and require normalisation.
- Use of renewables and self-generation may not necessarily lead to plant-level efficiency improvements despite reducing primary energy; self-generation will have different levels of losses compared with purchased electricity.
- Companies typically require confidentiality of data before participating in benchmarking studies.

Monitoring country- and sector-level performance

Brazil has developed the Atlas of Energy Efficiency, which identifies indicators to monitor energy efficiency. It benchmarks Brazilian performance on the sectoral level as compared with international performance levels.

The **European Union**-funded project ODYSSEE-MURE administers a database containing energy efficiency indicators of top-down national data. The database allows comparisons between countries and different sectors, such as transport, households and services, and industry.

Setting mandatory targets

Japan introduced a benchmark system for industry in 2009, covering 7 industries and 12 categories, adding the commercial sector in 2016 with 10 categories. The system covers 80% of energy used in the industrial and commercial sectors. Benchmark target levels are set based on best available technology, high domestic performance levels, and competitive international levels. The target year

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is set at 2030 with benchmarks subject to revision if most companies have achieved the target ahead of time. The system allows government to conduct inspections of business sites with insufficient energy efficiency efforts, it also provides incentives in the form of subsidies when benchmark targets are achieved.

Saudi Arabia has baselined and benchmarked more than 180 plants covering around 60 different production processes as part of its Energy Efficiency Frameworks for new and existing plants. Energy intensity benchmarks are used to set requirements for new and for existing plants. The Saudi Energy Efficiency Centre works with 11 government entities to help plants implement the requirements.

China uses benchmarking to push energy efficiency implementation in high-energy-consuming industries. The 2023 Benchmarking Levels of Energy Efficiency in Industry Key Areas covers more than 80% of the total energy consumption of the industrial sector, providing benchmarking levels for 36 subsectors. It sets out the time frame needed for companies with inadequate energy efficiency to improve their performance.

The **European Union's** Emissions Trading System (EU ETS) is a cap-and-trade system to limit emissions from energy-intensive installations; the cap is reduced over time. With operations beginning in 2005, the EU ETS is currently in its fourth trading phase (2021-2030). Benchmarks (based on the 10% most efficient installations) are used to determine free allocations so that efficient installations do not need to purchase additional allowances to cover their emissions, thereby incentivising cost-effective emissions reductions.

India's Perform, Achieve and Trade scheme requires companies to reduce specific energy consumption and uses associated market-based mechanisms to enhance cost-effectiveness through certification of excess energy savings that can be traded. The specific energy consumption benchmarks are set through sector-specific studies.

Helping companies check performance

The **United States'** Environmental Protection Agency has developed energy performance indicators as part of ENERGY STAR that are based on actual plant data. The indicators are used to generate an energy performance scale of 1-100 covering 21 subsectors. The use of these indicators is voluntary and can help companies identify energy efficiency opportunities and earn recognition.

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Information **Benchmarking**	
What?	**Why?**
• **National-level and sectoral benchmarking**	• **Provides a baseline energy performance** against which to track progress over time • Provides ability to **compare progress** with that of other countries • Provides ability to **identify opportunities**
• **Subsectoral, segment, process, company-level benchmarking**	• **Provides insights needed to set energy efficiency targets** or identify where implementation gaps exist and where additional support can be directed • Demonstrates to companies that **significant energy efficiency opportunities exist** • **Helps drive ambition** by sparking competitiveness (if other companies can, then we can also) while inspiring action
Works well with:	
• Benchmarking works well for target setting; it can be used in outreach to demonstrate opportunities. The possibility to do benchmarking is worth considering when setting reporting requirements. Benchmarking can also be combined with incentives – creating a drive to implementation by awarding benefits to best performers.	

Incentives to motivate

Governments can offer subsidies, grants, or low-interest loans to businesses for the implementation of energy management systems. These financial incentives can help cover the upfront costs of system implementation, training, and certification. Governments can also provide incentives to promote the implementation of energy efficiency opportunities. Incentives can reduce financial barriers, making the initial investment in energy management systems more accessible to companies of all sizes. Incentives can also make energy management more of a strategic priority.

Measures to provide incentives to support the uptake of energy management include:

- Grants and access to finance.
- Awards and recognition.
- Tax rebates.
- Favourable procurement.

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Awards and recognition

Recognition programmes create incentives for businesses to adopt energy management by offering them public acknowledgement, which can enhance their brand reputation and market competitiveness. Highlighting success stories of businesses that have implemented energy management through media or on government websites can provide motivation and visibility, encouraging others.

Awards are an opportunity to recognise achievements, raise awareness, and bring a celebratory feel to what is usually a technical and serious topic area. They can bring a bit of fun and suspense – who will be the next **South African** Energy Efficiency Legend? Who will be voted into the Energy Efficiency Hall of Fame?

Incentives **Awards and recognition**	
What?	**Why?**
• **Recognition programmes that celebrate businesses** that have successfully implemented an energy management system • **Energy efficiency certifications or awards** for organisations that achieve significant energy reductions through effective management systems	• **Creates incentives** for businesses to implement energy management by offering them public acknowledgement • **Enhances brand reputation** and market competitiveness of successful recipients • **Drives increased ambition levels** – who wants to be silver when you could be gold?
• **Success stories** in the media or on governmental channels highlighting businesses that have implemented energy management and efficiency implementation • **Recognition and positive publicity** via write-ups, videos, during peer-to-peer exchanges, or during site visits	• **Elevates the topic** of energy management within companies • **Provides motivation and visibility**, encouraging others • **Drives other companies in the same sector** by showing energy efficiency is possible and impactful • **Gives a competitive edge** and generates positive attention
Works well with:	
• Success stories can be used to generate case studies, opening an opportunity for policy makers to get better data and insights that can be used for improving programmes and for reporting the impact of programmes. Programme or award logos can be offered for use in participant publicity materials. An offer to include company names or logos on government websites can also be an incentive. An attractive website offering a one-stop shop for information, guidance, results, and updates can be enhanced with success stories, case studies, and coverage of awards ceremonies.	

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Recognition and the opportunity to be congratulated by a minister or other dignitary can help put a positive spin on energy efficiency for company managers. Awards are also an opportunity for policy makers to identify leaders in different areas who can potentially be engaged to help promote programmes and initiatives. They can also be used to identify innovations and best practices that governments can use to inform and inspire companies, without needing resources to research.

International awards can be a strong driver, especially as many companies operate across a range of countries. Through the **Clean Energy Ministerial's** Energy Management Campaign, leaders from public and private sectors are working together to promote ISO 50001. Comprising 18 governments, 8 companies, and 4 organisations, the campaign runs the energy management leadership awards, annually issuing awards since 2016 to companies successfully implementing ISO 50001. To date, the campaign has collected 300 best practice case studies showing the benefits of energy management.

Regional awards such as the Association of Southeast Asian Nations (ASEAN) Energy Awards can be an effective way of sharing best practices and innovative approaches across borders. They can also help spur national efforts. Twenty of the 25 recipients of 2024's Malaysian National Energy Awards went on to represent **Malaysia** at the ASEAN awards, with 13 achieving regional-level wins.

Recognition programmes can be effective levers towards continual improvement. The Energy Management Gold Standard (EMGS) is a certification system delivered under the ASEAN Energy Management Scheme (AEMAS) based on excellence in energy management. The scheme began training certified energy managers in all participating **ASEAN** countries in 2010 before launching officially in 2011. EMGS has three rating levels: 1 star, 2 star, and 3 star. To get 1 star, the company needs to put in place a sustainable energy management system and appoint a certified energy manager. To get a 2-star rating, a company needs to have implemented all opportunities identified during the 1-star certification process and demonstrate energy efficiency improvements according to set requirements. For 3 stars, the company must have addressed opportunities raised during the 2-star certification process, demonstrate continual energy efficiency performance improvement and integrate the energy management system with other management systems that the company has. For all ratings, the company must demonstrate performance across seven aspects: management, organisation, process, information, financial, corporate responsibility and achievement.

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Awards can also be utilised to recognise and raise awareness of innovations and achievements across the whole energy efficiency value chain. The United Kingdom's Energy Efficiency Awards does exactly that, with awards given across 22 categories in two tracks – one national, one regional.

Governments can also support awards orchestrated by others. For instance, in **India**, the Confederation of Indian Industries has been issuing an award for energy management and innovation for the past 25 years. The Bureau of Energy and ministry officials support the process by handing out the awards at the ceremony, thereby contributing to the prestige of the award and generating positive media attention for recipients.

Germany gives awards to outstanding projects. Winners are awarded a corporate video that promotes the project, and award winners and nominees receive a certificate and a label. The winner of the special award for SMEs gets a EUR 5 000 prize.

Grants, subsidies, and access to finance

Access to affordable financing enables businesses, especially SMEs, to overcome the financial barriers associated with implementing energy management systems and energy efficiency.

Governments can set up specific funds or bonds that finance energy efficiency projects, including energy management implementation. These funds can provide affordable financing options for businesses that may not otherwise have the capital to implement these systems.

Governments can create or support financing mechanisms that allow businesses to invest in energy-saving technologies, including those that support the adoption of energy management systems.

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Incentives
Grants, subsidies, and access to finance

What?	Why?
• **Specific funds** or **green bonds** set up by government that finance energy efficiency projects, including energy management implementation	• Provides **affordable financing options** for businesses that may not otherwise have the means to implement systems • Helps businesses **overcome financial barriers** and **reduce payback periods** • Helps **alleviate risk perceptions** that energy management implementation could be a sunk cost due to difficulties in accessing funding for identified efficiency projects
• **Financing mechanisms** created or supported by government that allow businesses to invest in energy-saving technologies, including those that support the adoption of energy management systems • **Subsidies** or **grants** provided by governments to encourage energy management	• Helps **overcome barriers** associated with upfront cost • **Raises interest** in energy management due to the availability of grants or subsidies • **Drives further investments** in energy efficiency from grants with co-funding requirements
• **Training**, **capacity building**, and **guidance** or templates on how to develop an investment-grade energy efficiency project	• **Supports smaller companies** that may not have sufficient expertise in developing bankable projects • **Helps alleviate mismatched perceptions** of how a project is viewed by an engineer versus a bank or other finance-provider
• **Capacity building** and **tools** to help internal de-risking • **Guarantees** that are provided to help de-risk and help companies access finance	• **Helps companies de-risk** and **access finance** • Helps **alleviate internal and external risk perceptions**, which are a pervasive barrier • **Counteracts risk-aversion** from companies who are not receiving support from banks, the latter of which often lacks experience working with energy efficiency projects

Works well with:

- Combing measures to encourage audits with access to funding opportunities can increase the likelihood of implementing recommendations. Combining training and capacity building with content on how to finance projects can save time and resources. Training and capacity building of banks can help the development of energy efficiency finance products.

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The **German** Federal Funding Scheme for Energy and Resource Efficiency in the Economy is the main public funding programme for improving energy efficiency in companies. In 2023, it exceeded a funding volume of EUR 1 billion for the first time. The multi-measure scheme consists of several modules. Originally, the scheme supported investments in 1) energy-efficient, cross-cutting technologies; 2) process heat from renewable energies; 3) measurement and control equipment, sensors, and energy management software; and 4) energy and resource optimisations of plants and processes.

Two new modules were recently added, focusing on 5) transformation concepts; and 6) electrification in micro- and small enterprises. Depending on the module, the scheme offers three modes of funding: a grant-based line that offers direct investment grants, a credit-based line that offers low-interest loans with a repayment subsidy, and a competition-based line. By using different modes, the scheme caters to diverse needs and projects with different degrees of complexity.

Overview of grants and subsidies in select countries

Country	Incentive type	For what	How much
Canada	Grant	Financial assistance for ISO 50001 in commercial and institutional buildings	Up to 75% of eligible costs to a maximum of CAD 40 000 per building.
Ireland	Grant	Voucher for SMEs to conduct an energy audit	EUR 2 000
Japan	Subsidised energy audits	Energy audits for SMEs	90%
Mauritius	Grant	Energy audit	75% of audit cost up to a maximum of MUR 300 000 (Mauritian rupees)
Singapore	Grant	Pre-approved energy-efficient equipment or equipment delivering a minimum amount of carbon abatement	Up to SGD 30 000 (Singapore dollars) (70% of costs for SMEs, 30% for non-SMEs) or up to SGD 350 000
Republic of Türkiye	Grant	Energy efficiency investments	Up to 30% for medium and large enterprises, up to 70% for micro- and small

Tax rebates

Tax rebates can offer powerful incentives and contribute to raising the strategic profile of energy efficiency.

Italy provides a combination of different types of incentives for different investment categories, including digital assets, the installation of devices for self-generation

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of energy from renewable sources, and staff training programmes. Businesses that invest in these offers can benefit from a tax credit, conditional upon reducing final energy consumption by at least 3% or achieving energy savings of at least 5% in processes (at least 5%). The tax credit increases based on the certified improvement in energy efficiency (from 5% to 45% of investment). Projects must be certified by an independent evaluator, with ex ante and ex post certifications. SMEs may soon be eligible for additional incentives to help cover costs of energy-saving certifications.

Overview of tax incentives in select countries

Country	Type of incentive	For what	How much
Australia	Bonus deduction on expenditure	SME energy efficiency	20% with max deduction AUD 20 000 (Australian dollars)[4]
Belgium	Tax deduction	Energy-saving investments	20-40%
Luxemburg	Investment tax credit	Energy-efficient equipment	Up to 14%
Netherlands	Investment allowance allowing a deduction of investment costs from profit, reducing taxable profit	Assets that reduce CO_2 emissions	40%
Republic of Türkiye	Exemption of value added tax for machinery and construction, customs duty exemption, provision of support for employer's contribution to social security premiums (for 7-12 years), interest support	Companies with a minimum of 100 toe annual consumption and projects to reduce energy consumption by at least 15%	Total benefit varies depending on the size of the company
United Kingdom	Reduced carbon taxes	Organisations that enter into Climate Change Agreements with the government	92% for electricity 89% on gas

Preferential procurement

Public procurement – purchase by governments and state-owned enterprises of goods, services, and works –can stimulate the uptake of energy management and energy efficiency implementation. A 2022 survey by the Organisation for

[4] Exchange rate: 1 Australian dollar (AUD) = USD 0.65 (as of 4 September 2025).

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Economic Co-operation and Development (OECD) shows that 35 out of 38 OECD countries have some form of green public procurement framework.

To date, green public procurement frameworks and criteria have mainly considered efficiency in terms of the efficiency of the products that are procured rather than efficiency of the companies that produce or deliver these products. Experience in some jurisdictions indicate that there could be the possibility to further leverage public procurement towards supporting energy management and energy efficiency implementation.

The **Netherlands** developed a CO_2 performance ladder to guide public procurement towards favouring efficient companies. Tenderers are evaluated and assigned a rating of 1 to 5 based on the measures they have envisaged or implemented to limit CO_2 emissions. These ratings can be used in the procurement process as an award criterion with higher levels of certification leading to greater advantage.

Rijkswaterstaat and other government agencies have been using the ladder for over a decade. Over 1 200 certificates have been issued to date in the Netherlands and Belgium. Moreover, research demonstrates that certified organisations reduce their CO_2 emissions much faster compared with uncertified organisations. Furthermore, all certified companies have adopted a full-fledged energy management system, and the reduction of CO_2 emissions emerges as a key business strategy.

Regulations that reinforce

Regulatory measures support the uptake and quality of energy management. In some cases, these are used as stand-alone measures; in other cases, countries have opted for a comprehensive regulatory policy package. Frequently, regulation is combined with information and incentives to support implementation.

Types of requirements include:

- Hiring an energy manager
- Implementing an energy management system
- Conducting regular audits
- Requiring implementation of audit recommendations
- Incorporating directives to reduce energy intensity
- Mandating reporting of energy consumption.

When setting mandatory requirements, the threshold above which the requirement applies must be defined. Different approaches have been used. Initially in the European Union, requirements were set in terms of the size of the company, shifting later to energy intensity. In some countries, the requirements are nuanced according to sector and segment. Still other countries have a trajectory towards lowering thresholds. In all cases, best practices involve announcing changes well ahead of time and engaging with industry to support implementation.

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Good data can help underpin effective threshold setting and can avoid situations where undue burden is placed on small companies or where additional tailored support can be offered.

Examples of energy management requirements and thresholds across select countries

Country	Segment	Types of requirements
China	Large energy-intensive companies	The largest companies with an energy demand above 10 000 tonnes of coal equivalent (tce) (covering two-thirds of industrial demand) must implement energy management systems, invest in efficiency measures, and achieve sectoral savings targets. Performance is penalised for non-compliance. The threshold will reduce to 5 000 tce at the end of 2025.
Denmark	Energy-intensive companies	Companies must undertake audits (above 10 terajoules [TJ]) or implement a certified energy management system (above 85 TJ). Companies under the requirement must conduct a climate audit. Mandatory reporting on current energy consumption, CO_2 emissions, savings projects, and an action plan.
European Union	All enterprises based on energy demand	All EU companies above 85 TJ are required to implement energy management, and those above 10 TJ are required to carry out audits. Requirements must be completed by the end of 2027. *Regulations are detailed in the 2024 update of the Energy Efficiency Directive.*
Germany	Energy-intensive companies	Companies with annual demand over 7.5 GWh should implement energy management. Companies over 2.5 GWh, covering around 95% of industrial energy demand, should conduct audits and develop energy efficiency plans with savings measures identified.
India	Companies in different sectors over a set threshold limit	Companies must designate an energy manager, conduct an energy audit, and reduce specific energy demand to a set level. Performance is checked by accredited auditor and penalised for non-compliance. Companies have the possibility to take part in an energy savings certificate trading scheme. *Regulations are detailed in the Perform, Achieve and Trade scheme.*

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Country	Segment	Types of requirements
Italy	Energy-intensive companies	Two different mechanisms for energy-intensive industries are active (companies with electricity or natural gas consumption higher than 1 GWh) Companies are required to implement part of mandatory audit recommendations. Audit reports are collected and analysed to inform policy making and monitor audit quality.
Japan	Factories and businesses using above 1 500 kL per year	Companies must designate an energy manager, set management criteria (based on guidelines), perform periodic reporting, submit mid- and long-term plans, participate in a benchmark system to achieve improvement of energy intensity by on average 1% or more per year over five years. Cement, pulp and paper, petrochemical, iron and steel, automobile manufacturers, and transport business entities are required to meet non-fossil fuel targets by 2030 (set as a different ratio for different sectors).
Korea	Energy-intensive companies	Companies must implement energy audits and energy management. Support is provided based on company size, with greater levels of support available for smaller companies.
Netherlands	Energy-intensive companies	Energy-saving obligation (above 50 000 kWh electricity or 25 000 m^3 natural gas equivalent) and energy notification obligation. Energy savings investigation obligation (above 10 million kWh electricity or 170 000 m^3 natural gas equivalent). Energy audit obligation (October 2025 onwards – 10 TJ or 2.7 million kWh) or certified energy management system (above 85 TJ).

Mandatory reporting

Mandatory reporting on energy use for energy-intensive companies is an early-stage measure that helps government identify which measures to target. It provides a baseline to which progress can be tracked and can be used to develop benchmarking. To maximise the value of data, governments should develop a plan on how the data will be used, how it can be shared, and what other datasets could deepen analysis.

To build trust and improve the quality of reporting and compliance, governments can provide clarity about how data will be used and how it will be protected. Clear communication on the purpose of reporting requirements, as well as the potential value of the data received, will help garner support from companies. A good practice is to provide clear instructions and make it as easy as possible for

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companies to report. Looking at other reporting requirements can help identify opportunities to streamline and lessen regulatory burdens. Often countries include penalties in cases of non-compliance.

Regulation **Mandatory reporting** 	
What?	**Why?**
• **Required reporting** on energy use, emissions, energy efficiency improvements, investments, and multiple benefits • Obligations for companies to **share audit reports**	• Helps governments track and analyse progress • Helps identify best practices and successes • **Enables benchmarking** • Eases businesses' **ability to track and report their progress** in implementing energy management
Works well with:	
• Reporting requirements combine well with data management systems and analytical capacity on the side of government to analyse data. Using data for benchmarking can help identify opportunities, set targets, and prioritise policy focus. Reporting can be linked to incentives, and conversely, access to incentives can be made conditional upon reporting.	

The United Kingdom implemented the Streamlined Energy and Carbon Reporting requirements in 2019 with the following objectives:

- Increasing awareness of energy costs and enhanced visibility to decision-makers
- Creating a more level playing field among large organisations in terms of energy and emissions reporting
- Providing data to inform the adoption of energy efficiency measures and opportunities.

Further countries requiring energy or emissions reporting include Australia, Canada, Indonesia Japan, Korea, South Africa, and the United States.

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Requiring an energy manager

While a requirement to have an energy manager does not necessarily lead to systematic energy management implementation, it is a starting point. Often in companies, energy efficiency is treated in an ad hoc manner – ultimately, no one is responsible for implementation. By allocating responsibilities and mandates, governments can increase the likelihood that some measures will be taken. The requirement can be further strengthened by combining it with other requirements, such as reporting or audit requirements, and with other measures, such as offerings of training and capacity building.

Japan has required the appointment of an energy manager for designated businesses since 1979, also putting in place a qualification course that the energy manager must pass. In 1998, it expanded the number of companies that need to comply with this requirement and streamlined the examination process. Japan also provides additional training courses for energy managers to build capacity.

Indonesia and **Malaysia** also require the appointment of an energy manager.

Regulation **Requiring an energy manager**	
What?	**Why?**
• **Required appointment of one or several energy managers** • **Requirements based on qualifications**	• Puts companies at **a starting point for energy management** • **Provides a point of contact** for communications about available tools, incentives, and existing and forthcoming requirements • **Minimises risk during staff turnover**, preventing the backtrack of energy efficiency efforts wane as staff changes occur or priorities shift
Works well with:	
• Training courses and accreditation can help ensure that energy managers are effective. Tools, guidelines, and technical support help save time and resources. Peer-to-peer learning opportunities and networks will provide further support and opportunities to build internal capacity. Further requirements in terms of reporting on energy usage and efficiency progress (to government agencies, boards, or company management) can help ensure that the energy manager is properly mandated. Mandatory or subsidised audits can further help identify opportunities.	

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Audits and resulting recommendations

An energy audit is a measure used to inform companies about how and where energy is used. Importantly, it also identifies savings opportunities. Many countries offer subsidised audits, especially for smaller companies. An increasing number of countries are mandating regular audits and setting requirements both on how the audit should be carried out and on what actions the company should take following its results. Some countries require that audit reports be published or shared with management.

After receiving audit recommendations, many companies might be unable to implement them due to upfront costs or lack of incentives. Therefore, stronger incentives for implementing audit recommendations or penalties for inaction may improve the policy's effectiveness.

Mandatory energy audits in **Spain** must cover 85% of a company's total energy consumption and include a detailed analysis of energy management practices, equipment, and operational inefficiencies. The audits are submitted to the government for validation. Compliance is enforced through penalties for companies should they fail to meet the audit requirement or submit insufficient audits. Enforcement includes fines of up to USD 112 000. Non-compliant companies are subject to further scrutiny. The audits are assessed every four years, with follow-up checks to ensure companies are adhering to the policy's guidelines.

Business locations in the **Netherlands** that use 50 000 kWh of electricity or 25 000 m^3 of natural gas (or an equivalent) or more per year are required by the Environment Buildings Decree to implement energy-saving measures with a payback period of five years or less.

Three green conditionalities were introduced in **Italy** following revisions of the framework for energy audits in energy-intensive companies in Decree Law 131 in 2023, and a subsequent Ministerial Decree in 2024. The first requires the implementation of energy efficiency measures with a payback period of less than three years. The remaining two allow companies to either use Guarantees of Origin from renewable sources for at least 50% of their electricity consumption or achieve certified CO_2 reductions equivalent to those expected from cost-effective energy efficiency measures.

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Regulation **Requiring regular energy audits**	
What?	**Why?**
• **Regular audits combined with plans for implementation or reporting** • **Required implementation of audit recommendations,** sometimes combined with audit requirements	• **Effectively identifies energy efficiency opportunities**, noting that barriers can constrain voluntary use of audits even with financial incentives; barriers may include a reluctancy to have external experts on site, to allocate necessary time and resources, or to acknowledge the value
Works well with:	
• Energy audits work well with training and capacity building, and support for the implementation of audit recommendations. Information-sharing efforts can drive implementation of audit recommendations, such as networks to share experiences, and initiatives that clarify requirements, processes, and opportunities. Guidelines for audits, training of auditors, certification of auditors, and review of audit reports all ensure high-quality audits.	

Requiring an energy management system

An increasing number of countries are moving from voluntary approaches towards mandatory approaches to energy management, notably driven by EU directives.

However, an issue with mandatory requirements persists, sometimes energy management can be perceived more as an obligation requiring a tick box approach rather than an opportunity providing value for the business. This misconception can be countered by combining requirements of energy management with incentives and information about its benefits. Some countries have restrictions on providing financial incentives in support of implementing mandatory requirements; however, other incentives could be considered, such as positive publicity or awards for best performers.

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Regulation **Requiring an energy management system**	
What?	**Why?**
• **Required energy management systems for companies over a set threshold**, either certified to international standard or complying with national standards or guidelines • **Linked access to incentives or to voluntary networks**, contingent upon having an energy management system	• **Increases adoption of energy management,** given the low uptake of energy management when participation is voluntary despite its proven benefits • Allows governments to place measures that **ensure the high quality of energy management implementation**
Works well with:	
• Training and capacity building, incentives, information, and networks.	

EU member states are now obliged to implement certain energy efficiency regulations following the 2023 revision of the **EU** Energy Efficiency Directive. Member states must put in place regulation requiring all companies with annual demand over 85 TJ to have an energy management system (independently certified), and those over 10 TJ to have an audit and prepare an action plan.

China mandates that large energy-consuming enterprises establish energy management systems. The government has additional specific guidelines, audits, and reporting frameworks that companies must follow, especially those in energy-intensive industries.

Examples of regulation for energy management across select countries

Country	Segment	Types of requirements
China	Large energy-intensive companies	The largest companies with an energy demand above 10 000 tce (covering two-thirds of industrial demand) must implement energy management systems, invest in efficiency measures, and achieve sectoral savings targets. Performance is penalised for non-compliance. The threshold will reduce to 5 000 tce at the end of 2025.
Denmark	Energy-intensive companies	Companies must undertake audits (above 10 TJ) or implement a certified energy management system (above 85 TJ). All under requirement must also conduct a climate audit.

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Country	Segment	Types of requirements
European Union	All enterprises based on energy demand	All EU companies above 85 TJ are required to implement energy management, and those above 10 TJ are required to carry out audits. Requirements must be completed by the end of 2027. *Regulations are detailed in the 2024 update of the Energy Efficiency Directive.*
Germany	Energy-intensive companies	Companies with annual demand over 7.5 GWh should implement energy management. Companies over 2.5 GWh, covering around 95% of industrial energy demand, should conduct audits and develop energy efficiency plans, identifying savings measures.
India	Companies in different sectors over a set threshold limit	Companies must designate an energy manager, conduct an energy audit, and reduce specific energy demand to a set level. Performance is checked by accredited auditor and penalised for non-compliance. Companies have the possibility to take part in an energy savings certificate trading scheme. *Regulations are detailed in the Perform, Achieve and Trade scheme.*
Italy	Energy-intensive companies	Two different mechanisms for energy-intensive industries are active (companies with electricity or natural gas consumption higher than 1 GWh) - Companies are required to implement part of mandatory audit recommendations. - Audit reports are collected and analysed to inform policy making and monitor audit quality.
Netherlands	Energy-intensive companies	Energy-saving obligation (above 50 000 kWh electricity or 25 000 m^3 natural gas equivalent) and energy notification obligation. Energy savings investigation obligation (above 10 million kWh electricity or 170 000 m^3 natural gas equivalent). Energy audit obligation (October 2025 onwards – 10 TJ or 2.7 million kWh) or certified energy management system (above 85 TJ).
Japan	Factories and businesses using above 1 500 kL/year	Companies must designate an energy manager, set management criteria (based on guidelines), perform periodic reporting, submit mid- and long-term plans, participate in a benchmark system to achieve improvement of

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Country	Segment	Types of requirements
		energy intensity by on average 1% or more per year over five years.
Japan (continued)		Cement, pulp and paper, petrochemical, iron and steel, automobile manufacturers, and transport business entities are required to meet non-fossil fuel targets by 2030 (set as a different ratio for different sectors).

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5. Stages of energy management policy packages and recommendations

Summary

This section provides an overview of the three stages of energy management policy packages according to level of maturity and ambition. Based on best practices and lessons learned from implementation across a wide range of countries, we provide recommendations for governments to consider when looking to develop new policy packages or updating existing ones. This section offers ideas on where countries can leapfrog stages by learning from others.

- Initiating (early stage): Focus on awareness, assessment and planning, tools, and pilot programmes.
- Expanding (developed stage): Broaden coverage, engage SMEs, capture multiple benefits, and integrate digital tools.
- Optimising (innovation stage): Link to innovation, supply chains, decarbonisation, and AI.

Energy management policy packages develop over time. Different policy measures and actions are relevant to the policy package during different stages of maturity.

The initiation early stage is light, centred on initial assessment and planning, information, supporting tools, capacity building, and access to support. This type of focus can rally the support necessary to adopt energy management.

At a developed stage of maturity, policy packages expand through ramped-up outreach or enhanced requirements for companies of a certain size or energy intensity to have energy management systems in place. They can also be expanded to include more regulations such as certification, reporting of identified energy savings opportunities, or evidence of implementation. Policy packages can also expand data collection to guide further policy making and strengthen evidence of energy management benefits. Building on lessons learned to date, measures in this stage could also target harder-to-reach segments such as SMEs.

In an innovative stage, policies can be further developed to boost implementation. This can be accomplished by promoting deeper energy efficiency improvements

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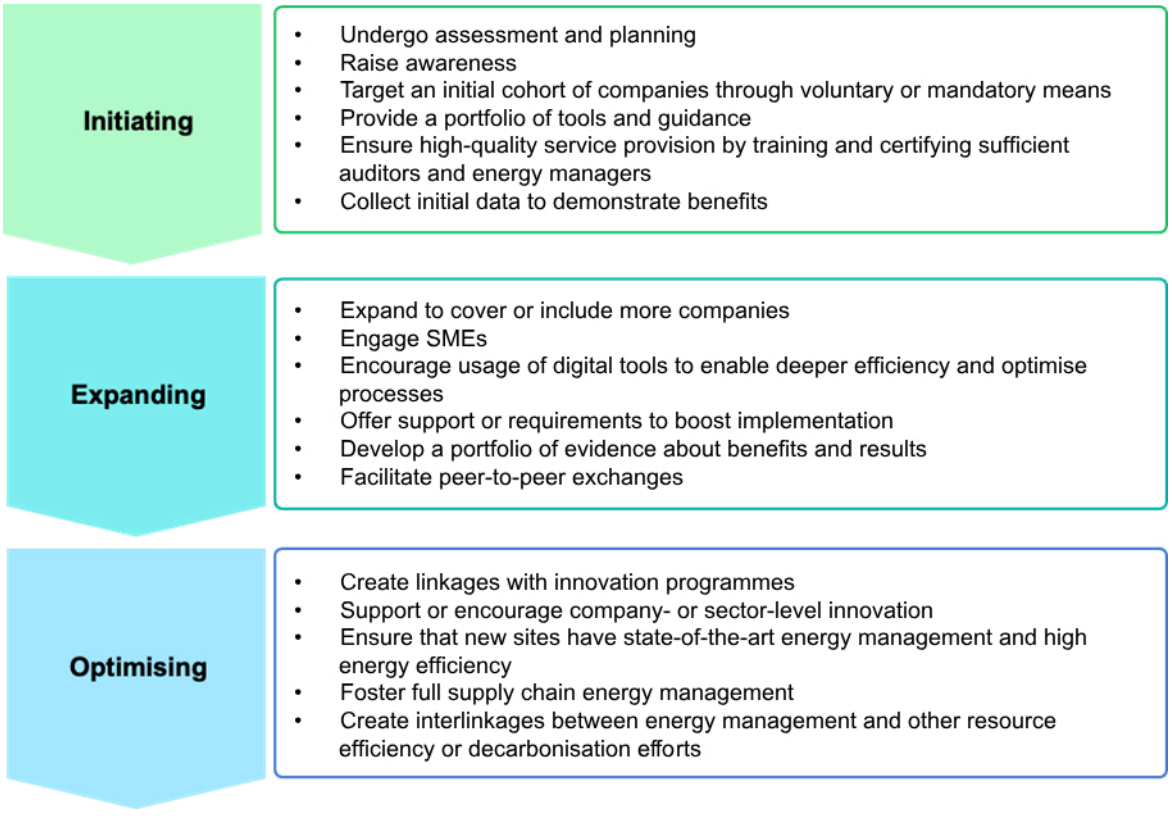
through process design and change, extending the reach of the policy package to include supply chains, pairing energy management with resource and materials management, and expanding to include decarbonisation paths or Scope 2 and 3 emissions. Further options include creating linkages with energy management and demand flexibility and stimulating innovation and the uptake of digital technologies and AI.

Evolution of energy management policy packages



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These stages are not linear. Significant learnings are available to enable countries that are initiating programmes to leapfrog towards higher levels of scope and impact. It is also important to acknowledge that programmes develop over time – not everything has to happen at once. Continuous review and evaluation of programmes can help identify improvement opportunities.

While many energy-efficient technologies for industry are at a mature stage, continued innovation ensures that future industrial needs for efficiency are met and that new opportunities for improved processes are developed.

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Initiating (early stage)

Early-stage programmes or policy packages can be either regulatory, voluntary, or hybrid in nature, i.e. linking networks or voluntary agreement to commitments. Early-stage regulatory approaches should include:

- Plan and review, including assessment of the current situation, existing policies, implementation barriers.
- Review policy packages in other countries to identify measures that could be replicated and provide evidence on benefits achieved, with an aim to garner support for selected measures.
- Set initial thresholds and time frames.
- Develop requirements.
- Develop information, guidance documents, and support measures.
- Ensure sufficient workforce of qualified auditors, certifiers, and consultants to guarantee implementation along set timelines.

For voluntary or hybrid approaches, more attention should be placed on creating an attractive package of incentives, developing information and support, and enticing an initial cohort to sign up through targeted outreach.

All types of policy packages require consultation with industry and partnerships. Investing sufficient time and resources in the planning stage can help avoid future challenges and problems. Planning ensures that essential elements can be incorporated at the outset, avoiding delays, duplication of efforts, or confusion. Transparent planning, which involves consulting stakeholders from the outset, will likewise ensure critical aspects of the programme have been considered, will help increase target group buy-in, and foreshadows any future implementation issues or difficulties. Piloting with a smaller group of companies can provide early insights into what works and what needs to be developed further.

Identifying leaders and champions during this stage can provide goals for programme development and means for effective communication of benefits. Accessing and analysing data and creating plans for future data collection will help ensure effectiveness of the package as it develops.

Even in instances where a programme or policy package for energy management is not feasible, a range of measures could be considered. One simple measure is including information on energy management in existing training offerings or information. Another light option could be providing an award or recognition for good practices towards energy management to a company currently without a system but taking steps towards more systematic consideration of energy efficiency. The addition of reporting requirements can be a first step in raising awareness about energy usage and in providing more thorough data for

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programme development. Audits - whether required or subsidised - are a good starting point towards identifying opportunities and accessing better data on energy use.

Actions for governments in early stages:

- Create links to broader policy framework. Review existing industrial policies and measures at all levels to identify additions or modifications and to create effective interlinkages among regulation, information, and incentives.
- Review current data and develop plans to access better data, including case studies and quantifications of non-energy benefits, to target efforts towards quick wins and convey a more compelling business case for energy management.
- Ensure that reporting requirements effectively convey successes of the programme to participants, administration managers, ministers, and the public. Review other reporting requirements or voluntary reporting mechanisms, such as environmental reporting, health and safety reporting, and carbon reporting. Look for ways to avoid duplication and possibilities to merge or align reporting processes in terms of content and timing.
- Consult with industry associations and companies to get a better understanding of the specific barriers or reluctancies to implement energy management.
- Investigate policies and measures that have been effective in different jurisdictions, leveraging opportunities for peer-to-peer exchanges.
- Consider piloting.
- Consider longer-term goals and how the programme or package could evolve.

Expanding (developed stage)

In a developed stage, countries typically look towards expanding and supporting further implementation of energy efficiency. Programmes can be broadened by lowering thresholds; they can be deepened by adding requirements; and they can be strengthened to provide more support for companies already involved. A sectoral focus can help target efforts and start a shift towards process changes.

Changing thresholds for expanded coverage

Thresholds can have a significant impact on coverage and results. Lower thresholds will augment coverage to include not only the most energy-intensive industrial sectors but a wider range of sectors. Analysis of sectoral company sizes and energy demand for major world regions demonstrates the impact of increasing thresholds in stringency and shows how much of industrial energy demand would be covered.

As the threshold for company size (by energy demand) required to implement energy management decreases from left to right, the higher the proportion overall of industrial energy demand is included in the policy coverage. For example, the

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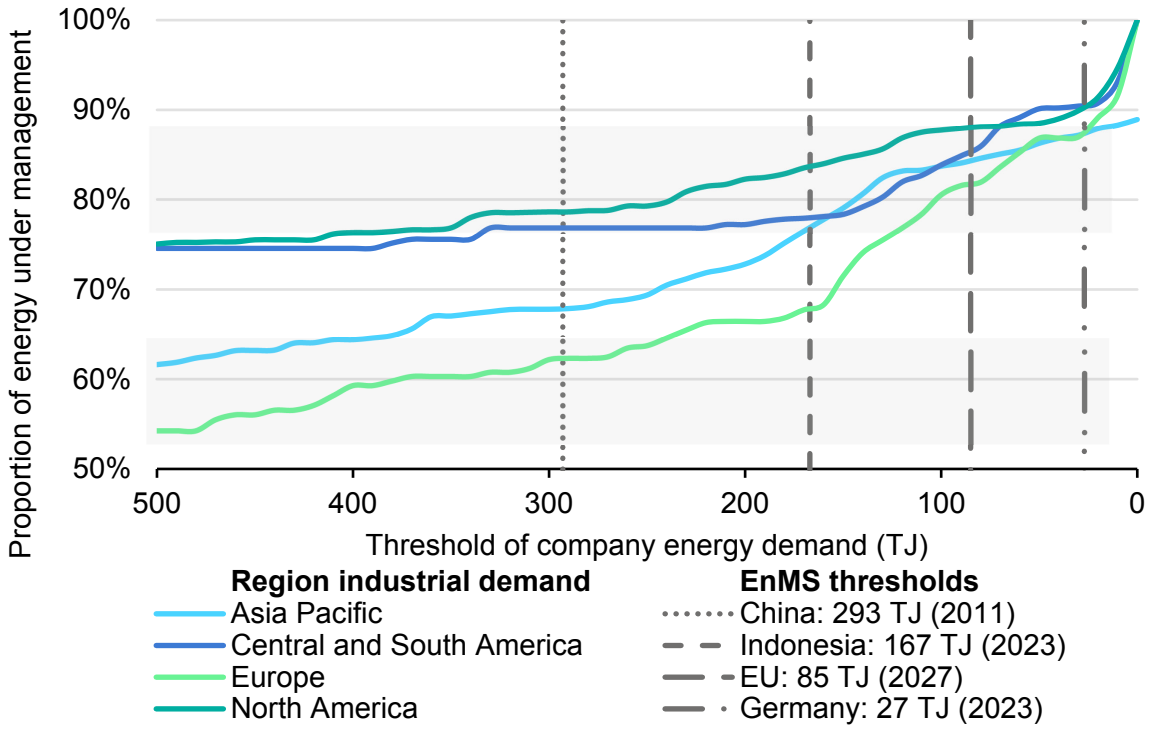
2011 Chinese threshold (the leftmost vertical line) would cover around 62% of European industrial energy demand, 68% of Asia Pacific, and about 77% of the Americas. Regions differ due to differences in company sizes – the fact that Europe has the lowest proportion of energy covered for the same threshold above shows that Europe has a higher proportion of smaller companies.

Select energy management thresholds (terajoules) and the proportion of industrial energy demand covered by use of these thresholds for select world regions, 2023



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Notes: TJ = terajoules; EnMS = energy management system. Asia Pacific does not end on the right side at 100% due to differences in business reporting methodologies.

Sources: IEA analysis based on IEA (2025), World Energy Balances and OECD (2025), Structural Business Statistics.

Introducing thresholds gradually can be effective, focusing first on the largest companies that have lower barriers to implementing energy management. Focusing on larger companies also requires less engagement with stakeholders, since there are fewer. In China, the Top 10 000 set a threshold of 293 TJ (covering about two-thirds of total industrial demand) in 2011, with a lower threshold for more energy-intensive companies.

A gradual approach allows governments to build up support, gain lessons from implementation, identify opportunities for improvement, and broaden a portfolio of sectoral guidance. In the European Union, a threshold of 85 TJ will come into force in 2027, which would cover around 80% of industrial energy demand. Germany set a more ambitious threshold of 27 TJ in 2023, resulting in around 90% of industrial energy demand coverage.

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Targeting SMEs

Despite the acknowledged importance of energy to the operation of many SMEs, energy management practices are not widely adopted. From a government perspective, supporting the SME segment and equipping companies with the ability to better manage their energy use is of strategic importance for a number of reasons:

- The cumulative energy efficiency potential in SMEs is significant.
- SMEs constitute the majority of companies and jobs in most economies.
- SMEs are more vulnerable to energy price increases.

Developing effective programmes targeting the SME sector is challenging due to the sector's heterogeneity. SMEs vary in terms of activity and processes, but also in terms of size, the considerable number of entities involved and difficulties in gaining access to data on energy use. Characterisation of the industry subsectors can be helpful in identifying both which subsectors to prioritise and developing tailored approaches.

Low levels of energy management in SMEs can be tackled by focusing on supply chains and incentivising larger companies to work with their suppliers. **Mexico's** Programa Liderazgo Ambiental para la Competitividad (Environmental Leadership for Competitiveness) programme was developed to improve the competitiveness of businesses through pollution prevention projects, including energy efficiency. The programme operated from 2012 to 2019 and worked with more than 7 000 SMEs through customer-supplier co-operation networks.

Leveraging digital tools

Digital energy management systems collect, track, and analyse energy and other relevant data. They can help uncover new energy efficiency opportunities, especially in terms of process optimisation and preventative maintenance. They can also facilitate the implementation of energy management systems by making it easier to share data and insights across a company and to track progress and the impacts of energy efficiency implementation.

In **Germany**, companies can get funding to procure digital energy management systems including software, sensors, and process controls. The amount of funding based on the costs of the eligible investment is 45% for small enterprises, 35% for medium-sized enterprises, and 25% for enterprises without SME status. In 2022, the grant leveraged three times more private investment than was paid in grants and delivered annual energy cost reductions for companies in the region of EUR 14 million.

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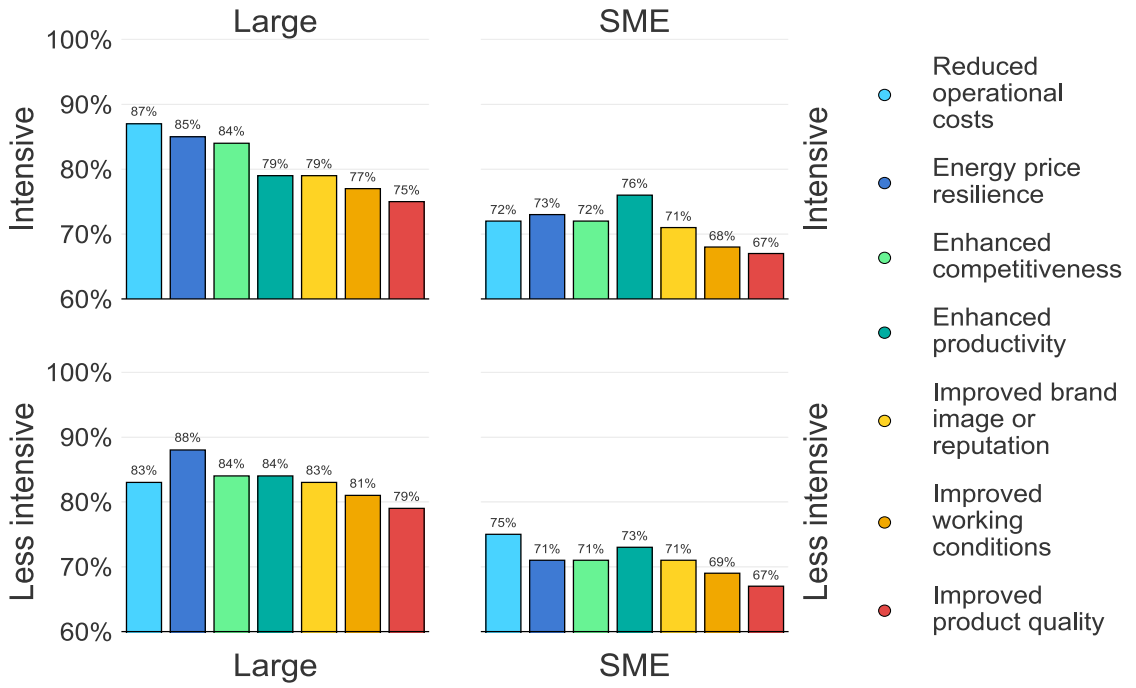
Capturing data and multiple benefits

Energy efficiency increasingly demonstrates its importance for competitiveness, job creation, and energy security. Evidence of energy management's multiple benefits could positively impact the development of energy management policy in both early and later stages. Evidence would not only strengthen budget applications but would also increase the impetus for programme continuations when included in policy and programme evaluation and reporting.

Robust systems of managing and analysing data will encourage the development of increasingly effective policy measures. Governments could expand reporting requirements to include energy efficiency's multiple benefits, such as labour productivity, to strengthen the case for energy management and efficiency. **Ireland**, **Italy**, and **Portugal** have established structured databases for energy savings measures derived from audits. The KNOWnNEBs project, funded by the **EU** developed tools to help quantify the value of multiple benefits during energy audits. While a second **EU**-funded project, REFEREE, has developed a national and local tool for assessing the multiple benefits of energy efficiency policies.

Understanding the relative importance of multiple benefits can provide insights into certain areas needing attention. Energy price, resilience, and reduced operational costs are cited in an IEA survey as the most crucial factors for large companies, whereas enhanced productivity can be more important for SMEs.

Proportion of firms that agree efficiency can contribute to each factor, global, 2025



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Source: IEA (2025), Gaining an Edge: The Role of Energy Efficiency in Enhancing Competitiveness.

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Optimising (innovation stage)

Focusing on process change and innovation

While improving the efficiency of industrial equipment can deliver significant savings, larger and deeper savings require a focus on process change. Further potentials can be realised through new production methods and the increased interlinking of different areas of the energy system (sector integration e.g. use of industrial waste heat).

The **Irish** Excellence in Energy Efficiency Design (EXEED) Certified programme enables organisations to establish a systematic approach to design, construction, and commissioning processes for new investments and upgrades to existing assets. The programme supports the delivery of new best practices in energy-efficient design management. EXEED designs, verifies, and manages optimum energy performance and management at the earliest stages of the life cycle, providing up to EUR 3 million in grants per project, per year.

The **Austrian** Energy Research Programme of the Climate and Energy Fund identified approaches towards industrial transformation and developed 12 sectoral action plans.

As part of the **Canadian** Industrial Systems Optimization programme, teams of researchers and engineers tackle the complex problems associated with optimising large-scale energy systems and support the development and adoption of industrial technologies in various fields.

Boosting energy management with AI

Japan is focusing on the promotion of digital technologies and the use of AI for energy efficiency in the industrial and commercial sectors. In addition to offering an energy-optimised audit, which includes opportunities associated with distributed solar generation, the Japanese Energy Conservation Audit programme now provides an information technology diagnosis audit. This audit focuses on data and analytics to identify energy-saving opportunities in production processes, energy systems, and demand response.

Broadening the scope

Energy management can be an effective tool in supporting decarbonisation of industry and further resource efficiency. In an innovation stage, governments should ascertain what types of support or levers (whether voluntary or mandatory) inspire companies to consider both how their systems could be optimised and what other opportunities could improve environmental performance. While there

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are significant opportunities to improve energy efficiency through materials or water efficiency, they may not be well mapped.

The **United States** developed a guide for 50001 Ready decarbonisation management guidance in 2022. **Canada** updated its 50001 Ready Navigator tool in early 2025 to include guidance on integrating GHG emissions reductions into energy management practices.

Governments can develop complementary tools that can help guide companies towards system and resource efficiency. The **Korean** national heat map was established in 2021 and provides information on the waste heat available by location across power plants, incineration facilities, district heating systems, and industrial sites. This information can be used by companies to facilitate the use of wasted heat. The government is planning to upgrade the map to provide greater granularity.

A new ISO standard is under development, which combines energy management systems and energy savings – Decarbonization. Adoption is expected in 2026. The new standard, ISO 50100, will combine GHG targets, action plans, and verification, enabling internal action and external credibility while building on ISO 50001. ISO 50100 has the potential to enable credible differentiation, offering a transparent platform to show past emissions reductions and to meet future targets, enabling emissions reporting and reductions across supply chains.

Exploring policy innovation

While many good practices for stimulating the uptake and effective use of energy management in industry already exist, novel approaches could create stronger incentives. Including energy management requirements and demonstrated results in public procurement could help drive uptake. Similarly, grants, or subsidies could be programmed to include an advantage for companies that have an energy management system.

As energy management delivers benefits beyond energy, governments could also explore increased co-ordination between measures across the entire industrial development policy portfolio.

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